# ENCYCLOPÆDIA BRITANNICA

*1768*

*The Encyclopædia Britannica*
*is published with the editorial advice*
*and consultation of the faculties of*
*the University of Chicago*

*

"LET KNOWLEDGE GROW FROM MORE TO MORE
AND THUS BE HUMAN LIFE ENRICHED."

# ENCYCLOPÆDIA BRITANNICA

*A New Survey of Universal Knowledge*

Volume 16

MUSHROOM to OZONIDES

THE UNIVERSITY OF CHICAGO

ENCYCLOPÆDIA BRITANNICA, INC.

CHICAGO · LONDON · TORONTO

COPYRIGHT

IN THE UNITED STATES OF AMERICA

1929, 1930, 1932, 1936, 1937, 1938, 1939
1940, 1941, 1942, 1943, 1944, 1945, 1946

1947

BY ENCYCLOPÆDIA BRITANNICA, INC.

COPYRIGHT 1947. COPYRIGHT UNDER INTERNATIONAL COPYRIGHT UNION BY ENCYCLOPÆDIA BRITANNICA, INC.

ALL RIGHTS RESERVED UNDER INTER-AMERICAN COPYRIGHT UNION (1910) BY ENCYCLOPÆDIA BRITANNICA, INC.

PRINTED IN THE U.S.A.

FOUNDED A.D. 1768

# ENCYCLOPÆDIA BRITANNICA

## Volume 16

## MUSHROOM to OZONIDES

**MUSHROOM.** The well known, edible, umbrella-shaped fungus which is grown for the market and commonly served as a delicacy is called by many people "the mushroom." Botanically it is known as *Agaricus campestris,* or by some authors as *Psalliota campestris.* In the temperate regions of the earth it is often found growing wild, in pastures, lawns, golf courses, etc., where the grass is kept short and the ground is enriched by manure. Restriction of the name mushroom to this fungus alone is not in accordance with the terminology accepted by botanists, nor in most regions does it correspond with popular usage. Hundreds of other umbrella-shaped fungi occur in nature and are to be found in numbers unbelievable to those who have not made a deliberate search for them. These differ from *Agaricus campestris* in minor characters of form, structure, and colour. Many of them are edible, a few are deadly poisonous, others are too tough or unpalatable to serve as food. The botanist calls all of these mushrooms. Such umbrella-shaped fungi in most cases bear on the under side of the expanded upper portion or cap (*pileus*) a number of flat, knife-blade shaped parts (*gills*) which radiate like the spokes of a wheel from the handle or stalk (*stipe*) to the margin of the cap. Possession of these radiating gills marks a fungus as a member of the family Agaricaceae, these fungi being commonly called "agarics." Other closely related umbrella-shaped fungi outside this family lack gills. In the Boleti, for example, there may be seen on the under side of the umbrella, myriads of tiny pores which are the mouths of cylindrical tubes, while in members of the family Hydnaceae pendent spines occur instead. Still other related fungi lack the typical umbrella-shape, and show wide variation in form. The coral fungi (Clavariaceae) have the aspect of delicately coloured coral, and may be much branched like a deciduous tree. Others occurring on the sides of stumps, fallen logs, or trees are known as the bracket fungi and have the aspect of little shelves overlapping one above the other. The hundreds of species of all these various sorts of fungi possess, for the most part, a soft texture or flesh and the whole aggregation are commonly termed the "fleshy fungi." The application of the name mushroom to all of them accords with professional and popular usage for the most part. Some people use the term mushroom only for the edible members of this great group, and call those which are not edible toadstools. Although botanists recognize the word toadstool they regard it as synonymous with mushroom and write at times "edible toadstool" or "poisonous mushroom." In general they avoid the term toadstool.

The Agaricaceae, characterized as noted above, by the possession of gills on the under side of the pileus, embrace more than fifty different genera. These constitute five groups differing in the colour of the dust or powder which falls from the gills at maturity. This dust, composed of many thousands of tiny, unicellular spores, which float downward in such quantity as to form a noticeable deposit on the grass or earth beneath the fungus, may be easily caught for examination if a sheet of paper be placed directly beneath the cap. The colour of this spore dust in some genera is white. In others it is pink, purple-brown, rusty brown or black. The group characterized by possession of purple-brown spores contains about ten genera, one of which is Agaricus. The well known mushroom of commerce, *A. campestris,* is only one of a dozen or more species composing this genus. Some genera contain many dozens of species. In any given genus the species all possess in common certain prominent features of form, colour or structure which serve to distinguish them from those of other genera. Within a genus the species differ from one another in more minor characters of the same sort, it being necessary in many cases to take note of microscopic points of dissimilarity. Consideration of the genus Agaricus in this connection will serve to illustrate this situation concretely. All the species of the genus have purple to purple-brown spores, and the gills, which are white when young, change gradually through pink and successive shades of deepening brown as the spores reach maturity over their surface. The ends of the gills nearest the stipe are not attached to it and are not disturbed when the stipe is torn from the pileus. On the under side of the pileus of the young opening umbrella there is a chamois-skinlike membrane stretching from the stipe to the margin of the pileus and hiding the gills from view. A little later this membrane (*veil*) detaches itself from the margin of the pileus and falls to form a ring (*annulus*) around the stipe. In the other genera having purple-brown spores the gills are attached to the stipe and an annulus is lacking. The characters which serve for the identification of the genus Agaricus are thus seen to be few and readily recognized.

In the group of white-spored forms the genus Amanita is very important, because to it belong all the deadly poisonous mushrooms. Though a few of its species are regarded as edible, most of them are definitely dangerous, and some are capable of causing death. It is necessary, therefore, that the characters which separate this genus from others be clearly understood. As an annulus is present and as the gills are free from the stipe, there is a pronounced resemblance in form to Agaricus. However, the spore powder is white, and the gills are never brown. In most species they are white, and remain so even in old specimens. Though a young individual of Agaricus in which the gills are still white may be easily confused with one of Amanita, there is present in the latter an additional structure which, if not overlooked, will serve as a danger signal. While yet in the young more or less globose stage the plant in Amanita is completely enveloped in a definite sheath similar in character to the membrane which forms the annulus. This outer layer of enveloping tissue is called the *volva.* As the young plant grows and enlarges it bursts this membrane, emerges from it, elongates upward, and opens out into the umbrella shape. In some species of Amanita the entire volva persists thereafter at the base of the plant as a bag or cup surrounding the base of the stipe. This "death-cup" is not well formed in all cases, and even when present may be overlooked by careless individuals who fail to pick the entire plant including its base. Furthermore, in other species of the genus the rupture of the volva occurs equatorially in such a fashion that approximately the whole upper half of it remains attached over the upper surface of the pileus and is carried upward, the portion left at the base being insufficient to form a definite cup. In these cases the part carried up on the surface of the pileus is later broken up there into loosely adherent, flake-like scales by the expansion of the tissue beneath as the pileus opens into the umbrella form and increases in lateral diameter. The presence of such loosely attached, flake-like scales on the pileus should hold a fungus under suspicion until study of its other features proves it to be in fact not an Amanita. Though in many edible species in other genera scales occur on the pileus they are more firmly attached in character, and can be seen to have resulted from cracking or fraying of the tissue of the pileus itself. Specimens suspected of being Amanita should be examined carefully in every instance in the young state if possible, for the presence of the volva is then more readily noted. Most certainly all questionable plants should be discarded.

There have been many well authenticated cases of death from mushroom poisoning, and many in which whole families have been rendered desperately ill. In most of these instances poisonous species of Amanita were undoubtedly involved. However, records of symptoms of poisoning, and even death, exist in cases in which the plants consumed were apparently recognized as edible forms. Such cases have probably arisen from the eating of specimens already in a state of decay. Collectors should avoid all fungi which are not in a wholly fresh and wholesome condition. Old, wormy, or semi-putrid ones may well contain poisons similar to those present in rotting vegetables and meats. When poisoning by mushrooms is suspected it cannot be too strongly urged that a competent physician be summoned with the least possible delay. The poisonous element is not the same in all species of Amanita. In *A. muscaria,* the fly agaric, it is chiefly muscarine, an extremely dangerous alkaloid. Symptoms of poisoning with muscarine usually appear in from one-half to two hours. Vomiting and diarrhoea, pronounced flow of saliva, suppression of the urine, dizziness, derangement of vision, and loss of confidence in ability to make ordinary movements, are succeeded by drowsiness, stupor, cold sweating, and marked weakening of the heart's action. In fatal cases stupor persists for two or three days, and death follows the gradual weakening of the pulse. Treatment for this poison consists chiefly in the prompt removal of the unabsorbed mushroom material from the alimentary canal and the giving of subcutaneous injections of some powerful heart stimulant such as atropine. The poison phallin, present in *A. phalloides* and related species, is albuminous in nature and more deadly than muscarine. Preliminary symptoms of poisoning do not appear, unfortunately, until about ten hours after the mushrooms are eaten. Then severe abdominal pains are associated with cramps in the limbs and convulsions. Weakening of the pulse, vomiting, and extreme diarrhoea are followed by death in two to four days. The fundamental injury to the body is due to direct attack on and rapid dissolution of the blood corpuscles. The undigested mushroom material in the stomach and intestines should be removed as promptly as possible. Though it is usually stated that there is no known antidote for phallin, a report from the Pasteur Institute in Paris records preparation there of an antiphallinic serum which has proved so effective that the French Government requires a supply of it to be kept available for use by physicians.

In picking wild mushrooms for the table it is necessary to avoid not only the extremely poisonous Amanitas, but also the more or less poisonous and distasteful species of other genera. Such forms exist in genera whose other members are in all respects wholesome. Consequently, it is necessary to know the specific identity of every plant eaten. There is no royal road to this knowledge. Careful observation of the details in which one species differs from another, combined with the study of pictures and descriptions in some standard book on mushrooms will enable the amateur student to recognize with certainty at least a few desirable forms. All others should be avoided. One species often differs from another in various minor features of form or colour, and only critical observation will enable the collector to recognize a given species with certainty and assure him that it is not a somewhat similar, perhaps poisonous one.

The tiny spores which fall in countless thousands from the gills of mushrooms, float about in the air currents and are disseminated over a wide area. They are analogous to the seeds of higher plants and function in propagating the species. Each spore is a microscopic, more or less globose or ovoidal, cell, composed of a bit of protoplasm surrounded by a thin wall. Though capable of remaining quiescent for a time, it finally undergoes renewed growth, and if it finds adequate moisture and food in the spot where it has fallen it germinates. The side of the spore bulges outward and forms a cylindrical tube-like outgrowth which gradually lengthens and develops into a system of branching threads. These permeate the elements of the substratum, and are readily visible to the unaided eye as a network of delicate strands, usually white, though in some species of other colours. Strands arising from different spores may merge, and threads as heavy as ordinary twine may result. The tips of these heavy cords at the surface of the substratum in time enlarge into more or less globose bodies, commonly termed buttons. Each button is in fact a young mushroom, and by increase in size and internal differentiation of tissues, the umbrella-like mature plant gradually comes into being. It will be understood then that this umbrella is not the whole plant but merely the above ground fruiting portion of it. The mycelium below ground is the vegetative or feeding portion. In some wild species it occurs in the soil, in others in leaf mould, in rotting wood, or in any other material from which the fungus may obtain its food. The mushroom of commerce, *Agaricus campestris,* is grown in beds of specially prepared manure to which soil, straw, or other materials are sometimes added. In this mixture the mycelium grows luxuriantly. The grower calls manure in which the mycelium is abundantly present *spawn.* Old spawn is mixed into the manure in the preparation of new beds, and flakes of spawn or bricks of it are sold. Horse manure has been preferred to other sorts, and the coming of the automobile era has reduced the amount available while increasing its price. Efforts have been made to make use of other materials. Research has shown that the application of urea to mixtures of straw and other composting elements gives satisfactory results. Much more investigation is desirable.

Not uncommonly, commercial mushroom beds are invaded by the mycelium of other species of fungi. In these cases the reduction in the crop necessitates the removal of the infested material, sterilization of the beds, and the use of new spawn.

Like all widely spread and much-cultivated plants, the mushroom of commerce has developed a number of recognized varie-

PAINTED FOR THE ENCYCLOPÆDIA BRITANNICA BY HELEN DAMROSCH TEE-VAN

## MUSHROOMS

Thousands of kinds of mushrooms grow widely throughout the world. While many are highly prized table delicacies, others, comparatively few in number, are deadly poisonous. At certain stages in their growth—*See* the article Mushroom—the most dangerous kinds closely resemble some of the finest edible forms, so that in the selection of wild mushrooms for food extreme care is absolutely necessary

1. Chanterelle (*Cantharellus cibarius*), edible. 2. Barometer Earth Star (*Geaster hygrometricus*), edible. 3. Warty Puffball (*Scleroderma vulgare*). 4. Pine Flammula (*Flammula sapinea*). 5. Bitter Boletus (*Boletus felleus*). 6. Jack-my-lantern (*Clitocybe illudens*), luminescent, poisonous. 7. Net-bearing Dictyophora (*Dictyophora duplicata*). 8. Stink Horn (*Ithyphallus impudicus*), offensive. 9. Honey Agaric (*Armillaria mellea*), edible. 10. Coral Milky Cap (*Lactarius torminosus*). 11. Pungent Russula (*Russula emetica*), poisonous. 12. Peppery Milky Cap (*Lactarius piperatus*). 13. Fly Agaric (*Amanita muscaria*), deadly poisonous. 14. Reddish Agaric (*Amanita rubescens*). 15. Death Angel (*Amanita phalloides*), deadly poisonous. 16. Yellow Amanita (*Amanita velatipes*)

ties, and in different regions and under different modes of culture it shows differences as do the various garden plants. There is always the desire to obtain even more attractive or productive varieties. Toward this end research work in various laboratories has been carried on, and pure cultures obtained from single germinating spores have been prepared and tested. Such pure cultures are in some cases maintained under laboratory conditions and made available to the grower on request.

Mushrooms are grown in caves, in abandoned coal mines, in dark cellars, and in specially built mushroom houses. They are not allowed to reach the fully expanded condition, but are harvested in the large button stage while still very firm, and before the discolouring spore dust begins to fall from the gills. They are usually packed neatly in attractive containers. Though they are being grown in increasingly large quantities, they are still expensive and constitute a delicacy rather than a staple article of food. Though nutritious, their food value is not as great as their extremely high protein content would indicate. *See* FUNGI; MOREL; PUFF-BALL; TRUFFLE.

BIBLIOGRAPHY.—Carleton Rea, *British Basidiomycetae* (1922); W. Falconer, *Mushrooms; How to Grow Them* (1925); M. C. Cooke, *Edible and Poisonous Mushrooms* (1894); George F. Atkinson, *Mushrooms, Edible, Poisonous, etc.* (1900, 1901, 1903); N. L. Marshall, *The Mushroom Book* (1905, 1923); Louis C. Krieger, *The Mushroom Handbook* (1936). (H. M. F.)

**MUSHROOMS, COOKERY OF.** Edible mushrooms contain some nitrogenous food and about 90% water. Eaten with other foods they are of great service in the diet on account of their flavouring properties. It is dangerous to eat mushrooms which have been gathered by anyone who has not studied the different kinds.

Among the most familiar kinds are the common meadow mushroom (*Agaricus campestris*); button (immature) mushrooms employed chiefly for garnishing purposes and as an addition in high-class dishes; and truffles (underground fungi).

To prepare ordinary mushrooms for cooking, pick over and wipe with a flannel dipped in salt. Peel and remove stalks where necessary. The latter may be used for flavouring stews, soups, sauces, etc.

Mushrooms may be grilled (broiled) and served with maître d'hôtel or plain butter, etc.; baked in the oven under glass (or in a shallow dish); stewed in a casserole with other foods, *e.g.*, Italian pastes, rice, or in a well-flavoured sauce; or, they may be used in stuffings for turkey, poultry and game; they are also employed for garnishes in making galantines, etc.

**Stewed Mushrooms.**—Place the mushrooms in a stewpan with 2 oz. of butter, salt, a squeeze of lemon juice and a blade of mace. When cooked, stir in a white liaison of flour and butter blended together. Stir well and serve either as an entrée, or on toast as a savoury. This dish may be varied by adding other ingredients and may be served as a cream by adding a sauce of cream and beaten-up eggs.

**Fried Mushrooms.**—These are frequently added as an addition to a mixed grill. Frying should be done in a frying pan and not in a deep pan of fat. It is best to use good margarine or butter.

**Grilled Mushrooms.**—Large mushrooms should be chosen for grilling. Grease the gridiron before cooking. Place flesh side uppermost on the gridiron.

**Stuffed Mushrooms.**—Good-sized mushrooms are needed for stuffing. Any well-flavoured forcemeat can be used though certain flavours blend better with mushrooms than others, *e.g.*, game. To stuff, remove the stalks and pile the forcemeat in the centre of each mushroom. Squeeze lemon juice over and cover with buttered paper or place under glass. Bake in the oven for half an hour.

**Mushroom Ketchup.**—Sprinkle salt freely over large meadow mushrooms and leave them to stand for a few hours, then mash them in a mortar and set aside for 48 hours. Stir from time to time. Press through a colander and place in a pan. Boil up, skim carefully and simmer for an hour. Strain into a pan and leave until the next day. Then strain again leaving the sediment at the bottom of the basin and add one ounce of black peppercorns, a blade of mace, half an ounce of allspice, one quarter of an ounce of ginger and half an eggspoonful of grated lemon rind to each quart of liquor. Boil up and reduce to half the quantity Bottle and store in a dry place.

**MUSIC.** The Greek μουσική (*sc.* τέχνη) from which this word is derived was used comprehensively for all the arts of the Nine Muses. Contrasted with γυμναστική (gymnastic) it included the culture of the mind as distinguished from that of the body. Thus the singing and setting of lyric poetry formed but a small, if a central, part of a "musical" education which ranged from reading and writing to the sciences of mathematics and astronomy besides all the arts of literature. The philosophers valued music both in the ancient general sense and in our restricted sense, chiefly as an educational element in the formation of character; so that we obtain little light from them on the pure aesthetics of the Greek art of musical sounds.

### 1. INTRODUCTION

The present article deals mainly with the musical art-forms matured by European civilization since the 14th century. More ancient music is discussed frankly as beyond our power of appreciation except in the light of prehistoric origins. Our Western art of music stands in the unique position that its language has been wholly created by art.

Music owes but little to nature in the form of acoustic science, and still less to the sounds that occur outside works of art. It is already a mature musical art that selects the acoustic facts, just as in painting it is art that determines the selection of optical facts. Wise critics have, since Ruskin's day, abandoned the attempt to settle *a priori* how much of nature an aesthetic system ought to digest; and music differs only in degree from literature and the plastic arts as to independence of nature.

Yet the difference is often important. Perspective existed as a science before it was taken up by painters, and as a human experience before it became a science. The naïve Western spectator has seen enough of it in pictures to make him resent its neglect, whether in modern art or in the masterpieces of China and Japan. In music the nearest analogy to perspective is the system of tonality developed by the great composers from Alessandro Scarlatti to Wagner. (*See* HARMONY.) Every step in its evolution has been fiercely contested; and even twenty years after the end of Wagner's long career not every responsible musician was ready to admit Wagnerian tonality as a legitimate enlargement of the classical system.

If we set aside language and the organized art of music, the power of distinguishing sensations of sound is no more complex than the power of distinguishing colours. On the other hand sound is the principal medium by which most of the higher animals both express and excite emotion; and hence, though until codified into human speech it does not give any raw material for elaborate human art, it suffices for bird-songs that are as long prior to language as the brilliant colours of skins, feathers and flowers are prior to painting. Again, sound as a warning or a menace is an important means of self-preservation; and it is produced instantly and instinctively.

All this makes musical expression a pre-human phenomenon in the history of life, but is unfavourable to the early development of musical art. Primitive music could mysteriously re-awaken instincts more elemental than any that could ever have been appealed to by the deliberate process of drawing on a flat surface a series of lines calculated to remind the eye of the appearance of solid objects in space. But the powers of music remained magical and unintelligible even in the hands of the supreme artists of classical Greece. We may be perfectly sure that if the Greeks had produced a music equivalent to the art of Palestrina, Bach or Beethoven, no difficulty of deciphering would have long prevented us from recovering as much of it as we have recovered of Greek literature. Some enthusiasts for Oriental lore assure us that long ago the Chinese knew all about our harmonic system but abandoned it after they had exhausted it. This need not worry us. The Oriental aristocrat conceals in his politeness a profound contempt for our efforts to patronise his culture; and that contempt is justified when we show such ignorance of our own music as to suppose that a music of similar calibre could have utterly

disappeared from a living nation whose most ancient plastic art and literature commands our respect and rewards our study. When we trace the slow and difficult evolution of our harmonic system we cease to wonder that it was not evolved sooner and elsewhere, and we learn to revere the miracle that it was evolved at all.

### 2. NON-HARMONIC AND GREEK MUSIC

Music before the rise of a harmonic system is of two kinds, the unwritten or extemporaneous, and the recorded or scientific. At the present day the music of races that have not acquired Western harmony often pleases us best when it seems most extemporaneous. Tradition can go far to fix the forms and even the details of a performance that may, without the aid of words or dance, last for hours. With words or dance, music becomes more capable of being fixed by writing; but the first musical problems are as far beyond conscious reasoning as the origins of language. Birds solved them before human beings; and folk-music can show real beauty when the systematic music of its day is arbitrary and uncouth. Moreover, folk-music, together with the present music of barbarous races and Oriental civilization, can give us materials such as anthropology uses in reconstructing the past from its vestiges in the present.

For us the music of ancient Greece is by far the most important branch of musical archaeology. Unfortunately the approach to this most difficult subject has been blocked by lack of co-ordination between scholarship and musicianship; and the ascertained truth is less instructive to the general reader than the history of opinions about it. These opinions begin to be interesting when they are expressed by musicians whose music we can understand. The natural tendency of such musicians was to suppose that Greek music was like their own; and each advance in knowledge is marked by disillusion. The first difficulty presented by ancient Greek writers was sufficiently disconcerting. The Greek terms for "high" and "low" were found to be reversed. Our own meaning seems founded in nature; and science confirms it. Our "high" or "acute" notes demand tense vocal cords and correspond to vibrations of "high" frequency. A great 16th century composer, Costanzo Porta, inferred a mystery here, and argued that the Greeks had mastered the art of a totally invertible polyphony, such as Bach afterwards displayed in two fugues in *Die Kunst der Fuge*. Porta accordingly wrote a 4-part motet (*Vobis datum est cognoscere mysterium*) which could be sung upside down: and his contemporary Vincentino composed 4-part motets in each of the three Greek *genera*, diatonic, chromatic and enharmonic. (*See* Hawkins's *History of Music*, i. 112, *seq.*) They are as good as any other music written on *a priori* principles, and the enharmonic motet may be commended to some of our modern experimenters in quarter-tones. But they represent as much knowledge of Greek music as we possess of the inhabitants of Mars.

The truth must be sought by other methods and by far the most promising is the study and comparison of the present scale of nations, whether barbarous or cultured, who have not come into contact with the classical harmony of the West.

A readable account of musical origins may be found in Parry's *Evolution of the Art of Music*. Following the researches of A. J. Hipkins and A. J. Ellis, Parry illustrates the fact that most of the primitive scales, notably the pentatonic scales prominent in Scottish and Chinese music, are built around the interval of a downward 4th (as from C to G) which was probably the first melodic interval to become fixed in the human mind as being simple enough but not too wide. A scale would begin to form by the accretion of other notes near the bottom of this interval. Now take another 4th with similar accretions below the former, either conjunctly (as G to D below the C–G) or disjunctly (as F–C). The resulting scale will either fill or include an octave, it does not matter which; for the filled octave of the conjunct tetrachord contains in another position the notes of the included octave of the disjunct tetrachords, as can be seen in the combined series C, A, G, E, D, C, A, G. And the octave was recognized from the outset as a limit after which a musical series repeats itself.

The Greeks had three *genera* of scale: the diatonic, the chromatic and the enharmonic. Of these the diatonic divides the tetrachord most evenly, as E, D, C, B:A, G, F, E. This gives us our diatonic scale in what Palestrina would call the Phrygian mode. The Greeks found that all its notes could be traversed (as a knight's move can traverse our chessboard) in a series of intervals which they called concords. (They thought of them only as successions, not combinations of sound.) These were the 4th (in the ratio 4:3); the 5th (3:2); and the octave (2:1). (Our own "perfect concords" are in these ratios.) Scales with chromatic tetrachords (E, C♯, C♮, B:A, F♯, F♮, E) could also be traversed by the concordant intervals, but not so easily. The enharmonic tetrachords, which only the most accomplished singers could sing, were beyond the reach of perfect concords; and for us they would need a special notation, as E, C, B′, B ; A, F, E′, E♮; where B′ and E′ signify something like quarter-tones above the B♮ and E♮. Yet this difficult scale was said to be the oldest of all; which seems not unlikely when we observe that it gathers three notes closely to the bottom of the tetrachord, leaving a gap of a major 3rd from the top. Eliminate the quarter-tones, and there remains a pentatonic scale E, C, B:A, F, E, which is more likely to be the earliest filling out of the downward 4th than the scales in which the auxiliary note is a whole tone away. And if this nucleus had the prestige of a mystic antiquity musicians would feel a pious pride in mastering the difficulty of filling it up like the other genera.

If authorities on Greek music would abandon their habit of writing scales and reckoning intervals upwards, their results, whether correct or not, would become much more lucid. For, as Parry points out, it is only our harmonic system which makes us think of scales as normally rising; and when a musician applies the term "cadence" to chords that rise from dominant to tonic he contradicts the literal meaning of the word.

Until the most recent times classical scholars have ruthlessly closed the door upon all hope of further light from the comparison of Greek data with the phenomena of extant non-harmonic folk-song and Oriental scales. If such a comparison is to have any meaning we must assume that the now universal phenomena of modes existed in ancient Greece. Modes, as far as non-harmonic melody is concerned, are various cross-sections of a standard scale. Thus, Scottish music shows very clearly five pentatonic modes. Adding the 8ve to complete the scale, these are, 1. C, A, G, F, D, C; 2. D, C, A, G, F, D; 3. F, D, C, A, G, F; 4. G, F, D, C, A, G; 5. A, G, F, D, C, A. In the article HARMONY the ecclesiastical modes of pure polyphony are given with their fondly-imagined Greek names. Pre-harmonic music without modes is contrary not only to our Western prejudices but to the whole trend of anthropological research. In these circumstances classical scholars, under the guidance of D. B. Monro, crushed all hopes by deciding that the Greeks had no modes at all, but that either their ἁρμονίαι or their τονόι (the terms, whatever they mean, are not synonymous) were mere transpositions of the three genera into various pitches, just as our "keys" are transpositions of our pair of major and minor modes.

When Monro published his *Modes of Ancient Greek Music* in 1894, musicians had learnt too well the lesson that Greek music must not be expected to make sense. They would never dispute a point of classical scholarship; and it did not occur to them that Monro might be just so innocently familiar with modern music as not to realize that he might as well impute high-church tendencies to Alcibiades because of "the splendour of his liturgies" as impute to the ancient Greeks a system of keys related by mere transposition. But musicians only thought that even the most unprejudiced anthropological comparison of extant scales could prevail no more than Macfarren's Victorian assumptions could do in a dispute with Monro. Fortunately in 1916 Mr. G. H. Mountford, in a degree thesis, satisfied classical scholars that Monro was in error and that the Greek modes were modes in the universal and proper sense of the term.

Miss Kathleen Schlesinger has found, by experiments with a monochord, a means of producing modes on mathematical principles. Certainly the Greeks did measure musical intervals mathe-

matically on a string; certainly Miss Schlesinger's system is among the very first things that could have happened in that way; and its results produce many phenomena that ought to have occurred in ancient Greek music. There is, for instance, a remarkable passage in Plato's *Republic* (VII., 531) where Socrates gibes at the pedantries of the merely practical musicians who spend hours in arguing whether this and that note are too near to allow another note between them. And Miss Schlesinger's various scales comprise between them notes quite close enough to explain how the practical musician could get into difficulties about what was obvious to the philosopher. Miss Schlesinger has, moreover, tuned a pianoforte on the basis of her theory, and the result is acoustically very interesting. So much then, for *a priori* theory and practical experience. If Miss Schlesinger's results are not Greek they ought to have been.

The other line of approach is through the experience of setting the choruses of Greek tragedy to a modern music which confines itself to a strict representation of the metre and sets strophe and antistrophe to the same melody. The composer should not attempt Greek modes, on whatever theory, or he will achieve nothing better than an effect of singing "We won't go home till morning" on the supertonic of a minor key and with a beat missing. Instead of thus warping his imagination the composer should translate all that modern culture enjoys in Greek poetry into a music that he can enjoy; restricting himself mainly to one note to a syllable and, while making his instrumental accompaniment as beautiful as he likes, straying into no by-paths of musical tone-painting other than the most natural symbolisms. The Greek rhythmic forms prove musically fascinating, and there is full scope for fine melody within them. The strict correspondence of strophe and antistrophe causes difficulties which reveal much. Even a unisonous accompaniment, such as the Greeks had, can glide over a difference of punctuation or indeed a running on of the sense between strophe and antistrophe, as at the end of the enormous first chorus of *Agamemnon;* and the technique of such compromises closely resembles that of Schubert and Brahms in strophic songs, and has the subtlety of Greek simplicity. Aristophanes, in the *Frogs,* laughs at the interlinear *θρατο θρατο θρατ* (or "plunketyplunk") of the Aeschylean lyre. The passage seems to indicate something more extensive than a merely connective tissue; but exaggeration is not unknown in comedy.

More difficult and therefore still more instructive are the occasional contrasts of sentiment between strophe and antistrophe. In another chorus in *Agamemnon* the pretty ways of a lion-cub are to be sung to the same music as the tale of disaster that befell the man who adopted it when, on growing up, it behaved as might be expected. The highest point of pathos in the first chorus, one of the supreme things in poetry, is the moment where the description of the sacrifice of Iphigeneia turns into a reminiscence of her singing in her father's halls and then runs on into the antistrophe, with the words "The rest I saw not, nor will I tell." After which the same music has to express the pious hope that the queen who now approaches shares the wishes of the chorus for the welfare of the land she holds in trust.

From Plato we learn that musicians degraded themselves by imitating the roaring of lions and the whistling of winds. But what was the Greek criterion for the singing voice? Certainly very different from ours; for Aristotle says that certain high-pitched modes (but what is "high" in this context?) are suited to the voices of old men. An age-limit is the only criterion the heartless modern critic has for the voices of old men. Be this as it may, the safest inference from it is that every educated Greek was expected to sing well as an integral part of the art of speaking well. Perhaps our modern contrast between the singing and the speaking voice did not exist. Nowadays it is not uncommon to find a high soprano speaking normally around the A or G below the treble staff.

(*See* also ARISTOTLE; ARISTOXENUS; EUCLID; PYTHAGORAS.)

### 3. HARMONIC ORIGINS

The latent harmonic sense of the Greeks is shown in the fact that their diatonic scale was amenable to the Pythagorean science of harmonic ratios. And we cannot suppose that no notice was taken of the combined sounds resulting from reverberation in halls and caverns, or from striking several strings of the lyre at once. Yet the fact remains that outside the orbit of our own Western music of the last six centuries we know of no harmonic system that has advanced beyond drones below the melody and cymbals (our Authorized Version is right in reading "tinkling cymbal") or bells above it.

Music, as we now understand it, consists in the interaction of three elements as inseparable (but not as interchangeable) as the three dimensions of Newtonian space. The Greeks knew two, rhythm and melody, which are as ancient as human consciousness and evidently have their meaning for some other animals. But non-harmonic melody is a very different thing from melody that implies harmony. (*See* MELODY exs. 1 and 2 with their discussion.) When we hear an unaccompanied folk-song we involuntarily think of it as the top line of a series of harmonies. If it is really pre-harmonic it will prove unamenable to that interpretation, and then we shall think it quaint. Neither the quaintness nor the harmonic interpretation ever entered into its intention. Life is too short for Western musicians to devote much of it to the violent mental gymnastics of thinking away the harmonic ideas that have made Western music enjoyable throughout five centuries. We may perhaps widen our experience by going back another two centuries; for it was agreed by all the musicians in Vienna that a concert of "Gothic" music was their most interesting musical experience of the year 1928.

In the article HARMONY the main steps are indicated by which mediaeval musicians advanced from doubling melodies in 4ths and 5ths (as the unoccidentalised Japanese are said to be doing now) to an aesthetic system of polyphony that demands complete independence in its melodic threads and forbids consecutive 5ths and 8ves as barbarous. The details of this evolution are abstruse; but two main issues may be mentioned here. Polyphony could not have been established without fixed scales and a repository of known melody for composers to work upon.

The scale was set in order in Graeco-Roman times by Ptolemy the astronomer, who flourished A.D. 130 and from whose time the history of the "ecclesiastical modes" becomes continuously traceable until the records of music are secured by the art of printing.

The necessary repository of melody was supplied by the ancient plain-songs of the church, many of which claimed to have come uncorrupted from the music of Solomon's temple and certainly had a continuous history reaching back to early Christian services in the catacombs of Rome. In A.D. 384 a large body of these "tones" was set in order by St. Ambrose. According to a tradition accepted, after some "historic doubts," by good authorities, St. Gregory revised and enlarged the Ambrosian collection; and the whole corpus of Gregorian music undoubtedly familiarizes Roman Catholics of to-day with a music enormously more ancient in its origin than any harmony. This music forms the principal melodic foundation of Palestrina's polyphony; but by his time it had become corrupted, and we must look to the Solesmes edition of 1904 for the text and method of singing plain-song in the perfection it is held to have attained shortly after the death of St. Gregory. The essential difference between the Ratisbon tradition (which we may loosely call Palestrinian) and that of Solesmes is that the Palestrinians impatiently curtailed the flourishes of the plain-song much as Palestrina did with the Gregorian themes he used in polyphony; whereas the Solesmes method restores the free speech-rhythm which makes the flourishes (or melismata) possible in a rapid delivery. Some of these melismata are very extensive, and the Palestrinians (who gradually developed the modern organist's habit of providing each note of a Gregorian melody with a separate chord) had some excuse for mistaking them for corruptions of style.

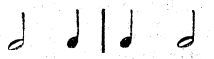
The Gregorian tradition did not stand alone. There was an ancient Visigoth (or "Spanish") tradition; and there are the traditions of the Eastern Church. Professor J. J. W. Tillyard has shed much light on Byzantine music (*q.v.*), including a promising opening in the deciphering of the earliest *Neumae,* diacritical signs above the words, supposed to indicate musical notes.

He uses the method of interpreting the past from vestiges of primitive usage in the present. Controversies as to the number of modes, whether 8 or 12, raged till late in the 16th century. The *Dodecachordon* of Glareanus settled the question in favour of twelve, as its name implies. Meanwhile composers developed polyphony by ear and got no help whatever from the theorist. Quite independent of modes and entirely practical was the hexachord scheme (*see* HEXACHORD) developed in the 11th century by Guido of Arezzo (*q.v.*).

The general reader may learn something of the hexachord system very pleasantly from the music-lesson in *The Taming of the Shrew*. Hortensio's gamut says "Gamut am I, the ground of all accord . . . D sol re, one clef [*i.e.*, sign, or key], two notes have I: E la mi: show pity or I die." "Gamut" is a survival of Greek tradition; for the bottom note of the Greek scale was identified with the bass G, and this "ground of all accord" is an octave below the Ut of the hard hexachord. Hence it is Gamma-ut. D is Sol in the hard hexachord $\left\{\begin{matrix}\text{G, A, B, C, D, E}\\\text{Ut Re Mi Fa Sol La}\end{matrix}\right\}$ and Re in the natural hexachord $\left\{\begin{matrix}\text{C, D, E, F, G, A}\\\text{Ut Re Mi Fa Sol La}\end{matrix}\right\}$. It has two names but only one position or "clef," unlike B which has to be flattened in the soft hexachord (F to D). (Morley writing in 1597, calls A flat the B clef.) E is La in the hard hexachord and Mi in the natural hexachord.

Between Fa of the natural hexachord and Mi of the hard hexachord a dissonant tritone 4th exists. It gave great trouble to mediaeval musicians, who assigned it to the devil. *Mi contra Fa est Diabolus in Musica.*

To the early harmonic and contrapuntal processes alluded to in the article HARMONY some details must be added. The famous unwritten songs of the aristocratic troubadours or *trouvères* of the 12th and 13th centuries undoubtedly set the fashion in melody, and probably set it in the direction of *Sumer is icumen in;* that is to say, in the Ionian mode (that *modus lascivus* that is identical with our major scale) and in a lilting trochaic rhythm



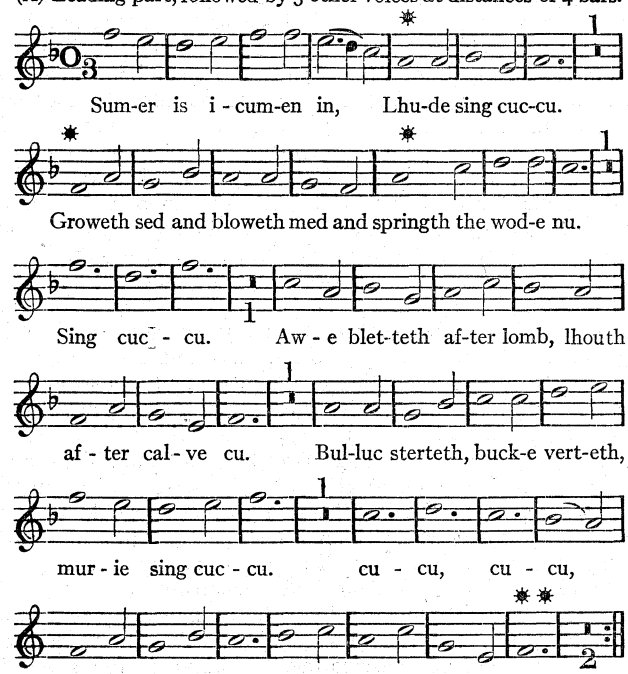
*Sumer is icumen in* contains no technical feature that has not been found in other compositions of its period, but nothing within two centuries of it achieves either its euphony or its easy handling of canon in four parts on a canonic bass in two. Its consecutive 5ths which sound licentious to us were in its own day the sole justification of the scheme.

It confirms other evidence that the imperfect concords (3rds and 6ths) must have obtained squatter's right in music in spite of theorists; for a very early practice known as ghimel or gymel consisted in singing in 3rds. This is not merely doubling, for the 3rd must oscillate between major and minor according to its position in the scale; and this adjustment requires an advanced harmonic system. When scholars tell us that singing in 3rds was traditional in Britain before the Roman Conquest, we must demur, especially when they tell us (in *Grove's Dictionary of Music and Musicians,* 3rd edition) that we must not expect to find written records of "so simple a process." Similarly we must not expect to find ancient Greek written records of so simple a process as steam locomotion. Still, let us not be unduly sceptical as to the extent to which popular licence and unrecorded extemporisation could advance beyond all the theoretic lore that scribes will record.

The troubadours disdained both the practice of accompaniment (which they left to their servants) and the art of scientific or written music. Not until the time and work of Adam de la Hale, surnamed the Hunchback of Arras (*c.* 1230–1288) can we trace the development of the troubadour into the learned musician. Nearly a century later, when literature is unbending from its universal Latin and becoming truly universal by becoming vernacular, we find the poet Machault, who stands with Petrarca among Chaucer's masters in the technique of verse, producing music that marks a technical advance discoverable by grim toil of expert analysis. But so far we may pardonably dismiss all such

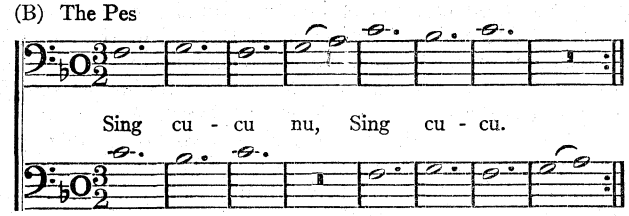
Ex. 1. *Sumer is icumen in.*

(A) Leading part, followed by 3 other voices at distances of 4 bars.



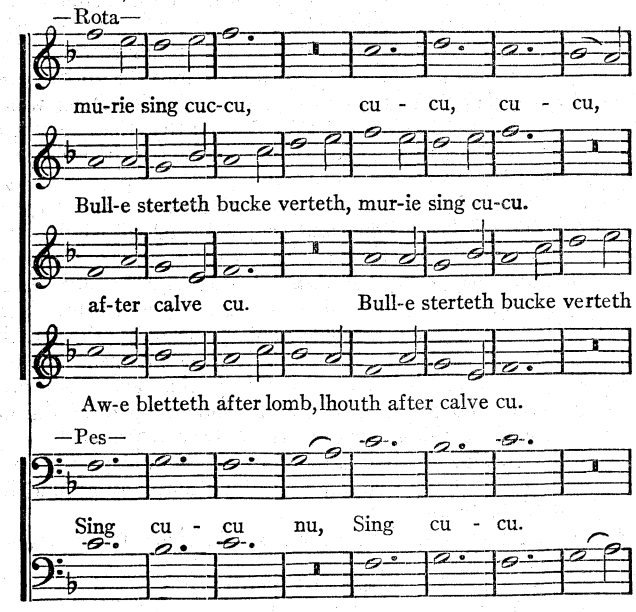

Repeat ad infinitum; each voice ending at ✱✱.

(B) The Pes




Repeat so long as the upper voices are singing

(C) Bars 33–40 in score. (The reader may with pleasure and profit make his own score of the whole, or, still better, sing it with five friends, from the above.)



archaic work (except *Sumer is icumen in*) with Burney's sly comment on the earliest piece of recorded music known to him: "It is not of such excellence as to make us greatly regret the loss of such music; though the disposition of those who were pleased by it may have been a great blessing to them." When music is too archaic or inaccessible to give us aesthetic data more may be learned from the disposition of those who were pleased by it than from its recorded technical data.

Before the middle of the fifteenth century music had passed for ever out of the stage at which we need know other things of the composer than his music. As early as 1437 an Englishman, John Dunstable, had acquired a European reputation. The Golden age of the 16th century had no use for archaic music, and Morley in his *Plaine and Easie Introduction to Practickall Musicke* quotes Dunstable much as we might now quote Bach if all Bach's works were lost except for traces of contemporary hostile criticisms and awe-inspired laudations. To call Dunstable the "inventor of counterpoint" is no better than to call Cadmus the inventor of the alphabet. But he is the earliest composer whose polyphony is in direct line with that of the golden age; for Dufay the first important master of the Netherlands, where the true polyphonic tradition was for long thought to have originated, is now known to have died in 1474, twenty-one years after Dunstable. And when Dr. Walker, in his *History of English Music* praises a motet by Dunstable for its extraordinary distinction of style, he is indulging in no pious fancies but is describing permanently intelligible aesthetic values. By the end of the 15th century counterpoint was substantially fixed, practice was still imperfect and aims were uncertain, but skill was increasing and in the 16th century we leave archaic music behind.

### 4. THE GOLDEN AGE

From this point onwards the history of music is best studied in the masterpieces of the art. Each period has its own art-forms. Articles relevant to the Golden Age are HARMONY, Section 3; INSTRUMENTATION; CONTRAPUNTAL FORMS; COUNTERPOINT; MADRIGAL; MASS; MOTET; with the biographies and critical notes on PALESTRINA, GIOVANNI; VICTORIA; LASSO; TALLIS; MORLEY; BYRD. *See* also AICHINGER; ALLEGRI; ANERIO (G. and F.); ANIMUCCIA; ARCADELT; BATESON; BENNET (J.); BULL; DES PRÉS (Josquin); ECCARD; FARRANT; GABRIELI (A. and G.); FESTA (Constanzo); GIBBONS (O.); GUERRERO; HANDL (Gallus); HASLER; ISAAC (Heinrich); MARENZIO; MORLEY (Thomas); OBRECHT; OKEGHEM; SWEELINCK; TAVERNER; WEELKES; WILBYE.

The external history of music is not so easily brought into true relation with the art as popular legends would have it. Everybody is familiar with the story of the drying up of polyphony in the foolish ingenuities of Flemish contrapuntists until, at the behest of the Council of Trent, Palestrina wrote the *Missa Papae Marcelli* in a pure and simple style which convinced the authorities that polyphonic music could be devout. The facts are not quite so simple. Undoubtedly there was a great deal of barren ingenuity in the work of the lesser Flemish masters; and the great Obrecht himself had written masses in which the liturgical text is drowned beneath five other texts which each voice sings to other plain-chants and themes of old songs. The secular tunes thus freely introduced were not always sung as *canti fermi* too slow to be recognized. Recognition sometimes even led to the singing of the original words. One old song, *L'homme armé*, became the string round which every possible ingenuity crystallized in the composition of the Mass. There is no reason to doubt that the state of church music both deserved and received the serious attention of the Council of Trent.

On the other hand, not all Flemish music was silly, and many of the quaintest "canonic" devices were really nothing but harmless cryptography applied to music that was composed on purely artistic lines. Burney discovered this when, with his usual *flair* for good illustrations, he quoted some dry ingenuities from Okeghem (or Okenheim) and followed them by the wonderful *Deploration de Jehan Okenheim* by that master's great pupil Josquin des Prés who is the first unmistakably great composer and who has been well named "the Chaucer of music." No listener can fail to recognize, from anything like a competent performance, the spontaneous beauty and poetic depth of this music, throughout which, while the other voices sing an elegy in French, the tenor intones in Latin the plain-chant of the Requiem beginning on a note a *semitone lower* than the liturgical pitch, and continuing in the wailing melodic mode thus produced. Burney had the wit to see that the "canon" *ung demiton plus bas* did not mean that some other part was to answer the tenor in canon, but was merely the "rule" for reading the cryptogram, the tenor being written at the normal pitch.

Many Flemish devices are well calculated to give coherence or climax to a large composition. One voice may wander up and down the scale with a single figure and a single motto-text while the other voices tell their whole story in polyphony. For instance, declaim the words *Miserere mei Deus* in monotone rising one step just for the first syllable of *Deus*. Start on the fundamental note of the scale, and at intervals repeat the phrase a step higher each time. After reaching the 5th degree go down again. Josquin's *Miserere* is a setting of the whole 51st Psalm, woven round a tenor part entitled *Vagans* and constructed on this plan. It is one of the first mature masterpieces in the history of music. Palestrina's art is too subtle for rigid Flemish devices; but once, in one of his finest motets, *Tribularer si nescirem* he uses Josquin's *Miserere* burden in exactly Josquin's way. Lasso is thoroughly Flemish in both sacred and secular music; and in a motet on the resurrection of Lazarus he makes a soprano *Vagans* cry *Lazare, veni foras* from the beginning of the narrative until the chorus reaches these words, and joins in with them in triumphant polyphony.

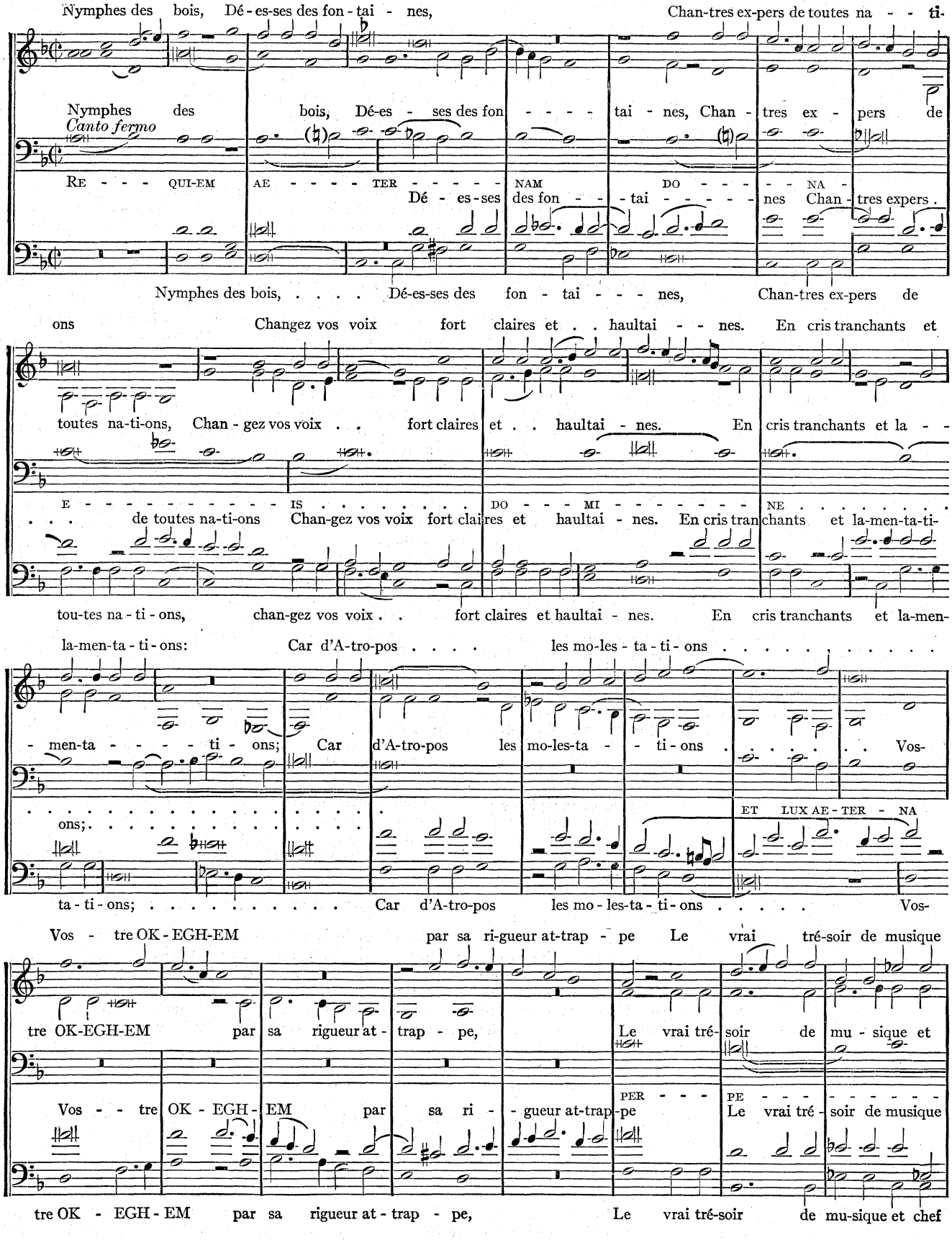
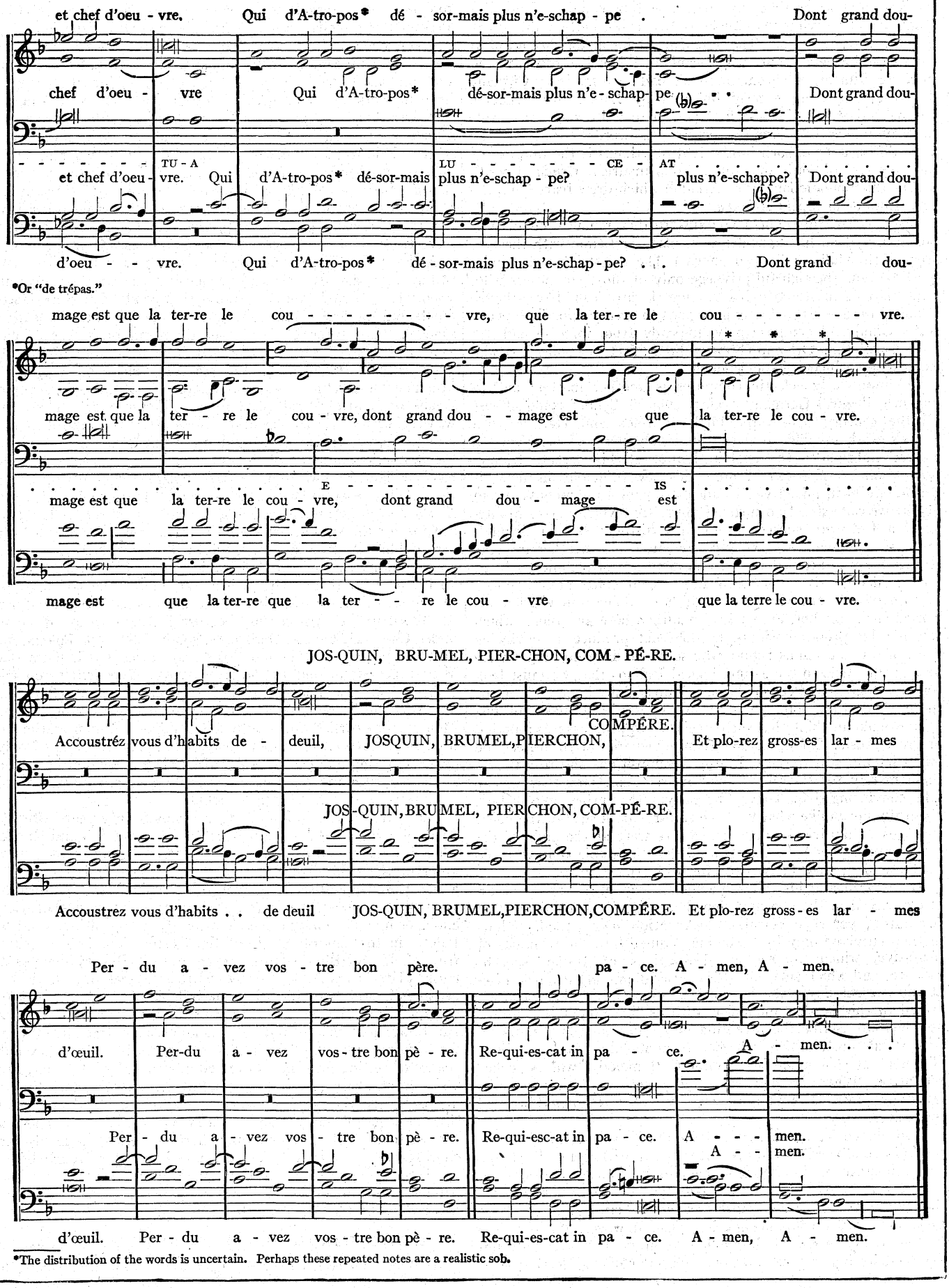
We must not, then, be misled by the ecclesiastical tradition that condemns Flemish music wholesale. In any case the concern of the church authorities was liturgical rather than artistic. The bishops would have been for the most part glad enough to see Church music restricted to the note-against-note style of Palestrina's litanies, *Stabat Mater, Improperia* and last book of *Lamentations*. A very sublime style it is, and Tallis's Responses, in their authentic form, are a noble illustration of it. But, as Dr. Jeppesen (*The Style of Palestrina and the Dissonance*) has clearly shown, Palestrina's *Missa Papae Marcelli* shows special signs of being a deliberate demonstration that a high degree of polyphony can be reconciled with clear choral delivery of the words. Certainly the ecclesiastical authorities did not long succeed in preventing the use of secular themes in church music.

Many great musicians of to-day have a musical culture which ignores the Golden Age; and a knowledge of Palestrina is still considered, as it was in the days of Bach and of Beethoven, rather an out-of-the-way specialty. This is like a culture based on Latin and sceptical of Greek; good as far as it goes, but limited and cocksure like an 18th century gentleman's artistic impressions of the Grand Tour. An illustration of the most perfect style of the Golden Age is appended to the article MOTET.

### 5. THE MONODIC REVOLUTION AND ITS RESULTS

Until Palestrina's art attained its height, the path of progress in music for the best part of two centuries was that of purity. It was not the free and bold spirits but the idlers and dullards who broke rules and disliked contrapuntal forms. The Hispano-Roman style of Victoria and Palestrina was not everything. It was not secular (though Palestrina's madrigals make him as supreme in that form as in church music), and it was not, like the glorious English polyphony, experimental or racy of the soil. But it was metropolitan, and the boldest of the Tudor composers would have been no such fool as not to hold it supreme. But already before the death of Palestrina a new music was groping towards the light; and for this music the path of progress was no more that of purity than the path of omelette-making is that of the conservation of egg-shells.

Eve's apple was not more fatal to man's earthly paradise than the rise of instrumental music and dramatic solo declamation was to the hope of continuing the Golden Age of music into the 17th century. The revolution did not consist in this detail or that. To

Ex. 2. *La Déploration de Jehan Okenheim*, for soprano, male alto, two tenors and bass
(Barred according to the main rhythms.)
Phrygian mode transposed.
by JOSQUIN DES PRÉS

*The distribution of the words is uncertain. Perhaps these repeated notes are a realistic sob.

say that Monteverdi "invented" the dominant 7th, or that anyone else invented it, or that any such invention could revolutionize music, is like saying that Shakespeare revolutionized drama by inventing strange oaths. The important point is not the technical names of the details but their meaning. When Lasso was young some experiments in chromatic music had been made by Cipriano de Rore, and were eagerly imitated by Lasso. But what is Lasso's object in being the first person to write such an out-of-the-way note as A♯? Simply to express the words *"novum melos."* Very different from such intellectual playthings is the purpose of the powerful discords of Monteverdi's madrigal *Cruda Amarilli* and of the monodic lament of Ariadne which drew tears from the spectators of his opera *Arianna.*

The article MONTEVERDI contains further remarks on his importance and on his coincidence in place and time with the creators of the violin. (*See* also OPERA.) The Palestrina style henceforth became the rightful privilege only of those composers who, either having mastered it before monody arose, or, like Orlando Gibbons (1583–1625), living in regions too remote for it to penetrate, could still compose polyphonically from impulse and not from asceticism. Orlando Gibbons did, in fact, try some monodic experiments which are poor enough.

An impulsively eclectic composer is another matter; and in uncouth, illogical Germany a giant such as Schütz could almost fill the century before the birth of Bach and Handel, with a life's work ranging from the pure polyphony of his Venetian master Gabrieli to the exploitation of all his "astute friend" (*scharfsinniger Freund*) Monteverdi's new principles in most gigantic efforts in mixed vocal and instrumental polyphony. From Schütz we can extract no such system as that which makes Monteverdi a favourite subject in musical history; but in Schütz's chaos the elements may at any moment come together in some strange work of art that fits into no historical or technical scheme but speaks clearly to us through its own coherence. Schütz's "astute friend" always knows what he is doing and whither his work is leading; but, except in a madrigal here and there, which was not his proper business, he does not produce a convincing work of art so often as Schütz who seems to have no proper business at all. It is to the astute, logical Italians that we must look for the progress and consolidation of musical art in general during the 17th century; but we must not let the enthusiasm of historians make us think that such a century of progress was a period of great music. The historians themselves are apt to neglect the intrinsic values of the 17th century compositions and to estimate them merely for their tendency towards something that was to take convincing shape later. The early 17th century was, in fact, musically not unlike what we have so far experienced of the 20th; the eyes of musicians and music-lovers were at the ends of the earth prophesying Wagner, when all that the whole century could finally achieve was the *da capo* form of aria.

Monteverdi and his fellow monodists had, in no mood of caprice, moved in the one direction that was universally important for music; yet their formless declamation soon palled, and its method survived only by becoming codified into the formulas of recitative, which are happy idealizations of Italian speech-cadence, and which survive as dramatic idioms in all music even at the present day. The "invention" of recitative has been ascribed to this or that monodist, with as little room for dispute as when we ascribe the invention of clothes to Adam and Eve. Any vocal music which, whether from inability or from disinclination, avoids organizing symmetrical melody, will be called recitative. When Wagner was still a subject of controversy, critics on both sides used to say that *Das Rheingold* was all recitative.

Two tendencies converged to make music become formal after the "first fine careless rapture" of monody was spent. First, the dramatic stage, with baroque scenery in magnificent development as early as 1667, in Cesti's *Pomo d'Oro,* greatly encouraged the ballet; so that when serious musicians cultivated the stage they also cultivated dance-music. This, however, was less important than the rise of the violin. Monteverdi had already understood its importance; and one symptom of the decadence of polyphony had been the growing habit of solo-singers to sing the top parts of madrigals with all manner of ridiculous flourishes. Persons less legendary than King Cole felt the fascination of the "tweedle-dee" of the fiddle; the great Dutch polyphonist Sweelinck (*q.v.*) used to adorn his organ works with passages of *imitatio violinistica;* and the last quarter of the 17th century saw the brilliant work of Biber with his queer abnormal violin-tunings, and the sober classical *sonate da chiesa* and *sonate da camera* of Corelli (*q.v.*). Artistically as well as morally this development of the violin was healthier than that of the voice, wherein coloratura singing tended to become an acrobatic monstrosity though it had first been regarded as a means of emotional expression. A talent for the violin was no danger to a boy; but a beautiful voice put a boy in deadly peril in an age when all the great opera-singers were *castrati.* Even Haydn had a narrow escape in his youth.

And yet there is, on the whole, more beauty than decadence in the vast mass of solo vocal music produced between 1630 and 1760. That period takes us from the advent of mature instruments and instrumentalized music to a time beyond the death of Handel. Except for the device of the ground-bass (*see* VARIATIONS) the first form that emerged from chaos organized itself on a method of balance between a solo voice and a group of instruments, together with a development of melodic form by means of a firmly-established classical key-system. The result was the classical aria, one of the most effective art-forms ever reduced to the capacity of normal musicians. It entirely destroyed the dramatic character of opera for a whole century; but this has been lamented with unnecessary vehemence. With the exception of the early monodic works and of Purcell's *Dido and Aeneas,* opera before Gluck is not an art-form at all; it is merely a name for the spectacular conditions under which the 18th century public could be induced to listen to a string of thirty arias by one composer who could either handle no other forms or find no listeners for them. The article ARIA shows the intimate connection of this form with that of the CONCERTO. Other art-forms developed in the 17th century for use in the 18th are discussed under CANTATA, OPERA, ORATORIO, SONATA, SONATA FORMS, and SUITE. Matters of style and texture are discussed in CHAMBER MUSIC, HARMONY and INSTRUMENTATION. The articles on monodic composers include CACCINI, CAVALIERI, CESTI, PERI and MONTEVERDI, besides ARTUSI and BANCHIERI who wrote against Monteverdi's earlier works with well-grounded demonstrations of their subversive effect on pure polyphony. The survival of polyphony in grimy and pompous decadence is represented by Pitoni, and later and more as a renascence by LOTTI. Early violin music is represented by BIBER and CORELLI.

The short career of PURCELL (*q.v.*) ends twenty years after the death of Schütz and ten years after the birth of Bach and Handel. Almost any random quotation from Purcell might be by a composer of the calibre of Bach or Handel. Purcell is one of the greatest contrapuntists that ever lived; one of the greatest inventors of themes; one of the greatest masters of declamation; and a completely mature master of early orchestration. And his fellows in the English music of the Restoration, Pelham Humfrey, Child and Blow were no mean spirits. Burney devotes an entire plate in his *History of Music* to examples of "Dr. Blow's crudities"; and later historians need look no farther afield for examples of intelligent prophesy. But the Restoration music lacks one thing; and that is power of composition. Purcell, in small dance-forms and short lyrics, is unsurpassable. But his only chance of getting through a sustained movement is when he writes on a ground-bass. In this fascinating forlorn hope of English music we see the fruit of nearly a century of bold endeavour ripening a generation too soon. Parry ascribes the patchiness of Purcell to the subtle humour of Charles II. in sending his best chorister to learn from Lully, the master of the French ballet-opera, how to write English church music. But Lully is not patchy, and Purcell's music is a crazy-quilt, purple with foreshadowings of the music of the future.

### 6. BACH, HANDEL AND THE NEAPOLITAN SCHOOL

If all music between 1685 and 1759 were annihilated except the

BY COURTESY OF (2) COPR. THE NATIONAL PORTRAIT GALLERY, LONDON; PHOTOGRAPHS, (1, 5) THE PRESS PORTRAIT BUREAU, (3, 4, 6-12) RISCHGITZ, (13) PHOTOGRAPHISCHE GESELLSCHAFT, BERLIN, (15, 17) BROWN BROTHERS, (16, 19, 20) WIDE WORLD PHOTOS, (18) INTERNATIONAL NEWSREEL

## EUROPEAN MUSICIANS, 16TH–20TH CENTURY

1. Giovanni Pierluigi da Palestrina (1525/6–1594), Italian
2. Georg Friedrich Händel (1685–1759), German
3. Johann Sebastian Bach (1685–1750), German
4. Joseph Haydn (1732–1809), Austrian
5. Wolfgang Amadeus Mozart (1756–91), Austrian
6. Ludwig van Beethoven (1770–1827), German
7. Nicolo Paganini (1784–1840), Italian
8. Franz Peter Schubert (1797–1828), Austrian
9. Frédéric François Chopin (1810–49), Polish
10. Robert Alexander Schumann (1810–56), German
11. Franz Liszt (1811–86), Hungarian
12. Richard Wagner (1813–83), German
13. Johannes Brahms (1833–97), German
14. Joseph Joachim (1831–1907), German
15. Johann Strauss, The Younger (1825–99), Austrian
16. Maurice Ravel (1875–1937), French
17. Claude Achille Debussy (1862–1918), French
18. Richard Strauss (1864– ), German
19. Giacomo Antonio Puccini (1858–1924), Italian
20. Igor Stravinsky (1882– ), Russian

work of Bach and Handel, the ordinary music-lover would miss nothing but a large collection of decorative and decorous violin music and a still larger collection of arias; and to most of these favourite *gemme d'antichità* the mid-19th century editor has contributed much of their lusciousness. For us the age of Bach and Handel is the age of nobody else in music. But the contemporaries of Bach and Handel thought of Handel as a fashionable opera-writer who with advancing years developed choral music as a pious fad; while nobody thought of Bach except people within coaching-range of Saxony where Bach was known as a wonderful organist and an impracticably deep scholar. The polyphony of Bach and Handel stands almost alone in an age when polyphony was utterly unfashionable. It was inculcated as a staple subject in musical education; but to carry it into mature art was to discuss Latin grammar in the drawing-room. The opportunities and the difficulties of early symphonic orchestration alike arose from the neglect of polyphony after 1750. Apart from Bach and Handel, that neglect can be traced much further back; and it characterized musical connoisseurship much later; so that Burney could say of Philipp Emanuel Bach that wherever he got his beautiful and natural style from it was not from his father, for that eminent organist, though profoundly versed in all devices of canon and fugue, was so fond of crowding all the harmony he could into both hands that he must inevitably have lost melodic grace.

The vast and accurately-perfected aesthetic system of Bach and the improvisatorial opportunist eclecticism of Handel are discussed in the articles on those masters, and also under the headings of ARIA, CANTATA, CONCERTO, CONTRAPUNTAL FORMS, COUNTERPOINT, FUGUE, HARMONY, INSTRUMENTATION, ORATORIO, SONATA FORMS and SUITE. But, while this information covers the aesthetic values of the period, it tells us little of its historic trend. We must not look for light from the "spirit of the age" as shown in its politics or even in its religious history. Palestrina writes, from habit and preference, a devout music which neither Luther nor the Council of Trent could blame as representing the spirit of the age; and Bach achieves the ideal Lutheran music while Voltaire is at the court of Frederick the Great.

The music that pleased the contemporaries of Bach and Handel was that which continued, not too elaborately, the Neapolitan tradition founded by Alessandro Scarlatti. Lully (an Italian by birth) took this tradition to France, and transformed Italian opera by encouraging the French taste for the ballet. Rameau, greatest of classical French composers and epoch-making theorist, carried on the Lully tradition in opera, and joined forces with the exquisite school of clavecinistes, whose leader, Couperin, was admired and imitated by Bach in his suite-forms. Italian violin music and concertos in the Neapolitan style were produced by composers who were also great players. The enormous industry of Bach and Handel was nothing unusual. Arias could be written as easily as letters, and distributed by thirties in operas. Oratorios and church music, though less fashionable, were more highly organized; mainly because they kept choral music in being. And thus the Neapolitan tradition of choral music passes straight into the polyphony of Mozart, quite independently of Handel and wholly ignoring Sebastian Bach, of whom Mozart knew not a note until he was grown up. Meanwhile cultured Europe was unvexed by doubts as to who were the immortals. The Handel-Bononcini rivalry had been little more than a nine-days' wonder. Six years after Handel's death, the seven-year old Mozart in London dedicated his violin-sonatas to Queen Charlotte in the hope that under Her Majesty's protection "je deviendrai immortel comme Haendel et Hasse." Graun would probably have been the third name of European repute; and Telemann, the most voluminous composer of his voluminous day, was a great figure in his own country. As for Bach—everybody in London knew Mr. J. C. Bach, of the Bach and Abel concerts, and report said that his father had been a great musical scholar.

Behind the dignified musical history, but not (like Sebastian Bach) aloof from it, vital forces were at work in comic music-drama. This was admitted by way of *intermezzi* between the acts of serious operas. One of these intermezzi, *La Serva Padrona* by Pergolesi (known in the 19th century by his conventional *Stabat Mater* for two-part female chorus) not only broke from its moorings, like many other intermezzi, but found its way to Paris where it created a furore of popular success and precious disputation dividing musical Paris into *Buffonnistes* and *Anti-buffonnistes*. Except for the untimely blossom of English opera in the hands of Purcell in the previous century this is the only moment at which opera after Monteverdi and before Gluck (with all respect to Rameau) becomes a genuine art-form instead of a concert on the stage.

Biographical articles dealing with the following named composers who belong to this period: the violin writers CORELLI, GEMINIANI and TARTINI: the clavier writers COUPERIN and D. SCARLATTI (the Paganini of the harpsichord and a most unclassical son of the founder of classical tonality); the opera writers (which meant the all-round musicians) DURANTE (Francesco), GALUPPI (who certainly never wrote Browning's "sixths diminished, sigh on sigh"!), LEO (Leonardo), PERGOLESI and SCARLATTI (Alessandro). RAMEAU is equally important in three capacities as a master of French opera, a livelier master of instrumental music, and an epoch-making theorist. German beginnings of serious and comic music-drama were sumptuously inaugurated at Hamburg by KEISER (*q.v.*) whose influence is traceable in Handel's first opera *Almira*.

### 7. THE RISE OF DRAMATIC MUSIC AND THE SONATA STYLE

The fashionable distaste for polyphony was a mere negative force in the early 18th century. The positive force was, as in the monodic revolution a hundred and fifty years earlier, an impulse towards drama. Unlike the monodists who, when they rejected polyphony had no power of composition beyond the single musical sentence, the 18th century musicians could easily cover ten minutes with a well-balanced form; and the problem of making such forms dramatic was no longer confined to the monodist's problem of making them rhetorical. On the contrary, the rhetoric had to be demolished; for the action of drama is not the action of rhetoric.

The distaste for polyphony was no unfavourable condition for the rise of dramatic music; it was the inverse aspect of a growing sense of contrast in various textures cheap and valueless in themselves. The rest of the story is told in the articles, INSTRUMENTATION, HARMONY, OPERA, SONATA FORMS, and GLUCK, BEETHOVEN, HAYDN, MOZART.

It is inadequate to call Gluck a "reformer" of opera. Music itself was not dramatic before Gluck made it so. Hence it is a mistake to separate Gluck's "reform" from the whole process of the development of the sonata style. Lastly, we miss the whole meaning of that style unless we realize that as soon as it arose the purely instrumental music became more dramatic than any drama. At the same time it also became more powerfully architectural than any earlier music. The art comprised in the works of Haydn, Mozart, and Beethoven constitutes one unbroken aesthetic system, more universal in emotional range than any art since Shakespeare, and as perfectly balanced as the arts of ancient Greece. Until the end of the 19th century it would have seemed a paradox to maintain that Beethoven's work belonged to the same aesthetic system as Haydn's and Mozart's; for critics were slow to escape from the habit of estimating works of art by the face-value of their subjects and the dignity of their language. And the language of Haydn and Mozart corresponds with that of the comedy of manners, while Beethoven is the most tragic composer that ever lived. Nevertheless the huge expansion which music underwent at Beethoven's hands was no revolution, and the popular idea of Beethoven as a revolutionary artist is based on two errors; first, the commonplace habit of seeking parallels between the works of genius and the personal eccentricities of their authors; and, secondly, the inadequacy of orthodox doctrine on musical forms. This inadequacy results from the fact that the doctrines are contemporaneous with the compositions and are accordingly hostile to all but the easiest conventions. A proper grammar of a classical art requires something of the attitude of

the unjustly-despised Byzantine scholars who sacrificed aesthetic pleasures in humble devotion to the task of securing the texts. It is when the languages are dead that they live for ever and suffer no corruption.

We need not expect scholarship in the orthodoxies that were current as to musical forms used in the lifetime of the classics themselves. (*See* FUGUE for a demonstration of the irrelevance of traditional doctrine on that art-form.) Still more impertinent is our orthodoxy on sonata-forms. It ignores the differences between Haydn and Mozart which are as radical as any innovation Beethoven introduced; and, having thus cut away all ground for appreciating Beethoven, treats him as the central symphonic classic, and also as a stupendous revolutionary. This result is correct as far as it goes: central classics can be stupendous revolutionaries. But correct pious opinions are the healthier for facts that can give us a right to them; and the beginning of the 19th century was unfortunately the beginning of an age of humbug in musical education. (*See* CHERUBINI, who, however, has other claims to our respect.) One consequence is that many a musical revolt purports to revolt against the classics when its nearest contact with classical forms has been the perky generalizations of textbooks by writers who regarded the great masters as dangerous, and who deduced their rules from the uniform procedures of lesser composers. Now these procedures were often derived from one or two popular works by the greatest men: thus Beethoven himself produced one model sonata (op. 22)—if its "first subject" had only been long enough. And if Mozart's great C major quartet had not such a subversive introduction it might (and did) serve as a jelly-mould for all the quartets of Spohr. Take another jelly-mould from Spohr, and you have classical tradition.

But now comes the fundamental difficulty in all attempts to distinguish the classical from the pseudo-classical. Every individual work must be judged on its own merits. No generalizations are trustworthy. Many movements by Mozart are as alike as peas. But, being alive, they are not as alike as buttons. With Mozart and Haydn the individuality of each work is all-important for the critic, and if he neglects this all that he says about the common form is superficial. On the other hand, the materials of Beethoven's work developed so rapidly that he seems to be driven to invent a new technique for almost each composition. Hence the external differences become obvious; and unless the critic penetrates to the common form he is lost.

With the symphonic classics we enter the period when these considerations become important; for there is no gulf between that period and our own. No musical art known to Haydn has suffered, like the art of Bach, a period of total eclipse; nor, on the other hand has it had preserved a character that Haydn could have understood. Not much light is shed on Haydn and Mozart by calling them court composers, and little more on Beethoven by calling him a child of the French Revolution. In an age of court patronage Bach the theologian had been inspired to write warlike music not more by ancestral memories than by scriptural texts of war in Heaven. Mozart and Haydn were restive in the service of courts and their musical language was that of the comedy of manners when it was not racy of the soil. In Paris, where musicians might be expected to know most about the French Revolution, the modest, lovable Etienne Méhul (famous for the biblical opera *Joseph*) produced his prettiest comic operetta *Le Jeune Sage et le Vieux Fou* in the year of the Terror; and on French music the immediate effect of these tremendous days was the rise of a new type of sentimental opera concerning the hair-breadth escapes and sufferings of the political prisoner rescued by the heroic wife. Hence Cherubini's *Les Deux Journées* (*The Water-Carrier*) and Beethoven's *Fidelio*. Genius is the wind that bloweth where it listeth. In Bach's day Beethoven would have been musical interpreter of the Apocalypse; and in this 20th century Bach would be something like Dr. Schweitzer.

When we contemplate the impassable gulf that separates Bach's art not only from Haydn's and Mozart's but from the apparently more kindred spirit of Beethoven, we find it hard to realize that contemporaries were unaware of any catastrophic development. In the case of choral music a little study shows us that its forms and language remained Neapolitan. Haydn's and Mozart's masses are flamboyant Neapolitan music; and Michael Haydn, who was merely decorative as an instrumental composer, was rightly thought by his brother to be the better man at church music. Again we regard Philipp Emanuel Bach as bridging the gulf between his father's and the new art; but Philipp Emanuel was writing quite mature sonatas in the year of his father's B minor Mass and his last set of sonatas was produced in the year of Mozart's *Don Giovanni*. Clementi, born in the year after Bach's death, was an infant prodigy of eight when Handel died; he had developed an extraordinarily massive and genuine pianoforte technique (more powerful than beautiful) when he encountered Mozart in a musical tournament, and he survived Weber, Beethoven and Schubert. Nothing can be gained by a further attempt to summarize this "Viennese" period. We may call it the period of the sonata and of Mozartean comic and French romantic opera. More particular information is given in the following technical and categorical articles: HARMONY (on Key-relations); INSTRUMENTATION; MELODY; OPERA: ORATORIO; OVERTURE; RONDO; SCHERZO; SONATA FORMS; SYMPHONY; VARIATIONS, and the biographies ABEL (K. F.); BACH (C. P. E.); BEETHOVEN; BENDA; BOCCHERINI; CHERUBINI; CLEMENTI; DITTERSDORF; DUSSEK; GLUCK; HAYDN (J. and M.); MOZART; PUCCINI; SCHUBERT; SPOHR; WEBER.

### 8. THE ROMANTIC PERIOD

With the romantic period comes the development of lyric music in the forms of songs and short pianoforte pieces. Schubert, Weber, Spohr, Mendelssohn and Schumann would be the romantic composers in this sense, and many contemporaries would have added Cherubini to the list, for they thought of him not as the martinet who directed the Paris Conservatoire but as the composer of *Les Deux Journées*. Romanticism was thrilling and classicism was cold.

But this list traverses another sense of the term which opposes the romantic to the classical. The classical is in this connection identified with both formalism and mastery. Mendelssohn and Spohr chose romantic subjects to no purpose; their mastery was unromantically slick (there is no other word for it) and Spohr's forms were more thoroughly ascertained than anybody else's except those of Mozart's brilliant pupil, J. N. Hummel. Mendelssohn's forms were free; but he never got into difficulties, so how could anybody recognise his freedom? Philipp Emanuel Bach's vein of sentimental rhetoric was not only typically romantic but enabled him to write some genuinely lyrical songs. J. Schobert is another romantic writer who influenced Mozart at an impressionable time of his boyhood. Every thrilling modulation in Beethoven's music was romantic, and so were the double-bass passages at the beginning of Cherubini's overture to *Les Deux Journées*.

But the facts are more interesting than this generalization. Mastery is not the line of cleavage that ranges Spohr and Mendelssohn on the one side and Schubert, Schumann and Chopin on the other. Beethoven's later tonality and polyphony had made music ready for lyric forms which he himself adumbrated in a few of his bagatelles for pianoforte and some sporadic good things in his songs. Mendelssohn and Spohr took up song-writing and produced in that line masterpieces for the drawing-room. We ought not to despise the drawing-room. Schubert became the supreme master of song, and Schumann achieved greatness there as in his pianoforte lyrics; but you might as well think of Keats and Shelley as writers for the drawing-room.

Another line of cleavage separates Schubert from Schumann and Chopin as fundamentally as it separates him from Mendelssohn and Spohr. When Schumann and Chopin handle the large classical forms they show obvious weaknesses. Schumann makes an effective new artificial sonata form out of his stiff antithetic epigrammatic style, as a man might construct a landscape in mosaic. Chopin merely shows that he has taken the sonata forms uncritically from Hummel, though the first two movements of the B flat minor sonata are almost as happy in their classical form as the Ballades are in Chopin's unique way. But Schubert's large

forms have only the weaknesses of youth, and their positive qualities and tendencies set him above all schools and indicate that if he had lived we should not so readily have closed a historic chapter with Beethoven. The mastery that Schubert lacks is not anything that Spohr could have supplied. Younger composers with new worlds to conquer could with some truth accuse Spohr of playing with classical forms as one might play chess; but they could never have so accused the Schubert that died young or the Schubert that might have reached old age.

We do not know what Mendelssohn might have achieved if he had lived longer. His influence on the musicians he knew personally was wholly stimulating and good. But he too, seemed able to play chess with symphonies, oratorios and songs with and without words, while other composers were grappling in their music with real life, perhaps confined to one narrow art-medium like Chopin, or, like Schumann, deserting lyrics for larger forms or some artificial hypothesis, or, like young Berlioz, kicking right and left against all teaching and all criticism while dreaming new wonders of orchestral sound, and correctly dreaming the practical means to them also.

Meanwhile a greater than Berlioz was arising, a dreamer of new sense as well as of sound. Mendelssohn and Schumann saw only the beginning of Wagner's development, and could not feel very sure that this voluble and stormy reformer of music-drama was really likely to achieve anything better than the tinsel of the astute Meyerbeer who dominated the world of cosmopolitan opera. The early style of Wagner is indeed an alloy of many metals besides iron and potter's clay; but even in the 'forties his work marks the eclipse of the first romantic period and the dawn of another and greater epoch.

The art-forms peculiar to the Romantic period have no definite names, though composers began to use many literary titles, such as Ballade, Romance (already used by Mozart for slow movements in sonata-form), Nocturne and the like. Dance-rhythms, especially those of Poland, were brought into prominence in the pianoforte music of Chopin. Mendelssohn's invention of the song without words was very successful, but the notion is too facile to lead far, or always, even in Mendelssohn's hands, to justify its existence. Fantastic titles, used in the 18th century by the French clavecinistes, assumed great prominence in the pianoforte works of Schumann who created a new type of long connected cycles of epigrammatic little pieces. The articles PROGRAMME MUSIC and SONG concern this period vitally. Relevant biographical articles are CHOPIN, MENDELSSOHN, SCHUBERT, SCHUMANN, SPOHR, WEBER; while the crowd of pianoforte composers whose brilliance on that instrument obstructed all wider musical prospects, include the respectable HUMMEL, the less respectable STEIBELT, the flimsy WOELFL and the Irish writer of beautiful pre-Chopin nocturnes, FIELD (John).

### 9. THE WAGNERIAN DEVELOPMENT AND THE RENASCENCE OF CLASSICAL FORM

Wagner formulated his principles of music-drama long before he matured his musical style. It is impossible to understand the musical history of the second half of the 19th century until we frankly admit that the composers of instrumental music saw in Wagner not only the subversive operatic theorist and erotic dramatist but the composer who was popular because of the salvation-army religiosity of the end of the *Tannhäuser* overture and the downright vulgarity of the entr'acte before Act III in *Lohengrin*. His theories and methods might be controversial, but these lapses never were.

Strange to say, Wagner received something like recognition from the doyen of classical champions, Spohr, whose attitude to Beethoven had been merely condescending, but who saw in *Der Fliegende Holländer* and *Tannhäuser* interesting, if faulty, works which well deserved painstaking production at his theatre at Cassel. Schumann too, after joining in the general hostility towards *Tannhäuser*, frankly recanted and praised its many noble features. Personally he and Wagner did not get on so well; he found Wagner too talkative and Wagner found that Schumann had nothing to say. Later on when Wagner was in exile, *Lohengrin* found a powerful champion in Liszt at Weimar.

Liszt presented another problem to sober musicians. Wagner himself at first saw nothing in Liszt but the virtuoso who, when asked for music, would give you a fantasia on *Robert le Diable*. On the other hand, persons who became bitterly hostile to all the musical tendencies that Liszt fostered went out of their way to declare that no such wonderful interpretations and technique as Liszt's pianoforte playing had ever before been heard on any instrument or orchestra. All Liszt's gestures were superb, from his monumental immobility at the pianoforte to his princely and often really self-sacrificing generosity to other musicians. And at the age of 37 he made the most superb of all his gestures in giving up playing in public. And so the one incontrovertible power of his art became a legend and his actual activity became the championship of unorthodox artists. He took to composing on a more ambitious scale than that of the marvellous pianoforte virtuoso; and became himself the leader of a new development of romantic music. Although he took little pleasure in counterpoint he had none of Berlioz's clumsiness in harmonic texture; and his orchestration, in which his first efforts had the secret assistance of Raff, was always brilliant and novel, though it never caught the Berliozian fire or plumbed the Wagnerian deeps. Liszt realised no more than Berlioz the true musical purport of the new ideas which his symphonic poems and Berlioz's symphonic-dramatic phantasmagorias were putting forward under all kinds of literary and pictorial names. While the new romantic composers purported to be devoting instrumental music to the illustration of literature (*see* PROGRAMME MUSIC) they were really struggling with a new musical time-scale.

As we have already seen in the present article and in the discussion of HARMONY, musical history may be traced in terms of the time-limit over which the listener's memory is brought into play. In the 16th century that limit is from accent to accent; by the end of the 17th century it ran from phrase to phrase. The great architectural forms of Bach could stretch it easily to six minutes, and, in extreme cases to ten. The rise of the dramatic sonata style did not greatly enlarge the time-scale; for there are few well-constructed sonata-movements that exceed a quarter of an hour, though on no smaller scale could Beethoven have prepared the famous harmonic collision that gave such offence in the first movement of the Eroica symphony. Now this ten-minute time-scale obviously compelled musicians to handle the action of an opera by means of conventions. (*See* OPERA.) It is less obvious that it also produced a similarly conventional artifice in the relation of sonata-forms to their emotional content. A design may complete itself in ten minutes while raising emotional issues that cannot be dealt with in less than forty. And so the sonata-forms are grouped in from two to four (rarely more) movements as artificially as the musical sections of classical operas. Wagner's enormous achievement in music-drama consisted essentially in giving music the same time-scale as that of the drama. As with all first solutions of an art-problem he achieved an extreme case, for his drama became cosmically slow. But from *Das Rheingold* onwards every Wagnerian opening instantly, and without any introductory gestures, lays down the lines of its vast time-scale, to the utter bewilderment of his contemporaries who continued to expect *Das Rheingold* to show its pattern on Beethoven's time-scale, just as Beethoven's contemporaries had heard seven *pianissimo* bars on the chord of E flat, not as that vaulted vacancy appears in the middle of the andante of the C minor symphony, but as it would have sounded if it were intruded into an andante by Mozart.

Nobody else before Richard Strauss achieved Wagner's mastery of his new time-scale; and few, if any, of his contemporaries, whether hostile or friendly to him, realised its existence. Liszt was trying, in his symphonic poems, to make a music that filled its half-hour or forty minutes continuously; but his first effort of the kind, *Ce qu'on entend sur la montagne*, spends the first twenty of its forty minutes in a series of introductions, and the remaining twenty in retracing the series backwards. And his more successful efforts, such as *Orpheus* and *Les Préludes*, are either essentially lyric or not on the new time-scale at all. He never achieved so

effective a symphonic poem as Schubert had already long ago unwittingly produced in the "Wanderer" fantasia. Musicians who might not have been repelled by new doctrines of musical form found Liszt's style even more demi-mondaine than that of the early works of Wagner; nor did Liszt show any tendency to purify it. Moreover he rivalled Meyerbeer in the efficiency of his press-bureau by which he made propaganda, often in his own fluent French, more generously for others than for himself

Meanwhile another musical development was arising, conscious of its continuity with the past, and, like Judaism as defined by Matthew Arnold, tinged with emotion in the morality of its aesthetic principles. Joachim, as great an interpreter on the violin as Liszt on the pianoforte, at first found in Liszt a congenial friend, until he saw his compositions. These horrified him, and the horror completed an estrangement already begun by his dislike of the atmosphere of Liszt's press-bureau. He and his younger friend Brahms were united not only in general musical taste but in personal devotion to the heroic widow of Schumann, who, after her husband's tragic and lingering death, was bringing up a large family on the proceeds of her concerts. These three artists soon came to regard the musical atmosphere of Weimar, where the *Lisztianer* gathered around their master, as unhealthy. In the correspondence and mutual criticism of Brahms and Joachim the word *Lisztisch* became synonymous with "devilish"; and indeed it is true that any characteristic Lisztian and many Wagnerian idioms would have a disgusting effect if intruded into Brahms's music. To-day we can be wise after the event and find matter for regret in the drastic out-spokenness of Joachim and Brahms which elevated matters of taste into questions of artistic honour. If Liszt could have been contented with *sachlich* criticism on definable issues of technique without requiring attestations of sympathy and enjoyment, and if Joachim could have resolved matters of taste into questions of artistic proportion, the neo-classical and neo-romantic musicians would have joined forces instead of condemning each other. Similar economies might be effected in nature if lions could be converted to vegetarianism.

The controversy was unequal, in two compensating ways. Wagner had a tremendous, if acrid, fluency in prose and did not care where his vitriol might alight. Moreover, Wagnerian and Lisztian music was much easier to write about, whether in attack or defence, than music which had no literary aspect. Brahms, like Wagner, needed and found friends who adored his music, but he hated the idea of a press-bureau and snubbed anybody whose compliments aroused the least suspicion of flattery. These drawbacks had their own compensation. It might be difficult to write as interestingly about Brahms as about Wagner; but Wagner, whether in exile or enthroned at Bayreuth, had Wagnerian music-drama as his whole province, while Brahms reigned over the whole of the rest of music, instrumental, choral and lyric. If criticism came to persecution, on the whole the neo-classics had the worst of it; for Brahms had no equals since Joachim gave up composition, and the position of a champion of classical forms was easily confused with that of a persecutor of the prophets of progress. As a matter of fact, Brahms was no anti-Wagnerian and was annoyed when his friends bracketed Wagner with Liszt.

But, apart from the clash of flying inkpots, the recognition of Brahms was assured by two facts; first the propaganda of his work not by words but by consummate and authoritative performance, and second, the very fact that his music required an experienced love of music for its understanding. A man might become an enthusiastic Wagnerian or even a well-equipped conductor of Wagner's music and be as the brutes that perish about symphonic orchestration, choral music, chamber-music, songs and all pianoforte music except Chopin. But it was long before any musician could venture to tackle Brahms's music on any basis except that of the most comprehensive musical culture and technique. Brahms lived long enough to become worshipped unintelligently; and after his death (in 1897) the reaction was more evident than the fashionable worship had been. There are signs that the reaction is over by now.

The Wagnerians felt deeply that their propaganda was incomplete for lack of a master of purely symphonic music. This they found in Bruckner (*q.v.*). Brahms was appalled by the clumsiness of Bruckner's forms, and the most official Wagnerians admitted the frequent lapses of their symphonic master. On the other hand Bruckner's Nibelungen-tetralogy openings to his symphonies obviously dwarfed the terse themes of Brahms. By the time Brahms and Bruckner had come into their own, the public had long lost all sense of form in its appetite for bleeding gobbets of musical butcher's-meat hacked from the living body of Wagnerian music-drama and served up in concert rooms as *Waldweben, Karfreitagszauber* and *Walkürenritt.* After this it was pedantry to quarrel with any symphonic composer's form so long as his openings were vast enough. Brahms was no pedant; obvious weakness of form and style did not deter him from being the first to recognize Dvořák (*q.v.*); and he was drastic in his rebuff of anybody who thought to flatter him by talking against Wagner.

The song-writer Hugo Wolf (1860–1903) became recognized too late to be made use of as a lyric-pawn in the Wagner-Bruckner party politics of music. As far as his theory of song can be summarized, it consists in the application of Wagnerian declamation to lyric poetry. If his practice were not better than this essentially prose theory of verse-rhythm (*see* RHYTHM) and the perky censorship of classical musical declamation that goes with it, Hugo Wolf's art would not have survived his short and ailing life. But it is deeper than the theories on which it is supposed to rest and its apparent revolt from lyric melody only partly conceals a powerfully organized lyric form, and does not at all conceal a great gift of characterisation.

### 10. NON-GERMAN MUSIC OF THE 19TH CENTURY

While these great issues were being debated in Germany, the music of other countries was awakening from long sleep or outgrowing infancy and provinciality. France had, since Rameau, been remarkably content to have its music dominated by foreigners. Before Rameau, French opera was established by the Italian Lully. After Rameau it was reformed by the Austrian Gluck. Early 19th century French classicism was dominated by the Italian Cherubini. Another Italian, Rossini, was in the prime of his life absorbed by Paris; and the result was *Guillaume Tell,* with its rich orchestration and grandiose forms. But the crown of French opera was imposed on it by the German Jew Meyerbeer. The pretensions of the native French composers were more modest, except for the volcanic eruptions of that typical Gascon Berlioz. The popularity of Gounod (1818–1893) rested on the same misunderstanding of the meaning of art as the vogue of Doré in the capacity of an illustrator of the Bible. *Faust* was a success. Another development, more improvisatorial, uncertain of its style, but fundamentally sincere, was initiated by the Belgian, César Franck (1822–1890) (*q.v.*). From him, and not from the more prolific and facile Saint-Saëns, originated the main stream of modern French music. His style had too much affinity with Liszt to please the musicians who continued to regard Liszt as the author of all modern musical evil; but he achieved mastery in a wide range of forms all his own and he never wrote for effect.

In Italy music after Rossini was long contented to imitate the things in which Rossini was imitable. These were the mechanical cultivation of *bel canto* and the use of a full orchestra to support the voice in a thick unison of the melodic instruments, with a brassy dance-rhythm in the rest, and the big drum and cymbals to mark the rhythm. The genuine melodic inventiveness of Bellini and Donizetti did little to improve the other categories of the art; but in Verdi (1813–1901) a new genius was arising together with the Risorgimento. In *Rigoletto, Il Trovatore* and *La Traviata* Verdi's dramatic sincerity triumphs over the defects of a musical texture which still clung to traditional squalor, though strokes of genius occurred unpredictably in the orchestration of many passages. In *Aïda* the style silences all cavil; and in *Otello* (written at the age of 74) and *Falstaff* (written at the age of 80) Verdi created a new kind of opera, Wagnerian in its perfect continuity and dramatic movement, but utterly independent of Wagner's style and method.

Bold prophets in Beethoven's time had been heard to say that a great musical future was in store for Russia. The fulfilment of

this prophecy was long delayed, for when Rubinstein averred that Michael Glinka (1803–1857) was the equal or the superior of Haydn and Mozart he expressed an opinion which could have occurred only to a Russian, and then only as a patriotic paradox. Rubinstein himself achieved only a weak cosmopolitanism in his voluminous compositions, though his pianoforte playing remained, for all its waywardness, till near the end of the century, as the most monumental power of interpretation on that instrument since Liszt. The first composer to make a genuinely Russian music recognized over the whole civilized world was Tschaikovsky (1840–1893) whose symphonies were held by some critics to have eclipsed those of Brahms. This was the eclipse of drama by melodrama. The true merits of Tschaikovsky were eclipsed by the rising reputation of his less immediately successful contemporaries. Moussorgsky (1835–1881) had the posthumous fortune to have his two great operas *Boris Godunov* and *Khovantschina* revised by Rimsky-Korsakov (1844–1908) the most brilliant contemporary master of pure orchestral colour and texture. This was unquestionably good fortune in so far as it speeded these unconventional works on their way into the wide world; but something like indignation accompanied the later study of Moussorgsky's original scores, with the discovery that besides altering clumsinesses Rimsky-Korsakov constantly meddled with features in his friend's style that were far beyond his comprehension.

The 19th century was over before any musician on the continent could be persuaded that there were composers in England. Schumann had repeated St. Gregory's pun about Angles and angels when he hailed Sterndale Bennett as "ein englischer Componist"; but the trials of English musical life dried Bennett up. All who knew and loved him denied hotly that his music reflected Mendelssohn's; and perhaps, to-day, a leisurely study of it might vindicate his independence. Macfarren (1813–1887), who succeeded Bennett in his educational offices, was a widely-cultured musician whose influence for good was frustrated by his violent conservatism which co-existed with a fatal readiness to be led by faddists. (*See* HARMONY.) The renascence of English music began in the work of Parry (1848–1918) and Stanford (1852–1924). They put an end to the provincial absurdities of British oratorio tradition, and consistently set great literature in a way that revealed to contemporary poets that the antithesis between musical and general culture was false.

They also had wide and deep influence as teachers of composition.

Still, recognition of English music on the continent was rare and capricious. Englishmen wrote church music for the stage, stage music for the church, organ music for the orchestra, and, as far as they had any orchestral ideas at all, orchestral music for the organ. The one famous English composer who could be understood on the continent as saying intelligible things in fit terms, was Sullivan, with his Savoy operas. And his serious colleagues and critics urged him with owlish solemnity to produce no more light masterpieces but to go on with his serious and luscious Golden Legends and Martyrs of Antioch and generally to consummate the final merging of English music into "The Lost Chord." We may thankfully hope that that chord is now lost for ever; but the Savoy operas live, and might, without delay to their popularity, have risen to the position of great music if Sullivan had had enough steadfast love of music to finish those parts of his work to which the public did not listen; if for example, he had provided his operas with better orchestral introductions than the perfunctory pot-pourris of their favourite tunes which he calls overtures and which are quite as long as artistically-decent overtures would have been.

It is customary to explain the failure of all but the most recent British music by saying that the native art was crushed by the ponderous genius of Handel. It is a great pity that the united ponderosity of Handel and the middle-weight Mendelssohn could not avail to dam the output of oratorios by composers who might have become good song-writers or even acquired some knowledge of orchestration beyond that of choral accompaniment. The complaint of foreign domination is nonsense. No nation has had its music so long and so completely dominated by foreigners as France; and French music has always remained exclusively French and has made thoroughly French artists of the foreigners who dominated it. The traces of foreign influence on English music have always been the echoes of individual phrases or mannerisms.

While Englishmen echoed, as fashions changed, Mendelssohn, Brahms and Debussy, they learned no technical lessons from them. Such mechanical echoes show no foreign domination, but are the best proof of an inveterate provincialism and the kind of ignorant and irritable independence that goes with it. Since music ceased to be an integral part of an Englishman's culture (about the time of William and Mary) their musicians, as a rule, began its serious study far too late. The language of music cannot be begun at the age of 19 like courses in law or medicine. Their universities have played a considerable part in shaping British musical destinies; but a mighty Oxford treads on the tongue of the encyclopaedist who would pursue this topic.

### 11. MUSIC OF THE 20TH CENTURY

The 20th century inherited the last development of the 19th in the symphonic poems and operas of Richard Strauss (*q.v.*). Much acrid controversy at first raged around the details of his style which dashed through all the traffic regulations of classical part-writing. And nothing was easier than to identify all carping critics with Beckmesser and to accept humbly Strauss's own self-portrait as the hero of *Ein Heldenleben*. The elements that were sensational in Strauss's symphonic poems became so familiar that we are in some danger of underestimating the importance of these works as real achievements of the problem in which Liszt failed; not the trivial problem of program-music, but the vital problem of writing purely instrumental music on the Wagnerian time-scale. The power of composition in these works is unquestionable and remains eminent in their facile aftermath, the *Alpen-Sinfonie*, which, designed before the World War, appeared in 1915. But Strauss had eclipsed the fame of his symphonic works by his operas, which began to be important with *Salome* (1905), a setting of Oscar Wilde's play. Then came the long and fruitful partnership with Hugo von Hofmannsthal (*q.v.*) (1874–1929) which enabled the poet and musician to prove the possibility of many different kinds of modern opera, Wagnerian and non-Wagnerian. The purity of the Straussian metal had been strongly alloyed with worldly wisdom in every phase of Strauss's career; in the period of the good boy of the conservatoire; in the romantic symphonic poet of *Tod und Verklärung;* in the timely musical adaptation of Wilde while he was still a new discovery on the German stage; in the seizing of the opportunity presented by Hofmannsthal's *Elektra* after its triumph as a play; and not least in the later phase of naïve melodiousness. Nevertheless *Die Frau ohne Schatten* was one of the most noble gestures in music after the war of 1914–18. From the twilight of *fin-de-siècle* and erotic art and from its always selfish and sometimes abnormal sexual preoccupations, *Die Frau ohne Schatten* breaks away with a heroic plea for normal love and life, unassailable by any cavil that does not write itself down as ignoble, musically, Strauss's grandest and most grandly realised opportunity for beauty. As a theatrical spectacle it is a gorgeous pantomime, no more disturbed by its allegorical meaning than *Die Zauberflöte,* which it in some ways intentionally resembles. *Die aegyptische Helena* (1928) descends from this high level into all manner of cleverness in its stage-technique and of facility in its music.

Whatever has been gained in the 20th century music, Strauss presents an almost solitary example of mastery of movement. Elsewhere, neither in academic teaching nor in new musical developments does any sense of movement seem to be cultivated. The vast cosmic movement of Wagner is attempted in Bruckner's fashion, by composers who seem to think that huge dimensions can impress us as huge without any reference to human measurements. The best work of Sibelius shows a true sense of cosmic movement and a real freedom and economy in the forms by which this is expressed. With other modern composers the most curious musical inhibition is that which makes them continue to write

sonata works in the four classical movements with a rigidity unknown to Mozart, Haydn and Beethoven, though the modern matter has no more connection with sonata form than Wagnerian music-drama has with the da capo aria.

This lack of necessity in form is nowhere more conspicuous than in the whole work of Max Reger who is usually regarded as the Brahms of the 20th century. His untimely death happened when he was evidently about to change his style. He was a pupil of the most mechanically-systematized musical scholar of recent times, Hugo Riemann; and anyone who has groaned in spirit at the sight of one of Riemann's instructive editions of a piece of classical music may easily recognise in Reger the traces of Riemann's teaching. Every external feature of the classical art-forms is present without any trace of the classical reasons for it. Everything has been worked out from one detail to the next as if it had been plotted on squared paper ready marked by someone else with points of reference.

Whatever is to be learnt from Reger, it is not the meaning of classical art-forms. And much is to be learnt from Reger. His texture is inevitably thick, for its systematic completeness vetoes the suggestiveness of the highest art. But it is astonishingly sonorous, and its numerous notes are the fewest and most effective for its ponderous purpose. Every instrument is treated according to its natural technique; and while the player who claims that he can read Reger at sight is probably mendacious, he will enjoy his instrument the better for playing Reger well. The fundamental reality of Reger is that he is not only a sincere artist but a consummate rhetorician. But this age must be very ill-informed as to the foundations of music if it elects Reger as its Brahms.

There is at present no Brahms; the 20th century must enlarge its musical experience before another renascence of classical form can either be expected or recognized when it comes. It might be as likely to come from Russia as anywhere; the gigantic geniality of Glazunov (1865–1936) was active in the composition of brilliant classical and symphonic polyphony, and generously stimulating to younger composers; and the efforts of young artists to find out things for themselves may lead to something more fundamental than revolt against academicism or than the still narrower academicisms that young revolutionaries are apt to set up among themselves.

Scriabin's later harmonic system has been touched upon in the article HARMONY, Section X. At this point we may sum up the lessons of three harmonic revolutions distributed over five centuries of musical history in the generalization that whenever a composer becomes permanently pre-occupied with harmonic ideas his power of composition is in great danger of paralysis. The reason for this lies deeper than the nature of music itself. Similar tendencies in literature reduce the power of sentence-building to that of the first Ollendorfian exercises. Scriabin's Chopinesque but stiff style of composition was fortunately well mastered by him before he doomed himself to discover that the harping on any chord however strange and novel in the long run only produces the effect of a sophisticated dominant seventh. Before his style receded into its theosophical fastnesses Scriabin had achieved in his fifth sonata and in his orchestral *Poème d'Extase* (both inspired by a literary poem from his own pen) works of powerful impulse that could not have been written on earlier harmonic and rhythmic resources.

The chances of producing permanently living work are heavily weighted against the composer who confines his art to things which he alone can understand. The Russian Ballet gave abundant vital occasion for music as long as it dealt intelligently with drama, fairy-tale, fable and life; and the young Stravinsky found in it inspiration for music that remains intelligible apart from the spectacle. In *Petrouchka* he produced rhythms and tones that enhance the moods of a fascinating pantomime; but the concert-goers who profess to enjoy it without ever seeing the ballet show themselves to be of the tribe who will gaze "as ducks that die in tempests" at anything they are told to admire.

Self-deception and dry-rot set in when the designers as well as the composers of the ballet retire into the arbitrary kingdom of abstractions which they call symbolic and which common sense calls nonsense. Opinions will never unite as to where the line should be drawn; but the 20th century will differ from all other periods of human history if a large percentage of its most precious nonsense does not vanish into the limbo of mere nonsense before its generation becomes middle-aged.

The art of Debussy made its mark without any such artifices. Some aspects of it are discussed in HARMONY, Section X; but Debussy would have indignantly repudiated the resolving of his whole-tone scale as a six-part polyphonic chord, though he himself cannot resist the impulse to resolve it on to a pentatonic scale which is itself constructable as a chord. Debussy's propagandists believed him to be more closely confined to his special system than was the case. Eclecticism was always breaking in without any damage to the aesthetic coherence of the style. It is probable that Debussy's art, discreetly anthologized, will remain vital when the work of the more voluminous and hard-headed Ravel will have become no more distinguishable from an echo than Sterndale Bennett is from the echo of Mendelssohn. Independent origin does not settle such questions. Cyril Scott has been called the English Debussy, but he began to form his style before Debussy was known.

One of the eternal questions in aesthetics is the proportion of means to ends. The war of 1914–18 tragically dictated to all artists a preference of the study of reduced rather than of increased resources; yet performances, on the scale of the Handel Festivals in the Crystal Palace, at London continue, though the music for organizations of even half that size has never yet been composed. Here, then, is material for a real and strenuous aesthetic discipline; and the zeal of Mengelberg created in Holland a great vogue for the vast works in which Mahler, while writing for existing conditions, set himself the task of pioneer-work in the aesthetic and technical principles of music designed for 1,000 performers and upwards. Taste is of secondary importance in such an enterprise, and Mahler is likely to be underrated in countries where naïve sentimentality and boyish grandiosity encounter the inhibitions of a musical culture that thinks itself wiser. Mahler was one of the greatest orchestral and opera conductors that ever lived. On the total value of his compositions tastes may agree to differ, but this century has seen no more strenuous idealist. The main stream of music still flows within the Wagner-Strauss limits and seldom requires 150 instrumental players. Arnold Schönberg's "Gurrelieder" (a large song-cycle for chorus and soli, the great success of which is held to be a hindrance to the spread of his later and more revolutionary gospel) requires an extraordinary orchestra; but the polyphony that requires 50 staves for its notation implies detail rather than mass.

The performance of Elgar's *Dream of Gerontius* at Düsseldorf in 1902, its enthusiastic reception there, and finally the generous speech of Richard Strauss then delivered in its honour, inaugurated the recognition of modern English music on the continent and gave English critics and audiences a not unneeded lesson after their lukewarm reception of it at its inadequate first performance at Birmingham. Elgar's rich and subtle orchestration is not more remarkable than the wealth of his invention of themes. His contemporary, Bantock, is a prolific composer in a style far easier but not less personal and sincere, in which the influence of Strauss and the schematic purity of Rimsky-Korsakov's orchestration may be traced by their technical results but not by mannerisms. Nowhere in Europe is there a more radiant source of musical health.

In Italy the masterful personality of Boïto (1842–1918) developed in the 19th century but his musical ideas anticipate the 20th. He wrote brilliant libretti to Verdi's last works and those of younger composers and achieved extraordinary musical fame by two operas, *Mefistofele* and the posthumous *Nerone*. These have taken their place among the historic documents of musical Italy on the strength of less actual musical content than any other operas in existence. Their aristocratic refinement and *flair* for atmosphere is unquestionable. Very different is the full-blooded efficiency of Puccini (1858–1924) in whose hands Italian

opera advanced in the estimation of a public that was in all countries becoming too experienced in music to be satisfied with perfunctory orchestration and histrionic convention. The razor-edge intellect of the great pianoforte artist Busoni (1866–1924) achieved important results in compositions for the pianoforte, the orchestra and the stage, in spite of the energy he spent in demonstrating how much more cleverly the classics would have been written if they had possessed his advantages. If Casals (*q.v.*) had got his way, the musical awakening of Spain would have been a leading feature in the history of the modern art.

In England there are encouraging signs that musicians are beginning to think for themselves without confusing between independence of academic tradition and independence of truth. Gustav Holst's interest in oriental subjects was (like Bantock's) no whim for *chinoiseries* but a true expression of the nostalgia of the West for the East. His *Hymn of Jesus* is worthy of its awe-inspiring Byzantine eucharistic text. Vaughan Williams, with less of Holst's wide and clear-sighted exploration of pre-harmonic regions, composed with consistent nobility on a large scale and in a style that it would be an impertinence to try to trace to its various historic origins.

Thus the work of doctrinaires is not all that is happening in modern music; and, in any case, music is in the happy position of existing, like architecture, on practical terms which forbid mere lunacy to flourish unchecked. A large proportion of modern musical developments have been tested by enthusiastic and capable public performers almost before the ink of the manuscript was dry. Before the World War of 1914–18, Rutland Boughton's small-scale Glastonbury festivals of music-drama were a stimulus of incalculable importance in the history of modern British opera; and still later on the continent the younger composers of chamber-music had the help of knights-errant in the masterly Amar Quartet which, with Paul Hindemith as viola and his brother as violoncello, spared no pains to secure for the most difficult experiments (such as the quarter-tone works of Haba) a perfect performance. Hindemith himself is one of the boldest and most masterly experimenters, if indeed, he is not the master of them all. It is very significant that his vocal writing, which seems to contradict all previous orthodoxies, stays uncommonly firmly in the vocal memory once it is mastered; whereas many otiose modulations in the Lisztian music of the seventies, such as the part-songs of Cornelius, sink in pitch however much choirs may practice them. The young masters who sternly renounced romance made a romantic gesture in the very act.

Much has been said as to the fructifying or deleterious influence of jazz. The highest class of jazz-band is undoubtedly composed of sensitive artists; but the conductor of a symphony orchestra in a musically not metropolitan town will, if he engages for a symphony concert the gentleman who handles the percussion apparatus of the best local jazz-band, discover that that artist's methods are entirely extemporaneous, and that, except with a drumstick, he has never clashed the cymbals otherwise than flat on to the top of the big drum, and never counted rests in his life. Ordinary jazz-music distributes its rhythmic surprises over the most imperturbable eight-bar ambling trot that ever lulled the rhythmic sense to sleep. Most drugs that begin with a stimulating action end as narcotics.

### 12. PROBLEMS OF THE FUTURE

The explorers of new musical intervals are hampered by having to deal with classical keyboards and other practical limitations. Perhaps they would do well to investigate Miss Schlesinger's pianoforte-tuning, already mentioned in connection with Greek music; for, whether it be Greek or not, it is scientific and therefore more natural than most of the experiments that composers have yet tried in the way of quarter-tones. But new instruments cannot be so readily produced as in the 18th century. Harpsichords and early pianofortes were *made;* but pianofortes are now *manufactured.* Emanuel Moór's duplex-coupler pianoforte enormously extends the resources of the instrument without compelling the player to unlearn the classical technique. But its progress is impeded by the commercial difficulty of promoting an improvement that cannot be added as an extra apparatus to existing and standardized pianofortes, and its reputation is damaged by the tendency to expound it as a device that makes existing feats of technique nugatory, a policy that infuriates the pianoforte virtuoso and ignores the great new possibilities of the invention.

Resonators have been invented for many instruments. The claim that by such devices one violin can sound like sixteen ignores the real effect of the choral multiplication of instruments, which consists far more essentially of a change in quality of tone than of a mere increase of volume. No resonators, phonograph discs or loud speakers for wireless transmitters will ever replace the quality of sounds that combine in the ear from the various directions of their dispersed orchestral sources. The listener need only put his hands around his ears while listening to an orchestra in a concert-room, and he will realize that a "gramophone effect" is little more than the result of cutting off the waves that reach the ear from other than the frontal direction.

The main importance of "wireless" lies in the fact that it appeals *viva voce* to millions without producing the phenomena of crowd psychology. Here and there it leads to a revived interest in intimate early pianoforte music that would never satisfy modern ears in the concert-room, and a new fact in musical aesthetics is the beauty of microphonically-magnified tones of very faint instruments such as the clavichord. Wireless is undoubtedly increasing the number of fireside music-lovers; but it needs careful administration to prevent it from a tendency to cut off orchestral music at the source; for many of the new music-lovers prefer tinned music at the fireside to live music in the concert-room. It is urgently necessary that the wealthy supporters of music should be made to see the folly of the notion that good music should be expected to pay its way commercially.

Wireless music may prove less subversive than another revolution by means of the microscopic study of phonographic records. There is nothing to prevent the eventual production of music directly in terms of the track of the phonograph-needle. That is to say, the composer, untrammelled by the technique of instruments, will prescribe all producible timbres in whatever pitches and rhythms he pleases, and will have no more direct co-operation with the craftsman who models the phonographic wave-lines than the violinist may with Stradivarius. The crudest beginnings of this new method of composition will be enormously important; but its highest development will still leave the handling of human voices and instruments supreme as the infinite source of inspired music. (D. F. T.)

BIBLIOGRAPHY.—*See* Grove's *Dictionary of Music and Musicians* (1878–89; 3rd ed., H. C. Colles, 5 vols., 1927) with very full bibliography under heading *Histories of Music;* also R. Eitner, *Quellenlexikon* (1900–04); A. Proshiz, *Compendium der Musikgeschichte* (3 vols., 1889, 1900–15); H. Riemann, *Musiklexikon* (5th. ed. 1900); M. Mersenne, *Traité de l'harmonie universelle* (1625); P. A. Kircher, *Musurgia Universalis* (1650); *The Oxford History of Music* (ed. W. H. Hadow, 6 vols. 1901–05); C. E. H. de Coussemaker, *Histoire de l'harmonie au moyen age* (1852), and other works; Carl Engel, *Music of the most ancient nations* (1864–70); F. J. Fétis, *Histoire générale de la musique* (1869–76); F. A. Gevaert, *Histoire et théorie de la musique de l'antiquité* (1875–81); R. Batka, *Allgemeine Geschichte der Musik* (Stuttgart, 1909, etc.); R. Wallaschek, *Primitive Music* (1893); H. P. Landorny, *Histoire de la Musique* (1910–11, trans. F. H. Marten, *History of Music,* 1923); K. Nef, *Einführung in die Musikgeschichte* (1920); L. Laloy, *Les origines de la musique* (1913); F. Torrefranca *Le origini della musicà* (1907); G. Adler, *Handbuch der Musikgeschichte* (1924).

Aesthetics, Theory, etc.:—H. Ehrlich, *Die Musik-Aesthetik in ihrer Entwickelung von Kant bis auf die Gegenwart* (1882); E. Hanslick, *The Beautiful in Music* (1891); R. Wallaschek, *Aesthetik der Tonkunst* (1886); R. Pohl, *Die Höhenzüge der musikalischen Entwickelung* (1888); A. Schnez, *Die Geheimnisse der Tonkunst* (1891); J. A. Zahm, *Sound and Music* (1892); C. Bellaique, *Psychologie musicale* (1893); W. Pole, *Philosophy of Music* (1895); L. Lacombe, *Philosophie et musique* (1896); Sir C. H. H. Parry, *The Evolution of the Art of Music* (London, 1897); H. Riemann, *Präludien und Studien* (1896); *Geschichte der Musiktheorie im IX.–XIX. Jahrhundert* (1898); B Widmann, *Die strengen Formen der Musik* (1882); S. Jadassohn, *Die Formen in den Werken der Tonkunst* (1885); M. Steinitzer, *Psychologische Wirkungen der musikalischen Formen* (1885); J. Combarieu, *Théorie du rhythme dans la composition moderne d'après la doctrine antique* (1897); P. Goetschius, *Homophonic Forms of Musical Composition* (1898); E. Gurney, *The Power of Sound;* F. Busoni, *Entwurf*

*einer neuen Ästhetik der Tonkunst* (1907; Eng. trans., 1911), and *Von der Einheit der Musik* (1923); G. Dyson, *The New Music* (1924); A. Eaglefield Hull, *Modern Harmony* (1914).

Greek Music:—The standard works are: R. Westphal, *Die Musik des griech. Altertums* (1883), *Griechische Harmonik u. Melopoie* (1886); *Aristoxenus. Melodik u. Rhythmik* (1893); F. A. Gevaert, *Histoire et Théorie de la Musique de l'Antiquité* (1875), *La Melopée Antique* (1895), *Les Problèmes Musicaux d'Aristote* (1903); H. Abert, *Die Lehre vom Ethos* (1899); H. Riemann, *Handbuch der Musikgeschichte* (1904); M. Emmanuel, in A. Lavignac, *Encyclopédie* (1912); Th. Reinach, *La Musique Grecque* (1926, the only work which contains transcriptions of all the known fragments). Theories of the Greek modes are of two kinds: (*a*) based mainly on ancient evidence: D. B. Monro, *The Modes of Ancient Greek Music* (1894); H. S. Macrani, *Aristoxenus* (1902); W. Denniston, in *Class. Quart.* (1913); J. Curtis, in *Journ. Hellenic Stud.* (1913–1922, 1924); J. F. Mountford, in *Journ. Hell. Stud.* (1920), and *Class Quart.* (1923); (*b*) based mainly on analogy with Indian music etc., or considerations of mathematics and acoustics: K. Schlesinger, in *Musical Times* (1914, 1917), and *Mus. Standard* (1926, 1927); E. Clements, in *Journ. Hell. St.* (1925); W. Perrett, *Some Questions of Musical Theory* (1926, 1928). Critical summaries of the whole literature of the subject will be found in Bursian, *Jahresberichte* (1883, 1900, 1903, 1909, 1922).

British Isles:—W. Chappell, *Popular Music of the Olden Times* (1855–59); W. A. Barrett, *English Glee and Madrigal Writers* (1877); W. Nagel, *Geschichte der Musik in England* (Strassburg, 1894); H. Davey, *History of English Music* (1895); S. Vantyn, *L'Evolution de la musique en Angleterre* (Brussels, 1900); E. Walker, *History of Music in England* (1907); H. V. Hughes, *Early English Harmony* (1913); H. Orsmond Anderton, *Early English Music* (1920); J. S. Bumpas, *A History of English Cathedral Music* (1908); W. H. Grattan Flood, *History of Irish Music* (1905–06); Macdonald, *Ancient Music of Caledonia* (1820).

America:—W. S. B. Mathews, *A Hundred Years of Music in America* (Chicago, 1889); L. G. Elson, *The National Music of America and its Sources* (1900), and *History of American Music* (1904); T. Baker, *Über die Musik der nord-amerikanischen Wilden* (Leipzig, 1882); H. C. Lahee, *Annals of Music in America* (1922); R. Hughes, *Contemporary American Composers* (1900); M. de Oliverra-Lima, *La Musique au Brésil* (1909); L. Cortijo Alahija, *La Música popular y los músicos célebres de la América latina* (Barcelona, 1919).

France:—N. M. Schletterer, *Studien zur Geschichte der französischen Musik* (1884–85); H. Lavoix, *La musique française* (1891); T. Galino, *La musique française au moyen âge* (1890); A. Cognard, *De la musique en France depuis Rameau* (1891); G. Servières, *La musique française moderne* (1897); A. Pougin, *Musiciens du XIX^e siècle* (1911); O. Séré, *Musiciens français d'aujourd'hui* (1911); A. Gastué, *Les Principes de la musique française* (1922); A. Coeuroy, *La Musique française moderne* (1924).

Germany:—W. Baeumker, *Geschichte der Tonkunst in Deutschland bis zur Reformation* (1881); O. Ebben, *Der volksthümliche deutsche Männergesang* (1887); A. Soubies, *Histoire de la musique allemande* (1896); A. Schering, *Deutsche Musikgeschichte in Umriss* (1917); H. J. Moser, *Geschichte der deutscher Musik* (2 vols. 1920–24).

Italy:—G. V. Orlov, *Traité de musique* (1822); Emil Maumann, *Die italienischen Tondichter* (1874–76); R. A. Streatfield, *Masters of Italian Music* (1895).

Russia:—A. Soubies, *Histoire de la musique en Russie* (1898); M. Montagu Nathan, *History of Russian Music* (1914).

Scandinavia:—C. Valentin, *Studien über die schwedischen Volksmelodien* (1885); T. Norlind, *Svensk musikhistorie* (1901–21); A. Soubies, *Histoire de la musique de Danemark et Suède* (1901); O. M. Sandvik and G. Schjelderup, *Norges Musikhistorie* (2 vols., 1921).

Czechoslovakia:—H. Hantich, *La musique tchèque* (2 pts. 1907); R. Batha, *Geschichte der Musik in Böhmen* (1906); A. C. Mackenzie, *The Bohemian School of Music* (1905–06).

Spain:—J. F. Riaño, *Notes on Early Spanish Music* (1887); H. Collet, *La musique espagnole moderne* (1908); J. B. Trend, *Manuel de Falla and Spanish Music* (1929); J. Ribera, *Music in Ancient Arabia and Spain* (Stanford Univ. 1929).

Switzerland:—A. Soubies, *Histoire de la musique en Suisse* (1899); A. Niggli, *La Musique dans la Suisse allemande* (1900); F. Held, *La Musique dans la Suisse romande* (1900).

Instruments:—F. Boudoin, *La musique historique* (1886); A. Jacquot, *Étude de l'art instrumental. Dictionnaire des instruments de musique* (1886); H. Boddington, *Catalogue of Musical Instruments illustrative of the history of the Pianoforte* (1888); A. J. Hipkins, *Musical Instruments: Historic, Rare and Unique* (1888, 2nd. ed. 1921); W. Lynd, *Account of Ancient Musical Instruments and their Development* (1897); Sir J. Stainer, *Music of the Bible* (1879); K. Schlesinger, *Instruments of the Orchestra* (1910); R. Brancour, *Histoire des instruments de musique* (1921). *See* also separate articles on the instruments.

Conducting:—R. Wagner, *On Conducting* (1887); M. Kufferath, *L'Art de diriger l'orchestre* (1891); F. Weingartner, *Über das Dirigiren* (1896); A. C. Boult, *A Handbook on the Technique of Conducting.*

Biography:—F. Hueffer, *The Great Musicians* (1881–84); C. H. H. Parry, *Studies of Great Composers* (1887); T. Baker, *A Biographical Dictionary of Musicians* (1900). Grove's *Dictionary* has been mentioned above. (X.)

## THE UNITED STATES

The musical history of America does not begin, properly speaking, until the 19th century. To be sure, songs were sung and instruments played upon during the 17th and 18th centuries; but such performances were the casual pastime of the Southern and Middle Atlantic gentry, rather than the expression of a national art. New England, rigidly Puritan, sang psalm tunes, and but few of those. In 1759 Francis Hopkinson, of Philadelphia, published his first song, "My Days Have Been So Wondrous Free"—the first American secular composition.

Colonists, being recruited from the ranks of adventurers, farmers, traders and refugees, had neither the time nor the inclination to cultivate the arts. They were too completely preoccupied with life's exigencies to bother about its adornments. It is hardly surprising, therefore, that music played a negligible rôle in American civilization until such time as the pioneers had conquered their natural and political enemies, and the 13 Colonies, finally emancipated and achieving a measure of peace and economic security, had settled down to the business of becoming a nation. Repeating summarily the musical history of Europe, America's early musical contributions were religious and popular; the former through the hymns of Lowell Mason (1792–1872); the latter through the now-forgotten but once ubiquitous salon pieces of Louis Moreau Gottschalk (1829–69), and the songs of Stephen Foster (1826–64).

To realize what a recent growth American music is, it is necessary only to reflect that such musicians as Arthur Foote (1853–1937), George W. Chadwick (1854–1931), Edgar Stillman Kelley (1857–1944) and Frank Van der Stucken (1858–1929) were virtually pioneers in musical composition in their native land, their only predecessors of any considerable note being Benjamin J. Lang (1837–1909), John Knowles Paine (1839–1906) and Dudley Buck (1839–1909). Other members of this group were Ethelbert Nevin (1862–1901), Horatio Parker (1863–1919) and Edward MacDowell (1861–1908), the latter being the most gifted composer that America has yet produced. To the same epoch belong also Reginald de Koven (1859–1920) and Victor Herbert (b. Dublin, 1859; came to America 1886; d. 1924), both of whom achieved international fame as composers of light opera.

All these composers, Foote alone excepted, were German-trained, the lack of adequate instruction at home rendering European study almost imperative. The virtual impossibility of obtaining a thorough musical training in America, thus obliging the student to spend his formative artistic years in a foreign country, has been a great handicap to the American composer. Coupled with the want of any authentic background of native folk music, it has been the cause of the slowness of American music to exhibit any distinctive national characteristics. One suggested solution has been to turn for musical inspiration to the American Indian. Of this method Charles Wakefield Cadman (1881– ) and Arthur Farwell (1872– ) are enthusiastic champions. Another, of which Henry F. Gilbert (1868–1928) was the best-known advocate, was the exploitation of American negro spirituals and slave songs. In recent years, the popularity of American jazz has suggested this as a third possible foundation for a national musical idiom. In this field George Gershwin (1898–1937) was most successful.

Other modern American composers, whose work follows no definite nationalistic program, are Howard Brockway (1870– ), Frederick Converse (1871–1940), Edward Burlingame Hill (1872– ), Daniel Gregory Mason (1873– ), Henry Hadley (1871–1937), John Alden Carpenter (1876– ), John Powell (1882– ), Emerson Whithorne (1884– ) and Deems Taylor (1885– ). The untimely death of Charles T. Griffes (1884–1920) cost America a brilliant talent. To this group belong also Charles Martin Loeffler (1861–1935) and Ernest Bloch (1880– ), who, though born respectively in Alsace and Switzerland, should be considered American composers.

In the interpretative field of music America has been particularly prolific in famous opera singers. These include—to name a few—Minnie Hauk, David Bispham, Sybil Sanderson, Lillian Nordica, Edyth Walker, Emma Eames, Clarence Whitehill and

Geraldine Farrar. Opera itself, on the other hand, has never been a successful form of American musical expression, principally because the scarcity of permanent companies made it impossible for the would-be operatic composer to gain practical experience.

The growth of symphony orchestras has been extraordinarily rapid. Beginning with the Philharmonic Society of New York (founded in 1842), they have increased in number until in 1927 the country contained nearly 50 of them, the more important being, as a group, without a peer in the world. Pioneers in this work were Leopold Damrosch (1832–85) and Theodore Thomas (1835–1905). The custom of giving concerts especially for children is universal among the larger orchestras, and has had much to do with the rapid growth of musical appreciation in America. An extension of this movement, inaugurated in 1928 by Walter Johannes Damrosch (b. 1862), was the broadcasting of an entire series of educational concerts to schools and colleges throughout the country as far west as the Rocky mountains. Walter Damrosch's greatest services to American music were rendered in connection with the New York Symphony Orchestra and as a conductor of opera, but he was himself a distinguished composer.

In 1928 the future of music in America looked bright. Largely on account of the World War, which drove scores of Europe's finest interpretative artists to migrate to America, the concert centre of the world was then in New York. The country's wealth has made possible the expenditure of lavish sums upon the development of musical resources. American orchestras are the finest to be heard. The Metropolitan Opera Company of New York, and the Chicago Civic Opera Company, offer productions that, in scenic elaborateness and vocal resources, challenge comparison. American conservatories have vastly increased in number and immeasurably improved in quality. Two of them, the Curtis Institute of Music in Philadelphia and the Juilliard Musical Foundation in New York, are richly endowed and offer instruction at the hands of world-famous masters.

Interest in music is wide-spread, its growth augmented by such factors as the broadcasting of symphony concerts, the excellent orchestras of the larger motion picture theatres, and the extensive use of mechanical reproducing devices. The American musician can at last approximate the opportunities for technical training, practical experience and intelligent appreciation that have so long been enjoyed by his European colleagues. A corresponding growth in his self-respect, individuality and artistic stature is virtually inevitable.

BIBLIOGRAPHY.—W. S. B. Mathews, *One Hundred Years of Music in America* (Chicago, 1889); Lawrence Gilman, *Edward MacDowell* (New York, 1909); Stanford-Forsyth, *A History of Music* (New York, 1916); D. Gregory Mason, "Music in America," *The Art of Music*, vol. iv. (New York, 1917); Walter Damrosch, *My Musical Life* (New York, 1923); C. E. Russell, *The American Orchestra and Theodore Thomas* (New York, 1927); Grove's *Dictionary of Music and Musicians*, American supplement (New York, 1928). (D. T.)

**MUSIC, TEACHING OF.** As there are three possible parties to any musical transaction, the composer or maker of the music, the performer or reproducer of it, and the listener or appraiser of it, it follows that the art of teaching, as applied to music, naturally falls into three categories: (1) the teaching of the nature of music itself; (2) the teaching of singing or playing some instrument or of conducting; and (3) the teaching of the appreciation of music. This last manifestly should be the same thing as (1) but without the creative incentive.

The teacher and the self-taught in all three categories have obviously one supreme obligation in common, namely, to train the ear with a serviceable exactitude to detect musical tones and to relate them instantaneously with each other into sensible and delightful order, whether together as chords, or in succession as melody, or in a succession of chords, or a combination of melodies, as in harmony and counterpoint.

Teachers of singing, and of playing, have the added task of inducing their pupils to hear the whole, of which what they are singing or playing is a contributory part—to see the whole building of which they themselves are an essential brick. Consideration of the art of teaching as applied to the act of singing and playing lies beyond the present purpose. But it may be noted with satisfaction that in the present day a steadily increasing attention is being given to the crucial matter of ear training. Aural exercises and ear tests are now common in practical examinations, but have yet to become adequate and universal. It is astonishing that they have been so neglected that to-day Doctors of Music can still probably be found who cannot with ease give an instant and accurate account of even a few simple chords as they are played, but would "rather see that done on paper."

Incidentally the teaching of the art of reading music offers problems and interests of its own to teacher and taught alike. It is with some quite good musicians a life-long problem to learn to correlate the efforts of eye and ear and voice (in singing) or fingers (in playing) into one well-synchronised act. In the study of a field of literature, or poetry, through the medium of reading it would be a heavy handicap to any lover of fine thought to have to struggle with the mere problems of reading as he went along, and in music there is no reasonable hope of an effectual national culture without a recognition of the proved need and possibility of teaching small children to read music before they leave school.

At the present day it seems quite exceptional, either in a school or in a place of worship where singing is expected, to find even the melody of the tune supplied to the scholars or the congregations. Indeed it seems probable that if by some magic wand all the "Words only" editions of hymn books and song books in the whole country could be transformed into "Melody editions" for twenty years, a standing, but apparently needless, difficulty would be automatically removed. The present writer met a young airman during the recent war, who, being driven to find relief from war in trying to make melody for himself, had actually to invent a queer and original notation of his own by the use of numerals in which to write down his melodies.

It is interesting here to note that the thousand-year-old Sol-Fa syllables, by which notes are still to this day set down and learnt, were originally the result of an effort by Guido, a monk of Arezzo, to teach music-reading by associating the first syllable of each line of a certain hymn to St. John the Baptist with one of the six degrees of the hexachord. Just as the monastic schools of Europe contributed to the teaching of music much that was based on immediate experience, so also have our own choir schools, attached to the cathedrals, collegiate chapels, and to some churches. Nevertheless, it seems clear that the great hope of a broad basis of music teaching and of general musical culture lies in the ordinary schools of the country, and to some extent also in that choral singing which is so wholesomely associated with the act of worship.

Apart altogether from teaching performance, or mere reading, the art of teaching as applied to music itself seems to have lingered, up to the present, in what are naturally first stages. Just as the first stage of teaching a small child its mother-tongue is naturally that of imitative repetition, so in music the communication of the art from mind to mind has, broadly speaking, continued to dwell, up to the present, in that region where imitation of the practice of admirable composers is urged upon the learner, or where, at the best, the composer's customs and ways are reduced to certain bye-laws (necessarily with many exceptions) treated as laws, or even as high principles, and invested with an authority often pathetically falsified by events. To take a notorious example, the excellent bye-law against the writing of so-called consecutive fifths in similar motion between any two parts (say a tenor and a bass part) is laid down in almost all text-books, and yet it is cautiously set aside by many, and by others freely flouted, obviously not for caprice, but faithfully.

### MODERN OUTLOOK

Still, in spite of the conspicuous absence of an accepted way of teaching music on any logical and generally comprehensible basis —an absence, that is, of any *corpus* of teaching based on broad principles which commend themselves to the common sense of all men—good sectional teaching has been evolved, either by following the general course of musical history, or by following merely the particular practice of one period (such as that of the 16th century, for so-called Strict Counterpoint) and sometimes

even of one towering, dominating mind (such as that of Bach, for Fugal Counterpoint). There has consequently been a voluminous and careful output of useful treatises which have done much to help the student, if also often to puzzle him as to the why and wherefore of their inhibitions. These treatises usually still divide musical study into what seem to be arbitrary partitions.

Our leading colleges and academies of music, as well as our university musical faculties, have, up to the present, prescribed courses, both of teaching and of examination in music, broadly under the following six sectional heads:—harmony; counterpoint; fugue and fugal counterpoint; musical form; musical history; composition. The gaps, the overlappings, and the confusions of such a system are glaring, and increasingly disconcerting to teachers and students alike.

To name but one gap, it will be noticed that melody is not itself a fixed subject of tuition at all, though a moment's thought would probably cause 999 out of any 1,000 teachers to admit gladly that if their pupils in all the other sections came to them after a special course in melody, and in the mastery of melodic sense, construction and analysis, their powers to cope with and co-ordinate the rest of their musical studies—including Harmony, Counterpoint, Fugue, Form, and the whole range of Composition —would be measurelessly enhanced.

Again, to name but one of the many overlappings, harmony and counterpoint are practically and admittedly inseparable. It is as impossible to detach harmony from counterpoint as it is impossible to do the simplest cross-word puzzle without thinking both vertically and horizontally. Yet they are definitely divorced for study, though all good teachers help their pupils to the habit of unified thinking.

Finally, to name but one confusion, counterpoint may still be taught by one good teacher (following perhaps Rockstro and R. O. Morris) as a method of acquiring understanding of sixteenth-century musical style, and by another equally good teacher (following perhaps Albrechtsberger via Macfarren) as a mere artificial method of restricted mental exercises under temporary bye-laws. As a result, perhaps in the same music school or university, a student may be counselled in his counterpoint exercises to write gracious melody, mostly consisting of steps of a second and leaps of a perfect fourth or fifth (not because they accord with musical principles, but because Palestrina wrote in that way), and in another room he may be told mainly to restrict himself to one chord in a bar and to write a given number of notes to that chord in each exercise, and he may be allowed to leap diminished fifths and major sixths in the process as he pleases, so long as the one chord is maintained.

Obvious as are all three kinds of drawbacks, present-day teachers of music can at least claim the merit of sending students to consult and emulate the personal perfections of the composers who seem most trustworthy and admirable. But it is clear that we await a new and simpler teaching, more impersonal, more tolerant yet more precise, based on high common-sense.

Three notable factors in today's position as to the general teaching of music throughout the country may here be briefly noted, one of which is new. The first is that the mere technical difficulties of performing music (whether vocally or instrumentally) seem to musical aspirants so numerous and formidable as perpetually to side-track the essential work of the teacher. When a mother says "I wish my daughter to learn music" she naturally means her to learn to play or sing, and to that both time and cost are constantly devoted.

A second formidable factor in the position is the mere technical difficulty, still felt, of teaching music-reading and script. Curwen's excellent adaptation of the ancient solmization and the ingenious French Chevé method of using numerals have helped to ease the situation in schools. But until the books are in the schools and the acts of reading from, and writing on a music-stave can be taken by the children in their stride while they are daily making melody together and enjoying it with disciplined zest, it is hard to see improvement ahead.

The third and hopefully new factor, which may render the present article speedily obsolete, is the sudden vast increase in availability of good music, and consequently of musical stimulus and enjoyment, by means of wireless and the gramophone. (*See* SCHOOL AND CURRICULUM: *Music.*) (H. W. D.)

### THE UNITED STATES

Music received slight attention in the days of the American colonists. For the improvement of church music, manuals of instruction in singing were prepared early in the 18th century by two Massachusetts ministers, the Rev. John Tufts and the Rev. Thomas Walter. These books and their successors provided the text material for the "singing schools" and "musical conventions" which for years represented the chief activity in music study.

The first well organized effort to provide a more complete musical education was the Boston Academy of Music founded by Lowell Mason in 1833. From about 1840 a considerable number of Americans went abroad to study music, chiefly in Germany. These pioneers, reinforced by many foreigners, were leaders in the marked advance of their profession, especially after the Civil War. Music education was recognized by instructors in music at Oberlin college from 1838 and at Harvard from 1862. The college music department and the independent music school were first exemplified by the foundation of Oberlin conservatory (1865) and the New England conservatory (Boston, 1867). Then followed the Cincinnati Conservatory of Music (1867), Chicago Musical college (1867), Peabody conservatory (1868), College of Music in Cincinnati (1878) and the American conservatory (Chicago, 1886).

The most important music schools have developed along two general lines, either as independent music schools or as college or university departments. In the former the graduate receives a degree or diploma; in the latter music study is credited toward an academic or musical degree. Further additions to the list include the Yale School of Music, University of Kansas, University of Michigan, Vassar, Wellesley and Smith colleges, Combs conservatory (Philadelphia), Northwestern university, Syracuse university, Columbia School of Music (Chicago), Bush conservatory (Chicago), Newcomb college, Detroit Conservatory of Music, MacPhail School of Music (Minneapolis), Cornish school (Seattle), Louisville conservatory, Pittsburgh Musical Institute, Horner Institute (Kansas City, Mo.) and Cleveland Institute.

Four music schools have special endowments. The oldest was founded in 1904 as the Institute of Musical Art of New York; since 1926 it has been called The Institute of Musical Art of the Juilliard School of Music. The bequest of Augustus D. Juilliard (1919) left some millions of dollars for the promotion of musical education and culture, and led to the founding of a music school in New York city (1924). It is now a graduate school for students of unusual talent, with the Institute of Musical Art and an extension department as under-graduate provisions. The Eastman School of Music (1919) at Rochester, N.Y., a department of the University of Rochester, has been endowed with $12,000,000 by George Eastman. The Curtis Institute of Music in Philadelphia (1924) has been endowed with more than $12,000,000 by Mrs. Edward W. Bok.

In 1908 Arthur L. Manchester prepared a report on music education in the United States for the Bureau of Education, dealing with schools and departments of music, not with public schools. The widely varying curricula quoted led the compiler to the conclusion that undue exaltation of the vocational aspects of music had led to the separation of music from general educational thought. An improved condition is shown by the 1928 report of the National Research Council of Music Education, which shows that 85% of colleges and universities now allow entrance credit for music, and 77·5% offer courses in music for credit toward a degree. The organization (1924) of the National Association of Schools of Music is also promoting a more satisfactory state of curricula and credits. Efforts have been made in some States to demand certain standards of attainment for the work of the private music teachers, who flourish in abundance, but State regulation is not yet common. Chief among the teachers' organizations is the Music Teachers National Association, founded in 1876 by Theodore Presser. Many State associations of music

teachers have functioned along similar lines.

Public school music implies the recognition of music education for everyone, as contrasted with its study as a speciality. It began with Lowell Mason's work in the Boston public schools in 1837, an example followed promptly in Buffalo, Pittsburgh, Louisville, Cincinnati, San Francisco and other communities. The text-books were derived from those of the "singing schools." The first provided for public school use were by Lowell Mason and Charles Aiken. *The National Music Course* (Luther Whiting Mason, 1870) was the first of numerous courses providing systematically arranged vocal material for all public school grades. In 1885 the Bureau of Education reported 90 special music teachers in 247 communities. By 1914 the number of communities had risen to 622, of which only 15 had no special supervisor of music. This report indicates decided advances in the education of the music supervisor; the existence of 238 high school orchestras (evidently beginning at Richmond, Ind., under the direction of Will Earhart); the teaching of harmony, music history or appreciation in school; the accrediting of private music lessons outside school; and a higher standard of choral music. The Music Supervisors National Conference was organized in 1907; in 1928 its membership exceeded 5,000.

The literature of musical education has received important contributions in theory from George W. Chadwick, Hugh A. Clarke, Benjamin Cutter, Arthur Foote, Percy Goetschius, Walter R. Spalding, Adolf Weidig and Bernhard Ziehn; in history from Edward Dickinson, Louis C. Elson, Waldo S. Pratt and O. G. Sonneck; in aesthetics and appreciation by Charles H. Farnsworth, Clarence G. Hamilton and Daniel Gregory Mason; in musical education by Frank Damrosch, Carl E. Seashore and Archibald T. Davison; in public school music by Karl W. Gehrkens, T. P. Giddings, P. W. Dykema and Edward B. Birge.

Scholarship is evidenced by *The Musical Quarterly.* Of the magazines devoted to music teaching *The Etude, The Musician, The Musical Observer* and *Singing* are among the most popular. Regular publications of various associations provide a valuable aggregate of educational ideas. Reproducing instruments of player-piano and gramophone types have had considerable place in school-music teaching and offer large supplies of educational material. Organizations deserving mention are the American Guild of Organists (1896), The American Academy of Teachers of Singing (1922), the Associated Glee Clubs of America, the Intercollegiate Musical Council and the National Federation of Music Clubs. The Carnegie Foundation has financially encouraged educational efforts in music, including the church music school at Northwestern university.

The trend of organized music instruction is toward a curriculum which balances performance and general music learning. There is abundant interest in music study and great activity in all its departments. This reflects public as well as professional concern.

(C. N. B.)

**MUSICAL-BOX.** The modern musical-box is an elaboration of the elegant toy musical snuff-box in vogue during the 18th century. The notes or musical sounds are produced by the vibration of steel teeth or springs cut in a comb or flat plate of steel, reinforced by the harmonics generated in the solid steel back of the comb. The teeth are acted upon and musical vibrations produced by the revolution of a brass cylinder studded with projecting pins, which, as they move round, raise and release the proper teeth at due intervals according to the nature of the music. The revolving motion of the cylinder is effected by a spring and clockwork, and the rate is governed by a fly regulator.

**MUSICAL COMEDY,** a popular form of theatrical entertainment, developed almost exclusively by the English-speaking peoples.

Clearly it bears little relation to the classical *opera buffa* of Italy. For that had no spoken dialogue, its place being taken by *recitativo secco,* a formal and rhetorical delivery of the words, supported by the lightest accompaniment. Mozart's *Figaro* and Rossini's *Il Barbiere* are good examples of *opera buffa.* Nor has musical comedy any real connection with the German *Singspiel* although in this case spoken dialogue is used instead of *recitativo secco.* In France the *Singspiel* developed into *opéra comique.* But the French comic opera was not necessarily comic, being so called merely to differentiate it from grand opera. But one may look to the *vaudeville,* which dates its popularity from the time of the French Revolution, as being a more direct ancestor of modern musical comedy. But the *vaudeville* was written in verse, and musical comedy employs lyrics only for musical setting, the play itself being carried on by spoken dialogue.

A much closer analogy is to be found in the French *opéra bouffe,* which it may be noted is not to be identified with the Italian *opera buffa.* In the former, spoken dialogue alternates with light music, and in the play itself there are generally topical or satirical allusions. From the *opéra bouffe* and *vaudeville* sprang the operetta; at first, as its name implies, a short opera of one act which was employed to lengthen the evening's entertainment. Gilbert and Sullivan practically founded their operas on the operetta and *opéra bouffe,* but, except at first, they cast them into two acts of sufficient length to fill the bill. On its formal side, the English ballad opera may be considered one of the models for musical comedy. The English ballad operas came into being as a protest against the Italian operas of the 18th century. The English works were even composed in the Italian manner, recitative taking the place of dialogue. But they did not have much success until Gay wrote *The Beggar's Opera.*

The *genre* of musical comedy, then, is in direct descent from the *opéra bouffe* and the *vaudeville* of the French, combined with our own ballad operas, and, as it is known in London and New York, is an expression of a love of boisterous and farcical humour rather than of the high comedy of the operetta. Its humour is broader, more farcical and more eccentric than anything to be found in light French or Viennese opera, and the student will find curious evidence of this in the change which French or Viennese light operas undergo when adapted to the British or American stage as musical comedies. André Messager's *Véronique,* for instance, was first performed in London by a French company (1903) as a light opera. When it was produced, shortly afterwards, in an English version, the comedy part of the florist was developed by Mr. George Graves into that of an eccentric low comedian. The same procedure has been followed in the case of the many Viennese operas by Oscar Straus, Leo Fall, Franz Lehar and others which in more recent years have enjoyed such popularity in England and America. The farce of musical comedy was added, this element being a relic of the old-fashioned Gaiety burlesque. Those burlesques were in themselves more in the nature of what afterwards came to be known as *revue* in London and New York than of the musical comedy of to-day, with its definite plot and sentimental scenes. But it was from the Gaiety burlesque that the Gaiety musical comedy developed, with its music written by Lionel Monckton, Howard Talbot, Ivan Caryll and others.

During recent years the popularity of musical comedy of the older kind has been rivalled by that of the more go-as-you-please type of entertainment known as revue. In Paris, where it had its origin, the revue had a special character of social satire and topical interest. As adapted to the requirements of English-speaking audiences the revue has been a much more miscellaneous affair, a mere *mélange* of songs, sketches, low comedy, ballets and pageants strung together haphazard, although frequently including a strong infusion of the satirical and topical elements and thus recalling its French ancestry. So far as the London stage was concerned George Grossmith, who had taken such a large part in the Gaiety musical comedies, was the first to adapt the revue from France.

Revues became more and more spectacular, and gradually the best of these entertainments included ballets and pageants of great beauty. In a sense, that type of revue was a throw-back to the masque. With the popularity of revue, "syncopated" or "jazz" music found its way to the stage from the variety halls. From revue it gradually crept into musical comedy, and the long continuance of the World War, which automatically put an end to the domination of the Viennese school of musical comedy or light opera, gave this newer musical fashion full scope.

In the United States there is a College Musical Comedy League, founded in 1927 and consisting of various university bodies, one of which, the Hasty Pudding Club, of Harvard university, dates back as far as 1795; others being the Mask and Wig Club of the University of Pennsylvania (1889), the Triangle Club of Princeton university (1893), the Haresfoot Club of the University of Wisconsin (1898), the Blackfriars of the University of Chicago (1904), and the Mimes of the University of Michigan Union (1906).

**MUSICAL INSTRUMENTS, MECHANICAL.** (*See* BARREL-ORGAN; MUSICAL-BOX; GRAMOPHONE; PLAYER-PIANO; MUSIC FROM ELECTRIC OSCILLATIONS.)

**MUSICAL NOTATION,** a graphic method of representing sounds to the ear through the medium of the eye. It is probable that the earliest attempts at notation were made by the Hindus and Chinese, from whom the principle was transferred to Greece. The exact nature of the Greek notation is a subject of dispute, different explanations assigning 1680, 1620, 990, or 138 signs to their alphabetical method of delineation. To Boethius we owe the certainty that the Greek notation was not adopted by the Latins, although it is not certain whether he was the first to apply the 15 letters of the Roman alphabet to the scale of sounds included within the two octaves, or whether he was only the first to make record of that application.

Indications of a scheme of notation based, not on the alphabet, but on the use of dashes, hooks, curves, dots and strokes are found to exist as early as the 6th century, while specimens in illustration of this different method do not appear until the 8th. The origin of these signs, known as neumes (*q.v.*) (*νεύματα*, or nods) is the full stop (*punctus*), the comma (*virga*), and the mound or undulating line (*clivus*), the first indicating a short sound, the second a long sound, and the third a group of two notes. The musical intervals were suggested by the distance of these signs from the words of the text. The variety of neumes employed at different times, and the fluctuations due to handwriting, have made them extremely difficult to decipher. In the 10th century a marked advance is shown by the use of a red line traced horizontally above the text to give the singer a fixed note (F=fa), thus helping him to approximate the intervals. To this was added a second line in yellow (for C=ut), and finally a staff arose from the further addition of two black lines over these.

A variety of experiments resulted in the assignment of the four-lined staff to sacred music and of the five-lined staff to secular music. The yellow and red colours were replaced by the use of the letters F and C (fa and ut) on the lines. This use of letters to indicate clef (*q.v.*) is forestalled in a manuscript of Guido of Arezzo's *Micrologus,* dating from the 12th century, in which is the famous hymn to St. John, printed with neumes on a staff of three lines (*see* GUIDO OF AREZZO and HEXACHORD). The use of letters for indicating clefs has survived to the present day, our clef signatures being modified forms of the letters C, F and G, which have passed through a multitude of shapes.

Before the 12th century there is no trace of a measured notation (*i.e.,* of a numerical time division separating the component parts of a piece of music). It was at the time of Franco of Cologne that measured music took its rise, together with the black notation in place of neumes, which disappeared altogether by the end of the 14th century. In the black notation, which led to the modern system, the square note with a tail (𝅗𝅥) is the long sound; the square note without a tail (𝅜) is the *breve;* and the lozenge shape (𝅝) is the *semibreve.* In a later development there were added the *double long* 𝅜 and the minum (𝅗𝅥). The breve, according to Franco of Cologne, was the unit of measure.

The development of a fixed time division was further continued by Philippe de Vitry. It has been noted with well-founded astonishment that at this period double time (*i.e.,* two to the bar) was unknown, but only triple time which was regarded as "perfect"—"because it hath its name from the Blessed Trinity which is pure and true perfection." Vitry championed the rights of imperfect time and invented signs to distinguish the two. The perfect circle 𝅝 represented the perfect or triple time; the half circle 𝄴 the imperfect or double-time. This 𝄴 has survived in modern notation to indicate four-time, which is twice double-time; when crossed 𝄵 it means double-time. The method of dividing into perfect and imperfect was described as *prolation.* The addition of a point to the circle or semi-circle (𝅝 𝄴) indicated major prolation; its absence, minor prolation. The substitution of white for black notation began with the first year of the 14th century and was fully established in the 15th century.

It has already been shown how the earlier form of alphabetical notation was gradually superseded by one based on the attempt to represent the relative height and depth of sounds graphically. The alphabetical nomenclature, however, became inextricably associated with the graphic system. The two conceptions reinforced each other; and from the hexachordal scale, endowed with the solmization of *ut, re, mi, fa, sol, la*—which was a device for identifying notes by their names when talked of, rather than by their positions when seen on a page of music—arose the use of what are now known as accidentals (*q.v.*).

Of these it may here be said that the flat had originated from the necessity of sinking the B of the scale in order to form a hexachord on the note F in such a way as to cause the semitone to fall in the right place—which in the case of all hexachords was between the third and fourth notes. This softened B was written in a rounded form thus: ♭ (*rotundum*), while the original B remained square thus: ♮ (*quadrum*). The original conception of the sharp (*q.v.*) was to cross or lattice the square B, by which it was shown that it was neither to be softened nor to remain unchanged. The flat, which originated in the 10th century, appears to have been of far earlier date than the sharp, the invention of which has been ascribed to Josquin Des Près (1450–1521). The B-sharp was called B *cancellatum,* the cross being formed thus ♯.

The use of key signatures constructed out of these signs of sharp and flat was of comparatively late introduction. The key signature states at the beginning of a piece of music the sharps and flats which it contains within the scale in which it is written. It is a device to avoid repeating the sign of sharp and flat with every fresh occasion of their occurring. The double bb and the double sharp 𝄪 are conventions of a much later date, called into existence by the demands of modern music, while the sign of the natural (♮) is the outcome of the original B quadration or square B♮. (*See* TONIC SOL-FA and CHEVÉ SYSTEM.)

### PROPOSED NEW SYSTEMS OF NOTATION

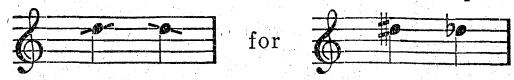
As regards the many new systems of notation which have been proposed during recent times, it must be remembered that although the staff notation (as we call the system of two separate staves of five lines each) was originally invented at a time when the unequal temperament system of tuning prevailed (*see* TEMPERAMENT), yet this old notation developed and is now employed in conjunction with equal temperament, from which it can never really be dissociated. Hence, for practical purposes, and theoretical implications apart, the result is the same, whether we write G sharp or A flat, for instance. For while some musicians still refuse to accept equal temperament save as an unavoidable compromise and you find such declaring that they "never think of the keyboard" when composing, yet the notation which they are compelled to use has no means of showing any finer divisions than equal temperament affords. The existing notation is not capable, for instance, of showing the difference between the real natural major third of the horn and the major third of the tempered keyboard.

It is possible that a means of doing this may be devised in time. If so, it may perhaps follow the system adopted by Anselme Vinée in his *Principes du Système Musical et de l'Harmonie* (Hamelle, Paris, 1909), in which he applies various marks (tiny curves, dashes and crosses) to the notes of the staff notation to indicate these extremely small variations in pitch.

As music became more and more chromatic, the complexities of notation increased tremendously by the multiplication of signs for what was practically the same sound. Thus C sharp, D flat

and B double-sharp have three different signs, but, in equal temperament, only one sound. Hence, during the last quarter of a century or so, many attempts at a simplified form of notation have been made either by improving the old staff system or by the invention of an entirely new system.

H. Orsmond Anderton, a London composer, proposed, in his *Simplified Notation,* a new method of representing the chromatic signs called "accidentals" by substituting a line through the head of the note for the sharp or flat sign; thus D sharp and D flat

 for

A Spanish pianist and composer, Manuel Guervós (1863–1902), invented a system by writing the two staves (pentagrams) now called treble and bass into one "decagrama." He replaced the F and G clef (*see* CLEF) by a C clef resting on his 6th line. A German musical theorist, Hermann Stephani, went further in the reduction of lines. In 1905 he invented a system of notation which was entirely confined to the treble stave, all the higher and lower sounds being indicated by various octave signs. This system he called *Einheitspartitur* (unit-score) and he published in it the overture to Schumann's *Manfred.*

The acceptance of atonal music naturally makes for a system which shall ignore the difference between C sharp and D flat, D sharp and E flat, etc., and one of the chief apostles of that music, Josef Matthias Hauer, has published works with a special kind of atonal notation (Goll, Vienna).

Walter Hampton Thelwall, a London civil engineer, from 1893 onwards gradually evolved a system known as the Thelwall system, which uses two staves of seven lines each, the two staves reading alike, and the system involving a complete acceptance of the dodecuple principle, which divides the octave into 12 equal parts. Thelwall adopted for these the Roman numerals I. to XII. and his thick middle line is always the note VII., *i.e.,* middle C. In order still more to destroy that back-lying feeling of C major, he calls F sharp I. He repeats his seven-line stave for every octave, dotting in the upper staves as required, the octaves all being numbered—the bass octave 4, the tenor octave 5, the treble octave 6, and so on.

An Argentine musical theorist, Angelo Menchaca, invented a new system, an exposition of which was published in 1904 under the title of *Nuevo Sistema teorico grafico de la Musica,* by Pleyel, Lyon & Co., Buenos Aires. In this system the staff is dispensed with altogether and the sign represents the sound *Sól.* This note sign is written (or printed) in various positions for the various notes; and short and long stems represent the high or low octaves. The length of a note is shown by a point. (A full explanation of the system may be seen in Dent's *Dictionary of Modern Music and Musicians,* 1924, p. 352.)

Ferrucio Busoni (1866–1924) invented a new notation and published Bach's *Chromatic Fantasia* in it (Breitkopf and Härtel). Jean Hautstont, a Belgian composer and theorist (b. Brussels, Dec. 13, 1867), devoted himself to the reform of musical notation, and invented his *Notation Autonome* (Paris, 1907), which he applied in his *Solfège* (Paris, 1913). The system is based on the classification of sounds according to their vibration numbers, taken in conjunction with the physiological development of the human ear. In 1921 a society for publishing music in this notation was formed in Brussels.

In 1915, the Russian composer, Nicolas Obukof (b. Moscow, 1892), produced a work published in a new notation which abolishes the sharp and the flat and thus avoids duplication of signs. He ascribes new names to the notes represented by the black keys of the keyboard, viz., *Lo, To, Ra, Tu, Bi.* These were also derived from the ancient hymn from which the other syllables were derived by Guido of Arezzo. His scale reads *Do, Lo* (C sharp), *Re, Te* (D sharp), *Mi, Fa, Ra* (F sharp), *Sol, Tu* (G sharp), *La, Bi* (A sharp), *Si.* For the ordinary diatonic notes he uses the usual signs. For the sharp he uses the sign X or ⊗.

The English composer, John H. Foulds, has used tertia-tones in his orchestral *Music-Pictures.* op. 33 (1913), and in parts of his *World Requiem,* op. 60 (1923). He marks his two-thirds sharpened tone ♯, and his two-thirds flattened tone ♭.

Ivan Wischegradsky, a Russian composer, who has written much music on the quarter-tone system, has used the following signs: Ascending, one quarter-tone sharp, ; two quarter-tones sharp, ♯; three quarter-tones sharp, ; descending, one-quarter-tone flat, ; two quarter-tones flat, ♭ three quarter-tones flat, ♭.

Alois Haba, a Czech composer, who has quarter-tone pianos made for him by the firm of Foerster, at Georgswalde, in Bohemia, has written pianoforte pieces and also string quartets on the quarter-tone system. He uses the existing notation for the ordinary tones and semitones, and adds new signs like "accidentals" for the new quarter-tone notes. Thus C raised a quarter-tone is represented by  and C raised three quarter-tones by , D flattened a quarter-tone by  and D flattened three quarter-tones by .

But the best quarter-tone notation will not be one that is founded on the existing notation, which is already too complicated and over-burdened with signs; it will be one much simpler than the old. For our semitonal system we have 39 signs for but 12 sounds. A well-designed quarter-tone system will only need 24 signs for 24 sounds. According to Haba, the new system will give no fewer than 288 new intervals; and 253 new three-note chords, with an infinite number of 4-, 5-, and 6-note chords.

Reform must certainly take the way of simplification, and a new notation is long overdue. The great obstacle is, of course, the cost of replacing the immense amount of music already published in the existing notation.

BIBLIOGRAPHY.—E. David and M. Lussy, *Histoire de la notation musicale* (Paris, 1882); H. Riemann, *Notenschrift und Notendruck* (1896); C. F. Abdy Williams, *The Story of Notation* (1903); Robert Eitner, *Bibliographie der Musik: Sammelwerke des 16. und 17. Jahrhunderts* (Berlin, 1877); Friedrich Chrysander, "Abriss einer Geschichte des Musikdrucks vom 15.–19. Jahrh.," *Allgemeine musikalische Zeitung* (Leipzig, 1879, Nos. 11–16); W. H. James Weale, *A Descriptive Catalogue of Rare Manuscripts and Printed Works, chiefly Liturgical* (Historical Music Loan Exhibition, Albert Hall, London, Jan.–Oct. 1885) (London, 1886); W. Barclay Squire, "Notes on Early Music Printing," in the *Zeitschrift bibliographica,* p. ix. s. 99–122 (London, 1896); Grove's *Dict. of Music;* Dent's *Dict. of Modern Music;* and works named in text. (A. E. HUL.)

**MUSIC FROM ELECTRIC OSCILLATIONS.** The mathematical theory of electric oscillations was given by Lord Kelvin so long ago as 1853, in a famous Paper in *The Philosophical Magazine* called "Transient Currents." Helmholtz had already shown that the conservation of energy required an electric discharge under certain conditions, even a flash of lightning, to be oscillatory. And the fact that the discharge from a leyden-jar or other condenser consisted of an alternating current was subsequently verified by Feddersen, who photographed the spark in a revolving mirror, and saw that the band to which it was spread out was beaded. The merit of Lord Kelvin's paper was that it recognized the two chief causes of the oscillation, the electrostatic capacity of the condenser, on the one hand, which may be likened to the storage of energy in a spring with elastic recoil, and what he called the electrodynamic capacity of the discharger, on the other, which may be likened to the momentum of a stream of water or other material. These two properties are essential to oscillations. They may be called elasticity and inertia or momentum.

Whatever may be the reason, electricity exhibits these two properties. An electric charge displays the one, an electric current the other. Every detail of the oscillations was worked out by Kelvin, considered as the free and dying out oscillations resulting from the running down of stored energy, on the analogy of a tuning-fork. But whereas the oscillations of matter are to be estimated at the rate of a hundred, or at most a few thousand, per second, the rate of electric oscillation, which is concerned not with matter but with the ether, is to be reckoned in millions a second. Consequently electric oscillations are far too rapid to affect the ear, unless they are rectified and made tractable by some

such device as Fleming's vacuum valve.

Of late it has become possible, by means of valves, to maintain the oscillations continuously, from any convenient source of power, and such oscillations are in common use for wireless telegraphy. When two such circuits are operating in the same neighbourhood, though independently, they produce interference phenomena or beats, corresponding to the difference in their rate of vibration; and then, if the circuits are not too different or far apart in their rate of vibration, the beats may be of audible frequency when they are rectified, and communicated to a telephone or loud-speaker. For instance if one oscillated at 1,000,000 a second, and the other at 999,000, the beats would be 1,000 a second, which corresponds to a high note, say C, above the treble clef. Any variation in the capacity of one of the circuits, modifying its rate of vibration so as to bring the two nearer together, would lower the pitch of the beat-note, and might abolish it altogether if the two circuits were exactly in tune. The pitch of the beats can in fact be raised or lowered at will. The process of extracting beat-notes is often called "heterodyning."

A Russian inventor, M. Leo Theremin, by constructing the circuits so that the condenser of one of them has an exposed part whose capacity can be varied by bringing the hand near it, found that he could control the pitch of the beat-note in a satisfactory manner by alternately approaching and withdrawing his hand, and that by another device he could vary the loudness by similarly moving the other hand. He thus had what might be called a musical instrument, in which electric oscillations were controlled both in pitch and in loudness by the movement of the two hands, and thus, after a good deal of practice, by skilfully waving his hands, he was able to perform serious music. (O. J. L.)

M. Theremin's experiments took final shape in an instrument which he called the Etherophone, remarkable performances by which were given in the Albert Hall, London, and elsewhere. Other instruments operating on similar lines which have been invented include Taubmann's Electronde (1923); the Martenot, of Maurice Martenot (1928), for which many of the leading French composers have written special works; Trautwein's Trautonium (1930); the Enicorn, of American origin (1930); the Mellertion (1933); the Obukov, of Nicholas Obukov, a Russian (1934); and the Dynaphone, of René Bertrand. (*See* an informing article on the whole subject in Scholes's *Oxford Companion to Music.*)

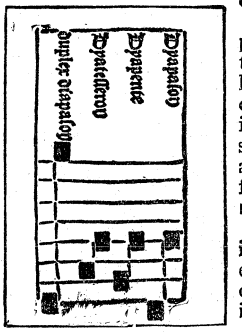
**MUSIC PRINTING.** Printed music originated soon after the invention of typography and the year 1465 is given as the earliest date of any record of its existence. At first the method was only used for printing the staves in red ink from a woodcut, the notes being written in by hand. Later the staves and notes were engraved separately on wood blocks and printed respectively in red and black. Then followed the practice of cutting both the staves and notes on one block for printing in black. There are no records of music being printed from separate characters before 1473 when a theological work by a German printer named Gerson was issued containing five notes of music evidently so printed. This may be regarded as the foundation of music printing.

In 1482 William Caxton, the first English printer, published a work entitled *Polychronicon,* in which there are a few notes of music, though apparently filled in to the printed stave lines by hand. Wynkyn de Worde, who succeeded Caxton, reprinted this work in 1495, introducing both the notes and stave lines by type characters, so that he must be given the credit of being the first English printer of music from movable type. The *Mainz Psalter* of 1490 contained type-printed music. In 1500 Ottaviano Petrucci, in Venice, produced music with the staves and notes printed from type by separate operations.

Thenceforward the system of printing the stave lines separately fell into disuse. Pierre Attaignat, in Paris (1529), was the first to print the words of songs under the notes. In 1530 music began to be printed in England with type similar to that used by Petrucci, and it was done in two printings, but in 1539 a London printer named Gough issued music from type characters with the staves and notes printed at one impression. In 1550 Richard Grafton printed in London the *Booke of Common Praier noted,* the musical part being executed in type with red stave lines. Printing from type then became general and by 1700 it had assumed the appearance of present day music.

Music printed from plates dates from 1525, when Pierre Hautin, a French engraver, cut punches for the notes and stamped them into metal plates, which were finished by engraving. This style of work became general in England and continued to hold the field until about 1710, when music printed from punched plates began to appear.

Lithographic music printing dates from 1799, being first applied by Senefelder, the inventor of lithography, who drew the music direct on stone, or on transfer paper.



FROM THE "POLYCHRONICON," PRINTED BY WYNKYN DE WORDE

SPECIMEN OF THE EARLIEST EXAMPLE OF TYPE-PRINTED MUSIC

Typographical music printing recovered its position with the production of better music type by the English letter-founders and came largely into use for hymnals, song books, and other musical works for which large editions in a cheap form are required. The work of setting-up music type is however very tedious as the staves and notes have to be built up from a large number of small pieces. A font may contain from 400 to 500 characters.

At the present day the bulk of music printing, at least for sheet music, orchestral parts, etc., is done by lithographic printing, the original plates being made partly by punching and partly by engraving on pewter.

The method of engraving starts with ruling the staves on the plate with a five-pointed rake-like tool, called a "score"; then the spacing between the notes (previously determined by marking-off the manuscript) is set out by a method called "pointing," which is done with a small compass. The character of the notes and their position on the stave are roughly indicated on the plate with a blunt steel point called a "marking pin." During the punching the plate is laid on a stone slab and the punches are held in contact with the plate while a smart blow is given with a steel mallet. A set of punches usually consists of 50 to 53 pieces as a rule. Only the heads of the notes are punched, the hooks, ties, etc., being finished by gravers and other engraving tools. All the usual signs are punched and the words of songs are filled in with letter punches. Photo-lithography has been largely used for reproducing out-of-print music, the plates of which have been destroyed. Collotype has been found very effective in reproducing old music in *facsimile.*

BIBLIOGRAPHY.—Robt. Steele, *The Earliest English Music Printing* (1903); Andrew Deakin, *Musical Bibliography* (Birmingham, 1893); F. Kidson, *British Music Publishers, Printers and Engravers* (1900); William Gamble, *Music Engraving and Printing* (1923); John Southward, *Modern Printing,* 5th ed., 1921; Article in Grove's *Dictionary of Music* (3rd ed.). (W. GAM.)

**MUSK,** the name originally given to a perfume obtained from the strong-smelling substance secreted in a gland by the musk-deer (*q.v.*), and hence applied to other animals, and also to plants, possessing a similar odour. The variety which appears in commerce is a secretion of the musk-deer; but the odour is also emitted by the musk-ox and musk-rat of India and Europe, by the musk-duck (*Biziura lobata*) of West Australia, the musk-shrew, the musk-beetle (*Calichroma moschata*), the alligator of Central America, and others.

To obtain the perfume from the musk-deer the animal is killed and the gland completely removed, and dried, either in the sun, on a hot stone, or by immersion in hot oil. It appears in commerce as "musk in pod," *i.e.,* the glands are entire, or as "musk in grain," in which the perfume has been extracted from its receptacle. Three kinds are recognized: (1) Tongking, Chinese or Tibetan, imported from China, the most valued; (2) Assam or Nepal, less valuable; and (3) Karbardin or Russian (Siberian), imported from Central Asia by way of Russia, the least valuable and hardly admitting of adulteration. The Tongking musk is exported in small, gaudily decorated caddies with tin or lead linings, wherein the perfume is sealed down; it is usually sent to the merchant by parcel post.

Good musk is of a dark purplish colour, dry, smooth and unctuous to the touch, and bitter in taste. It dissolves in boiling water to the extent of about one-half; alcohol takes up one-third of the substance, and ether and chloroform dissolve still less. A grain of musk will distinctly scent millions of cubic feet of air without any appreciable loss of weight, and its scent is not only more penetrating but more persistent than that of any other known substance. In addition to its odoriferous principle, it contains ammonia, cholesterin, fatty matter, a bitter resinous substance, and other animal principles. As a material in perfumery it is of the first importance, its powerful and enduring odour giving strength and permanency to the vegetable essences, so that it is an ingredient in many compounded perfumes.

*Artificial musk* is a synthetic product, having a similar odour to natural musk. It was obtained by Baur in 1888 by condensing toluene with isobutyl bromide in the presence of aluminum chloride, and nitrating the product. It is a symtrinitro-Ψ-butyl toluene. Many preparations have been made, and the odour seems to depend upon the symmetry of the three nitro groups.

MUSK in botany is *Mimulus moschatus.* (*See* MIMULUS.) The musk orchis is *Herminium monorchis;* musk mallow, *Malva moschata;* muskmelon, *Cucumis melo;* musk thistle, *Carduus nutans.*

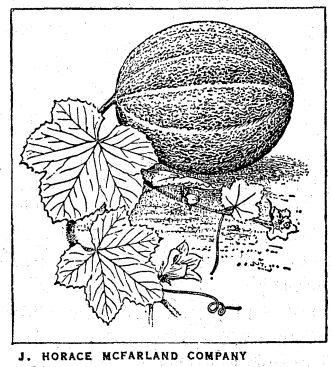
**MUSK-DEER** (*Moschus moschiferus*), an aberrant deer, presenting many peculiar characteristics (*see* DEER). There are no antlers, but in lieu of such weapons, the upper canine teeth of the male form projecting tusks. About 20 in. high at the shoulder, the musk-deer possesses long limbs, and there is a great development

of the lateral pair of hoofs. The ears are large and the tail rudimentary. The grayish-brown hair is long, coarse, and brittle. This animal inhabits the forests of the Himalayas as far west as Gilgit, always at great elevations and preferring thickets of birch, juniper, and rhododendrons. It extends into Tibet, Siberia and northwestern China. In habits the musk-deer is solitary, shy and nocturnal, but very active; it feeds on moss, grass and leaves. The deer takes its name from the secretion of a sac, about the size of an orange, beneath the skin of the abdomen, opening in front of the preputial aperture. This contains a dark brown substance of the consistency of "moist gingerbread." It is only present in the male (*see* MUSK). There is an allied species (*M. sifanicus*) inhabiting Kansu, distinguished by its longer, black ears.

**MUSKEGON** (mŭs-kē′gŏn), a city of western Michigan, U.S.A., on Lake Michigan, at the mouth of the Muskegon river, which expands here into a lake 5 mi. long by 1 to 5 mi. wide; a port of entry and county seat of Muskegon county. It is on federal highways 16 and 31 and is served by the Grand Trunk Western, the Pennsylvania, the Pere Marquette railways and by the Grand Trunk-Pennsylvania car ferry and boat service to Milwaukee. The population was 41,390 in 1930 (84% native white). By the census of 1940 the population had increased to 47,697, a growth of 6,307 or 15.2% in the decade. Muskegon Heights, also a city with an industrial population, had at the same date 16,047 and North Muskegon, 1,694. Muskegon has a fine landlocked harbour, with traffic amounting to 2,086,480 tons in 1940. It is the centre of a summer resort region; the metropolis of a fine dairying, farming and fruitgrowing district; and above all a modern industrial city, with 200 manufacturing establishments, employing 20,000 workers and producing an annual output valued at $100,000,000. Leading products are automobile motors and castings, aviation engines, office equipment, bowling and billiard equipment, piston rings, electric refrigerators, washers, gasoline pumps, window-shade rollers and laboratory-table equipment. The city's public parks cover 1,500 ac. and include 7 mi. of lake front. The assessed valuation of property for 1940 was $52,458,550. Bank clearings in 1940 were $34,114,514. The city operates under a commission-manager form of government. A trading post was established here in 1812, and permanent settlement began in 1834. The first sawmill was built in 1837. The town was laid out in 1849, was incorporated as a village in 1861, and chartered as a city in 1869. In 1870 the population was 6,002. The lumber industry reached its peak in 1887, with a cut of 700,000,000 bd.ft., and the population at that time was about 24,000. With the depletion of the forests, the population dwindled. The renewed prosperity began about 1900. The name Muskegon is probably derived from a Chippewa word meaning "grassy bog."

**MUSKET,** the term generally applied to the fire-arm of the infantry soldier from about 1550 up to and even beyond the universal adoption of rifled small-arms about 1850–60. The word originally signified a male sparrowhawk (Italian *moschetto,* derived perhaps ultimately from Latin *musca,* a fly) and its application to the weapon may be explained by the practice of naming fire-arms after birds and beasts (*cf.* falcon, basilisk). The "musket" proper, introduced into the Spanish army by the duke of Alva, was much heavier and more powerful than the arquebus. Its bullet retained sufficient striking energy to stop a horse at 500 and 600 yards from the muzzle. A writer in 1598 (quoted *s.v.* in the *Oxford English Dictionary*) goes so far as to say that "One good musket may be accounted for two callivers." Unlike the arquebus, it was fired from a rest, which the "musketeer" stuck into the ground in front of him. But during the 17th century the musket in use was so far improved that the rest could be dispensed with. The musket was a matchlock, weapons with other forms of lock being distinguished as wheellocks, fire-locks, snaphances, etc., and soldiers were similarly distinguished as musketeers and fusiliers. On the disuse, about 1690–95, of this form of firing mechanism, the term "musket" was, in France at least, for a time discontinued in favour of "fusil," or flint-lock, which thenceforward reigned supreme up to the introduction of a practicable percussion lock about 1830–40. But the term "musket" survived the thing it originally represented, and was currently used for the fire-lock (and afterwards for the percussion weapon). To-day it is generally used for military fire-arms anterior to the modern rifle. The original meaning of the word *musketry* has remained almost unaltered since 1600; it signifies the fire of infantry small-arms (though for this "rifle-fire" is now a far more usual term), and in particular the technique of using them (*see* INFANTRY and SMALL ARMS, THE DEVELOPMENT OF). A *musketoon* was a short, large-bore musket somewhat of the blunderbuss type, originally designed for cavalry use, but in the 18th century chiefly a domestic or coachman's weapon.

**MUSKMELON,** *Cucumis melo,* a polymorphic species of the family Cucurbitaceae, including numerous varieties. The muskmelon is a tender annual trailing herb with palmately-lobed leaves, and bears tendrils by means of which it is readily trained over trellises. It is monoecious, having male, female, and, in some varieties, complete flowers on the same plant; the yellow flowers have deeply five-lobed campanulate corollas and three stamens. It is a native of south Asia "from the foot of the Himalayas to Cape Comorin" (*see* Charles Naudin, *Annales des sciences naturelles,* vol. 4., 1859), where it grows spontaneously, but is cultivated in the temperate and warm regions of the whole world. It is variable both in diversity of foliage and habit, but much more so in the fruit, which in some varieties is no larger than an olive, while in others it rivals the squash (*Cucurbita maxima*). The fruit is globular, ovoid, spindle-shaped, or serpent-like, netted or smooth-skinned, ribbed or furrowed, variously coloured externally, with white, green or orange flesh when ripe, scented or scentless, sweet or insipid, bitter or even nauseous.



J. HORACE MCFARLAND COMPANY

MUSKMELON (CUCUMIS MELO)

Like the squash and pumpkin the melon undergoes strange metamorphoses by crossing its varieties, though the varieties preserve their characters when alone. The offspring of all inter-variety crosses within the species are fertile.

Naudin thought it probable that the culture of the melon in Asia is as ancient as that of all other alimentary vegetables. The Egyptians grew it, or at least inferior races of melon, which were either indigenous or introduced from Asia. The Romans and doubtless the Greeks were familiar with it, though some forms may have been described as cucumbers. The melon began to be extensively cultivated in France in 1629, according to Olivier de Serres. Gerard (*Herball,* 772) figured and described in 1697 several kinds of melons or pompions, but he included gourds under the same name.

The region of origin of some of the chief modern races, such as "cantaloups," "Dudaim," "Cassaba" and probably the netted or nutmeg sorts, is believed to be Persia and the neighbouring west Asian regions. The first of these was brought to Rome from Armenia in the 16th century, and supplies the chief sorts grown for French markets; but many others are doubtless artificial productions of west Europe.

In the coolest parts of the temperate zones muskmelons, like cucumbers, can be grown to perfection only under glass. In Great Britain and northern Europe the rock and cantaloup types may be grown with a soil temperature of 70° F. and an air temperature of 75° to 80° in the sun; the Persian varieties require temperatures about 5° higher, and will tolerate 90° or more in the sun. Most varieties are subject to many diseases, control of which is aided by keeping the air humidity relatively low. Muskmelons grow well on a wide range of soil types but require high fertility and ample soil moisture, and respond well to heavy applications of manure.

In the United States and in the warmer parts of the temperate zones, muskmelons are grown very extensively in the field. The plants are usually spaced about 2 ft. apart in rows 5 ft. apart or in hills 5x5 ft. apart. Some of the earliest plantings are protected by wind-breaks of brush and paper or by individual plant covers of paper until warm weather arrives. Plants are sometimes started in pots in hotbeds or greenhouses, then set in the field when danger of frost is past. Since muskmelons are favoured by a relatively dry atmosphere they are especially adapted to growing in the irrigated valleys of western and southwestern United States. Plant breeders developed (1935–42) a number of varieties resistant to one or more forms of powdery mildew, a disease that nearly destroyed the muskmelon industry of the Imperial valley in California. In greenhouse culture, the flowers must be hand-pollinated, or hives of bees established inside the houses to effect pollination. The fruits must be supported in slings since the trellised vines are not strong enough to carry them. In the U.S. muskmelons are very widely grown in home gardens and in 1940 and 1941 about 126,000 ac. were grown for market. The states producing the largest quantities (1930–39) were California, Arizona, Colorado, Maryland, Michigan, Indiana, New Jersey, Texas and Delaware. A large share of U.S. production is shipped 2,000 to 3,000 mi. to market in refrigerated railway cars. (V. R. B.)

**MUSKOGEE** (mŭs-kō′gē), a city of eastern Oklahoma, U.S.A., 130 mi. E.N.E. of Oklahoma City, near the confluence of the Verdigris, the Grand and the Arkansas rivers; county seat of Muskogee county. It is on federal highways 62, 64 and 69; has a well equipped airport (Hat Box field) controlled by the United States air service; and is served by the Frisco, the Kansas, Oklahoma and Gulf, the Midland Valley and the Missouri-Kansas-Texas railways and many motor carriers. Pop. (1920) 30,277

(24% Negroes); in 1940, 32,332. It is the location of U.S. Veterans Administration facility No. 51 (general medical and surgical hospital and regional office) and the Oklahoma School for the Blind, headquarters of the Indian Agency for the Five Civilized Tribes, and the home of the Oklahoma free state fair. At Bacone, 2 mi. N.E., is Indian university (Baptist, 1884). Muskogee is the metropolis of a rich agricultural and oil-producing territory. It has large railway shops, yards, and offices; wholesale and jobbing houses; cotton gins and compresses and cotton-seed oil mills. The factory output in 1940 was valued at $15,000,000. Bank transactions ending in 1940 totalled $112,640,580. The assessed valuation of property for 1940 was $14,628,365. Muskogee was founded about 1870, and became the chief town of the Creek Nation and the administrative centre of the former Indian territory. The first railway (the "Katy") reached it in 1872. In 1893 the Dawes commission began to transform the tribal allotments into individual holdings. The city was chartered in 1898, and in 1900 it had a population of 4,154. By 1910 the population was 25,278, a six-fold increase in the decade. The managerial form of government was adopted in 1920.

**MUSKOGIAN INDIANS.** This group constituted one of the larger speech stocks of native North America, and was typical of and dominant in the southeastern area of aboriginal culture, comprising the region from the Gulf of Mexico to Tennessee, and from the Carolinas to Louisiana. The Muskogian family comprised a series of divisions: 1, Apalachee; 2, Hitchiti, Apalachicola, etc.; 3, Alabama, Koasati, etc.; 4, Choctaw, Chickasaw, Mobile, Pensacola, etc.; 5, Tuskegee; 6, Cusabo, Yamasee and other tribes of the Georgia coast; 7, Miskogi proper. The latter formed the bulk of what was later the Creek confederacy, in which the Hitchiti and other groups were included. The Natchez and Taensa of the lower Mississippi seem to be a remote Muskogian offshoot; the Calusa and other south Floridian tribes may be. Since the middle of the 18th century the historically important tribes have been the Choctaw, Chickasaw and Creek, plus a branch of the latter, the Seminole. With the non-Muskogian Cherokee, these make up the "five civilized tribes," which for three-quarters of a century, until 1906, maintained quasi-autonomous governments in Indian territory (Oklahoma), where they had removed under the pressure of American settlement.

Ethnographically the Muskogian or Southeastern culture province included, besides the groups listed, the Chitimacha and Tunica of the lower Mississippi, the Iroquoian Cherokee, the Timucua of central Florida and, in the lower region of Georgia and Carolina, the Yuchi, the Algonkin Shawnee and various eastern Siouan tribes. All these groups were agricultural, planting maize, pumpkins, beans, cane-millet, tobacco, sometimes Jerusalem artichokes, and sunflowers. They gathered hickory nuts and wild fruits, hunted deer and, in the west, bison, and stored nut oil and bear fat. The settlements were straggling; the "town" contained a square, on which were public and religious buildings; "villages" were often outlying. The towns were autonomous and essentially constituted tribes. They united into confederacies, directed by councils; such confederacies might break up and recombine. The most successful, like those of the Creek and Choctaw, grew in population during the colonial period, largely through absorption of smaller or scattered groups. The tribes were divided into matrilineal, totemic clans; chieftainship and office were hereditary, probably in the lineage within the clan. The Natchez and some other groups had superimposed a peculiar class or caste system. Chiefs in these cases were carried in litters, enthroned on raised seats or in arbours, and accompanied in death by sacrificial followers. All the tribes were warlike and in chronic but shifting embroilment with others. They took scalps and slowly tortured prisoners to death in a frame or tied to a post in the town square. Often there was a distinction between civil and military chiefs; the towns entitled to offices of one or the other kind in a confederacy were known as peace and war, that is, white or red.

Economic life was undeveloped as compared with the fairly well organized socio-political institutions. Houses were of logs or poles, wattled, chinked or plastered with mud, the roof of thatch. Bark or thatch houses were also built. Exposed settlements were palisaded, or log forts erected. Pottery was unpainted, basketry of cane splints; simple weaving was done in bark fibres and bison hair, but the principal clothing besides mantles was breech clouts for men and apron skirts for women. Many tribes deformed their heads. There was little property, almost no treasure, and limited trade before the coming of the whites. Ritual was also simple. The most important ceremony was the busk or green-corn festival, a first-fruits and new-fire rite. Purification by emetics was a common religious observance. There was little that could be called art. Most tribes had a migration legend.

The Muskogian-Southeastern culture extended with variations north into the Ohio valley to the prehistoric moundbuilders, and northeast to the tribes of Iroquois lineage; it was represented in pallid form among many of the Algonkin groups as far as New England and the Great Lakes. The total Muskogian population was about 50,000. At the time of discovery, there may have been 7,000 Creeks (increased to 20,000 by 1832), 3,500 Chickasaw, 15,000 Choctaw, 5,000 Apalachee, perhaps 5,000 Mobile. The first three of these tribes survive in increased numbers, but much mixed with white and Negro blood.

*See* J. Adair, *History of the American Indians* (1775); W. Bartram, *Travels* (1791); J. Swanton, *Bur. Am. Ethn. Bull.* 43 (1911); 73 (1922). (A. L. K.)

**MUSK OX,** an Arctic American ruminant of the family Bovidae (*q.v.*). The musk ox (*Ovibos moschatus*) is closely related to the takin of Asia and belongs in the goat-sheep subfamily. Its resemblances to the true cattle are entirely superficial. The musky odour from which the animal takes its name is not due to the secretion of a special gland, as is so often the case in mammals.

In height a bull musk ox stands about 5 ft. at the shoulder. The head is large and broad. The horns in old males have broad bases, meeting in the middle line, and covering the brow and crown of the head. They are directed at first downwards by the side of the face, and then turn upwards and forwards, ending in the same plane as the eye. In females and young males the horns are smaller, and their bases separated by a space. The ears are small, and nearly concealed in the hair. The space between the nostrils and the upper lip is covered with short hair; the rest of the animal is covered with long brown hair, thick, matted and curly on the shoulders, but elsewhere straight and hanging down, concealing the short tail. There is also a thick woolly underfur, shed in summer in blanket-like masses. The limbs are stout and short, terminating in unsymmetrical hoofs, the external being rounded, the internal pointed, and the sole in part hairy.

FROM A GROUP IN AMERICAN MUSEUM OF NATURAL HISTORY

MUSK OX (OVIBOS MOSCHATUS)

Musk oxen are confined to the northern parts of North America; they range over the "barren grounds" between lat. 64° and the shores of the Arctic sea. Northwards and eastwards they extend through the Parry Islands and Grinnell Land to north Greenland. The Greenland animal is distinguished by white hair on the forehead. Musk oxen ranged during the Pleistocene period over northern Siberia and the plains of Germany and France. They have also been found in Pleistocene gravels in England. They are gregarious, assembling in herds of 20 or 30 head, in which there are seldom more than two or three full-grown males; they run with considerable speed, but when attacked normally form a circle with the younger animals in the centre. Musk oxen feed chiefly on grass. The female brings forth one young in the end of May or beginning of June, after a gestation of nine months. The peculiar musky odour can be perceived from a distance of 100 yards. According to V. Stefansson (*The Friendly Arctic,* 1921), they are admirably suited for domestication. The flesh is excellent, the milk equal in quality to that of the domestic cow and the wool of considerable value. (J. E. Hl.)

**MUSKRAT** or MUSQUASH, large North American ratlike

rodent, *Ondatra zibethica,* related to the voles and meadow mice and included in the subfamily Microtinae. (*See* VOLE.) It is much larger than its close relative, the European water rat, the head and body being about a foot in length and the tail but little less. It is a heavily built animal, with a broad head and short limbs; the eyes are small and the ears project little beyond the fur. The hind feet are enlarged, the five toes partly united by webs. The tail is laterally compressed, nearly naked and scaly. The hair consists of a thick soft underfur, mixed with longer stiff, glistening hairs, which overlie and partly conceal the former on the upper surface and sides. The pelage is waterproof. The colour is usually rich brown, almost black on the back, the gray of the underfur showing through on the underside. The tail and naked parts of the feet are blackish. The musky odour from which it derives its name is secreted by two large glands associated with the genital openings, present in both sexes.

U.S. DEPT. OF INTERIOR
MUSKRAT (ONDATRA ZIBETHICA)

The muskrat is found only in North America, from Alaska to Mexico. It lives in the marshes, ponds and streams, swimming and diving with great facility, feeding on roots, stems and leaves of water plants, on vegetation growing nearby, and on fresh-water mussels. Muskrats are most active at night, spending the day concealed in their burrows in the bank or in a dome-shaped house built of cat-tails, sedges and other water plants and consisting of a chamber with several passages, all opening under water. The muskrat is one of the most important fur-bearers; although individual pelts bring only a dollar or two, enormous numbers are trapped annually. Four to six young are born in the spring, in the north, but in Louisiana muskrats breed throughout the year. (*See* RODENTIA.) (J. E. HL.)

**MUSK-SHREW,** a name for any species of the genera *Crocidura* and *Suncus* of the family Soricidae (*see* INSECTIVORA), but generally used of the common gray musk-shrew (*S. coerulea*) of India which commonly frequents human habitations. The head and body, blue-gray in colour, measure about 6 in., and the tail is rather more than half that length.

**MUSLIM:** *see* ISLAM.

**MUSLIN,** a light cotton cloth said to have been first made at Mosul, a city of Mesopotamia. Muslins have been largely made in various parts of India, whence they were imported to England towards the end of the 17th century. Some of these Indian muslins were very fine and costly. Among the specialties are *Arni muslin,* made in the Madras presidency, and *Dacca muslin,* made at Dacca in Bengal. Muslins of many kinds are now made in Europe and America, and the name is applied to both plain and fancy cloths, and to printed calicoes of light texture. *Swiss muslin* is a light variety, woven in stripes or figures, originally made in Switzerland. *Book muslin* is made in Scotland from very fine yarns. Mulls, jaconets, lenos and other cloths exported to the east and elsewhere are sometimes described as muslins.

**MUSQUASH:** *see* MUSKRAT.

**MUSSEL,** the name given to certain aquatic bivalve molluscs of the class Lamellibranchia. In its most regular usage, it is applied to the marine Mytilidae, of which the edible mussel, *Mytilus edulis,* is the most familiar example, and to the fresh-water genus *Anodonta.* The members of the large fresh-water genus *Unio* are sometimes called mussels.

The marine mussels (*Mytilus, Modiolaria, Modiolus*) belong to the suborder Mytilacea of the order Filibranchia. The edible mussel, *Mytilus edulis,* has a wide distribution. It is found on both sides of the Atlantic and in the Mediterranean, and on the eastern Atlantic seaboard its range extends as far south as Rio de Oro in Morocco. Its habitat is towards low-tide mark, where it lives attached to rocks or on consolidated shingle or sandbanks. It is usually found in large numbers, such mussel-beds sometimes covering several acres and containing millions of individuals.

The Mytilidae have an inequilateral shell, the apex or umbo appearing to be displaced to one end when compared with that of a cockle, for example. This is due to the imperfect development of the anterior end of the shell. The foot is provided with a byssus, a bunch of hairs secreted in a glandular cavity of the foot. From this cavity the hairs are extruded and harden on contact with the sea water, forming a means of attaching the mussel to a rock or stone. This fixation is not, however, permanent; the animal can discard the byssus and anchor itself afresh in a new situation. Such a means of anchorage and the faculty of occasionally changing position are highly important in animals which live, as the Mytilidae do, in the tidal zone where gales tend to shift the sand or shingle on which they live, and where the animal is liable to be swept away from its feeding ground or buried beneath the debris of the shore.

The edible mussel, *Mytilus edulis,* is of considerable economic importance as human food and as bait for edible fishes. In 1922, 1,888 tons of mussels were delivered at Billingsgate market in London. It is very little eaten in the United States. *M. edulis* is considered of fair size for eating when it is 2 in. long, a size attained in three years after the young mussel has settled down. Under favourable conditions it will attain a much greater size. The degree of salinity of the water has a considerable effect on the size of the shell. For example, those mussels which live in the comparatively fresh water of the Baltic sea are often a quarter or one-fifth the size of the North sea forms. Nevertheless, it seems to thrive best in water having a salinity lower than that of normal sea water. In Great Britain the chief mussel beds are in Morecambe bay (Lancs.) and in the Wash.

There are many genera in the family Mytilidae, which has a wide distribution. They include *Modiolaria, Lithophaga* (the date mussel), which bores into rock, *Modiolus* and *Crenella.*

The fresh-water mussels are members of the family Unionidae (order Eulamellibranchia) and include the genera *Anodonta, Unio, Quadrula,* etc. They are mainly found in rivers and lakes. They burrow in the soft mud of the bottom and, living thus in more tranquil conditions than the sea-mussels, have a byssus only in the juvenile stage. The developmental history of these mussels is unique among molluscs, as the young larva (*glochidium*) undergoes part of its development as a parasite on fish. The members of the genus *Unio* and its near allies are of considerable economic importance in the United States, where they are cultivated for their pearly shell, which is used in button-making. At one time the pearls obtained from these animals were widely sought in Europe; but this industry has decayed owing to the introduction of the Orient pearls of Ceylon, etc.

BIBLIOGRAPHY.—L. Boutan, *Zoologie Déscriptive* (anatomy, etc., of *M. edulis*) (1900); G. Lefevre and W. C. Curtis, "The Reproduction and Propagation of Fresh-water Mussels," *Bull. U.S. Fisheries,* vol. xxx (1910); I. A. Field, "The Food Value of the Sea Mussel," Dept. Commerce and Labor, *Bull. Bur. Fishery,* Washington, D.C., 29, p. 85 (1911); H. Marchand, "La Mytiliculture en France," *C.R. Ass. Franç. Avanc. Science,* 41, p. 438 (1912). (G. C. R.; X.)

**MUSSELBURGH,** a small burgh of Midlothian, Scotland, 5½ mi. E. of Edinburgh by the L.N.E.R. Pop. (1938), 17,562. The burgh, which lies on the south shore of the Firth of Forth, is intersected by the Esk and embraces the village of Fisherrow on the left bank of the river. While preserving most of the ancient features of its High street, the town, with its fine beach and golf course, has tended to become a suburb of the capital. Loretto school, one of the foremost public schools in Scotland, occupies the site of the chapel of Our Lady of Loretto, which was founded in 1534 by Thomas Duthie, a hermit from Mt. Sinai, and was the favourite shrine of Mary of Guise. The 1st earl of Hertford destroyed it in 1544, and after it was rebuilt the Reformers demolished it again, some of its stones being used in erecting the tolbooth. In the west end of the town is Pinkie house, a Jacobean mansion, with a fine fountain, formerly a seat of the abbot of Dunfermline, but transformed in 1613 by Lord Seton. The painted gallery, with an elaborate ceiling, was utilized as a hospital after the battle of Pinkie in 1547, and Prince Charles Edward slept in it after the fight at Prestonpans (1745). Near the tolbooth stands the market cross. At the west end of High street is a statue of David Macbeth Moir ("Delta," 1798–1851), born in Mussel-

burgh. A 16th-century stone bridge crosses the Esk, and Roman remains have been found near it. The chief bridge, which carries the high road from Edinburgh to Berwick, was built by John Rennie in 1807. The principal industries include papermaking, brewing, the making of nets and wire, confectionery, mats, boatbuilding, pottery, besides saltworks and seed-crushing works. The fishery is confined to Fisherrow, where there is a good harbour. Race meetings and archery contests are held on the links. About 1 mi. S.E. is the site of the battle of Pinkie, and 1½ mi. further is Carberry Hill, where Mary surrendered to the lords of the Congregation in 1567, the spot being still known as Queen Mary's Mount. Musselburgh is in the eastern parliamentary division of Edinburgh, which returns one member.

**MUSSET, ALFRED DE** [LOUIS CHARLES ALFRED] (1810–1857), French poet, play-writer and novelist, was born on Dec. 11, 1810 in a house in the middle of old Paris, near the Hôtel Cluny. In the summer of 1827 he won the second prize (at the Collège Henri IV.) by an essay on "The Origin of our Feelings." He took up law and medicine but could endure no profession. He was taken by Paul Foucher to Victor Hugo's house, where he met Alfred de Vigny, Prosper Mérimée, Charles Nodier, Sainte-Beuve, and others. His first original volume, *Contes d'Espagne et d'Italie* (1829), had an immediate success, provoked bitter opposition, and produced many unworthy imitations. This volume contained a fantastic parody in verse on certain productions of the romantic school. This was the famous "Ballade à la lune" with its recurring comparison of the moon shining above a steeple to the dot over an *i*. It was, to Musset's delight, taken seriously.

In December 1830 Musset was just twenty years old, and was already conscious of that curious double existence within him so frequently symbolized in his plays—in Octave and Célio for instance (in *Les Caprices de Marianne*), who also stand for the two camps, the men of matter and the men of feeling—which he has elsewhere described as characteristic of his generation. At this date his *Nuit vénitienne* was produced by Harel, manager of the Odéon. It failed and Musset was disgusted with the theatre.

Musset now belonged, in a not very whole-hearted fashion, to the "Cénacle," but the connection came to an end in 1832. In 1833 he published the volume called *Un Spectacle dans un fauteuil,* and was asked to contribute to the *Revue des deux mondes.* In this he published, in April 1833, *André del Sarto,* and he followed this six weeks later with *Les Caprices de Marianne.* The latter play has perhaps more of the Shakespearian quality—the quality of artfully mingling the terrible, the grotesque, and the high comedy tones—which exists more or less in all Musset's long and more serious plays, than is found in any other of these. Its brilliant dialogue and swiftness of action give it superficially the character of comedy, but throughout there runs the sense of fate.

In 1833 the *Revue* published *Rolla,* a symptom of the *maladie du siècle.* Rolla, for all the strain which is not to be denied of Wertherism, has yet a decided individuality. The poem was written at the beginning of Musset's *liaison* with George Sand, and in December 1833 Musset started on the unfortunate journey to Italy. It is well known that the rupture of what was for a time a most passionate attachment had a disastrous effect upon Musset, who was absolutely and completely struck down by the blow. But it was not so well known until Paul de Musset pointed it out that the passion expressed in the *Nuit de décembre,* written about twelve months after the journey to Italy, referred not to George Sand but to another and quite a different woman. As fiction, the story is told in the two volumes called respectively *Elle et lui* by George Sand, and *Lui et elle* by Paul de Musset.

During Musset's absence in Italy *Fantasio* was published in the *Revue, Lorenzaccio* is said to have been written at Venice, and not long after his return *On ne badine pas avec l'amour* was written and published in the *Revue.* In 1835 he produced *Lucie, La Nuit de mai, La Quenouille de Barberine, Le Chandelier, La Loi sur la presse, La Nuit de décembre,* and *La Confession d'un enfant du siècle,* wherein is contained what is probably a true account of Musset's relations with George Sand. To 1836 belong the *Nuit d'août,* the *Lettre à Lamartine,* the *Stances à la Malibran,* the comedy *Il ne faut jurer de rien,* and the beginning of the brilliant letters of Dupuis and Cotonet on romanticism. *Il ne faut jurer de rien* is as typical of Musset's comedy work as is *Les Caprices de Marianne* of the work in which a terrible fatality underlies the brilliant dialogue and keen polished characterization. In 1837 was published *Un Caprice,* which afterwards found its way to the Paris stage by a curious road. Mme. Allan-Despréaux, the actress, heard of it in St. Petersburg as a Russian piece. On asking for a French translation of the play she received the volume *Comédies et proverbes* reprinted from the *Revue des deux mondes.* In 1837 appeared also some of the *Nouvelles.* In 1839 Musset began a romance called *Le Poète déchu,* of which the existing fragments are full of passion and insight.

In 1840 Musset passed through a period of feeling that the public did not recognize his genius—as, indeed, they did not—and wrote a very short but very striking series of reflections headed with the words "À trente ans," which Paul de Musset published in his *Life.* In 1841 there came out in the *Revue de Paris* Musset's "Le Rhin allemand," an answer to Becker's poem which appeared in the *Revue des deux mondes.* This fine war-song made a great deal of noise, and brought to the poet quantities of challenges from German officers. Between this date and 1845 he wrote comparatively little. In the last named year the charming "proverbe" *Il faut q'une porte soit ouverte ou fermée* appeared. In 1847 *Un Caprice* was produced at the *Théâtre Français.* The word "rebonsoir" shocked some of the old school. But the success of the piece was immediate. In 1848 *Il ne faut jurer de rien* was played at the Théâtre Français and the *Chandelier* at the Théâtre Historique. Between this date and 1851 *Bettine* was produced and *Carmosine* written. The poet died on May 2, 1857.

Alfred de Musset now holds the place which Sainte-Beuve first accorded, then denied, and then again accorded to him—as a poet of the first rank. He had genius, though not genius of that strongest kind which its possessor can always keep in check. His own character worked both for and against his success as a writer. He inspired a strong personal affection in his contemporaries. His very weakness and his own consciousness of it produced such beautiful work as, to take one instance, the *Nuit d'octobre.* His *Nouvelles* are extraordinarily brilliant; his poems are charged with passion, fancy and fine satiric power; in his plays he hit upon a method of his own, in which no one has dared or availed to follow him with any closeness. He was one of the first, most original, and in the end most successful of the first-rate writers included in the phrase "the 1830 period." The wilder side of his life has probably been exaggerated; and his brother Paul de Musset has given in his *Biographie* a striking testimony to the finer side of his character. In the later years of his life Musset was elected, not without opposition, a member of the French Academy. Besides the works above referred to, the *Nouvelles et contes* and the *Oeuvres posthumes,* in which there is much of interest concerning the great tragic actress Rachel, should be specially mentioned. (W. H. Po.; X.)

The biography of Alfred de Musset by his brother Paul, partial as it naturally is, is of great value. Alfred de Musset has afforded matter for many appreciations, and among these in English may be mentioned the sketch (1890) of C. F. Oliphant and the essay (1855) of F. T. Palgrave. *See* also the monograph by Arvède Barine (Madame Vincens) in the "Grands écrivains français" series. Musset's correspondence with George Sand was published intact for the first time in 1904.

*See* M. Donnay, *Alfred de Musset* (1914); C. Maurras, *Les Amants de Venise: George Sand et Musset* (1916), pp. 316; E. Moroncini, *A. de Musset e l'Italia* (Milan, 1921), pp. 228.

**MUSSOLINI, BENITO** (1883–1945), Italian politician and journalist, was born July 29, 1883, at Dovia, in the commune of Predappio (province of Forli). His father, Alessandro Mussolini, was a blacksmith of antireligious and vaguely socialist opinions. His mother, Rosa Maltoni, was a school teacher of strong character. Young Mussolini was named Benito after Benito Juarez, the Mexican revolutionary leader. Benito Mussolini was sent by his mother to the Salesian school of Faenza. The boy showed there a vivid intelligence and an insubordinate temper. Later he went to the normal school at Forlimpopoli and qualified as a school teacher at 18, obtaining an appointment at Gualtieri (province of Reggio Emilia).

**The Leftist Period.**—As a youth Mussolini was interested

in the Italian revolutionary movement which was then a mixture of socialist, republican, syndicalist and anarchist tendencies. Looking for a better career than teaching in elementary schools, he went to Switzerland, where he earned a precarious livelihood, sometimes by manual work of various kinds, while engaging in revolutionary and atheistic propaganda. After having been expelled from various cantons, he was finally expelled from the confederation. On returning to Italy he performed his military service in the Bersaglieri (light infantry). Back in his native Romagna, Mussolini became an active member of the socialist movement. On one occasion he was arrested, condemned to ten days' imprisonment and placed under police surveillance.

At the end of 1908 Mussolini went to Trento (then belonging to the Austrian empire) to join the staff of local Italian socialist newspapers. At first he worked with *L'Avvenire,* then with the *Popolo.* The latter was edited by Cesare Battisti, an Italian irredentist patriot, always ready to fight the Vienna government. (Battisti was hanged by the Austrians in 1916.) The association with Battisti inspired Mussolini with nationalistic ideas and after publishing an irredentist article, he was arrested and expelled from Austria. In Trento Mussolini became acquainted with the newest German irrationalistic and pessimistic philosophy, particularly that of Friedrich Wilhelm Nietzsche, which strengthened his conviction that violence is the fundamental element of social transformation.

On his experiences Mussolini published an essay "The Trentino Seen by a Socialist" in *La Voce.* While in Trento Mussolini had published an anticlerical novel *Claudia Particella, the Mistress of the Cardinal.*

In 1910 Mussolini was appointed secretary of the section in Forli of the Italian Socialist party and edited *La Lotta di Classe,* a small paper in which he developed the idea that "Socialism is war and in war woe to those who have humanitarian feelings." More than with orthodox Marxism, he sympathized with the revolutionary theories of two Frenchmen: the insurrectionist Louis Auguste Blanqui and the syndicalist George Sorel.

When Giovanni Giolitti's government decided upon the military occupation of the then Turkish province in Africa, Tripolitania, Mussolini was among the more vehement opponents. He said that class war was wanted and not imperialistic wars, that the aim of the Socialists could not be a vast Italy, but should be an Italy "cultivated, rich and free." On Sept. 25–27, 1911, having led the workers of Forli in a movement of resistance to war, he was arrested and condemned to five months' imprisonment. At the next congress of the Socialist party in Reggio nell' Emilia (1912), the left wing obtained the majority, the reformist leaders Leonida Bissolati and Ivanoe Bonomi were expelled and Mussolini's position as a leader of the leftist majority was recognized. On Dec. 1, 1912 he was made editor of the *Avanti,* the official organ of the party. His closest collaborator was then the famous Russian revolutionary, Angelica Balabanoff. Under Mussolini's editorship the circulation rose considerably. His vigorous editorials, written in a synthetic, hammering style, and his support of the "Red week" of June 1914 in the Marches and in Romagna gave him considerable popularity. In the *Avanti* and in the review *Utopia*—founded by him in 1913—Mussolini stated that the Italian nation needed a "bath of blood," after which the revolutionaries would be able to take power. Mussolini then published another anticlerical book: *Jan Huss, the Truthful* (Rome, 1913). In that period Mussolini met Rachele Guidi who later became his wife. Of humble origin and possessing a good deal of common sense, Rachele Mussolini led a retired life. She bore her husband six children, of whom the best known was Edda, the eldest daughter, who married Galeazzo Ciano.

**World War I.**—When World War I broke out, Mussolini advocated at first a policy of absolute neutrality. In the *Avanti* he threatened the government with a proletarian uprising in case Italy intervened on the side of Austria and Germany, the powers to which the Italian government was bound by an alliance. After seeing many of his syndicalist friends (among them Filippo Corridoni) take the democratic interventionist side, he began to hesitate. The able diplomacy of the French ambassador Camille Barrère, who gave considerable help to many Italian interventionist groups, and the intermediary activity of his French Socialist friend Marcel Cachin (later a leader of the French Communist party) decided Mussolini to range himself on the side of the Allies.

Mussolini was obliged to leave the editorship of the *Avanti.* On Oct. 25, 1914 the Socialist congress at Milan refused to accept his justification that war would promote social revolution in Italy, and Mussolini left the Socialist party. On Nov. 15, 1914 first appeared the new daily paper of Mussolini, *Il Popolo d'Italia,* a Socialist daily. (The paper bore two watchwords: "Who has iron, has bread" of Blanqui and "The revolution is an idea plus bayonets" of Napoleon.) Mussolini openly advocated Italy's entry into the war. He explained that if Italy would help the western democratic powers win the war, "more liberty would exist in Europe and the proletariat would have better opportunities to develop its class capacities; on the contrary, if the Prussian reaction triumphs over Europe the level of human civilization would be lowered."

A small number of Socialists followed Mussolini to the *Popolo d'Italia.* The most valuable of them were Sandro Giuliani and Cesare Sarfatti. Together with them and several young republican interventionists, young Mussolini founded the *Fasci d' Azione Rivoluzionaria,* which made strong war propaganda. At a great meeting of the *Fasci* in Milan, on Jan. 25, 1915, Mussolini advocated war not only against Austria, but principally against Germany. For his violent speaking, Mussolini was arrested in April 1915. A few days later he was slightly wounded in a duel with the pacifist Socialist leader Claudio Treves. Summarizing his policy, Mussolini stated on May 15 that either the king would take Italy into the war or there would be a republican revolution. War was declared on May 24. In Sept. 1915 Mussolini was called up and served as a private in the Bersaglieri. On Feb. 23, 1917, while exercising, he was wounded by the explosion of a hand grenade. He spent many months in the hospital and on recovery returned to the editorship of the *Popolo d'Italia.* He wrote a graphic account of his experiences in his *Diario di Guerra.* In the last years of the war he changed the subtitle of his *Popolo d'Italia* to "Organ of the Combatants and of the Producers" and engaged in an active campaign against the Socialist party, which continued to advocate a pacifist policy.

**Fascism.**—Thanks to the help of wealthy people who feared a bolshevik revolution, and of ex-service men dissatisfied with peace conditions, Mussolini was able to found on March 23, 1919, at Milan, a new political movement under the name of *Fasci di Combattimento.* The program, adopted on Mussolini's suggestion, asked for a constituent assembly, the abolition of the senate and the recognition of workers' and technicians' control in the factories. Concerning foreign policy, Mussolini said that the League of Nations could be accepted only on condition that the claims of poor nations (like Italy) against the wealthy ones would be taken into consideration.

At first Mussolini tried to acquire the sympathies of the trade unions and to remove them from the influence of the Socialist party. He was not successful. At the elections of 1919 he stood as a fascist candidate for Milan and secured only a few votes. A few days later Francesco Saverio Nitti had him arrested on a charge of "plotting against the security of the state," but he was soon liberated. Meanwhile, Gabriele d'Annunzio had occupied Fiume. Mussolini supported him in the *Popolo d'Italia* and in public meetings. "D'Annunzio," he said on August 5, 1920, "is the only man who has dared to revolt against the plutocracy of Versailles." But when, in Dec. 1920, Giovanni Giolitti settled *manu militari* the question of Fiume, Mussolini refused to give armed support to d'Annunzio. He maintained that the moment had not yet arrived for a direct attack against Italy's liberal regime.

**The Conquest of Power.**—The social upheaval caused by the war and by the problems of the post-war period reached its climax in Italy in autumn 1920 with the seizure of some factories in northern Italy by metallurgical workers. Mussolini at first supported the movement. He tried to get in touch with its

leaders and offered a common front of direct action against the industrialists, the government and the extremist or bolshevik wing of the workers' movement. Mussolini's offer was rejected. Largely as a result of the wise policy of the government and in exchange of small concessions, the workers surrendered the control of the factories to the owners. The public interpreted this move as a failure of the revolutionary socialist movement. But the panic caused by the revolutionary threat remained and Mussolini decided to exploit the fear and desire for revenge then prevalent in large sections of the Italian nation, in order to achieve the destruction of the liberal parliamentarian regime of Italy. The Fasci received ample funds from many people, chiefly industrialists and landowners. Armed squads (*Squadre d'Azione*) were organized to destroy the political and economic organizations of the Socialists, whose capacity to resist was greatly hampered by their own divisions. The premier, Giolitti, ignored the fundamental principle that in no case can the state surrender to private organizations the obligation of maintaining order. He tolerated the actions of Mussolini's followers believing that it was good policy to let the fascists quell the Socialist revolutionary threat. His successor, Bonomi, actually ordered the armed forces to support the fascists. Blinded by hatred and fear of socialism, various Italian liberal groups and the Catholic democratic party (together with the Socialists, the most important political element in Italy at that time) observed a neutrality favourable to the fascists.

From the end of 1920 on, the fascist squads attacked and destroyed the organizations of the Socialists, the communists, the republicans, etc. Hundreds of people were killed. New fascist groups were formed everywhere. In May 1921 Mussolini and 35 other fascists were elected. In Nov. 1921 at the congress of Rome, fascism was organized into a political party. Mussolini was already known to his followers as il duce (the leader). During 1922 the Trade Union council, the Socialist party and the Railwaymen's union tried to stem the tide by declaring a general strike. The strike was broken by the fascist armed squads. To secure support of the army and important conservative groups, at a fascist gathering at Udine on Sept. 29, Mussolini renounced his former republican convictions. A fascist convention at Naples, on Oct. 24, 1922, provided the pretext for the concentration of armed squads from all over the country for a march on the capital (*see* ITALY: *History*). Mussolini went from Naples to Milan, near the Swiss border, and left the direction of the "march" to a quadrumvirate of his closest friends (Italo Balbo, Michele Bianchi, De Bono and C. M. De Vecchi). Practically no opposition was met from the civilian and military state authorities.

The Facta cabinet decided unwillingly to proclaim a state of emergency but the king refused to give his approval. Facta resigned and after a futile attempt on the part of the liberal-nationalist Antonio Salandra to form a coalition government, the king entrusted to Mussolini the task of forming the new cabinet.

**The Fascist Government.**—The first cabinet formed by Mussolini (Oct. 31, 1922) included several non-fascists, but Mussolini kept for himself every decision on vital questions. Later all non-fascists were eliminated.

There was a period when seven portfolios were in the hands of Mussolini himself. As years went by the quality of Mussolini's cabinet deteriorated. He eliminated all those who showed inclination for independence or had acquired a popular personal following and surrounded himself with more or less insignificant "yes men."

A convinced enemy of all democratic forms of government and particularly of the parliamentarian one, Mussolini devised a number of measures with the aim of concentrating all power in his hands. On Jan. 12, 1923 he created the Grand Council of Fascism, whose members he appointed and which was transformed later into one of the most important organs of the state. On Feb. 1, 1923 the fascist armed squads were officially militarized in the *Milizia Volontaria Fascista per la Sicurezza Nazionale,* and provided Mussolini with a large personal army. The murder of a leading member of the Socialist party, Giacomo Matteotti (June 10, 1924), made Mussolini's position extremely difficult for a while, but the opposition parties confined themselves to passive resistance only (the Aventino) and the king, after some hesitation, decided to support Mussolini, who was able once more to take the political initiative.

In 1925 (Dec. 24) and 1926 (July 31) Mussolini introduced laws which gave him a special position as prime minister, and the right to exercise—as head of the executive—legislative and judicial prerogatives. This meant the end in Italy of the classical "division of powers." In 1926 (Nov. 6) all opposition activity (parties, press, meetings) was definitely prohibited. After 25 years of a varied political career and seven years as the leader of fascism, Mussolini realized his dream of becoming the absolute ruler of his country. In 1928 (May 17 and Sept. 2) a new electoral law was also approved. The fascist political, syndical and cultural associations—through their leaders who were all appointed by Mussolini—were asked to present candidates among whom the Great council (also appointed by the duce) chose those who were to be nominated. The electors had only the right to accept or reject the whole list. New elections took place on this basis in 1929 and 1934.

For the purpose of bringing Italian economic life under the control of the executive, according to the leitmotiv "for the fascist all is in the state, nothing exists outside the state," Mussolini created the so-called *Corporazioni* in 1930 (March 20) and definitely organized them in 1934 (Feb. 5). The 22 *Corporazioni* were all presided over by Mussolini. In 1938 (Oct. 8) even the fascist parliament was abolished and replaced with the assembly of the *Corporazioni,* which met for the first time on March 23, 1939. The members of the assembly were all appointed by the government and even the formality of popular approval, maintained in the reform of 1928, was dispensed with.

Important reforms concerned Italy's judicial organization. The old codes were abolished and new ones, inspired by fascist principles, enforced. The judicial power was deprived of its autonomy. Also the structure of the fascist party was transformed. At first it included important groups more loyal to other fascist leaders than to Mussolini. Under the secretaryship of Augusto Turati and of Achille Starace, the influence of various leaders was eliminated and their clienteles dissolved. The duce emerged as the only man in control of the party. Mussolini granted special powers to the police which became the most important organ of the Italian fascist state. The chief of police was probably the only man who could see Mussolini whenever he wished. For many years the police was probably the most efficient of all fascist organizations. Its task was not an easy one because the opposition went underground but never surrendered. To the opposition were due numerous attempts against Mussolini's life, the organization of secret political parties, the publication of clandestine newspapers, acts of sabotage, etc.

**Foreign Policy.**—Violently opposed to ideas of human solidarity and of lasting peace, Mussolini's aim, after he seized power, in the international field was to take advantage of every possible situation to achieve Italy's territorial expansion. He first tried his hand as a conqueror in 1923, when he sent an expedition against the Greek island of Corfu. Pressure from the western democracies obliged him to retreat. Mussolini played for a long time on the differences among the principal European powers, in order to obtain concessions for Italy in Europe and in Africa. From France Italy had obtained a rectification of colonial boundaries in 1919. Further territories were given up as a result of an agreement between Laval and Mussolini in Jan. 1935. In 1925 England surrendered Jubaland in East Africa and a few oases on the Libyan-Egyptian border. By helping the Albanian Ahmed Zog to seize power in Albania, Mussolini was able to establish an Italian protectorate over that region in 1927. (Albania was definitely occupied in April 1939.)

The duce's imperial aspirations took definite shape at the time of the world depression of 1929–32. Mussolini was convinced that, as a result of economic crisis and social upheavals, the democratic powers were bound to collapse, that they were not in a position to defend the independence of the small states and would put up little fight for their colonial empires. Three regions exercised a particular fascination over Mussolini's imperial dreams: the Mediterranean, the Balkan-Danubian countries and the northeastern section of Africa. To acquire the control of the Mediterranean, Mussolini strengthened the Italian navy, intervened in Spain (1936–39) and subsidized all kinds of anti-French and anti-British movements in the Mediterranean countries controlled by these powers. But when the crucial moment arrived in World War II to achieve his ambitions, Mussolini found himself obliged to ask Germany's help and to open the Mediterranean to German influence.

As a result of internal divisions and fear of Germany, the Austrian republic under Engelbert Dollfuss and Kurt von Schuschnigg accepted an Italian protectorate. Hungary and Bulgaria drew close to Italy as Mussolini had decided to support their revisionist claims. The Croat separatists were supported by Mussolini, who wanted to weaken Yugoslavia as much as possible. But Germany's rise in power under Hitler soon destroyed what Mussolini had been able to achieve. Austria was annexed to the reich, Hungary and Bulgaria fell under German control. From the dismemberment of Yugoslavia in 1941, Mussolini received one-third of Slovenia, Dalmatia and a precarious protectorate over Croatia.

To acquire new territories in Africa, Mussolini began war preparations in the autumn of 1934 against Abyssinia and attacked, with overwhelming military forces, on Oct. 3, 1935. The League of Nations decided on economic sanctions against the fascist war (they lasted from Nov. 18, 1935 to July 15, 1936). Mussolini carried on, counting on the divisions between the powers belonging to the League and on the unwillingness of the democratic nations to go to war. The Italian army occupied Addis-Ababa, Abyssinia's capital, on May 5, 1936. On May 9, 1936 Mussolini nominated the Italian king emperor of Ethiopia. Hatred against western liberalism and territorial ambitions brought him close to the nazis. In 1936 he opened negotiations with Germany and when Count Ciano visited Berlin (Sept.–Oct. 1936) a secret agreement was reached. In the following years Mussolini went to Berlin, Hitler visited him in Rome and they met several times at the German-Italian frontier. In March 1938 he accepted Austria's annexation by Germany. In September of the same year—at the Munich conference—he helped Hitler to achieve a diplomatic success and the practical annexation of Czechoslovakia. On May 22, 1939 an

Italian-German military alliance was concluded. At the beginning of World War II Mussolini proclaimed a policy of nonbelligerency but on June 10, 1940, declared war on France and Great Britain at the moment he thought Germany had certainly won the war. Italy's subsequent military debacles are described in WORLD WAR II; they led finally to his downfall on July 25, 1943, after the Fascist Grand council, led by Count Dino Grandi, had repudiated his leadership by a vote of 19 to 7. The king "accepted" Mussolini's resignation and appointed Marshal Pietro Badoglio to succeed him. Il duce was placed in protective custody, but on Sept. 12, 1943, the Germans announced he had been rescued by nazi paratroopers at a place later identified as a hotel on Gran Sasso mountain in the Abruzzi. The Germans then set up a "republican fascist party" with Mussolini as its titular head. In April 1945, when the war in Europe was nearing an end, he and his party were apprehended by Italian Partisans outside the Italian village of Dongo, near Como, where, after "trial" they were executed on the 28th.

Mussolini's official biography was published in English by Margherita Sarfatti (Butterworth, 1925). *See* S. Jones, *Benito Mussolini* (1927); Prezzolini, *Benito Mussolini* (1924); P. Orano, *Mussolini da Vicino* (1932); G. Salvemini, *Mussolini diplomatico* (1930); G. A. Borgese, *Goliath: The March of Fascism* (1937). *See* also his own account of his life (Eng. trans. *My Autobiography*, 1928). (M. W. S.; X.)

**MUSSOORIE** or **MASURI,** a town and sanitarium of British India, in the Dehra Dun district of the United Provinces, about 6,600 ft. above the sea. Pop. (1941) 5,966, rising to 17,000 in the hot season. It stands on a ridge of one of the lower Himalayan ranges, amid beautiful mountain scenery, and is one of the chief summer resorts for European residents in the plains of the United Provinces. Mussoorie practically forms one station with Landaur, the convalescent depot for European troops, 7,362 ft. above the sea. Some distance off, on the road to Simla, is the cantonment of Chakrata, 7,300 ft. The climate makes it suitable for numerous schools for Europeans, including St. George's College, the Oak Grove School of the East Indian railway, and several Church of England and Roman Catholic institutions, together with a cathedral of the latter faith. The first brewery in India was established there in 1850. The town has botanical gardens, and is the summer headquarters of the Trigonometrical survey.

**MUSSORGSKY, MODEST PETROVICH** (1835–1881), Russian composer, was born at Karevo, Pskov, on March 28, 1835, and entered the army at an early age. He was a talented amateur, when his acquaintance with Balakirev and Dargomijsky led him to the serious study of music. In 1857 he left the army and devoted himself to music, though this step entailed earning his living as a government clerk and a prolonged period of poverty. He found an intimate friend in Rimsky-Korsakov. His greatest opera, *Boris Godunov,* based on Pushkin's drama, was produced in St. Petersburg in 1874. *Khovantschina,* also based on the period of Peter the Great, was finished by Rimsky-Korsakov. Other unfinished works were based on Gogol's *Marriage Broker* and on Flaubert's *Salammbo.* He also wrote exquisite songs and orchestral works, of a realistic national type. Mussorgsky died in the military hospital at St. Petersburg on March 28, 1881. He had taken to drugs and was a mere shadow of his former self.

*See* M. D. Calvocoressi, *Mussorgsky* (1908, Eng. trans. 1913); M. Montagu-Nathan, *Moussorgsky* (1916); and the article by Rosa Newmarch in *Grove's Dictionary of Music and Musicians.*

**MUSTAFA KEMAL** (1881–1938), Turkish soldier and statesman, was born in comparatively modest circumstances in Salonika. His father was a customs officer who afterwards entered the timber trade and died when Mustafa was yet a small child. The boy entered the military preparatory school. There he proved to be an exceptional student, especially in mathematics. His teacher in mathematics, who was also named Mustafa, gave him the distinctive surname of "Kemal" (an Arabic word meaning "perfection"), as a tribute to his unusual ability.

In 1904 he was gazetted lieutenant, but on the same day arrested, and after examination, banished to Damascus. Here, after observing the deplorable condition into which the civil and military organization of the empire had fallen, he founded in 1905 the secret political society "Vatan" ("Fatherland"). From Damascus he was transferred to Jaffa, whence he made his way secretly to Salonika to organize a similar political movement in the European provinces. The association which he founded at Salonika was afterwards affiliated with the Union and Progress society. The Constantinople government now again ordered his arrest; but he escaped, and the government presently forgot him. In 1907 he was promoted and sent to Salonika, where he resumed his revolutionary activities.

When the revolution of 1908 re-established the constitution of 1876, Mustafa Kemal found himself in serious disagreement with the leaders of the victorious Union and Progress party. In consequence he abandoned politics for the time and turned his whole energy into his military career, in which he advanced rapidly. In 1911 he went to Tripoli *incognito* to take part in the war against the Italians. There he was promoted major. The first Balkan war was over before he could return; but in July 1913, during the second Balkan war, he was appointed chief of the staff to the newly-organized army corps on the Gallipoli peninsula, where he made a detailed first-hand study of the problem of defending the Dardanelles. After the restoration of peace, he was appointed military attaché at Sofia, with the rank of colonel, and held this post until the autumn of 1914.

Mustafa Kemal believed that Turkey had entered the war prematurely and that Germany was doomed to eventual defeat. Possibly, for this reason, his desire to return to active service was not encouraged; but, on his insistence, he was appointed commander of the forces at Rodosto, and afterwards (in 1915) at the Dardanelles. He inspired the defense of the straits against the British attack—this, when the Turkish high command had lost hope. Mustafa Kemal was then sent to the Caucasus, where he was promoted to the rank of pasha and recovered Bitlis and Mush from the Russians. In 1917 he was posted to the Hejāz. At this time Germany's intervention in the internal affairs of Turkey had reached its height, and Mustafa Kemal Pasha put himself at the head of the opposition to it. He sent in a succession of reports adverse to the Baghdad expedition, which he thought would end in another disaster, and when his advice was ignored he resigned. In 1918 he yielded to the insistence of the Sultan Mehmed and accepted command of the VII Army Corps in Palestine, but all chance of taking the offensive, or even averting disaster, had now disappeared.

When the Turkish government negotiated the armistice of Mudros (Oct. 30, 1918), Mustafa Kemal was opposed to the policy of complete surrender, and after the signature of the armistice retired to Constantinople. The Greek landing at Smyrna on May 16, 1919, which reawakened the Turkish nation, and his appointment by the Ottoman government in Constantinople as inspector of the IX Army Corps in northeastern Anatolia gave him his chance. Mustafa Kemal meant to create a nucleus of national resistance against the partition of the country, and therefore accepted with alacrity the position offered him by the unsuspecting government. As soon as he landed at Samsun he began to organize his new movement locally at Amasia, Tokat and Sivas, and to correspond secretly with other parts of the country. The sultan's government, awaking too late, recalled him to Constantinople, but he went on instead to Erzerum and sent in his resignation to Constantinople. He next convened two congresses, one at Erzerum in July, and the other at Sivas in Sept. 1919. Both congresses endorsed his program of fighting for national existence to the bitter end, and relations between the capital and the interior of Anatolia were broken, but all the efforts of the Constantinople government and the Allied powers to frustrate Mustafa Kemal's activities simply strengthened his conviction that he had taken the right path. On April 23, 1920, Mustafa Kemal gathered together at Angora the Nationalist members of the late parliament who had escaped from Constantinople, and was elected unanimously president of this new national assembly.

During the two and one-half years which followed, Mustafa Kemal was the heart and soul of the Turkish national resistance. His exceptional military ability, his keen intellect and his persuasive oratory carried his countrymen through their ordeal. During the summer campaign of 1921, which was the supreme crisis of the Graeco-Turkish War, the Angora assembly appointed

Mustafa Kemal generalissimo of the Turkish forces, with unlimited power, and he took personal charge at the front during the 22 days' and nights' fighting of the battle of the Sakaria, which brought him the rank of field-marshal and the traditional title of "Ghazi" (the victorious). The destruction of the Greek army, the peace settlement at Lausanne, the abolition of the sultanate, the declaration of the republic and the abolition of the caliphate—were the direct work of Mustafa Kemal. On Oct. 29, 1923, the date on which the republic was proclaimed, the great national assembly unanimously elected Mustafa Kemal the first president of the republic.

From 1923 to his death on Nov. 10, 1938 Mustafa Kemal served his native land as president of the republic, an office to which he was re-elected on Nov. 1, 1927, May 4, 1931 and finally on March 2, 1935. But Mustafa Kemal was much more than the president of Turkey. He was the builder of a modern Turkish nation, the reformer of all Turkish life. Under his strong guidance the legacy of the mediaeval and oriental Ottoman empire was discarded and the country turned into a modern progressive secularized republic which could keep abreast of all human progress and take its constructive place on the side of other nations. Though Mustafa Kemal, in view of the general backwardness of the country, could accomplish his aim only by dictatorial methods, he remained faithful to the progressive and liberal ideas of his youth. He emancipated the Turkish women, established complete equality of all citizens, introduced universal education, and became an educator to democratic forms of life. The democratic constitution of the republic was jealously guarded; Mustafa Kemal regarded his dictatorship as a temporary institution for the purpose of strengthening the foundations of liberal democracy in a population not prepared for it by its past.

His democratic and progressive outlook in internal affairs was also maintained in foreign affairs, where he resolutely abandoned all dreams of expansion or of military glory, so dear to other nationalist dictatorships. He taught the Turks the virtue of moderation in their aspirations and even succeeded in making a lasting peace with the Greeks, with whom the Turks had fought bitterly for many centuries and whom he himself had defeated shortly before. The firm friendship with Greece allowed the new Turkey to become a cornerstone of peace and the leader in an effort to secure a lasting peace by collective agreements with all neighbours, the Balkan pact which united Turkey with Greece, Yugoslavia and Rumania, and the Near Eastern pact which united her with Iran, Afghanistan and Iraq. Mustafa Kemal maintained also close and friendly relations with the soviet union which had much helped Turkey to throw off the conditions of peace of Sèvres. But Mustafa Kemal joined also the League of Nations and soon made his peace with the former enemy nations, Great Britain and France. Thus his enlightened foreign policy, based upon peace and progress, corresponded to his enlightened domestic policy.

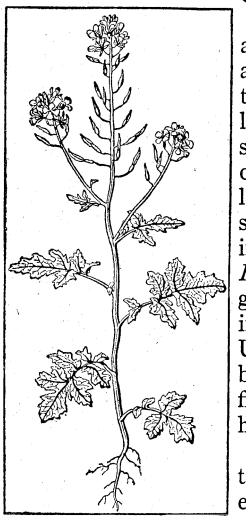
In December 1934 a law introduced family names into Turkey. Mustafa Kemal received the family name of Atatürk, and as the title Pasha had been abolished, his name was now Kemâl Atatürk. When he died he was followed by General Ismet Inönü, who had been for many years his faithful collaborator. Thus the great achievement of Mustafa Kemal, the transformation of Turkey into a modern progressive democratic republic, was assured of duration.

BIBLIOGRAPHY.—Mustafa Kemal delivered a long justification of his activities before the members of his party in Ankara from Oct. 15–20, 1927. An official translation of this speech was published as *Die Neue Türkei* (2 vol., Leipzig, 1928); *see* H. C. Armstrong, *Gray Wolf* (1932); Philippe de Zara, *Mustapha Kémal Dictateur* (Paris, 1936); H. Kohn, *Western Civilization in the Near East* (1936); Herbert Melzig, *Kamâl Atatürk* (Frankfurt a.M., 1937); D. E. Webster, *The Turkey of Atatürk* (1939).

(A. J. T.; H. Ko.)

**MUSTANG,** the wild or semi-wild horse of the prairies of North America, the descendant of the horses imported by the Spaniards after the conquest in the 16th century (*see* HORSE).

**MUSTARD.** The varieties of mustard-seed of commerce are produced from several species of the genus *Brassica* (family Cruciferae). Of these the principal are the black mustard, *Brassica nigra* (*Sinapis nigra*), the white mustard, *Brassica alba,* and the Sarepta mustard, *B. juncea.* Both the white and black mustards are cultivated to some extent in various parts of England, Europe and North America. The white is grown as a salad plant and has come into increasing favour in England as a forage crop or as a green manure. The black mustard is grown solely for its seeds, which yield the condiment. When white mustard is cultivated in England for its herbage it is sown usually in July or August, after some early crop has been removed. In about six weeks it is ready either for feeding off by sheep or for ploughing down as a preparative for wheat or barley.



BY COURTESY OF THE NATURAL HISTORY MUSEUM

WHITE MUSTARD (SINAPIS ALBA), SHOWING FLOWERS AND FRUITS (SILIQUAS)

*Brassica nigra* occurs as a weed in waste and cultivated ground throughout England and the south of Scotland, and widely in the United States and Canada. It is a large branching annual 2 to 3 ft. high with stiff, rather rough, stem and branches, dark green leaves ranging from lyrate below to lanceolate above, short racemes of small bright yellow flowers one-third of an inch in diameter and narrow smooth pods. *B. alba* is more restricted to cultivated ground in Great Britain and has only sparingly escaped from cultivation in the United States; it is distinguished from black mustard by its smaller size, larger flowers and seeds, and spreading rough hairy pods with a long curved beak.

The pungency and odour to which mustard owes much of its value are due to an essential oil developed by the action of myrosin, an enzyme, upon the glucoside (*see* GLUCOSIDES, NATURAL) sinigrin, $C_{10}H_{18}KNS_2O_{10}$. In presence of water myrosin acts on sinigrin, splitting it up into the essential oil of mustard, a potassium salt and glucose. The enzyme is destroyed by boiling water, and therefore it is not proper to use very hot water (above 120° F.) in the preparation of mustard. Essential oil of mustard is an isothiocyanate of allyl, $C_3H_5NCS$. The seed of white mustard contains in place of sinigrin a peculiar glucoside called sinalbin, $C_{30}H_{44}N_2S_2O_{16}$, in several aspects analogous to sinigrin. In presence of water myrosin splits sinalbin up into acrinyl isothiocyanate, sulphate of sinapin and glucose. The first of these is a powerful rubefacient, whence white mustard, although yielding no volatile oil, forms a valuable material for plasters.

Both as a table condiment and as a medicinal substance, mustard has been known from a very remote period. Under the name of *νᾶπυ* it was used by Hippocrates in medicine. The dry form in which table mustard is sold in the United Kingdom dates from 1720, about which time Mrs. Clements of Durham hit on the idea of grinding the seed in a mill and sifting the flour. In the United States a thin paste of mustard prepared with vinegar and spices is commonly sold in glass for table use.

The volatile oil distilled from black mustard seeds after maceration with water is official in the *British Pharmacopoeia* under the title *Oleum sinapis volatile.* In the United States *Pharmacopoeia* it is called *Sinapis nigra.* It is a yellowish or colourless pungent liquid, soluble only in about 50 parts of water, but readily so in ether and in alcohol. From it is prepared, with camphor, castor oil and alcohol, the *linimentum sinapis.* The mustard plaster or *Emplastrum sinapis* of the United States contains mustard mixed with flour from one to four parts. Used internally as a condiment, mustard stimulates the salivary but not the gastric secretions. It increases the peristaltic movements of the stomach. One drachm to half an ounce of mustard in a tumblerful of warm water is an efficient emetic, acting directly on the gastric sensory nerves. It should be used thus only for treatment of poisoning in an emergency.

*Brassica juncea,* leaf mustard, is grown extensively in the orient and to an increasing extent in the United States as a salad plant or potherb. There are numerous forms and horticultural varieties that produce large, rather upright rosettes of attractive leaves, varying from broad and flat through spatulate to very much curled. These forms shoot to seed much later than common white or black mustard and produce a much greater yield of leaves. The species is adapted to cool seasons, and grows well in any good garden soil. It is usually sown thinly in rows 1½ to 2 ft. apart and the plants thinned to stand 2 to 3 in. apart in the row.

(V. R. B.)

**MUSTARD GAS.** The name given to dichlordiethyl sulphide, by far the most devastating gas used in the World War. The fact that it was indestructible and gave off small quantities of vapour for a considerable period added to its potency. The inflammation of the respiratory passages which resulted either proved fatal or rendered the lungs subject to subsequent bacterial infection. (*See* RESPIRATION.)

**MUSTARD OILS,** a general term applied to compounds related to allyl mustard oil, the principal constituent of mustard oil obtained by distilling black mustard seeds (*Sinapis niger*). These seeds contain a glucoside (*q.v.*) termed potassium myronate which undergoes a fermentative change due to an enzyme (*q.v.*), myrosin, also present in the seeds. *Allyl mustard oil* (allyl isothiocyanate), $C_3H_5{\cdot}N{:}C{:}S$, is a colourless liquid sparingly soluble in water and boiling at 151° C; it has a sharp pungent odour and produces blisters on the skin, whence the efficacy of the mustard poultice as a counter-irritant. It can be prepared synthetically by heating allyl sulphide $(C_3H_5)_2S$, with potassium thiocyanate. The odour and taste of mustard (*q.v.*) are due to this substance.

The analogues of allyl isothiocyanate are readily prepared by the action of carbon bisulphide on primary amines, when alkyl dithiocarbamates are formed which on distillation with mercuric chloride yield the corresponding mustard oils. These compounds are colourless liquids with pungent irritating odours. This general reaction proceeds so smoothly that it is employed as a distinctive test for primary amines. (*See* AMINES.) Methyl and ethyl mustard oils are thus obtained from methylamine and ethylamine respectively; the former, a solid, melts at 35° C and boils at 119° C; the latter is liquid and boils at 134° C. Phenyl mustard oil from aniline is a colourless liquid boiling at 222° C.

**MUSURUS, MARCUS** (*c.* 1470–1517), Greek scholar, was born at Rhithymna (*Retimo*) in Crete, and was a pupil of John Lascaris at Venice. He was professor of Greek at Padua and Venice, and died in 1517. Since 1493 Musurus had been associated with Aldus Manutius, and belonged to the "Neacademia," a society founded by Manutius and other learned men for the promotion of Greek studies. Many of the Aldine classics were brought out under Musurus's supervision, and he is credited with the first editions of the scholia of Aristophanes (1498), Athenaeus (1514), Hesychius (1514), Pausanias (1516).

*See* R. Menge, *De M. Musuri vita studiis ingenio,* in vol. 5 of M. Schmidt's edition of Hesychius (1868).

**MUTATION:** *see* VARIATION: *Experimental;* HEREDITY; EVOLUTION.

**MUTIAN, KONRAD** (1471–1526), German humanist, was born in Homberg on Oct. 15, 1471 of well-to-do parents named Mut, and was subsequently known as Konrad Mutianus Rufus, from his red hair. At Deventer under Alexander Hegius he had Erasmus as schoolfellow; he took the master's degree at Erfurt in 1492. From 1495 he travelled in Italy, taking the doctor's degree in canon law at Bologna. Returning in 1502, the landgraf of Hesse promoted him to high office. The post was not congenial; he resigned it (1503) for a small salary as canonicus in Gotha. The circle which gathered round Mutian at Erfurt, known as the *Mutianischer Bund,* included Eoban Hess, Crotus Rubeanus, Justus Jonas and other leaders of independent thought. He wrote little himself, but inspired others. He desired the reform of the Church, but not schism. Like Erasmus, he was with Luther in his early stage, but deserted him in his later development. Though he had personally no hand in it, the *Epistolae obscurorum virorum* (due especially to Crotus Rubeanus) was the work of the Reuchlinists in his *Bund.* He died at Gotha on March 30, 1526.

*See* F. W. Kampschulte, *Die Universität Erfurt* (1858–1860); C. Krause, *Eobanus Hessus* (1879), and *Der Briefwechsel des Mutianus Rufus* (1885).

**MUTILATIONS AND DEFORMATIONS.** In every part of the world to-day, both in civilised as well as uncivilised communities some form of mutilation of the human body is found; but the widest variety of mutilations as well as the most severe occur among the more primitive peoples.

Early historians and writers, long before the Christian era, show that in those days such mutilations as tattooing and circumcision, as well as skull deformation, were well known. Some form of mutilation was probably practised from earliest prehistoric times. On the cave walls of France and Spain, where Aurignacian and Magdalenian man painted the mammoth, elephant and woolly rhinoceros during the closing phases of the last Ice Age (*see* ARCHAEOLOGY: *Stone Age*), are painted hands which indicate the removal of one or more finger joints, a practice common today in South Africa, India and elsewhere. The reason for this mutilation on the part of prehistoric man can only be conjectured by analogy with these modern primitive peoples. In the Wellcome Historical Medical Museum in London, there is exhibited a skeleton of an early man from a prehistoric grave at Gebel Moya in the Sudan. Found close to the jaw is a stone stud exactly similar to the lip studs worn by Nilotic peoples today. Other evidence may be found in folk tales; early paintings and carvings, and by a careful interpretation of objects found in the graves. The motives behind mutilation may be classified as: Tribal Convention; Adornment; Initiation Ceremonial; Religion; Punishment and Health.

**Skin.**—Tattooing consists of puncturing the skin in the pattern desired and rubbing in colouring material so that the pattern is indelibly fixed. In New Zealand the Maoris brought tattooing to a very high art, and the intricate patterns with which they adorned their faces were executed with exquisite workmanship and taste. In China, Borneo, India and other parts of the Far East tattooing is prevalent, and thence has been introduced into Europe, chiefly by sailors. Arms, legs, body and face are all considered suitable surfaces for decoration. To-day tattooing saloons exist in London and in many of the bigger sea-ports. True tattooing, but of a less lasting nature, is occasionally found in parts of Africa, and must not be confused with scarification.

**Scarification.**—This consists of cutting deep marks into the skin and rubbing in charcoal and other irritant material to keep open the wound which eventually is allowed to heal but which leaves a deep scar. Sometimes the wound is so treated that a shiny "keloid" instead of a flat scar results. Scarification occurs all over Africa for reasons as numerous as they are different. Very frequently small scars are made on the face which serve as tribal and clan marks. Often elaborate patterns are worked out on the chest for purely personal adornment; these are especially good on the West Coast. Sometimes the object of the operation is semi-magical, women of many African tribes being scarified on the abdomen during pregnancy. At other times, scarification is merely the result of surgical treatment and is the consequence of rather crude cupping methods followed by the application of an irritant powder. In Australia the aborigines scarify their arms and chests, which often show great black keloids representing many years of patient work, the wound being opened up from time to time and fresh irritants applied.

**Hair.**—Depilation by some means or other, has been practised by primitive peoples for hundreds of years, while all modern civilised peoples still continue to remove unwanted hair by various methods. One of the commonest primitive methods of hair removal is by plucking out each individual hair by its root, every time it grows. By starting at an early age the time comes when the hair on the parts so treated could only be grown sparsely even if desired. This plucking is usually done with the aid of special tweezers some of which—as those in use among the Akamba in Kenya Colony—are beautifully made. Depilation by plucking is common all over Africa and in many parts of the East and Oceania, and the areas so treated are more especially the face and pubic regions, and chest and under the arms. Some individuals even go to the length of removing all body hair.

Shaving of the face, as well as of the scalp, is a common practice among primitive people, and may be carried out with such instruments as a piece of broken glass, or a special iron blade. It is usually done dry, without the use of water or lather. Depilation by singeing, as well as by the use of ointments occasionally occurs. Removal of the hair is usually due to tribal custom, as hairy people are despised and often unable to find a mate.

**Head.**—There are few if any parts of the world where some portions of the head and face entirely escape mutilation, but the

most commonly maltreated are the ears, nose, lips and teeth. Skull deformation may be the result of deliberate intention, or of chance. In some tribes, especially in America every individual was intentionally treated as a child with the direct view of reducing the skull to a certain shape. In other cases, as in parts of Africa, deformation is the unintentional result of the local methods of carrying water pots or loads on the head. Young children, especially girls, start such work long before the skull is properly developed and the result is a definite and fairly uniform deformation. Skull deformation occurs in nearly every part of the world, though commonest in the Americas and least common, if at all existent, in Australia. Intentional deformation is carried out from various motives, sometimes a long pointed head, sometimes a flat depressed head being the shape required. Various methods are employed, commonest of which are by bandaging, and by tying the child's head to a flat board fixed to the occipital region.

**Ears.**—These are pierced to carry earrings all the world over, indeed very few, primitive or civilised peoples, leave the ears totally unmutilated, though the Andamanese, Bushmen and true Baganda are reported as doing so. Both the ear lobes, as well as the cartilage round the top of the ear, are commonly pierced. This is usually done during childhood and a small piece of wood is inserted into the wound which is then left to heal. Later this plug is removed and a larger one inserted, the process being continued until the required size of hole is obtained by reason of this continual stretching. In many countries both sexes treat their ears in this way, while in others it is confined to one or other sex. The greatest distensions are to be found in Borneo and East Africa. In both these places lobes are often seen so stretched that they hang down to the shoulder, with holes so large that it would be possible to pass a closed fist through them. In all these ear mutilations adornment is the end in view. Large carved wooden plugs, carved stone ornaments, metal rings and fibre and paper rolls, all are used as earrings, while to-day even earthenware jam pots and circular cigarette tins are popular in some parts of Africa.

In some tribes such as the Kikuyu, a husband if displeased with his wife breaks the lobe of her ear with his hands.

**Nose.**—The nose is often mutilated for purposes of personal adornment especially in India, and the East, as well as in New Guinea and Polynesia, S. America, Australia and in parts of Africa. Nose ornaments also signify social rank. Sometimes it is the alae, and sometimes the septum which is perforated. Often only a small hole is made through the septum from which a gold ring or other jewel is suspended; at other times the hole in the septum is big enough for a finger to be passed through. Elsewhere one, and occasionally both, nostrils are pierced and distended to carry coloured studs, sometimes of unbelievable size, as among the Makonde of Portuguese East Africa. Nose ornaments are more common with women than men, but in New Guinea and especially among the Tugeri and the Solomon Islanders, the men wear great pointed sticks, or sometimes the tusks of wild pig through holes in the nose.

**Lips.**—In several parts of Africa, especially in the Congo, the south east Tanganyika Territory, and the upper reaches of the Nile, and among the Botocudo of S. America enormous plates and plugs are inserted in hugely distended holes, cut in the upper and lower lips. The lip studs and pins of the Nilotic peoples of Uganda, Kenya Colony and the Sudan are usually small and made of ivory, rock crystal or stone, and are inserted through the upper and lower lips or both. Other lip mutilations include pricking and rubbing with irritant to cause them to swell. This is done in parts of West Africa.

**Teeth.**—Over the greater part of Africa, as well as in Australia, New Guinea and elsewhere, it is a common practice to remove one or more front teeth in the upper or lower or both jaws. Sometimes the ceremonial knocking out of the teeth accompanies initiation and is a test of ability to bear excruciating pain unflinching; sometimes it is simply a matter of custom; sometimes it serves as a tribal mark, while yet another reason given is the fear of lock-jaw. The removal of the teeth is in this case a precaution which would enable the patient to be fed if the disease were contracted.

Another common practice in Africa, found also in Southern India, is the filing or chipping of teeth to serve either as a tribal mark or as an initiation step, or for both purposes. The Akamba and certain Congo peoples file their incisors to sharp points, and for some unknown reason this was considered by early travellers as a sign of cannibalism—a most erroneous view. The Eskimo file the teeth to make them shorter and less like those of dogs and in south and central Africa the incisors are filed to all sorts of shapes and patterns as described by Dr. G. Turner in the *Transvaal Medical Journal* for 1911

The Dyaks of Borneo and other people in the East, occasionally drilled holes in the teeth, into which plugs of gold were driven to serve as ornament. This method of adornment was also used in ancient Mexico, precious stones being inlaid in the teeth.

**Tongue, Cheeks and Neck.**—Among the Bateso of East Africa a hole is sometimes bored through the tongue and a brass ring bearing one or two beads is inserted. The cutting out of the tongue was once a legal penalty in Europe, and has only recently been forbidden in some parts of Africa.

The Aleutian Islanders bored a hole through each cheek through which seal's whiskers were stuck. Feathers are put through holes in the cheek in parts of S. America.

The *Padang* of the South Shan States deform the necks of their womenfolk by making them wear—from early childhood onwards—high metal collars whose length is gradually increased; this eventually produces such elongation and dislocation of the neck that if the collars were removed the wearers would not be able to hold up their heads.

**Eyes and Body.**—Putting out eyes as a punishment for various crimes has existed at different times all over the world—Europe included. Priests and worshippers of certain eastern cults still gash and cut themselves with knives as did the priests of Baal in olden times. In parts of Africa it was once a practice to cut off the breasts of an unfaithful wife.

**Limbs.**—In former times both in England, and Europe generally, amputation of one or more limbs was a common punishment for crime (*see* Pike's *History of Crime in England,* 1893), and this method has only been suppressed in parts of Africa, as in the Congo and Uganda, by the European governments.

For purposes other than punishment and medical necessity, amputation consists chiefly of cutting off the finger joints, especially the little finger. In South Africa this is either done as mourning, or as a magical preventative measure in the case of a child born to a mother whose last baby was still-born. In Southern India grandmothers used (in some castes) to have to cut off one joint for each grandson born to them. In the Tonga Islands the practice is also considered as of magical importance against disease. There is too the bandaging of girl children's feet to prevent their development. This Chinese practice is now prohibited.

**MUTINY:** *see* MILITARY LAW and COURT-MARTIAL.

**MUTIS, JOSÉ CELESTINO** (1732–1808), Spanish naturalist, was born at Cadiz on April 6, 1732. He received his bachelor's degree at the University of Seville and afterwards studied medicine at Madrid where in the general hospital he became for a time a lecturer in anatomy. His preference, however, was for the study of mathematics and natural science, especially botany. He became one of the first disciples of the Swedish botanist, Linnaeus (*q.v.*), in Spain. Attracted by the wide and fruitful fields of study which South America then afforded he sailed in 1760 for New Granada (Colombia), accompanying the Spanish viceroy as physician. In New Granada he occupied himself collecting and describing plants both from the lowlands and from the higher Andean regions, but he did not neglect medicine as is shown by his appointment as king's physician in the viceroyship. He spent much time on sanitary problems such as the establishment of proper cemeteries, the prevention of small-pox and the reduction of malaria. He put into general use many American herbs, the properties of which he had studied, among them ipecacuanda, guaco and Peruvian balsam. Some of these, such as the cinnamon laurel of the Andes, he made known in Europe. His

favourite study, however, was quinine, which he studied from every angle from the distribution of the different species of cinchona down to experiments in the curative properties of the drug. His *El Arcano de la Quina* was published in 1793. Later studies were published in the *Papel Periodico* and after his death by his nephew, Sinforoso Mutis, who completed and arranged his notes on the subject (1828). His work probably had much to do with making possible the colonization of malaria-infested regions. His work attracted the attention of the king who created the Royal Botanical expedition of New Granada and placed Mutis at its head. With 18 of his best students, Mutis carried out a systematic survey in which material was collected for the monumental *Flora de Bogotá ó de Nueva Granada* which he planned in 13 folio volumes. Because of his immense activity in other lines only the first volumes of this intended work were arranged at his death. For the remaining volumes he left manuscripts, notes, illustrations and sketches in such profusion that only some one knowing his schemes of arrangement could have finished the work. Among these botanical riches were 6,480 illustrations, admirable in precision and colour, which were intended for an atlas volume. This material, amounting to over 4,000 folios of loose manuscripts, and his collection of over 20,000 plants were sent after his death to the botanical garden at Madrid, where they are preserved. For 18 years Mutis carried on a correspondence with Linnaeus, much of which was published in *A Selection of the Correspondence of Linnaeus* (1821). He furnished many specimens of plants which the Swedish naturalist described. Linnaeus named in his honor the beautiful genus *Mutisia,* of the family Compositae, comprising some 50 species of plants found in South America. He died at Bogotá on Sept. 11, 1808.

**MUTRACHA:** *see* CASTE (INDIAN).

**MUTSU HITO:** *see* MEIJI TENNO.

**MUTTON.** Mutton is the flesh of the sheep. With it should be included lamb, which is the flesh of the young sheep. With the demand for light, lean, tender cuts, lamb in many areas makes up a far greater percentage of ovine meat than does mutton. Lamb and mutton, like all lean meat, is a good source of excellent quality protein. Certain cuts of lamb and mutton contain appreciable quantities of fat which is a good source of energy. Lamb and mutton contain considerable amounts of iron, phosphorus and of the B vitamins, thiamin, riboflavin and niacin.

**Consumption.**—The per capita consumption of lamb and mutton in the United States is relatively low, being approximately seven pounds per annum. Relatively little lamb and mutton is consumed in the central and southern parts of this country. Most of the lamb and mutton is consumed in the northeastern part of the United States and in the Pacific coast states.

Sheep are ruminants and can subsist entirely on grass and forage. They are especially adapted to regions where the topography is too rough, or the fertility and rainfall too low for more intensive systems of agriculture. They are especially valuable in mountain, forest, desert and cutover land. Wool, the by-product of sheep production, provides additional revenue from sheep production. Lambs may be slaughtered directly off of range and pasture or they may be fattened in dry lot on grain, hay, silage and by-product feeds like those of the sugar beet.

Most range lambs are marketed at the end of the grazing season. In the United States this normally occurs in October. Those fat enough are slaughtered, the remainder being sold to feeders for fattening. These fed lambs are marketed in the late winter months. The greatest demand for lambs occurs at the Easter season when lamb is sought not only by the Gentile trade, but also by the Orthodox Jew for the Paschal lamb for the Feast of the Passover and also for the rites of the Greek Orthodox church. Some producers in the eastern part of the United States specialize in the production of "hot-house" or Easter lambs which are produced out of the normal season. They are dropped by the first of the year and liberally fed to be ready for the Easter trade. Hot-house lambs are usually farm dressed. They are slaughtered at 5 to 14 weeks of age when they weigh from 25 to 55 lb.

*World Trade in Mutton and Lamb, 1924–28, 1929–33, 1934–38*
(Averages in million pounds)

| Principal countries | 1924–1928 | 1929–1933 | 1934–1938 |
|---|---|---|---|
| **Exports** | | | |
| New Zealand | 296 | 387 | 401 |
| Argentina | 178 | 167 | 110 |
| Australia | 69 | 132 | 200 |
| Uruguay | 38 | 37 | 17 |
| Chile* | 36 | 34 | ... |
| **Imports** | | | |
| United Kingdom† | 616 | 750 | 757 |
| France | 23 | 27 | 20 |

*Fresh and frozen meat.
†Imports less re-exports.

In the spring season there are some lambs on the market from the previous year's production which are designated as spring lambs. There are also available some lambs of the current year's production, and to distinguish them they are known as "genuine spring lambs."

The term "Canterbury lamb" is applied to prime quality New Zealand lamb carcasses. They are highly esteemed on the British market.

In slaughtering, sheep and lambs are "round dressed," *i.e.,* the pelt, head and viscera are removed. The hind shanks are unjointed at the hoof head and the front shanks at the bottom of the cannon bone.

The relation of carcass weight to live weight in sheep and lambs will vary from 35% to 65% with the majority yielding from 45% to 52%. High yield is not as important with lambs as with cattle and hogs because of the high value of the by-products of the sheep, particularly the pelt. Finish or fatness and quality tend to increase dressing yields and fill or contents of the digestive tube to decrease it.

**Classes and Grades of Carcasses.**—Carcasses are divided into lambs and mutton, the distinguishing feature being the break joint at the bottom of the front shank bone. The bones of the lamb are immature and the break is made at the ankle, exposing a red, saw-toothed end of the shank bone. When the animal matures, the bone knits together and the result is a smooth, round or spool-shaped joint. Wether lambs will break until they are 15 to 18 months old but ewe lambs will break only until they are 12 to 15 months old.

Lamb carcasses are sometimes subdivided into lambs and yearlings. Yearlings are heavier and while they will show a break joint, it is white, showing that maturity is approaching.

Mutton is divided into wethers or mature castrated males, ewes or mature females and bucks or uncastrated males. "Bucky" carcasses usually have prominent necks and shoulders.

Lambs and yearlings are divided into the following grades: prime, choice, good, medium and common. Prime grade lamb carcasses are sometimes designated as "bag" lambs, because they are encased in a stockinet or paper bag. Grade is determined by shape, finish and quality. The ideal lamb carcass should be compact, blocky and straight-sided. It should have short shanks, plump legs and loin, well-fleshed rack blending into a compact shoulder and a short, thick neck. The carcass should be well and evenly covered with firm, white fat and show a well-covered kidney. Excessive fatness or wastyness is a justifiable basis for lowering grade. In quality, the carcass should be smooth and symmetrical; the fat white, flaky and hard; the bones and joints refined, and the flesh pink, firm and fine-grained.

Lambs, yearlings and wether carcasses are graded into prime, choice, good, medium and common grades. Very few carcasses are of sufficient merit to justify the prime grade which means that the choice grade is the practical top grade. In the United States lamb carcasses weighing 45 lb. or under are generally preferred because they produce small roasts and cut more chops to the pound than heavier ones.

**Lamb Cuts.**—Since the lamb or mutton carcass is relatively small, the wholesale cuts are few in number. Entire unsplit carcasses are generally sold by slaughterers. Sometimes carcasses are divided into fore-saddle and hind-saddle, the division being made between the 12th and 13th ribs.

By the conventional method of cutting, the breast or wing piece of the stew is cut off beginning in the flank and running forward across the middle of the arm. The shoulder is cut off between the third and fifth ribs. The shoulder and the wing pieces together comprising 40% of the carcass, are known as stew. The shoulder may be stewed or braised or it may be cut up into shoulder chops.

The short or hotel rack is separated from the carcass between the 12th and 13th ribs. The loin is separated from the legs at the

small of the back. The rack and loin are generally used for chops although both of these cuts may be roasted. The legs are usually roasted, although they may be cut into steaks. (For diagram of cuts of lamb *see* COOKERY.)

**Lamb Cookery.**—The tender cuts, leg, loin and rack may be roasted. When cut into chops and steaks they may be broiled or pan-broiled. It is generally recommended that the thin, papery membrane or fell be removed from the loin and rack chops before cooking. This fell should not be removed from cuts to be roasted, for doing so increases cooking shrinkage and cooking time.

Shoulder chops may be pan-broiled or braised. The entire shoulder may also be roasted or braised. The less tender lamb breast should be stewed or braised.

Lamb and mutton fat has a higher melting point than beef or pork, hence lamb and mutton should be served very hot.

**By-products of Sheep Slaughter.**—Due to the pelt, the by-product values of sheep and lambs are greater than for any other meat animals. Pelts are painted on the flesh side with a depilatory to loosen the wool. The wool is then pulled and sorted into various classes and grades and used for cloth. The skins, known as slats, are tanned for leather. Sheepskin is used for upholstery, bookbinding, gloves, clothing and cheap shoe uppers. Shorn pelts known as shearlings are used for clothing. The waxy grease or yolk scoured from the wool is known as lanolin or wool fat and is used as a base for high-grade ointments.

Livers, hearts, tongues and brains are used for food. Some of the glandular organs are extracted for pharmaceutical preparations. The tallow is used to some extent as an edible fat. It may also be used for inedible purposes. Other parts are used for the manufacture of animal feeds.

The small intestines of the sheep and the lamb are among the most valuable casings produced. Their small diameter and tenderness make them especially desirable as containers for high-quality sausage. These intestines are also used for making "cat gut" which is important as musical instrument, tennis strings and soluble surgical ligatures.

BIBLIOGRAPHY.—W. C. Davis and J. A. Burgess, "Market Classes and Grades of Dressed Lamb and Mutton," *U.S.D.A. Dept. Bul. 1470* (1927); *Readings in Packing House Practice, Part II, Beef, Mutton and Veal Operations* (1925); *Meat and Meat Cookery,* National Live Stock and Meat Board (1942); Rudolf A. Clemen, *By-products in the Packing Industry* (1927). (W. J. L.)

**MUTTON-BIRD:** *see* SHEARWATER.

**MUTTRA** or **MATHURA,** a city and district of British India in the Agra division of the United Provinces. The city is on the right bank of the Jumna, 30 mi. above Agra; pop. (1941), 76,716. It is an ancient town, mentioned by Fa Hien as a centre of Buddhism about A.D. 400; his successor Hsüan Tsang, about 650, states that it then contained 20 Buddhist monasteries and 5 Brahmanical temples. It was sacked by Mahmud of Ghazni in 1017–18; about 1500 Sultan Sikandar Lodi utterly destroyed all the Hindu shrines, temples and images; and in 1636 Shah Jahan appointed a governor expressly to "stamp out idolatry." In 1669–70 Aurangzeb visited the city and continued the work of destruction. Muttra was again captured and plundered by Ahmad Shah with 25,000 Afghan cavalry in 1756. The town still forms a great centre of Hindu devotion, and large numbers of Vaishnavite pilgrims flock annually to the festivals. Temples and bathing stairs line the river bank. The majority are modern, but the mosque of Aurangzeb, on a lofty site, dates from 1669. Most of the public buildings are of white stone, handsomely carved. There are an American mission, a Roman Catholic church, a museum of antiquities and a cantonment for a British cavalry regiment. Cotton, paper and pilgrims' charms are the chief articles of manufacture.

The DISTRICT OF MUTTRA has an area of 1,447 sq.mi. It consists of an irregular strip of territory lying on both sides of the Jumna. The general level is only broken at the southwestern angle by low ranges of limestone hills. The eastern half consists for the most part of a rich upland plain, abundantly irrigated by wells, rivers and canals, while the western portion, though rich in mythological association and antiquarian remains, is comparatively unfavoured by nature. Pop. (1941) 806,992. Principal crops are millet, pulse, cotton, wheat, barley and sugar cane. The eastern half of the district is watered by the Agra canal, which is navigable, and the western half by branches of the Ganges canal. The district is served by the Rajputana and other railways. The central portion of Muttra district forms one of the most sacred spots in Hindu mythology. A circuit of 84 kos around Gokul and Brindaban bears the name of the Braj-Mandal, and carries with it many associations of earliest Aryan times. Here Krishna and his brother Balarama fed their cattle upon the plain; and numerous relics of antiquity in the towns of Muttra, Gobardhan, Gokul, Mahaban and Brindaban still attest the sanctity with which this holy tract was invested. During the Buddhist period Muttra became a centre of the new faith. After the invasion of Mahmud of Ghazni the city fell into insignificance till the reign of Akbar; and thenceforward its history merges in that of the Jats of Bharatpur, until it again acquired separate individuality under Suraj Mal in the middle of the 18th century. The whole of Muttra passed under British rule in 1804.

**MUTULE,** in architecture, a rectangular block, beneath the soffit, or under side of the projecting portion of the cornice of the Doric order. (*See* ORDER.) It is usually decorated on the under side with guttae (*q.v.*), or little cylindrical projecting blocks. In Greek work its lower side is inclined, following approximately the roof slope; in Roman and Renaissance work it is generally level and is crowned with a cap moulding. In origin it is probably a stone representation of an original projecting wooden rafter end.

**MUZAFFAR-ED-DĪN,** shah of Persia (1853–1907), the second son of Shah Nasr-ed-Dīn, was born on March 25, 1853. He was in due course declared *valī ahd,* or heir-apparent, and invested with the governorship of Azerbaijan, but on the assassination of his father in 1896 it was feared that his elder brother, Zill-es-Sultan, the governor of Isfahan, might prove a dangerous rival, especially when it was remembered that Muzaffar-ed-Dīn had been recalled to Tehran by his father upon his failure to suppress a Kurd uprising in his province. Muzaffar-ed-Dīn was duly enthroned, with the support of the British and Russian governments, on June 8, 1896, the Russian general Kosakowsky, commander of the Persian Cossacks, presiding with drawn sword.

In the summer of 1906 popular discontent culminated in extraordinary demonstrations at Tehran, which practically amounted to a general strike. The shah proclaimed a liberal constitution, the first parliament being opened by him on Oct. 12, 1906. Muzaffar-ed-Dīn died on Jan. 8, 1907, being succeeded by his son Mohammed Ali Mirza.

**MUZAFFARGARH,** a town and district of British India, in the Multan division of the Punjab. The town is near the right bank of the river Chenal. Pop. (1941), 8,265. Its fort and a mosque were built by Nawab Muzaffar Khan in 1794–96.

The district of Muzaffargarh occupies the lower end of the Sind-Sagar Doab. Area, 5,605 sq.mi. In the northern half of the district is the wild *thal* or central desert, an arid elevated tract with a width of 40 mi. in the extreme north, which gradually contracts until it disappears about 10 mi. south of Muzaffargarh town. In cold weather large herds of camels, owned by the povindah merchants of Afghanistan, graze upon the sandy waste. The district forms part of Multan (*q.v.*). The population in 1941 was 712,849. The principal crops are wheat, pulse, rice and indigo. The boundary rivers are navigable, besides furnishing irrigation channels, originally constructed under native rule.

**MUZAFFARPUR,** a town and district of British India, in the Tirhut division of Bihar. The town is on the right bank of the Little Gandak river, and has a railway station. Pop. (1941), 54,009. The town is well laid out along two lakes, which originally formed part of the river bed, and is an important centre of trade, being on the direct route from Patna to Nepal. It is the headquarters of the commissioner of the Tirhut division, also of the Behar Light Horse, first raised as a volunteer corps in 1862.

The DISTRICT OF MUZAFFARPUR has an area of 3,025 sq.mi. and a population (1941) of 3,244,651. It is a fertile, alluvial plain watered by the Great Gandak, Baghmati and Little Gandak, and by their tributaries. The level plain is dotted with groves of mangoes and clusters of bamboo. It is closely cultivated and densely populated, the average density being 1,072 per sq.mi. Rice is the chief grain crop. The indigo industry, almost extinguished by the synthetic dye, has been largely replaced by sugar. Excavations have laid bare the remains of buildings dating back to about A.D. 300; hundreds of seals of the 4th or 5th century A.D. were also unearthed. At Kolhua, 3 mi. to the northwest, is a stone pillar crowned by a lion, set up by the emperor Asoka to mark a stage of his journey to Nepal in 249 B.C.

**MUZIANO, GIROLAMO** (1528–1592), Italian painter, was born at Acquafredda, near Brescia, in 1528. He died in Rome, and was buried in the church of Santa Maria Maggiore. He came to Rome about 1550, where his pictures gained him the name of *Il Giovane de' paesi* (the young man of the landscapes). His great picture of the "Resurrection of Lazarus" established his fame. As superintendent at the Vatican, he developed mosaic as a perfect imitation of painting. He helped to found the Academy of St. Luke in Rome.

Many of Muziano's works are in the churches and palaces of Rome; he also worked in Orvieto and Loreto. In Santa Maria degli Angeli, Rome, is one of his chief works, "St. Jerome preaching to Monks in the Desert"; his "Circumcision" is in the church of the Gesu, his "Ascension" in the Araceli, and his "St. Francis receiving the Stigmata" in the church of the Conception. A picture by him representing Christ washing the feet of His disciples, is in the cathedral of Reims.

**MWERU** (or MOERU), a large lake of eastern central Africa. It lies 3,000 ft. above the sea, in a western branch of the great Tanganyika rift-valley. The lake is about 68 m. long by some 25 in breadth, and is roughly rectangular. It is cut a little south of its centre by 9° S. Mweru, first visited in 1798 by Dr. Lacerda, was reached by Livingstone in 1867, but its western shore was first explored in 1890 by Sir Alfred Sharpe, who two years later circumnavigated the lake. The eastern shores belong to Northern Rhodesia, the western to the Belgian Congo. The district is a game preserve and shooting is prohibited.

**MYCENAE,** one of the most ancient cities of Greece. The citadel on the summit is triangular with sides facing north, south-east and south-west. Part of the south-eastern wall and the palace within have been undermined by the torrent which bounds the lower town on the east. For the artistic significance of the various graves and building remains scattered among the groups of houses forming the lower town, *see* AEGEAN CIVILIZATION. Mycenae is a natural rock citadel standing in the north corner of the Argive plain flanked to north and south by deep ravines. It watched the hills, controlled the plain, and was the key to the road from the Gulf of Argos to the Gulf of Corinth which afforded the shortest route from Crete to central Greece.

The hill is roughly triangular with the apex pointing south and is defended by massive cyclopean walls. At the northwest angle is the Lion Gate surmounted by the famous limestone relief of two confronted lions ten feet high. The gate itself is about ten feet square and with its approaches is built of ashlar masonry in hard conglomerate. In the north wall is a smaller but similar gate and near it lies a secret underground cistern fed by the Perseian spring and approached by a subterranean passage from inside the walls. The extreme northeast angle is a later addition to strengthen this important point and to provide a sally port. Within the Lion Gate lies the Grave Circle enclosing the Royal Graves found by Schliemann and by it are ruined houses and storehouses. From the gate an inclined roadway leads to the summit crowned by the palace. This was built at different periods, but the ruins now visible belong in the main to the last great age of Mycenae. At the northwest angle was a columned entrance porch, and a throne room, a shrine, a bathroom, and a room with store jars have been found. On the south a wide staircase with two flights ascends to a spacious court. To the east a porch and vestibule open into the great hall (*megaron*) in the centre of which is a large circular hearth covered with painted stucco and surrounded by four column bases. The walls and floors of the *megaron,* court and vestibule were covered with painted stucco and there are plentiful remains of frescoes which adorned other rooms at different periods. West of the court a staircase led to the upper stories and to its north ran two parallel corridors giving access to other rooms at higher levels.

From the citadel a narrow ridge runs westwards so that its backbone forms the natural approach to the Lion Gate. Here are three of the beehive tombs (the Tomb of Aegisthus, the Lion Tomb, and the Tomb of Clytaemestra) and also the north wall of the Hellenistic lower town and the ruins of its gymnasium and theatre. At its west end a wider and longer ridge runs due south. Its northern end was included in the Hellenistic lower town and somewhere along it must have run the prehistoric road. On its east side stands the Treasury of Atreus, the largest beehive tomb, and on its west another, and all about are rock cut chamber tombs. Below its southern extremity the ravine which runs from the south side of the citadel was spanned by a prehistoric bridge on the road leading southeast towards the Argive Heraeum and Tiryns. Subsidiary ridges running westwards to the plain are also honeycombed with tombs among which are four more beehive tombs. On one ridge, Kalkani, traces of early Bronze Age occupation have come to light, and in the hollows are two ancient wells. On the peak of Hagios Elias which overlooks Mycenae to the north stands a small fort of the later part of the Third Bronze Age which clearly served as a signal station, for thence the whole plain can be surveyed from Asine to Argos with the passes towards Arcadia, Nemea and Cleonae and the Acrocorinthus itself can be seen. A system of built roads radiates through the hills from Mycenae and they and the signal station emphasize its strategic and political importance.

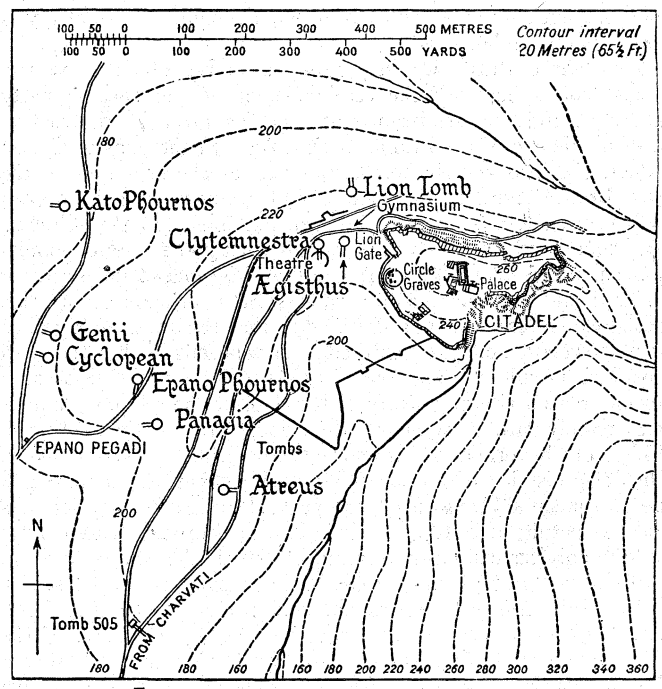



FIG. 1.—PLAN OF THE CITADEL OF MYCENAE

Argolis was inhabited in the Neolithic age by a branch of the race that occupied central and northern Greece. No settlement of this period has yet been found at Mycenae, whose history begins with the Bronze Age. Then the citadel was occupied by the bronze using folk of the Early Aegean period who seem to have come into Greece from the islands and southwest Asia Minor. There is no clue to the language of the neolithic race, but the Bronze Age people probably spoke a non-Hellenic tongue and brought into Greece the place names which end in -nthos, -assos, or -ene. Among these is Mykene, a heroine mentioned by Homer whose name is to Mykenai as Athene is to Athenai. It is hard to estimate either the date of the Bronze Age settlement, which probably existed before the third millennium B.C., or its size, for ceramic remains, though frequent, are much disturbed by later buildings. With the beginning of the Middle Aegean period soon after 2200 B.C. a new racial element of unknown origin entered Greece. Its presence is marked by a class of pottery called Minyan Ware which has several varieties. The plentifulness of this and of a matt painted fabric, developed from the Early Bronze Age pottery at Mycenae, shows that the city prospered under this new impulse. As Minyan ware is practically unknown in Crete, though common in the islands, relations between Crete and Mycenae cannot have been intimate, and so the latter's expansion would have been mainly independent of Crete. Through-

out the Middle Bronze Age, on the hillside where the Grave Circle and Lion Gate were afterwards built, a cemetery had been in use, as this was the nearest spot where the rock was soft enough for simple cist graves of the type usual at the period. Among them in one special area larger and deeper graves were hewn out to contain the remains of the princes, the famous Shaft Graves, the treasures of which, excavated by Schliemann, first revealed the great prehistoric civilisation of Greece. The earliest, the Sixth, contains some objects from Crete, but the bulk of its pottery is unmistakably indigenous.

This Shaft Grave Dynasty rose to power about 1600 B.C. almost coinciding with the establishment of the 18th Dynasty in Egypt and the renaissance of Knossos after its destruction towards the end of the Middle Bronze Age. Slight signs of Cretan influence appear shortly before, but now at the beginning of the Late Bronze Age Cretan fashions and art were largely adopted at Mycenae. Three explanations are possible: (1) that Cretans now conquered the mainland and displacing the native population colonized a large portion; (2) that Mycenaean kings, strong on land and sea, successfully raided Crete, bringing home rich treasures and craftsmen as slaves; (3) that the kings of Mycenae grew powerful and rich, entered into relations with Crete and absorbed its culture. The first view seems least probable because for one reason Cretan pottery of the date of the alleged conquest is extremely rare at Mycenae where local fabrics still continued. Which of the other two is more correct time alone can show. The "Crétoiserie" of the Shaft Grave kings can be compared to the European *Chinoiserie* of the early 18th century, which was not the result of a Chinese conquest of Europe. These kings undoubtedly resided on the summit of the citadel where there are traces of a "palace" underlying the later palace. No signs of a circuit wall have yet been found and in any case it would not have had the area of the later enceinte. Still the richness of the royal graves and of private tombs of the period shows that a high standard of civilisation had been reached. This was not due entirely to the adoption of the Cretan culture, but to the fact that the newcomers of the Middle Bronze Age, who may well have spoken Greek, were themselves keen, energetic, and well advanced in things material, and needed only the contact with Crete to develop artistically as well.

Towards the close of the 16th century B.C. a change in royal burials indicates a new dynasty, which laid its princes in stone built beehive tombs from 25 to 50 feet in height and diameter. Nine such tombs exist at Mycenae. Their architecture displays gradual advance in technical matters, the use and cutting of materials and the handling of the problems of stresses and weights, so that they fall by progressive development into three groups of three tombs each. The first group belongs to the later 16th and to the early 15th century B.C. and the second group to the later 15th century. The earlier tombs were smaller, the construction primitive, the material inferior, the stone unshaped, and stresses not understood. The second group is larger and better built, the stone was hewn but not sawn, and a relieving triangle over the lintel was employed. In the two first groups the finest are the Tomb of Aegisthus and the Lion Tomb which last was closed with a door and threshold instead of rude stone walling. The first Beehive Tomb kings must have lived in the citadel but, apart from signs of their activity in the palace area, no other building can be definitely assigned to this date. The standard of culture was the same and there was intercourse with the islands, Crete and Egypt. The private tombs show that comfort was extending and the rather simple rock cut tombs of the 16th century now developed into spacious chambers with wide entrances.

After 1400 B.C. when Knossos fell and Egypt decayed under the last Amenhoteps, Mycenae, which had been rapidly developing since the end of the Middle Bronze Age, now took first place. Greek traditions, Homer's picture of Agamemnon as suzerain of the princes who sailed against Troy, and its mighty ruins, all bear witness to its greatness. Under the aegis of Mycenae ruled by the later kings of the Beehive Tomb Dynasty the Minoan-Mycenaean culture spread throughout the Eastern Mediterranean, and echoes of this are found in Homer. To this great age the majority of the amazing buildings at Mycenae belong. The palace was reconstructed on a large and sumptuous scale, the cyclopean walls of the citadel were built with the Lion Gate. Within the walls rose storehouses and residences for the civil and military officers of the court, and for their guards and servants. The royal Shaft Graves with part of the old cemetery were enclosed within the enceinte and the space round them was levelled, ringed with standing slabs, and made into a sacred area for the worship of the dead princes.

These later kings of the Beehive Tomb Dynasty to whose energy and ability the greatness of Mycenae seems so largely due, were buried in the last group of Beehive Tombs, the Treasury of Atreus, the Tomb of Clytaemestra, and the Tomb of Genii. These are naturally the best in construction, plan and size, and are built throughout of hard stone, mainly sawn. Each had a door, and a threshold constructed on a wedge principle. The understanding of stresses and of the means to counteract them shows that their architects profiting by earlier experiments perfected their methods and materials, so that two of these tombs still stand almost intact. The Treasury of Atreus is structurally so like the Lion Gate and the palace that it is possible that the royal builder of the two latter prepared the former as his tomb. The same style occurs in the walls and palace at Tiryns which are contemporary. The civilian population of Mycenae must have lived in undefended settlements on the neighbouring hills and the many cemeteries of this date divide into local groups suggesting separate communities. The tombs are carefully hewn in the rock with long narrow entrance passages and were furnished with objects in pottery, bronze, glass, ivory and gold, which show that the culture of Mycenae at its zenith even if less artistic displays wonderful technical ability. During the 14th and 13th centuries B.C. at Mycenae not only were crafts such as the potter's intensively and skilfully practised, but also professions such as those of engineers and architects, for the cyclopean walls and great domes like the Treasury of Atreus imply structural genius.

Troy according to tradition was taken early in the 12th century. Then, as the use of iron spread, the Iron Age began and as the contemporary Egyptian records say "the Isles were restless." This was the age of the Dorian Migration. Then Mycenae fell and the palace and houses were burnt. The walls, however, were not destroyed and as such a stronghold could not be left untenanted Mycenae was inhabited during the early Iron Age, but was of small importance as Dorian Argos usurped her place. As a small city state it preserved its independence and a Doric temple of Athena who ousted the local heroine Mykene arose early in the sixth century upon the ruins of the palace of the Bronze Age kings. Some sculptures from this temple survive. The débris among the ruins proves Mycenae's continuous existence, through the geometric, orientalising and archaic periods of Greek art down to the Persian Wars. Then Mycenae sent her small contingent to join in resisting Xerxes' invasion. Her men fought at Plataea in 479 B.C. and the name Μυκανῆς can still be read on the serpent column from Delphi now in the Hippodrome at Constantinople. Argive jealousy, however, could not forgive and in 470 B.C. when Sparta was in difficulties an Argive army besieged Mycenae. The citadel was starved out, its walls and buildings were overthrown and the site laid waste.

In 235 B.C. the Argive tyrant Aristippos was murdered at Mycenae which like other small towns dependent on Argos was probably reoccupied by the Argive tyrants of the third century B.C. during their struggles with the Achaean League. The walls of the citadel were repaired and part of the hillside on the south was walled in to make a lower town. In this lay a small theatre directly above the Tomb of Clytaemestra and by it was a gymnasium. The Doric temple, which the Argives had perhaps spared in 470 B.C., still stood on the summit of the citadel. Inscriptions dating probably from 194 B.C. and referring to Mycenae's relations with Argos and Nabis of Sparta give some details of its government. After Argos was freed from Nabis Mycenae vanishes from history and Pausanias in the second century A.D. makes no mention of inhabitation. A few remains of the Roman period have been

found so it cannot have been entirely deserted, but the depopulation of Greece must have affected Mycenae and a few inhabitants among ruins so famous would give every impression of desolation. Soon after it must have been completely deserted, for there are no traces of Byzantine or later occupation.

The site of Mycenae was never forgotten as Pausanias who saw the Lion Gate shows and when Greece began to be revisited by travellers from western Europe it became a place of pilgrimage. Excavations were begun by Schliemann who made soundings in 1873, but conducted his epoch-making campaign in 1876 when he found the royal Shaft Graves. Stamatakes followed from 1877 to 1879 when he found the sixth Shaft Grave and cleared the Treasury of Atreus. From 1886 to 1902 Tsountas in a fruitful series of excavations cleared several houses, and found the palace, three beehive tombs, and a large number of private tombs. Rodenwaldt did valuable work on the frescoes in the palace between 1912 and 1914. From 1920 to 1923 Wace excavated here for the British School at Athens, when many tombs were found and new and important results were obtained from the Grave Circle, the Beehive Tombs and the palace.

BIBLIOGRAPHY.—Anderson, Spiers and Dinsmoor, *Architecture of Ancient Greece,* p. 32, 44 ff.; Furtwängler and Loeschcke, *Mykenische Thongefaesse, Mykenische Vasen;* Karo, *Schachtgräber von Mykenai (Anthenische Mitteilungen,* 1915, p. 113 ff.); Keramopoullos, Ἐφημερὶς Ἀρχαιολογική, 1918, p. 52; Kuruniotis, *Jahrbuch d. k. deutschen arch. Instituts,* 1919, p. 87 ff.; Rodenwaldt, *Der Fries des Megarons von Mykenai;* Schliemann, *Mycenae;* Steffen, *Karten von Mykenai;* Tsountas and Manatt, *Mycenaean Age;* Tsountas, Ἐφημερὶς Ἀρχαιολογική, 1887, p. 155 ff., 1888, p. 119 ff., 1891, p. 1 ff., 1896, p. 1 ff., 1897, pp. 97, 200 ff., 1902, p. 1 ff.; Πρακτικά, 1886, p. 59 ff., *Jahrbuch d.k. deutschen arch. Instituts,* 1895, p. 143 ff.; Wace, *Annual of British School at Athens,* vols. xxii., xxiv., xxv., *Journal of Hellenic Studies,* xlvi., p. 110 ff. *See* also AEGEAN CIVILISATION, TIRYNS.

**MYCETOZOA** (slime-fungi), low organisms (often classed with fungi, but undoubtedly more nearly related to the protozoa), of which the individuals (plasmodia) are essentially nothing but giant amoebae. In unfavourable conditions of life, such as hunger or drought, the plasmodia become changed into fructifications (usually stalked capsules, filled with numerous unicellular spores), which bear a close resemblance to the fructifications of some fungi. For further particulars *see* PROTOZOA.

**MYCOLOGY** is the science of fungi (Greek μύκης, a mushroom, λόγος, discourse), and is dealt with in the article FUNGI.

**MYCONIUS, FRIEDRICH** (1490–1546), Lutheran divine, was born on Dec. 26, 1490, at Lichtenfels on the Main, of worthy and pious parents, whose family name was Mecum. While a student at Annaberg, he had a memorable encounter with the Dominican, Tetzel, his point being that indulgences should be given *pauperibus gratis.* His teacher, Staffelstein, persuaded him to enter (1510) the Franciscan cloister. From Annaberg he passed to Franciscan communities at Leipzig and Weimar, where he was ordained priest (1516), and next year his "eyes and ears were opened" by the theses of Luther. For six years he preached his new gospel, under difficulties, in various seats of his order, lastly at Zwickau, whence he was called to Gotha (1524) by Duke John at the general desire. Here he married Margaret Jäcken. He had Luther's confidence, and was twice entrusted (1528 and 1533) with the ordering of the churches and schools in Thuringia. At the Convention of Schmalkalden he signed the articles on his own behalf and that of his friend Justus Menius. In 1538 he was in England, as theologian to the embassy which hoped to induce Henry VIII. to make common cause with the Lutheran reformation on the basis of the Augsburg Confession, a project which Myconius caustically observed might prosper if Henry were allowed to be pope. He died on April 7, 1546.

His *Historia reformationis,* referring especially to Gotha, was not printed till 1715. *See* Melchior Adam, *Vitae theologorum* (1706); J. G. Bosseck, *F. Myconii Memoriam . . .* (1739); C. K. G. Lommatzsch, *Narratio de F. Myconio* (1825); K. F. Ledderhose, *F. Myconius* (1854).

**MYCORRHIZA.** The roots of land plants live in soil, competing therein for water and nutrients with a crowded population of micro-organisms. They are surrounded by a rich and varied fungus flora many members of which are potential parasites, but the majority of roots are relatively immune to such parasitic attack and continue to flourish side by side with their fungus competitors. To the interaction of these three phenomena—the competitive struggle for food, the capacity of many fungi to penetrate living tissues and the properties of resistance to such invasion possessed by roots in common with organisms in general—is probably due the evolution of *mycorrhiza,* that curious and interesting partnership between the roots of vascular plants and fungus mycelium now known to affect a vast number of the higher plants and to be of great importance in their lives.

Mycorrhizae or fungus-roots (μύκης, a mushroom) (ῥίζα, a root) are formed alike by wild and cultivated plants, by species from the high mountains and by those from salt marshes at sea level, in the vegetation of tropical forests as in that within the arctic circle. The phenomenon was comparatively well-known, especially to foresters when, in 1885, the German botanist, Albert B. Frank, coined the name, 'mycorrhiza,' to register his view that the root with its associated mycelium constituted an independent organ of great importance in plant nutrition. He reported an invariable and intimate association of fungus mycelium with the roots of forest trees, especially oak, beech, hornbeam and other members of Cupuliferae, and certain conifers, such infection being, in his opinion, not parasitic but of definite service to the trees in relation to the absorption of water and nutrient salts. On a contemporary view associated especially with the name of Robert Hartig, the root fungi of trees were mischievous parasites hindering root action and conferring no benefit upon the hosts.

By the end of the nineteenth century it was realized by botanists that the mycorrhizal habit was widespread, affecting not only trees but an immense number of herbaceous species belonging to different families.

**Distribution and Structure.**—Mycorrhiza is formed by ferns, club mosses, conifers and an ever growing list of flowering plants belonging to many different families. It is constant and conspicuous in certain groups, *e.g.,* Orchidaceae, Ericales, Empetraceae and forest trees generally, and is invariably well developed in species lacking chlorophyll, e.g., *Neottia Nidus-avis, Corallorhiza* spp. and a number of tropical orchids belonging to this class, members of the Monotropoideae, and certain species belonging to the families Gentianaceae and Burmanniaceae. Structures closely resembling the mycorrhizal tissues of living species have been described in fossils of Coal Measure age. It is specially characteristic of the vegetation of humus soils, viz., those of moorlands, woodlands and heaths, but may be well developed in garden soil and in the most diverse situations elsewhere. It may be regarded as an annual phenomenon affecting all or a proportion only of the young absorbing roots of the current year.

It is assumed that the fungi concerned are widely distributed in soil, and with few exceptions invasion of the roots takes place from this source. The effect of infection is strikingly different from that in ordinary parasitism, there being no indication that the tissues suffer any permanent injury from the more or less extensive infestation by mycelium to which they are subjected. The external appearance of the root may be altered, as in trees, where arrest of growth accompanied by profuse branching results in the production of dense clusters of rootlets, brown or variously coloured according to the kind of mycelium present. Sometimes the appearance of the roots is not altered in any way. There is great variation in different plants and at different seasons in respect to the relative abundance of mycelium, its distribution upon and within roots and the details of structure of individual mycorrhizas.

It is still convenient to recognize two main types of structure and use the descriptive names given to them by Frank in 1885; the *ectotrophic* type, specially characteristic of trees, in which mycelium completely invests the tip and younger portion of the root as with a sheath of varying thickness, branches from which penetrate between the cortical cells to form a continuous network, while individual cells remain relatively immune from infection; and the *endotrophic* type, showing a variable amount of mycelium externally without formation of a sheath, combined with a more or less profuse distribution of hyphae within the

cells, sometimes irregularly distributed in the cortical tissues, sometimes localized in definite zones. The individual cells that suffer invasion become filled with coiled or branched hyphae continuous with those which form an irregular mesh upon the external surface of the root and permeate the soil around it. In a majority of fungus-roots these intracellular hyphal complexes disintegrate, dwindle and disappear, the soluble by-products presumably passing to the host cells.

These two types of mycorrhiza are not sharply distinguished from one another as Frank believed. It is known now that those of the ectotrophic type often exhibit relatively heavy infection of individual cells, and it seems probable that the structural differences are related to the character of the mycelium and to soil conditions rather than to any fundamental distinction in the association as a whole.

**The Mycorrhiza of Orchids.**—The mycorrhiza of orchids is of the endotrophic type and mycelium may be widely distributed throughout the root cortex or confined to certain regions. Two contrasting types of cell are observable: *Pilzwirthzellen* or "host cells," containing active hyphae, and *Verdauungzellen* or "digestion-cells," enclosing only their disintegrated remains subsequent to digestion. In the former the mycelium fills the cells with skeins or "pelotons" of characteristic appearance and probably abstracts nutrient materials from the host; in the latter these substances and possibly others brought in from the soil are placed at the disposal of the root.

The researches of a French botanist, Bernard, initiated a new method of experimental inquiry and demonstrated the far-reaching character of the relationship in orchids. The difficulties experienced by growers in germinating seeds of orchids had long been known. Bernard isolated the root fungi from a number of species and showed, by "pure culture" methods, that germination of seed and development of the seedling are bound up with infection by the appropriate root fungus at a critical stage of development. In nature, this *symbiotic* type of germination is ensured by the presence of mycelium of the root fungus in the soil about the roots of the parent plant; in horticultural practice, artificial cultures have been successfully utilized by L. Knudson for the same purpose. It has been discovered that the stimulus normally provided by the appropriate fungus can be replaced artificially by carefully adjusting the chemical constitution and reaction of the seedbed, and such *asymbiotic* methods of securing germination have been successfully applied by horticulturalists in the case of certain orchid species.

There remains much that is obscure in the relation of fungus and host in this group of plants. The nature of the problems awaiting solution is sufficiently indicated by the invariable association of particular fungus strains with individual orchid species, and by the fact that orchid growing is concerned not only with the cultivation of natural species but with the raising of new hybrids.

**Mycorrhiza in Ericaceae.**—In northern Europe certain members of the family Ericaceae, *e.g.*, various kinds of heath (*Erica* spp.), and heather or ling (*Calluna vulgaris*) are a constant feature of the vegetation of humus soils—moorland and woodland—on which they often monopolize large areas to the almost complete exclusion of other plants.

Described by Frank as *obligate mycorrhiza plants,* it was early recognized that members of this group might exhibit specialized relations with their root fungi. The mycorrhiza is of the endotrophic type with certain characteristic features, in some respects showing points of resemblance with that of trees. The young roots are excessively fine, the outermost layer of cells in each forming a definite mycorrhizal zone. In favourable soil conditions practically every cell in this layer is filled with a densely branched complex of fungal hyphae from which strands of mycelium extend outwards into the soil. The growth of mycelium on the outside of the roots is rather more profuse than in orchids, and, in certain species, may resemble the sheath-like condition found in ectotrophic mycorrhizas. As in orchids, the complexes of mycelium within the root cells are subject to rapid and complete digestion followed by disappearance of the resulting products.

In ling (*Calluna vulgaris*) and certain allied species an obligate relation unique of its kind has been revealed by experimental research. In these plants the mycelium which infests the root spreads throughout the tissues of the vegetative shoots, flowers and fruits reaching eventually the seed-coats of the developing seeds. These are shed bearing with them the mycelium of the fungus partner and at germination the emerging seedling is immediately subject to invasion.

The distribution of mycelium throughout the plant thus compares sharply with that found in orchids where it is limited to the roots of the adult and the embryonic tissues of the seedling. In *Calluna* and kindred ericaceous species it is practically co-extensive with the plant tissues. Only the embryo and endosperm of the resting seed are free from contamination; at all other stages of development and throughout its vegetative existence every plant of ling yet examined is a dual organism. In the genus *Vaccinium* the intimacy of the relation has been carried a stage farther and mycelium is present, not only externally upon the seed-coats, but internally throughout the tissues of the seed. The mode of infection observed in Ericaceae is unique, for, in all other known cases, the mycelium responsible for forming mycorrhiza enters the root from the soil.

In ling and probably in allied species the formation of functional mycorrhiza is closely related to soil conditions. It is at a maximum in peaty soils and in cultivated soils with abundant humus, much less conspicuous in sandy soils deficient in organic matter, and may appear to be absent under certain conditions, although roots are never free from fungus infection.

Since seedling development follows and depends upon invasion by fungus mycelium at germination, it is impossible to provide experimental evidence bearing on the behaviour of individuals with and without fungus infection.

**The Mycorrhiza of Trees.**—The mycorrhiza of trees is characteristic and easily recognized. Structurally, it belongs to the ectotrophic type; each rootlet is enveloped in a sheath of mycelium formed by the close interweaving of hyphae continuous internally with a branch system penetrating between the cells of the roots, externally with the network of mycelium in the soil.

Woodland soils possess an unusually rich and varied fungus flora among which members of the great group known as Hymenomycetes are conspicuous, as evidenced by the profusion of their spore-bodies—toadstools—produced during suitable seasons. So constant is the association of some of these with certain trees that it has been said that they follow the latter "as the dolphin follows the ship."

In order to prove a direct relation between these common woodland fungi and the mycorrhiza of the trees beneath which they grow, it was necessary to isolate the endophytes, learn something of their behaviour and compare the growth of young trees with and without mycorrhiza. By such means a number of Hymenomycetes have been identified as the specific root fungi of pine, spruce, larch, birch and other trees.

There is no evidence that seedling development is bound up with fungus infection or that anything in the nature of an obligate relation exists. As regards the effect of tree mycorrhiza on nutrition, it must be noted that woodland soils possess certain definite characteristics. There is severe competition for water and salts and they show a notable deficiency of certain plant nutrients, in particular nitrates. On the other hand, they possess large reserves of nitrogen in the form of organic compounds It has been proved experimentally that the possession of mycorrhiza is beneficial to trees, especially in relation to the supply of nitrogenous nutrients. Hence, the supply of nitrates being deficient it may be concluded that it possesses a vital significance for trees and other plants growing in woodland soils. The application of these conclusions to natural conditions raises problems of great importance to practical foresters.

**Identity of Mycorrhizal Fungi.**—It may be assumed that the fungi responsible for forming mycorrhiza are widely distributed in soil. Their systematic position is known only in those forms which have been isolated and grown in "pure culture" out-

side the root.

The root fungi of orchids are generally recognized as belonging to a common group, sometimes included in the well-known genus *Rhizoctonia,* sometimes placed in a new genus *Orcheomyces.* The mycelium must be locally present about the roots of wild orchids but nothing is known as to its wider distribution.

The mycorrhizal fungi of *Calluna* and other ericaceous species have been isolated and included in a single species of the genus *Phoma, P. radicis.* The specialized strains associated with different ericaceous species are distinct and must be locally distributed in heath and moorland soils but there is no certain knowledge of their wider occurrence.

The fungi definitely identified with the mycorrhiza of trees belong to the genera *Boletus, Amanita, Cortinarius, Lactarius, Russula* and *Tricholoma.* It is probable that many others will prove to belong to the same category.

Outside these specialized groups, the fungi responsible for mycorrhiza-formation still await identification. The mycelium present in a large number of herbaceous flowering plants, certain ferns and club mosses is uniform in type and produces characteristic structures: round or pear-shaped swellings or *vesicles,* variously regarded as organs relating to spore-formation or to the storage of reserves, and intracellular branch systems first described by Gallaud in 1905 under the name of *arbuscules.* Following upon digestive activity in the host cells the latter disintegrate to structureless masses named *sporangioles* before their true nature is recognized. The fungus responsible for this widespread type of mycorrhiza has hitherto resisted all attempts at isolation and nothing is known with certainty as to its systematic position.

It has been reported that the mycorrhiza of many herbaceous plants is of dual character, involving primary infection by a fungus with the characters just described followed by secondary infection by one of the type associated with orchid roots. Whether this reported "double infection" is of biological significance is at present unknown.

**Rôle of Mycorrhiza in Plant Growth.**—There can be little doubt that the mycorrhizal habit had its origin in parasitic attack on the part of certain soil fungi, or that existing mycorrhiza plants are the survivors of a long and perilous evolutionary history. Many must be regarded as cases of compromise fluctuating between an almost complete resistance to fungus invasion and a remarkable toleration of the same. That there is an exchange of nutrient material in practically all cases can hardly be doubted but, in the absence of information based on the behaviour of individuals with and without mycorrhiza, attempts to express the shifting relationships in terms of mutual advantage or the reverse are premature and often misleading.

In certain groups of plants mycorrhiza has become a regular feature in the life history, a condition of delicately balanced equilibrium between fungus and host has been established and critical experimental study has placed certain facts beyond doubt. In both orchids and heaths the normal development of the seedling is bound up with the presence and activities of mycorrhizal fungi showing marked adaptation to individual species, accompanied in members of Ericaceae by a distribution of mycelium throughout the tissues so extensive that it is difficult to conceive of the individual plant as other than a single entity of double constitution. In orchids, the traditional view attributes a beneficial rôle to the root fungi based on their utilization of organic soil constituents and the wholesale digestion of mycelium that takes place subsequently in the root-cells. A claim has been advanced for fixation of atmospheric nitrogen by the root fungi of several orchid species.

It may be safely concluded that mycorrhiza possesses a vital significance for trees and other plants growing in woodland soils, and there is reason to believe that the reaction and constitution of the soil are important factors in promoting its healthy development and functioning. In the Ericaceae, *Calluna* and many of its allies are characteristic and abundant members of the vegetation of humus soils thus pointing to similar conclusions, while in this group there is likewise evidence that the capacity to draw indirectly upon the organic compounds in the soil humus is supplemented by the ability of the root fungi to utilize atmospheric nitrogen. In both orchids and heaths the obligate character of the association is probably confined to the seedling phase and does not extend to the adult, although in heaths infection of the roots follows directly upon that of the seedling tissues.

The older theories of beneficial symbioses in mycorrhiza were deduced from distribution and structure untested by experiment. Modern research has been marked by the application of new and more precise methods and has revealed unsuspected relationships. On the whole, it supports the view that the possession of mycorrhiza is frequently of service to vascular plants, the nature and degree of benefit depending upon the physical conditions of the environment and the character of the association in individual cases. (M. C. R.)

BIBLIOGRAPHY.—The latest and most complete treatise, including a full bibliography, is that of M. C. Rayner, *Mycorrhiza: An account of non-pathogenic infection by Fungi in Vascular Plants and Bryophytes* (London, 1927). *See* also H. Burgeff, *Die Wurzelpilze der Orchideen* (Jena, 1909); W. B. McDougall, "On Mycorrhizas of Forest Trees," *Amer. Jour. Bot.,* vol. 1, p. 51 (1914); W. B. McDougall, "Mycorrhiza of Coniferous Trees," *Jour. of Forestry,* vol. ii., No. 3 (1922); E. Melin, *Untersuchung über die Bedeutung der Baummycorrhiza* (Jena, 1925); L. Knudson, "Physiological Study of the Symbiotic Germination of Orchid Seeds," *Bot. Gaz.,* vol. lxxix., pp. 345–379.

**MYDDELTON** or **MIDDLETON, SIR HUGH,** 1ST BART., CR. 1622 (*c.* 1560–1631), was born a younger son of Sir Richard Myddelton, governor of Denbigh castle. Hugh was a successful London goldsmith, occupying a shop in Bassihaw, or Basinghall street; he made money by commercial ventures on the Spanish main, being associated in these with Sir Walter Raleigh; and he was also interested in cloth-making. He was an alderman, and then recorder of Denbigh, and was member of parliament for this borough from 1603 to 1628. In 1609 Myddelton took over from the corporation of London the projected scheme for supplying the city with water obtained from springs near Ware, in Hertfordshire. For this purpose he made a canal about 10 ft. wide and 4 ft. deep and over 38 m. in length, which discharged its waters into a reservoir at Islington called the New River Head. The work was completed in 1613. Myddelton also worked lead and silver mines in Cardiganshire and reclaimed a piece of the Isle of Wight from the sea. He died on Dec. 10, 1631, and was buried at St. Matthew's, Friday street, London.

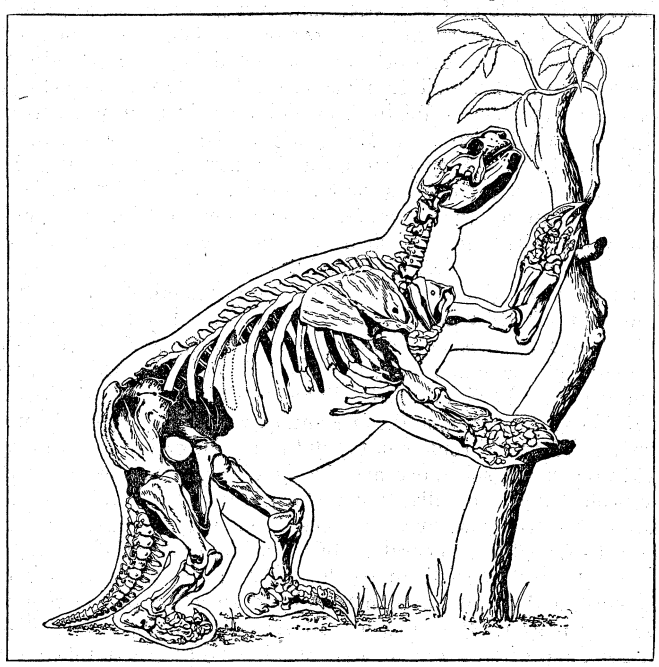
**MYELITIS.** A medical term for destructive changes involving the spinal cord. As the termination "itis" indicates, these changes formerly were regarded as inflammatory, but it is now known that although the spinal meninges are affected by inflammation, nervous substance is rarely, if ever, "inflamed" because of its paucity of blood-vessels. On the other hand, its nutrition is readily impaired by morbid processes in its neighbourhood, and it degenerates or dies and undergoes softening. Myelitis is such softening of the spinal cord, local or widespread, affecting a portion of the cord or its whole thickness, and the symptoms to which it gives rise depend upon the site and extent of the lesion. It may run a rapid or a chronic course, and in the latter instance the degenerated nerve substance may be, in whole or in part, replaced by proliferated neuroglial tissue which is of the nature of a scar. Any part of the cord may be affected, but it is commoner in the lower half. It leads to paralysis of lower limbs and other muscular parts by interference with conductivity in the white matter of the cord, and to nutritive changes by destruction of the cells in the grey matter. It causes loss of sensation below the level of damage, and often a zone of hyperaesthesia just above that level. If acute it is often followed with great rapidity by bed sores of great size and depth, and incontinence of urine and fæces, particularly when the lumbar cord is affected. The chief causes are injuries and diseases of the vertebræ or meninges leading to pressure on the cord, particularly syphilis. The disease principally affects adults. As might be anticipated, treatment is unsatisfactory and is directed towards relief of symptoms. (W. S. L.-B.)

**MYERS, FREDERIC WILLIAM HENRY** (1843–1901), English poet and essayist, son of Frederic Myers, was born at Keswick, Cumberland, on Feb. 6, 1843, and educated at Cheltenham and Trinity college, Cambridge, where he was

appointed classical lecturer in 1865. He had no love for teaching, which he soon discontinued, but he took up his permanent abode at Cambridge in 1872, when he became a school inspector under the education department. He published poems, for instance *St. Paul,* but is more likely to be remembered by his *Essays, Classical and Modern* (2 vols., 1883). The essay on Virgil, by far the best thing he ever wrote, represents the matured enthusiasm of a student and a disciple to whom the exquisite artificiality and refined culture of Virgil's method were profoundly congenial. In 1882 Myers led a small band of explorers (including Henry Sidgwick and Richard Hodgson, Edmund Gurney and F. Podmore), who founded the Society for Psychical Research. He was the mouthpiece of the society, and steered a middle course between extremes. He helped to revise the cumbrous mass of *Proceedings,* the chief concrete results being the two volumes of *Phantasms of the Living* (1886). His *Human Personality and its Survival of Bodily Death* (2 vols. 1903) was described by William James as "the first attempt to consider the phenomena of hallucination, hypnotism, automatism, double personality and mediumship, as connected parts of one whole subject." Also there was *Science and a Future Life* (1893). He died at Rome on Jan. 17, 1901, but was buried in his native soil at Keswick.

**MYLIUS-ERICHSEN, LUDWIG** (1872–1907), Danish explorer, was born at Viborg, Jutland, on Jan. 15, 1872. He made two notable expeditions to Greenland in 1902–04 and in 1906. The first of these yielded much valuable ethnographical information; the second provided increased geographical knowledge of the eastern coast. The explorer died as a result of the hardships he had suffered, on Nov. 25, 1907.

**MYLODON,** type of family of large ground sloths characteristic of the Pleistocene of the new world. *Paramylodon* was of the size of a rhinoceros, with short stout limbs, very large digging claws, five digits on each foot, but the outer ones had no claws, a broad body and massive tail. It walked on the outer edge of the sole, both fore and hind foot (compare fore foot of



SKELETON OF GLOSSOTHERIUM ROBUSTUM (PLEISTOCENE, SOUTH AMERICA)

modern anteater). The head was rather long, with wide blunt muzzle, no front teeth, and moderately large prismatic cheek teeth, five above and four below on each side. In cross-section the more anterior teeth were rounded oval, while the posterior ones were progressively larger and more elaborate, the last molar always two- or three-lobed. The skin was probably like that of the genus Mylodon itself, in which, as shown by specimens from a cave off the Straits of Magellan, the skin was studded with bony ossicles and covered with heavy coarse brown hair.

*Paramylodon* and its ally *Glossotherium* ranged from Canada to Patagonia, and many complete skeletons have been found in Argentina, California and the central United States. A number of related genera are also found in the Pleistocene of South America. *Lestodon* has the front pair of teeth enlarged as tusks and a flaring, bell-shaped muzzle. *Scelidotherium* has a much more elongate skull, narrower body and more reduction and specialization in the toes. These with some other less known genera form the family Mylodontidae, whose ancestry can be traced back to the Miocene in Patagonia although not so well known as the related Megatheriidae. These small Miocene ground sloths come near to being ancestors of the modern tree sloths as well; they likewise approach the anteaters in various particulars and suggest a more remote affinity to the armadillos. (W. D. M.; X.)

**MYLONITE,** in petrology, a rock which has been crushed and ground down by earth movement and at the same time rendered compact by pressure. Mylonites are fine-grained, sometimes even flinty, in appearance, and often banded in parallel fashion with stripes of varying composition. The great majority are quartzose rocks, such as quartzite and quartz-schist; but in almost any type of rock mylonitic structure may be developed. Gneisses of various kinds, hornblende-schists, chlorite-schists and limestones are not infrequently found in belts of mylonitic rock. The process of crushing by which mylonites are formed is known also as "granulitization" and "cataclasis," and mylonites are often described as granulites, though the two terms are not strictly equivalent in all their applications. Mylonites occur in regions where there have been intense earth-movements. Thrust planes and great reversed faults are often bounded by rocks which have all been crushed to fine slabby mylonites, that split readily along planes parallel to the direction in which movement has taken place. These "crush-belts" may be only a few feet or several hundred yards broad. The movements have probably taken place slowly without great rise of temperature, and hence the rocks have not recrystallized to any extent.

**MYMENSINGH,** a town and district of British India, in the Dacca division of Bengal. The town (formerly known as Nasirabad) is situated on an old channel of the Brahmaputra, and has a station of the Eastern Bengal State railway. Pop. (1941) 52,950. The District of Mymensingh, with an area of 6,156 sq.mi. and a population (1941) of 6,023,758, is the largest district in India, and its administration is an onerous charge. It occupies a portion of the alluvial valley of the Brahmaputra east of the main channel (called the Jamuna) and north of Dacca, for the most part level and open, covered with well-cultivated fields, and intersected by numerous rivers. The Madhupur jungle is a slightly elevated tract, extending from the north of Dacca district into the heart of Mymensingh; its average height is about 60 ft. above the level of the surrounding country, and it nowhere exceeds 100 feet. This tract divides Mymensingh into two distinct parts. On the west is an alluvial plain watered by the Jamuna; the eastern area is fertilized by the Surma or Meghna, the old Brahmaputra and other streams, and contains extensive marshes, which are under water for eight months in the year and are grazing grounds for cattle for the other four months. The only other elevated tract in the district is on the southern border, where the Susang hills rise. The Jamuna forms the western boundary for a course of 94 m.; during the rainy season it expands in many places to 5 or 6 m. in breadth. The Brahmaputra formerly flowed through Mymensingh till it joined the Meghna a little below Bhairab Bazar, but over a century ago the formation of bars of sand in the upper part of its course diverted the main volume of water into the present channel of the Jamuna. The staple crop is rice. A branch line of the Eastern Bengal State railway runs north from Dacca through Mymensingh, which is also connected with Jagannathganj and Bhairab Bazar.

**MYNAH,** the name given to several birds of the starling family (*sturnidae*). The Indian house mynah (*Acridotheres tristis*) is a well-known bird in the East and has been introduced into Australia and New Zealand. Somewhat larger than a thrush, with brown plumage, except for a black head and white on the wings and tail, the house mynah is easily domesticated and will

learn to talk. The true talking mynah (*Gracula religiosa*) is, however, a very different bird. (*See* GRACKLE.)

**MYNN, ALFRED** (1807–1861), perhaps the greatest of the older cricketers, was born at Goudhurst, in Kent, on Jan. 19, 1807, and died in London on Nov. 1, 1861. A huge man, standing 6 ft. 1 in. and weighing 250 to 280 lb., he was an all-round cricketer, but it is on his bowling that contemporary records lay most stress. "His delivery was noble, walking majestically up to the crease," and his bowling came so sharply in from leg that there is reason to suppose he may have been one of the first to practise the swerve. Two outstanding incidents in his career may be noted. Before the return North *v.* South match at Leicester, in 1836, he was hurt in practice. Going to bat, he made 146, when he had to retire in great pain. He was hurried to London, and nearly had to have his leg amputated. In 1838 he won two great matches for the championship of England at single wicket, at which he was never beaten, against Dearman of Sheffield. There are many portraits of Mynn; the best known is in the picture of the All England XI of 1847. No other cricketer, except "W.G." himself, ever captured so completely by his prowess and personality the hearts of his generation; his epitaph, which appeared in *Bell's Life,* is one of the most famous pieces of cricket literature. It begins with the echo of an old controversy:

Jackson's pace is very fearful, Willsher's hand is very high

and ends

as the changing seasons pass,
As our champion lies a-sleeping underneath the Kentish grass,
Proudly, sadly we will name him, to forget him were a sin;
Lightly lie the turf upon thee—kind and manly Alfred Mynn

See *Scores and Biographies,* vol. ii (1861); R. Daft, *Kings of Cricket* (1893); H. S. Altham, *History of Cricket* (1926).

**MYRA** (mod. *Dembre*), an ancient town of Lycia situated a short distance inland between the rivers Myrus and Andracus. Its early history is obscure. St. Paul touched Myra on his last journey westward, and changed into "a ship of Alexandria sailing into Italy." In the 3rd century St. Nicholas, of Patara, was its bishop. Theodosius II made Myra the Byzantine capital of Lycia, and as such it was besieged and taken by Harun al-Rashid in 808. The town seems shortly afterwards to have decayed. A small Turkish village occupied the plain at the foot of the acropolis, and a little Greek monastery lay about a mile westward by the church of St. Nicholas. The latter has formed the nucleus of modern Dembre. The western scarp of the acropolis has been sculptured into a number of sepulchres imitating wooden houses with pillared façades, some of which have pediment reliefs and inscriptions in Lycian. The theatre lies at the foot of this cliff and is partly excavated out of it, partly built. The church of St. Nicholas lies out in the plain, at the western end of Dembre. Its floor is far below the present level of the plain, and until recently the church was half filled with earth. There are also extensive ruins of Andriaca, the port of Myra, about 3 mi. west, containing churches, baths and a great grain store, inscribed with Hadrian's name. They lie along the course of the Andraki river, whose navigable estuary is still fringed with ruined quays.

**MYRIAPODA,** a convenient name for four classes of arthropods often studied together:—Diplopoda (Millipedes, *q.v.*). Symphyla (*q.v.*), Pauropoda (*q.v.*) and Chilopoda (Centipedes, *q.v.*). There is a superficial resemblance about all four classes because all possess a distinct head provided with one pair of antennae and an undivided trunk bearing a large number of jointed limbs, but the resemblance is deceptive and the grouping unscientific because the centipedes are more nearly related to insects than they are to the other three classes.

**MYRICA,** the only genus of the family Myricaceae, perhaps most nearly allied to the willows and birches. There are about 45 species widely distributed throughout the world. Well known representatives are the sweet-gale and wax myrtle (*qq.v.*).

**MYRISTICACEAE,** the nutmeg (*q.v.*) family, comprising 18 genera and 300 species, all tropical and especially numerous in Asia. They are trees or shrubs with evergreen leaves.

**MYRMIDONES,** in Homer, the inhabitants of Phthiotis in Thessaly. According to posthomeric legends their original home was Aegina, whence they crossed over to Thessaly with Peleus, but the converse view is now more generally accepted. Their name is derived from a supposed ancestor, son of Zeus and Eurymedusa, who was wooed by the god in the form of an ant (Gr. *μύρμηξ*); or from the repeopling of Aegina (when all its inhabitants had died of the plague) with ants changed into men by Zeus at the prayer of Aeacus, king of the island. As the fierce and devoted followers of Achilles, their name has come to be used in modern times to mean subordinates who carry out orders implacably. (*See* Roscher's *Lexikon,* art. Myrmidon.)

**MYROBALANS,** the name given to the astringent fruits of several species of *Terminalia,* largely used in India for dyeing and tanning and exported for the same purpose. They are large deciduous trees of the family Combretaceae. The chief kinds are the chebulic or black myrobalan, from *Terminalia chebula,* which are smooth, and the belleric, from *T. bellerica,* which are five-angled and covered with grayish down. There is also *Prunus cerasifera,* known as myrobalan and widely employed as stock for cherries.

**MYRRH,** a gum resin (*see* RESINS), highly esteemed by the ancients as an unguent and perfume, used for incense in temples and also in embalming; it was one of the gifts offered by the Magi. True myrrh is the product of *Commiphora myrrha,* a small tree of the family Burseraceae that grows in eastern Africa and Arabia, but the name is also applied to gum resins obtained from other species of *Commiphora. Baisa bol, bhesa bol* or *bissa bol,* from *Commiphora kataf,* resembles true myrrh in appearance, but has a disagreeable taste and is scarcely bitter. It is used in China, mixed with food, to give to cows to improve the quality and increase the quantity of milk, and when mixed with lime as a size to impart a gloss to walls. Opaque bdellium produced by *C. playfairii,* when shaken with water forms a slight but permanent lather. It is known as *meena hărma* in Bombay, and was formerly used there for the expulsion of the guinea worm. African bdellium is from *C. africanum,* and like opaque bdellium lacks the white streaks which are characteristic of myrrh and bissa bol; both are acrid, but have scarcely any bitterness or aroma. Indian bdellium, probably identical with the Indian drug googul obtained in Sind and Baluchistan from *C. mukul* and *C. pubescens,* Hook, is of a dark reddish colour, has an acrid taste and an odour like cedarwood, and softens in the hand.

As met in commerce true myrrh occurs in pieces of irregular size and shape, from ½ in. to 2 or 3 in. in diameter, and of a reddish-brown colour. The transverse fracture has a resinous appearance with white streaks; the flavour is bitter and aromatic, and the odour characteristic. It consists of a mixture of resin, gum and essential oil, the resin being present to the extent of 25 to 40%, with 2½ to 8% of the oil, myrrhol, to which the odour is due.

**MYRTACEAE,** the myrtle or eucalyptus family, dicotyledonous trees and shrubs found in all the warmer parts of the world, especially in Australia and tropical America. There are about 90 genera and some 2,800 species, all with oil glands in the evergreen leaves. Several species yield useful timber, and *Eucalyptus* also gives oil; *Eugenia,* cloves, etc. Some have edible fruits, as *Pisidium* (guava), *Rhodomyrtus* (hill-gooseberry), various species of *Syzygium* and *Eugenia,* and *Feijoa* (pineapple guava). *Pimenta officinalis* yields allspice (*q.v.*) and *P. acris,* bay oil. (*See* EUCALYPTUS; FEIJOA; GUAVA.)

**MYRTLE,** the *Myrtus communis* of botanists, as now found growing wild in many parts of the Mediterranean region. It is a low-growing, evergreen shrub, with opposite leaves, varying in size, but always small, simple, dark-green, thick in texture, and studded with numerous receptacles for oil. When the leaf is held up to the light it appears as if perforated with pinholes owing to the translucency of these oil cysts. The fragrance of the plant depends upon the presence of this oil. Another peculiarity of the myrtle is the existence of a prominent vein running round the leaf within the margin. The flowers are borne on short stalks in the axils of the leaves. The fruit is a purplish berry, enclosing very numerous minute seeds. Many varieties are in cultivation. The typical species is quite hardy in the south of England. The Chilean guava (*M. ugni*), a shrub with ovate, dark-green leaves and white flowers succeeded by globular red or black glossy fruit

with a pleasant smell and taste, is a greenhouse shrub, hardy in southwest Britain. The common myrtle is the sole representative in Europe of a large genus (100 species) which has its headquarters in extra-tropical South America, while other members are found in Australia and New Zealand. The genus *Myrtus* also gives its name to a very large family, Myrtaceae (*q.v.*). Myrtle is also used for the bog myrtle (*see* SWEET-GALE), the crape myrtle (*Lagerstroemia indica*), the sand myrtle (*Leiophyllum buxifolium*), the creeping myrtle (*Vinca minor*) and many others.

MYRTLE (MYRTUS COMMUNIS), SHOWING FLOWERING BRANCH AND VERTICAL SECTION OF FLOWER

**MYSIA,** a district of northwest Asia Minor, bounded by Lydia and Phrygia on the south, by Bithynia on the northeast, and by the Propontis and Aegean sea on the north and west. Its precise limits are difficult to assign, the Phrygian frontier being vague and fluctuating, while in the northwest the Troad was sometimes included in Mysia, sometimes not.

The most important cities were Pergamum (*q.v.*) in the valley of the Caicus and Cyzicus (*q.v.*) on the Propontis. But the whole seacoast was studded with Greek towns, several of which were places of considerable importance; thus the northern portion included Parium, Lampsacus and Abydos, and the southern Assus, Adramyttium, and farther south, on the Elaitic Gulf, Elaea, Myrina and Cyme.

Ancient writers agree in describing the Mysians as a distinct people, like the Lydians and Phrygians, though they never appear in history as an independent nation. That they were kindred with the Lydians and Carians, is attested by their common participation in the sacred rites at the great temple of Zeus at Labranda, as well as by the statement of the historian Xanthus of Lydia that their language was a mixture of Lydian and Phrygian. Strabo was of opinion that they came originally from Thrace (*see* BITHYNIA), and were a branch of the same people as the Mysians or Moesians (*see* MOESIA) who dwelt on the Danube. The Mysians appear in the list of the Trojan allies in Homer; the first historical fact we learn is their subjugation, together with all the surrounding nations, by Croesus of Lydia. After the fall of the Lydian monarchy they remained under the Persian empire until its overthrow by Alexander; they continued to form a part of the Syrian monarchy until the defeat of Antiochus the Great (190 B.C.), after which they were transferred by the Romans to the dominion of Eumenes of Pergamum. After the extinction of the Pergamenian dynasty (130 B.C.) Mysia became a part of the Roman province of Asia.

*See* J. A. R. Munro in *Geogr. Journal* (1897, Hellespontica); W. von Diest, *Petermanns Mitth.* (Erganzungsheft 94, Gotha, 1889; Pergamene). *Cambridge Ancient History,* vol. iii (with bibliography).

**MYSLOWICE** (Ger. *Myslowitz*), a town of Poland on the river Przemsa. It is 120 mi. S.E. of Breslau by rail and an important railway junction. Pop. (1931) 22,943. It became a town in 1857 and is in an industrial area with coal mines, flax spinning and brick making. Germany took it in 1939.

**MYSORE,** a native state of southern India, almost surrounded by the Madras presidency, but in political relations with the governor-general. It is naturally divided into two regions of distinct character—the hill country called the Malnad, on the west, and the more open country known as the Maidan, comprising the greater part of the state, where the wide-spreading valleys and plains are covered with villages and populous towns. The drainage of the country, with a slight exception, finds its way into the Bay of Bengal, and is divisible into three great river systems—that of the Kistna on the north, the Cauvery on the south, and the Northern and Southern Penner and Palar on the east. Owing to either rocky or shallow beds none of the Mysore rivers is navigable. The main streams, especially the Cauvery and its tributaries, support an extensive system of irrigation by means of channels drawn from immense dams (*anicuts*), which retain the water at a high level and permit only the overflow to pass down stream. The streams are embanked to form reservoirs or tanks.

Mysore is a very prosperous state. Situated on a healthy plateau, it receives the benefit of both the southwest and northeast monsoons, which, in conjunction with its irrigation system, has brought it a large degree of immunity from famine. The silk industry and gold mining are very profitable, and two sandalwood-oil factories have recently been opened. Manganese, mica and steatite are worked. The famous Kolar gold fields are worked by electric power, which is conveyed for a distance of 92 mi. from the Cauvery falls. A long period of administration by British officers led to the introduction of a system based on British models, and the state has developed rapidly in recent years. Departments of industry and commerce and of agriculture have been organized, welfare work for the agricultural population undertaken, a public health institution started, and a university opened at Mysore. There is an agricultural college, and several experimental farms.

The total area of the state, including the civil and military station of Bangalore, is 29,458 sq.mi., subdivided into 8 districts, namely: Bangalore, Kolar, Tumkur, Mysore, Hassan, Kadur, Shimoga and Chitaldrug. Pop. (1941), 7,329,140. The influenza epidemic of 1918 was very serious in the state. Kanada is spoken by the majority of the people, ¾ of whom are engaged in agriculture. The proportion of Hindus, who are 16 times as numerous as the Mohammedans, shows how ineffectual was the persecution of Hyder and Tippoo. Of 87,538 Christians, over 55,000 are Roman Catholics. The finances of the state have been successfully managed under native rule, assisted by large profits from railways and gold-mines. The revenue amounts to about £2,278,000, largely derived from land, and a subsidy and peshkash of £233,333 is paid to the British government. The state maintains a military force, which numbered 2,780 in 1925. A representative assembly has been in existence since 1881. In 1923 it was placed on a statutory basis, its powers extended, and the franchise widened. There is also a legislative council of 50 members, 30 nonofficial and 20 official.

**History.**—In the earliest historical times the north of Mysore was held by the Kadamba dynasty, whose capital, Banawasi, is mentioned by Ptolemy; they reigned during 14 centuries, though later they became feudatories of the Chalukyas (*q.v.*). The Cheras were contemporary with the Kadambas, and governed the southern part of Mysore till they were subverted by the Cholas in the 8th century. Another ancient race, the Pallavas, held a small portion of the eastern side of Mysore, but were overcome by the Chalukyas in the 7th century. These were overthrown in the 12th century by the Ballalas (Hoysalas), an enterprising and warlike race professing the Jain faith. They ruled over the greater part of Mysore, and portions of the modern districts of Coimbatore, Salem and Dharwar, with their capital at Dwarasamudra (the modern Halebid); but in 1310 the Ballala king was captured by Malik Kafur, the general of Ala-ud-din; and 17 years later the town was entirely destroyed by another force sent by Mohammed Tughlak. After the subversion of the Ballala dynasty, a new and powerful Hindu sovereignty arose at Vijayanagar. In 1565 a confederation of the Mohammedan kingdoms defeated the Vijayanagar sovereign at the battle of Talikota. The most important of the petty local chiefs was the *wodeyar* of Mysore, who in 1610 seized the fort of Seringapatam, and so laid the foundation of the present state. His fourth successor, Chikka Deva Raja, during a reign of 34 years, made his kingdom one of the most powerful in southern India. In the middle of the 18th century the famous Mohammedan adventurer Hyder Ali (*q.v.*), usurped the throne. His dynasty, however, was as brief as it was brilliant, and ended with the defeat and death of his son Tippoo at Seringapatam in 1799. Krishnarajah Wodeyar, only five years old, was placed on the throne, and until he came of age in 1811 the state was under the administration of Purnaiya, the

Brahman minister of Hyder and Tippoo. When Krishnarajah took over the management of his state he received an orderly and contented principality with a surplus of two crores of rupees. Within twenty years he had driven his subjects into rebellion and involved himself and his state in heavy debt. The British government therefore assumed the administration in 1831, and placed it in the hands of commissioners. In 1867 it was determined to secure the continuance of native rule in Mysore and on March 25, 1881, Chamarajendra, Krishnarajah's successor, having attained the age of 18 years, was publicly entrusted with the administration of the state. He made over to the British a small tract at Bangalore, forming the "civil and military station," and received in return the island of Seringapatam. By the signing of the "instrument of transfer," the young maharajah, for himself and his successors, undertook to perform the conditions imposed upon him. The maharajah died at Calcutta on Dec. 28, 1894. His eldest son, Krishnarajah Wadiyar (1884–1940), succeeded him, and his widow, Maharani Vanivilas, was appointed regent, until in 1902 the maharajah was formally invested with full powers by the viceroy in person. In 1913 the "instrument of transfer" was replaced by a treaty. Sri Jaya Chamarajah Wadiyar (1919– ) succeeded his uncle as ruler Sept. 8, 1940.

*See* B. L. Rice, *Mysore* (2nd ed., Bangalore, 1897); *Mysore and Coorg Gazetteer* (Calcutta, 1908); the annual *Administration Report* (Bangalore).

**MYSORE,** the capital of the state of Mysore, India, 10 mi. S.W. of Seringapatam on the Mysore State railway. Pop. (1941), 150,540. The city, which is spread over a large area, has its nucleus at the foot of the Chamundi hill, in a valley formed by two parallel ridges running north and south. The fort stands in the south of the town, forming a quarter by itself; the ground plan is quadrangular, each of the sides being about 450 yd. long. The palace of the maharaja within the fort contains the throne said to have been presented to Chikka Deva Raj by the emperor Aurangzeb. The houses of the European residents are for the most part east of the town. The residency or government house was built in 1805. The building afterwards used for the district offices was originally built by Colonel Wellesley (duke of Wellington) for his own occupation. The domed building for the public offices in Gordon park, the Maharajah and Maharani's training colleges, the Mary Holdsworth hospital, the fine new Palace offices and the law courts are conspicuous. A teaching and residential university was established in 1916, and the Mysore bank in 1913. There is also a chamber of commerce. Mysore, though the dynastic capital of the state, was superseded by Seringapatam as the seat of the court from 1610 to 1799, and in 1831, on the British occupation, the seat of administration was removed to Bangalore.

**MYSTERY.** It is necessary to differentiate *mystery,* Gr. *μυστήριον,* from its homophone, properly written *mistery,* late Lat. *ministerium,* a trade or craft; hence *mystery plays* (*see* DRAMA), those performed by trade-gilds. We must also set aside the Hellenistic meaning, common in modern languages, of "secret," "puzzling occurrence."

Properly, then, a mystery is a Greek rite which is kept secret (*μύειν,* to shut the mouth or eyes) from all save the initiated (*οἱ μύσται, οἱ μεμνημένοι*). These are specially prepared to have the secret revealed to them, under the guidance of a hierophant (*ἱεροφάντης,* "revealer of holy things"). According to Theon Smyrnaeus (*de util. math.,* p. 15, Hercher) there were four stages: (1) preliminary purification (*καθαρμός*); (2) communication of mystic knowledge, *τελετῆς παράδοσις,* presumably including a sort of sermon of instruction or exhortation; (3) *ἐποπτεία,* or revelation of the holy things, the central point of the rite; (4) the crowning or garlanding of the mystic, who was thus, as it were, badged as a privileged person. We know that the central revelation was something done (*δρώμενον*), not spoken, or not merely spoken; Lucian says (*de saltat.,* 15) that all mysteries included dancing. Hence it is usually, and reasonably, concluded that some sort of pageant or rudimentary sacred drama was shown.

We may now ask why the rites should be secret at all. A plausible but mistaken explanation has recently been revived by O. Kern (*Die Religion der Griechen,* i. 1926): the invading Hellenes oppressed, perhaps actually used religious persecution against, the earlier inhabitants of Greece, hence driving their cults into secrecy.

It might be urged in favour of this view that in Crete, according to Diodorus Siculus (v. 77, 3), rites similar to the Greek mysteries lay open to all and had nothing "mysterious" about them, and also that the *telesterion* or hall of initiation at Eleusis originates in Minoan-Mycenaean constructions, and Eleusis itself has a name probably pre-Greek (*cp.* A. W. Persson in *Archiv f. Religionswissenschaft,* xxi., p. 291 ff.; M. P. Nilsson, *Minoan-Mycenaean Religion,* 1927, p. 402, ff.); furthermore, that several survivals of things pre-Hellenic have been more or less certainly traced in the ritual of the mysteries, Eleusinian and other. But these considerations can hardly avail against the facts that the mystic deities include many undoubtedly Greek, as *Demeter, Kore, Ge, Aglauros,* the *Charites, Hecate,* and others; that the ritual is in the hands of noble and distinguished families, not of slaves or other remnants of a conquered population; and that a good magico-religious reason for secrecy can be given. The deities of these cults are one and all chthonian; these, however benevolent, are in their nature dangerous to approach; therefore, to avoid all possibility of disturbance at a critical time, it is but prudent to shroud the whole performance in secrecy, and keep the impure and unprepared at a safe distance.

For the student of Hellenism, the Eleusinian and Orphic ceremonies are of paramount importance; the Samothracian, which vied with these in attractiveness for the later Hellenic world, were not Hellenic in origin; nor wholly hellenized in character, and cannot be considered in an article of this compass.

As regards the Eleusinia, we are in a better position for the investigation of them than our predecessors were; for the modern methods of comparative religion and anthropology have at least taught us to ask the right questions and to apply relevant hypotheses; archaeology, the study of vases, excavations on the site, yielding an ever-increasing hoard of inscriptions, have taught us much concerning the external organization of the mysteries, and have shown us the beautiful figures of the deities as they appeared to the eye or to the mental vision of the initiated.

In seeking to guess what the secret of the mysteries was, we must first rid ourselves of the notion that it was any esoteric philosophy, or elaborate theology kept hidden from the world at large. Negatively, we have no jot of evidence that the initiates were more intelligent than the rest of Greece, or that their belief or practice differed from those of their fellow-countrymen to any marked degree, although there need be no doubt that a certain amount of verbal instruction was given by the hierophant (*see* below). Positively, we have the repeated insistence, from the Homeric hymn down (*hymn. Homer,* ii., 480) that the initiates saw something which greatly comforted their souls, not that they learned anything of great importance. What they saw was doubtless the sacred *dromenon.* We can realize what effect this might have on excited and believing minds, if we consider the importance, for a pious Catholic, of such impressive ceremonies as the elevation of the Host at mass.[1]

Our evidence is of two kinds. Firstly, a number of works of art show us scenes probably or certainly taken from the ritual of the Eleusinian or other mysteries. But here we may be certain that the artists, even if they themselves had no scruples, would not risk violating the deepest religious sentiments of thousands of their fellow-countrymen. Secondly, we have literary evidence. But this, if pagan, is restrained by the same reasons as the artists' from saying too much; if Christian, the writers seldom, if ever, can be shown to have been initiates themselves; some indeed cannot have been, for they were never pagans. Their

[1]This is well and sympathetically discussed by O. Kern, *Die griechischen Mysterien der klassischen Zeit* [1927], especially p. 23 ff. Aristotle [frag. 45, Rose] declares that the *mystae* learned nothing, but underwent "an experience and an influence" [*παθεῖν καὶ διατεθῆναι*;] an important testimony.

statements are generally uncritical and do not clearly differentiate between the Eleusinian mysteries and others, such as the Orphic, Sabazian, and those of Cybele and Attis.

The questions that the critical analysis of all the evidence may hope to solve are mainly these: (*a*) What do we know or what can we infer concerning the personality of the deities to whom the Eleusinian mysteries were originally consecrated, and were new figures admitted at a later period? (*b*) When was the mystery taken over by Athens and opened to all Hellas, and what was the state-organization provided? (*c*) What was the inner significance, essential content or purport of the Eleusinia, and what was the source of their great influence on Hellas? (*d*) Can we attribute any ethical value to them, and did they strongly impress the popular belief in immortality? Limits of space allow us only to adumbrate the results that research on the lines of these questions has hitherto yielded.

The paramount divine personalities of the mystery were, in the earliest period of which we have literary record, the mother and the daughter, Demeter and Kore, the latter being never styled Persephone in the official language of Eleusis; while the third figure, the god of the lower world known by the euphemistic names of Pluto (Plouton) and at one time Eubouleus, the ravisher and the husband, is an accessory personage, comparatively in the background. This is the conclusion naturally drawn from the Homeric hymn to Demeter, a composition of great ritualistic value, probably of the 7th century B.C., which describes the abduction of the daughter, the sorrow and search of the mother, her sitting by the sacred well, the drinking of the κυκεών or sacred cup, and the legend of the pomegranate. An ancient hymn of Pamphos, from which Pausanias freely quotes and which he regards as genuine[1], appears to have told much the same story in much the same way. As far as we can say, then, the mother and daughter were there in possession at the very beginning. The other pair of divinities known as ὁ θεός, ἡ θεά that appear in a 5th century inscription and on two dedicatory reliefs found at Eleusis, have been supposed to descend from an aboriginal period of Eleusinian religion when deities were nameless[2]. But for various reasons the contrary view is more probable, that ὁ θεός and ἡ θεά are later cult-titles of the married pair Pluto-Cora (Plouton-Kore), the personal names being omitted from that feeling of reverential shyness which was specially timid in regard to the sacred names of the deities of the underworld. And it is a fairly familiar phenomenon in Greek religion that two separate titles of the same divinity engender two distinct cults.

The question as to the part played by Dionysus in the Eleusinia is important. Some scholars, like M. Foucart, have supposed that he belonged from the beginning to the inner circle of the mystery; others that he forced his way in at a somewhat later period owing to the great influence of the Orphic sects who captured the stronghold of Attic religion and engrafted the Orphic-Sabazian ἱερὸς λόγος, the story of the incestuous union of Dionysus-Sabazius with Demeter-Kore, and of the death and rending of Zagreus, upon the primitive Eleusinian faith. A saner and more careful criticism rejects this view. There is no genuine trace discovered as yet in the inner circle of the mysteries of any characteristically Orphic doctrine; the names of Zagreus and Phanes are nowhere heard, the legend of Zagreus and the death of Dionysus are not known to have been mentioned there. Nor is there any print within or in the precincts of the τελεστήριον, the hall of the Μύσται, of the footsteps of the Phrygian deities, Cybele, Attis, Sabazius.

The exact relation of Dionysus to the mysteries involves the question as to the divine personage called Iacchus; who and what was Iacchus? Strabo (p. 468), who is a poor authority on such matters, describes him as "the daemon of Demeter, the founder of the leader of the mysteries." More important is it to note that "Iacchus" is unknown to the author of the Homeric hymn, and that the first literary notice of him occurs in the well-known passage of Herodotus (viii. 65), who describes the procession of the mystae as moving along the sacred way from Athens to Eleusis and as raising the cry Ἴακχε. We find Iacchus the theme of a glowing invocation in an Aristophanic Ode (*Frogs,* 324–398), and described as a beautiful "young god"; but he is first explicitly identified with Dionysus in the beautiful ode of Sophocles' *Antigone* (1119); and that this was in accord with the popular ritualistic lore is proved by the statement of the scholiast on Aristophanes (*Frogs,* 482) that the people at the Lenaea, the winter-festival of Dionysus, responded to the command of "Invoke the god!" with the invocation "Hail, Iacchus, son of Semele, thou giver of wealth!" We are sure, then, that in the high tide of the Attic religious history Iacchus was the youthful Dionysus, a name of the great god peculiar to Attic cult, and this is all that here concerns us to know.

We thus see that Iacchus was an Athenian, not an Eleusinian, god; his abiding-place was Athens, and he merely visited Eleusis for the mysteries. We may indeed conjecture that his votaries read Dionysiac interpretations into Eleusinian *dromena.* But all this is conjecture. The interpretation of what was shown would naturally change somewhat with the changing sentiment of the ages; but Demeter and Kore, τὼ θεώ, and no one else, are the paramount figures at Eleusis from the "Homeric" hymn to Alaric's invasion. Triptolemus the apostle of corn-culture, Eubouleus—originally a euphemistic name of the god of the under-world, "the giver of good counsel," conveying a hint of his oracular functions—these are accessory figures of Eleusinian cult and mythology that may have played some part in the great mystic drama that was enacted in the hall.

As to the history of the Eleusinian mysteries[1], the legends concerning the initiation of Heracles and the Dioscuri imply that originally they were closed to strangers, which, as they probably were in origin local rites in honour of local deities, is exactly what we should expect. But the "Homeric" hymn implies that they are open to all; with this we may connect the sagas of the conquest of Eleusis by Athens (*see* EUMOLPUS) and the early unification of Attica under Theseus (*see* CONSTITUTION OF ATHENS). By what steps the mysteries grew in importance and fame we do not know, but certainly Peisistratus paid attention to them, while Pericles found them highly important and made them more so. Decrees of his time[2] proclaim a holy truce for pilgrims to the festival and invite the subject-allies of Athens to send first-fruits of corn, a part of his imperial policy. The μυστικὸς σηκός at Eleusis is of his date.

At least from the 5th century onwards, Athens was in charge of the organization and external control of the mysteries, the management being in the hands of the archon basileus and a committee of four *epimeletai* (overseers) and a *paredros* (assessor). The State, as elsewhere in Greece, controlled the Church. But the priesthood was Eleusinian. Two ancient clans, the *Eumolpidai* (*see* EUMOLPUS) and the *Kerukes* (*see* HERALD) performed the whole ceremony between them; it appears that in the 4th century the *Kerukes* died out and the *Lukomidai* of Phlye took their place, perhaps bringing with them a tendency to Orphism. From the Eumolpidae was chosen the hierophant, who was so holy that his personal name was no longer used when once he was appointed, and he alone might enter the innermost shrine,—or perhaps, for the details are obscure, he and a priestess. Demeter and Kore had also each a *hierophantis* or female hierophant; considering that the Thesmophoria (*q.v.*) was entirely in the hands of women, it is not surprising that they took part in the mysteries also. The *Kerukes,* afterwards the *Lukomidai,* chose the δαδοῦχος or torch-bearer, who ranked next after the hierophant, from their number.

Turning now to the celebration itself, we can only sketch the more salient features here. On the 13th of Boedromion, the Attic month corresponding roughly to our September, the Ephebi (*q.v.*) marched out to Eleusis, and returned to Athens the next

[1] i. 38, 3; i. 39, 1.

[2] *See* Dittenberger, *Syll.* 83, 39; 200, 21; *C.I.G.* ii. Add. 1620c; *Ephem. archaiol.* (1886), πιν. 3; Heberdey in *Festschrift für Benndorf,* p. 3, Taf. 4; Von Prott in *Athen. Mittheil.* (1899), p. 262.

[1] To be distinguished from the Eleusinia, an important festival, but not connected with the mysteries, see *Revue des études grecques,* xxxii., p. 462.

[2] Dittenberger, *Sylloge,* 3rd. ed. 21 (=*I.G.* i. 1); 83, 30 ff.

day, bringing with them the "holy things" (ἱερά) to the "Eleusinion" in the city; these ἱερά probably included small images of the goddesses. The 16th was the day of the ἀγυρμός, the gathering of the catechumens, when they met to hear the address of the hierophant, called the πρόρρησις. This was no sermon, but a proclamation bidding those who were disqualified or for some reason unworthy of initiation to depart. The legally qualified were all Hellenes and subsequently all Romans above a certain—very youthful—limit of age, women, and as it appears even slaves; barbarians, and those uncleansed of some notorious guilt, such as homicide, were disqualified. We are sure that there was no dogmatic test, nor would time allow of any searching moral scrutiny, and only the Samothracian rites, in this respect unique in the world of classical religion, possessed a system of confessional. The hierophant appealed to the conscience of the multitude; but we are not altogether sure of the terms of his proclamation, which can only be approximately restored from late pagan and early Christian writers. We know that he demanded of each candidate that he should be "of intelligible speech (*i.e.,* Hellene) and pure of hand"; and he catechized him as to his condition of ritualistic purity— the food he had eaten or abstained from. It appears also from Libanius that in the later period at least he solemnly proclaimed that the catechumen should be "pure of soul" (*Or. Corinth,* iv. 356), and this spiritual conception of holiness had arisen already in the earlier periods of Greek religious thought. On the other hand we must bear in mind the criticism that Diogenes is said to have passed upon the Eleusinia, that many bad characters were admitted to communion, thereby securing a promise of higher happiness than an uninitiated Epameinondas could aspire to.

An essential preliminary was purification and lustration, and after the assembly the "mystae" went to the sea-shore (ἅλαδε μύσται) and purified themselves with sea-water, and probably with sprinkling of pigs' blood, a common cathartic medium. After their return from the sea, a sacrifice of some kind was offered as an essential condition of μύησις, but whether as a sacrament or gift-offering to the goddesses it is impossible to determine. On the 19th of Boedromion the great procession started along the sacred way bearing the "fair young god" Iacchus; and as they visited many shrines by the way the march must have continued long after sunset, so that the 20th is sometimes spoken of as the day of the exodus of Iacchus. On the way each wore a saffron band as an amulet; and the ceremonious reviling to which the μύσται were subjected as they crossed the bridge of the Cephissus answered the same purpose of averting the evil eye. Upon the arrival at Eleusis, on the same night or on the following, they celebrated a midnight revel under the stars with Iacchus, which Aristophanes glowingly describes.

The question of supreme interest now arises: What was the mystic ceremony in the hall; what was said and what was done? We can distinguish two grades in the celebration; the greater was the τέλεα and ἐποπτικά, the full and satisfying celebration, to which only those were admitted who had passed the lesser stage at least a year before. As regards the actual ritual in the hall of the mystae, much is still uncertain. That there was some kind of holy pageant or play, the accusations against Aeschylus and Alcibiades would suffice to prove, and Porphyry speaks of the hierophant and the δᾳδοῦχος acting divine parts. What the subject of this drama was may be gathered partly from the words of Clement—"Deo (Demeter) and Kore became the personages of a mystic drama, and Eleusis with its δᾳδοῦχος celebrates the wandering, the abduction and the sorrow" (*Protrept.,* p. 12, Potter), supported by Apuleius (*Met.* vi., 2). We may believe then that the great myth of the mother's sorrow, the loss and the partial recovery of her beloved was part of the Eleusinian passion-play. Did it also include a ἱερος γάμος? We should naturally expect that the sacred story acted in the mystic pageant would close with the scene of reconciliation, such as a holy marriage of the god and the goddess. But the evidence that this was so is mainly indirect, apart from a doubtful passage in Asterius, a writer of questionable authority in the 4th century A.D. (*Econom. martyr.* p. 194, Combe). At any rate, if a holy marriage formed part of the passion-play, it may well have been acted with solemnity and delicacy. We have no reason to believe that even to a modern taste any part of the ritual would appear coarse or obscene; even Clement, who brings a vague charge of obscenity against all mysteries in general, does not try to substantiate it in regard to the Eleusinia, and we hear from another Christian writer of the scrupulous purity of the hierophant.

It would be interesting to know if the birth of a holy child, a babe Iacchus, for example, was a motive of the mystic drama. The question seems at first sight to be decided by a definite statement of Hippolytus (*Philosoph.* 5, 8), that at a certain moment in the mysteries the hierophant cried aloud: "The lady-goddess Brimo has borne Brimos the holy child." But a careful consideration of the context almost destroys the value of his authority. For he does not pretend to be a first-hand witness, but admits that he is drawing from Gnostic sources, and he goes on at once to speak of Attis and his self-mutilation. The formula may then refer to the Sabazian-Phrygian mystery, which the Gnostics with their usual spirit of religious syncretism would have no scruple in identifying with the Eleusinian. And the archaeological evidence that has been supposed to support the statement of Hippolytus is deceptive.

The simple structure of the building and the absence of any reference, in the many inscriptions, to expenses for scenery or the like forbid us to suppose that there was any elaborate staging. The pageant-play produced its effect by means of gorgeous raiment, torches and stately figures.

But the mystic action included more than the pageant-play. The hierophant revealed certain holy objects to the eyes of the assembly. There is reason to suppose that these included certain primitive idols of the goddesses of immemorial sanctity; and, if we accept a statement of Hippolytus (*loc. cit.*) we must believe that the *epoptai* were also shown "that great and marvellous mystery of perfect revelation, a cut corn-stalk." The value of this definite assertion, which appears to be an explicit revelation of the secret, would be very great, if we could trust it; but unfortunately it occurs in the same suspicious context as the Brimo-Brimos formula, and we again suspect the same uncritical confusion of Eleusinian with Phrygian ritual, for we know that Attis himself was identified in his mysteries with the "reaped corn," the στάχυς ἄμητος, almost the very phrase used by Hippolytus. Only, it is in the highest degree probable, whether Hippolytus knew anything or not, that a corn-token was shown among the sacred things of a mystery which possessed an original agrarian significance and was intended partly to consecrate and to foster the agricultural life. But to say this is by no means the same as to admit the view of Lenormant[1] and Dr. Jevons[2] that the Eleusinians worshipped the actual corn, or revered it as a clan-totem. For of direct corn-worship or of totemism there is no trace either at Eleusis or elsewhere in Greece.

Among the δρώμενα or "things done" may we also include a solemn sacrament, the celebration of a holy communion, in which the votary was united to the divinity by partaking of some holy food or drink? We owe to Clement of Alexandria (*Protrept.* p. 18, Potter) an exact transcription of the pass-word of the Eleusinian mystae; it ran as follows (if we accept Lobeck's emendation of ἐγγευσάμενος for ἐργασάμενος) "I have fasted, I have drunk the barley-drink, I have taken (the things) from the sacred chest, having tasted therof I have placed them into the basket and again from the basket into the chest." We gather from this that some kind of sacrament was at least a preliminary condition of initiation; the mystae drank of the same cup as the goddess drank in her sorrow, partly—as we say—"in memory of her," partly to unite themselves more closely with her. We know also from an inscription that the priest of the Samothracian mysteries broke sacred bread and poured out drink for the mystae (*Arch. epigr. Mitth.,* 1882, p. 8, No. 14). But neither in these nor in the Eleusinian is there any trace of the more mystic sacramental conception, any indication that the votaries believed themselves to be partaking of the actual body of their

[1] Daremberg et Saglio, *Dictionnaire,* i., p. 1066.
[2] *Introduction to the Study of Religion.*

divinity[1], for there is no evidence that Demeter was identified with the corn, still less with the barley-meal of which the κυκεών was compounded. Nor is it likely that the sacrament was the pivot of the whole mystery or was part of the essential act of the μύησις itself. In the first place we have an almost certain representation of the Eleusinian sacrament on an archaic vase in Naples[2], probably of Attic *provenance*, and the artistic reproduction of a holy act would have been impious and dangerous, if this had belonged to the inner circle of the mystery. Again, there is no mention of sacrament or sacrifice among the five essential parts of μύησις given by Theo Smyrnaeus, nor in the imaginary narrative of the late rhetorician Sopatros (*Rhet. Graec.* viii., 121) who supposes the strange case of a man being initiated by the goddesses in a dream: they admit him to their full communion merely by telling him something and showing him something.

Besides the δρώμενα, then, there were also certain things said in the hall, or in the earlier stages of initiation, which we would gladly discover. Part of these were mystic formulae, one of which has been discussed already, the pass-word of the votaries. We gather also from Proclus and Hippolytus (*in Tim.* 293[c]; *Ref. Omn. Haer.* 5, 7, p. 146) that in the Eleusinian rites they gazed up to heaven and cried aloud "rain"—ὗε—and gazed down upon the earth and cried "conceive"—κύε. This ritual charm—we cannot call it prayer—descends from the old agrarian magic which underlay the primitive mystery. What else the votaries may have uttered, whether by way of thanksgiving or solemn litany, we do not know[3]. But there was also a certain ἱερὸς λόγος some exposition accompanying the unfolding of the mysteries; for it was part of the prestige of the hierophant that he was chief spokesman, "who poured forth winning utterance and whose voice the catechumen ardently desired to hear" (*Anth. Pal.*, app. 246); and Galen speaks of the rapt attention paid by the initiated "to the things done and said in the Eleusinian and Samothracian mysteries" (*De usu part.* 7. 14). But we have no trustworthy evidence as to the real content of the λόγος of the hierophant. We need not believe that the whole of his discourse was taken up with corn-symbolism, as Varro seems to imply (Aug. *de civit. Dei.* 20), or that he taught natural philosophy rather than theology, or again, the special doctrine of Euhemerus, as two passages in Cicero (*De natur. deor.* i. 42; *Tusc.* i. 13) might prompt us to suppose. His chief theme was probably an exposition of the meaning and value of the ἱερά as in an Australian initiation rite it is the privilege of the elders to explain the nature of the "churinga" to the youths. And his discourse on these may have been coloured to some extent by the theories current in the philosophic speculation of the day. But though in the time of Julian he appears to have been a philosopher of Neo-platonic tendencies, we ought not to suppose that the hierophant as a rule would be able or inclined to rise above the anthropomorphic religion of the times. Whatever symbolism attached to the ἱερά, the sacred objects shown, was probably simple and natural; for instance, in the Eleusinian, as in Egyptian eschatology, the token of the growing corn may have served as an emblem—though not a proof—of man's resurrection. The doctrine of the continuance of the soul after death was already accepted by the popular belief, and the hierophant had no need to preach it as a dogma; the votaries came to Eleusis to ensure themselves a happy immortality. And in our earliest record, the Homeric hymn, we find that the mysteries already hold out this higher promise. How, we may ask, were the votaries assured? The Egyptianizing theory of Foucart, that they were given directions and spells to take them past the terrors of the underworld, after the manner of the *Book of the Dead*, is wholly improbable. The terror of hell is not normal Greek, although something of the kind existed in Orphism; nor have we any evidence that spells of any kind were taught or that the λόγος was regarded as particularly important. If we could be sure that the Minoans had a developed eschatology (*see* Evans in *Journ. Hell. Stud.*, xlv. p. 43 ff., but *cf.* Nilsson, *Minoan-Myc. Rel.*, p. 549 ff.), we might suppose some of it to survive; but the matter is very doubtful.

The assurance of the hope of the Eleusinian votary was obtained by the feeling of friendship and mystic sympathy, established by mystic contact, with the mother and the daughter, the powers of life after death. Those who won their friendship by initiation in this life would by the simple logic of faith regard themselves as certain to win blessing at their hands in the next.

That the mysteries preached a higher morality than that of the current standard is not proved. That they exercised a direct and elevating influence on the individual character is nowhere explicitly maintained, as Diodorus (v. 49) maintains concerning the Samothracian. But on general grounds it is reasonable to believe that such powerful religious experience as they afforded would produce moral fruit in many minds. The genial Aristophanes (*Frogs*, 455) intimates as much, and Andocides (*De myster.* p. 36, § 31; p. 44, § 125) assumes that those who had been initiated would take a juster and sterner view of moral innocence and guilt.

Besides the greater mysteries at Eleusis, we hear of the lesser mysteries of Agrae on the banks of the Ilissus. Established, perhaps, originally by Athens herself at a time when Eleusis was independent and closed her rites to strangers, they became wholly subordinated to the greater, and were put under the same management and served merely as a necessary preliminary to the higher initiation into them. Sacrifice was offered to the same great goddesses at both; but we have the authority of Duris (*Athenae*, 253*d*), the Samian historian, and the evidence of an Attic painting, called the *pinax* of Nannion[1], that the predominant goddess in the mysteries at Agrae was Kore. And this agrees with the time of their celebration, in the middle of Anthesterion, when Kore was supposed to return in the young corn. Stephanus (*s.v.* Ἄγρα), drawing from an unknown source, declares that the Dionysiac story was the theme of their mystic drama; an isolated statement with nothing to confirm or interpret it.

The influence of Eleusis in early times must have been great, for we find offshoots of its cult, whether mystic or not, in other parts of Greece. In Boeotia, Laconia, Arcadia, Crete and Thera, Demeter was called Eleusinia, meaning in all probability "goddess of Eleusis." The initiation rites of Demeter at Celeae near Phlius, at Lerna in Argolis, and at Naples, were organized after the pattern of the Eleusinian. But of these and the other Demeter mysteries in the Greek world, there is little to record that is certain and at the same time of primary importance for the history of religion. The Arcadian city of Pheneus possessed a mystery that boasted an Eleusinian character and origin, yet in the record of it there is no mention of Kore, and we may suspect that, like other Demeter-worships in the Peloponnese, it belonged to a period when the goddess was revered as a single personality and Kore had not yet emanated from her. We know much more of the details of the great Andanian mysteries in Messenia, owing to the discovery of the important and much-discussed Andanian inscription of 91 B.C.[2]. But what we know are facts of secondary importance only. We gather from Pausanias (4. 33. 4; *cf.* 4. 1. 5. and 4. 26. 8; 4. 27. 6) that the rites, which he regards as second in solemnity and prestige to the Eleusinian alone, were consecrated to the Μεγάλαι θεαί (the great goddesses) and that Kore enjoyed the mystic title of Hagnē, "the holy one." The inscription has been supposed to correct and to refute Pausanias, but it does not really controvert his statements, which are attested by other evidence; it proves only that other divinities came at

[1]This is Dr. Jevons's supposition—*op. cit.*—on which he bases an important theory of the whole Eleusinian mysteries and their intrinsic attraction.

[2](Farnell, *Cults*, vol. iii. pl. xv.[b]).

[3]The other formula which the scholiast on Plato (*Gorg.* 497 *c.*) assigns to the Eleusinian rite: "I have eaten from the timbrel, I have drunk from the cymbal, I have carried the sacred vessel, I have crept under the bridal-chamber," belongs, not to Eleusis, but, as Clement and Firmicus Maternus themselves attest, to Phrygia and to Attis.

[1]Farnell, *Cults of the Greek States*, vol. iii. p. 242, Pl. xvi.

[2]*See* Sauppe, *Mysterieninschrift von Andania; cf.* Foucart's commentary in Le Bas, *Voyage archéol.* 2, No. 326[a]; H. Collitz, *Dialectinschriften*, 4689.

a later time to have a share in the mysteries, such as the Μεγάλοι θεοί who were probably the Cabeiri (*q.v.*). It is clear that the Andanian mysteries included a sacred drama, in which women personated the goddesses. The priestesses were married women, and were required to take an oath that they had lived "in relation to their husbands a just and holy life." We hear also of grades of initiation, purification-ceremonies, but of no sacrament or eschatologic promise; yet it is probable that these mysteries, like the Eleusinian, maintained and secured the hope of future happiness.

The Eleusinian faith is not wholly unattested by the grave-inscriptions of Hellas, though it speaks but rarely on these. The most interesting example is the epitaph of a hierophant who proclaims that he has found that "death was not an evil, but a blessing[1]."

Of equal importance for the private religion of Greece were the Orphic mystic societies, bearing a Thraco-Phrygian tradition into Greece, and associated originally with the name of Dionysus, and afterwards with Sabazius also and the later cult-ideas of Phrygia[2]. The full account of the Dionysiac mysteries would demand a critical study of the Dionysiac religion as a whole, as well as of the private sects that sprang up under its shadow. It is only possible here to indicate the salient characteristics of those which are of primary value for the history of religion.

Originally a great nature-god of the Thraco-Phrygian stock, powerful over all vegetation and especially revealing his power in the vine, Dionysus was forcing his way into Greece at least as early as the Homeric period, and by the 6th century was received into the public cults of most of the Greek communities. We can gather with some certainty or probability his aboriginal characteristics and the form of his worship. Being a god of the life of the earth, he was also a nether divinity, the lord of the world of souls, with whom the dead votary entered into privileged communion; his rites were mystic, and nightly celebrations were frequent, marked by wild ecstasy and orgiastic self-abandonment, in which the votary became at one with the divinity and temporarily possessed his powers; women played a prominent part in the ritual; a savage form of sacramental communion was in vogue, and the animal victim of whose flesh and blood the votaries partook was at times regarded as the incarnation of the divinity, so that the god himself might be supposed to die and to rise again; finally we may regard certain cathartic ideas as part of the primeval tradition of this religion. Admitted among the soberer cults of the Greek communities, it lost most of its wildness and savagery, while still retaining a more emotional ecstatic character than the rest. But this cooling process was arrested by a new wave of Dionysiac fervour that spread over Greece from the 7th century onwards, bringing with it the name of Orpheus, and engendering at some later date the Orphic brotherhoods (*thiasoi*). This religious movement may have started like the earlier one from the lands north of Greece; but Crete and even Egypt are supposed to have contributed much to the Orphic doctrine and ritual. Plato's contemptuous mention (*Rep.* 364A) of wandering Orphic initiators brings to our notice a phenomenon unknown elsewhere in Greek religion; the missionary spirit, the impulse to preach to all who would hear, which foreshadows the breaking down of the gentile religious barriers of the ancient world. And it is probable that some kind of "Orphic" propagandism, whether through books or itinerant mystery-priests, or both, had been in vogue some time before Plato. Orphism was known to Pindar (*Olym.* ii. and frags. 129-133 v. Christ) and Euripides, see *Hipp.* 952–4 and, yet more important, frag. 472 (*Nauck*) which attests the antiquity of these mystic Dionysiac associations in Crete. The initiated votary proclaims himself as sanctified to Zeus of Ida, to Zagreus and to the mountain-goddess Rhea-Cybele; he has fulfilled "the solemn rite of the banquet of raw flesh," and henceforth he "robes himself in pure white and avoids the taint of childbirth and funerals and abstains from meat." And—what is most significant—he calls himself by the very name of his god—he is himself Βάκχος. In spirit and in most of its details the passage accords well with the *Bacchae* of Euripides, which reflects not so much the public worship of Greece, but rather the mystic Dionysiac brotherhoods. Throughout this inspired drama the votary rejoices to be one with his divinity and to call himself by his name, and this mystic union is brought about partly, though Euripides may not have known it, through "the meal of raw flesh" or the drinking of the blood of the goat or the kid or the bull. The sacramental intention of this is confirmed by abundant proof; even in the state-cult of Tenedos they dressed up a bull-calf as Dionysus and reverentially sacrificed it (Ael. *Nat. an.* 12. 34); those who partook of the flesh were partaking of what was temporarily the body of their god. The Christian fathers at once express their abhorrence of this savage ὠμοφαγία and reveal its true significance (Arnob. *Adv. nat.* 5. 119); and Firmicus Maternus (*De error.*, p. 84) attests that the Cretans of his own day celebrated a funeral festival in honour of Dionysus in which they enacted the life and the death of the god in a passion-play and "rent a living bull with their teeth."

But the most speaking record of the aspirations and ideas of the Orphic mystic is preserved in the famous gold tablets found in tombs near Sybaris, one near Rome, and one in Crete. These have been frequently published and discussed; and here it is only possible to allude to the salient features that concern the general history of religion. They contain fragments of a sacred hymn that must have been in vogue at least as early as the 3rd century B.C., and which was inscribed in order to be buried with the defunct, as an amulet that might protect him from the dangers of his journey through the under-world and open to him the gates of Paradise. The verses have the power of an incantation. The initiated soul proclaims its divine descent: "I am the son of Earth and Heaven." "I am perishing with thirst, give me to drink of the waters of memory." "I come from the pure": "I have paid the penalty of unrighteousness": "I have flown out of the weary, sorrowful circle of life." His reward is assured him: "O blessed and happy one, thou hast put off thy mortality and shalt become divine." The strange formula ἔριφος ἐς γάλ' ἔπεσον "I a kid fell into the milk," has been interpreted by Dieterich (*Eine Mithras-Liturgie*, p. 174) with great probability as alluding to a conception of Dionysus himself as ἔριφος, the divine kid, and to a ritual of milk-baptism in which the initiated was born again[1].

We discern, then, in these mystic brotherhoods, the germs of a high religion and the prevalence of conceptions that have played a great part in the religious history of Europe. And as late as the days of Plutarch they retained their power of consoling the afflicted (*Consol. ad. uxor., c.* 10).

The Oriental mysteries, associated with Attis, Cybele, Isis and Sabazius, which invaded later Greece and early imperial Rome, were originally akin to these and contained many concepts in common with them. But their orgiastic ecstasy was more violent, and the psychical aberrations to which the votaries were prone through their passionate desire for divine communion were more dangerous. Emasculation was practised by the devotees of Attis, whatever the reason may have been[2], and the high priest himself bore the god's name. Or communion with the deity might be attained by the priest through the bath of blood in the taurobolium (*q.v.*), or by the gashing of the arm over the altar. A more questionable method which lent itself to obvious abuses, or at least to the imputation of indecency, was the simulation of a sacred marriage, in which the catechumen was corporeally united with the great goddess in her bridal chamber (Dieterich, *op. cit.* pp. 121–134). Prominent also in these Phrygian mysteries were the conception of rebirth and the belief, vividly impressed by solemn pageant and religious drama, in the death and resurrec-

[1] *Eph. arch.* (1883) p. 81.

[2] The best account of the origin and development of the Dionysiac religion is in Rohde's *Psyche*, vol. i.; for Orphic ritual and doctrine *see* Roscher's *Lexikon*, art. *Orpheus;* J. E. Harrison, *Prolegomena to the Study of Greek Religion*, pp. 455–659, with critical appendix by G. Murray on the Orphic tablets; and *cf.* ORPHEUS.

[1] *See* also C. W. Vollgraff, ἔριφος ἐς γάλ' ἔπεσον (over den oorsprong der dionysische mysteriën), Amsterdam, 1924.

[2] *See* H. J. Rose in *Class. Quart.*, xviii. p. 11, ff.; A. D. Nock. in *Archiv f. Relig.*, xxiii., p. 25, ff.

tion of the beloved Attis. The Hilaria in which these were represented fell about the time of our Easter; and Firmicus Maternus reluctantly confesses its resemblance to the Christian celebration (Farnell, *Cults,* iii, 299).

The Eleusinian mysteries are far more characteristic of the older Hellenic mind. These later rites breathe an oriental spirit, and though their forms appear strange and distorted they have more in common with the subsequent religious phenomena of Christendom. And the Orphic doctrine may have even contributed something to the later European ideals of private and personal morality.*

BIBLIOGRAPHY.—C. A. Lobeck, *Aglaophamus* (1829) is still very useful for material. General discussion of the subject in M. P. Foucart, *Les grands mystères d'Eleusis* (1900); Goblet d'Alviella, *Eleusinia* (1903); L. R. Farnell, *Cults of the Greek States,* vol. iii (1906), with collection of relevant passages. Anthropological parallels, etc., A. Lang, *Myth, Ritual and Religion* (1887); Sir J. G. Frazer, *Golden Bough,* 3rd ed., especially vols. ii (1911) and vii (1912) (bibl.). *See* also DIONYSUS; DEMETER; GREAT MOTHER OF THE GODS; MITHRAS; ORPHEUS, and literature cited in text. (L. R. F.; H. J. R.)

**MYSTERY STORIES.** Although the "mystery story" as a minor literary genre, a convenient category for book reviewers, is not old, its origins are lost in the blackout of antiquity. Its seeds are found in the folklore of the oldest nations: little tales, hints, anecdotes, superstitions, that are as old as recorded time. They are part of ethnology, philosophy, religion; and their long growth into a department of literary art or artifice parallels the history of man's mind.

In that history the emotion of fear always has bulked large, and the oldest and strongest of man's fears is fear of the unknown. Mystery, by definition, is that which is unknown. But tied in with fear of the unknown is the emotion of curiosity concerning it; and out of that fear and curiosity perhaps was born the mystery story, at first a tale of wonder and terror concerned largely with supernatural matters. Later it became a subsidiary of romance; and in still later times, notably our own, it came to be a sort of game invented and played for intellectual relaxation and artificial excitement.

"The art of self-tormenting is an ancient one, with long and honorable literary traditions," in the words of Dorothy L. Sayers[1]; and, commenting on the present scene, she adds: "Man, not satisfied with the mental confusion and unhappiness to be derived from contemplating the cruelties of life and the riddle of the universe, delights to occupy his leisure moments with puzzles and bugaboos." More pungently, Carolyn Wells[2] has observed that "in safe surroundings people like to be frightened."

Early examples of the mystery story are to be found in the folklore of all times and races, notably in that of Egypt, China, India and the Semitic nations. Cosmic terror appears as an ingredient of this mythology in all literatures; it is probable that great tracts of it vanished in prehistoric times for lack of a written medium. Certain supernatural themes appear, with little variation, in the traditions of all nations, pointing to yet earlier stories unknown to historians. The earliest known specimens are concerned with witchcraft, fairies, vampires, werewolves, ghosts (friendly and unfriendly), wraiths of the living and similar occult phenomena, much of it still in use by contemporary practitioners.

It will not do to identify the mystery story too completely with the horror story or the tale of terror; but in its origins it was probably no more than that—before the creative impulse added riddles and puzzles ingeniously devised for their own sake. Today a mystery story is, loosely, any story containing a mystery. It may be, and frequently is, a tale of horror and terror; but it may also be a pseudoscientific fantasy, a tale of diplomatic intrigue, an affair of codes and ciphers and secret societies, a crime story or a dozen other things involving an enigma. In the beginning, however, it was a tale of spectres and the supernatural.

It will be noted that the detective story *per se* is omitted from the above list. By recent arbitrary definition, the detective story, lustiest offspring of the mystery story, is a separate and distinct division of literature, a "pure" form that demands individual consideration. However, it is obviously a mystery story; the separation is largely one of convenience.

While mystery stories cannot always be classified with exactness—since mystery is everywhere present—they may be divided, for easy understanding, into three groups: ghost stories, riddle stories and detective stories. The literature of ghosts, as already stated, is time old. The middle ages took over the dark heritage of antiquity and amplified it with academically formulated magic and cabbalism. In Germany and England particularly, the tale took on a terrible intensity and a macabre atmosphere, with its Witches' Sabbaths, Daemon Lovers, and similar paraphernalia that doubled the force of its horrors. Perhaps the ghostly angle—complicated by devils, ghouls, ruined castles, subterranean passages, and suchlike mediaeval claptrap—began to emerge most clearly as a department of romance in the 18th century, with what is called the Gothic tale.

It was invented by a worldly Englishman, Horace Walpole, whose *Castle of Otranto* (1764) may be said to have founded the horror story as a permanent form. Among his outstanding successors were Anne Radcliffe (*The Mysteries of Udolpho,* 1794), Matthew Gregory Lewis (*The Monk,* 1795), Charles Robert Maturin (*Melmoth the Wanderer,* 1820) and the early American novelist, Charles Brockden Brown. Mary Godwin Shelley, the wife of the poet, took a hand in the game, in 1817, with her famous novel *Frankenstein,* still a classic horror story, and with it introduced the pseudoscientific note—the creation out of charnel fragments of a monster that ultimately destroyed its creator.

The influence of the Gothic tale persisted well into the 19th century in the work of such writers as J. Sheridan Le Fanu and Wilkie Collins; indeed, it is obvious in Bram Stoker's gruesome vampire tale *Dracula,* published as late as the year 1891. And pseudoscientific nightmares have not ended with H. G. Wells. Greatest of all names in the field, however, is that of Edgar Allan Poe (1809–1849), who first forced the tale of mystery and horror into the artistic regions of pure literature, and invented the modern short story form. He is the classic of the genre, and his influence has been enormous in nearly all lands. His masterly stories of bizarre incident, his tales of ratiocination, his psychological studies, tales of conscience and romances of death, have made him a major prophet of literature. His most relevant successors perhaps have been Le Fanu, a strangely neglected Irish genius, Robert Louis Stevenson, Arthur Conan Doyle, Ambrose Bierce, Arthur Machen, Algernon Blackwood, Lord Dunsany and the American *fantaisiste,* H. P. Lovecraft. But any such list of masters is inevitably and unfairly incomplete—such isolated masterpieces as W. W. Jacobs' "The Monkey's Paw," have not infrequently lifted writers of a more miscellaneous genius into the front rank of mystery masters.

Riddle stories too began in time out of mind, for the enjoyment of puzzles—Miss Sayers' "art of self-tormenting"—is as old as humanity itself. But there is a practical utility in puzzle-solving, also, that no doubt was recognized by the ancients; regular exercise is as necessary for the brain as for the body. The riddle of Samson, propounded in the Bible (*Judges,* 14: 12–18), is the most famous early example; but, although Samson has been called the Father of Riddles, it may be that older and better ones were even then buried in antiquity. "Out of the eater," *etc.,* propounded about 1200 B.C., at least contains the true principle of the riddle and the riddle story: the asker already knew the solution, and that was the reason the guessers strove to attain a re-solution. In those days riddles were commonly proposed at wedding feasts and other social events, and obviously they were very popular.

Among the Egyptians puzzling was a religious rite and the Sphinx was their goddess. We are told that such was the esoteric religion of the Egyptians that all the priests were riddlers and their religion one vast enigma. The classic "riddle of the Sphinx," however, belongs to Grecian mythology. Its date is not authenticated but it wears the halo of antiquity, for Sophocles wrote about it in the 4th century B.C.

So much for antiquity: the riddle story came down the years as did the ghost story, and not infrequently the two overlapped. Its distinguishing feature, at the moment, is that the reader shall be confronted with a number of mysterious facts and situations, explanation of which is reserved until the end of the story. Unlike the pure detective story—which also, of course, is a riddle story—there may be no clues, either leading or misleading, to assist or to trick the reader. The whole operation of reading may be one of sustained wonder and abiding curiosity. Equally, however, there may be numerous clues to solution: the tale will not turn into a detective story unless there is crime and detection—*i.e.,* crime *plus* detection.

A good example of the riddle story may be one describing a search for lost treasure, in which mysterious conditions are encountered. In many such, a cipher or cryptogram is added to the business of the tale, to complicate the over-all mystery with an interior riddle that most readers find irresistibly attractive. Poe's great short story, "The Gold Bug," is a classic example of this ingenious and popular story-plot. Of another kind is Kipling's short mystery, "The Sending of Dana Da," a tale involving a plethora of cats visited upon a hater of cats. In the more sinister field of murder are innumerable tales of roguery involving mystery and crime, but without the familiar detective interludes. Two notable—almost notorious—riddle stories of modern times offered no solution to the riddle posed and gained wide attention by their novelty—"The Lady or the Tiger" by Frank R. Stockton, and "The Mysterious Card" by Cleveland Moffett.

More nearly kin to the detective story than any of these are the spy stories, the secret service stories, the tales of international intrigue and adventure that, in our own day, have been entertainingly

*See *Archiv für Religionswiss.* (1906), article by Salomon Reinach.

written and prolifically produced by such men as E. Phillips Oppenheim, John Buchan, "Francis Beeding," Valentine Williams, H. C. McNeile and William Le Queux, to name only half a dozen out of many who are typical. These stories are on the borderline between adventure and bona fide detection; in certain instances—*Bulldog Drummond, Clubfoot, et al.*—they overlap the pure detective story and almost force an entrance into the more select field. But they have been relegated to the broader acres of general mystery by detective story students and specialists who prefer their detection straight.

BIBLIOGRAPHY.—[1]Dorothy L. Sayers (ed.), *Great Short Stories of Detection, Mystery and Horror* (1928); [2]Carolyn Wells, *The Technique of the Mystery Story* (1929); H. P. Lovecraft, "The Supernatural in Fiction," *The Outsider and Others.*

**Detective Stories.**—The detective story, as a literary form, celebrated its 100th anniversary in April 1941. Pedantry asserts that its seeds are to be found in the earliest folklores, and it is true that the antecedents of the various motifs combined in the genre are as old as man's mental habits, of which they are in part the history. The puzzle motif is as old as the Prophets, and the Erinyes theme—revenge relentlessly tracking down the wicked—is anterior to literature. Alleged examples of the "detective story," in this prenatal sense, have been dug from the pages of Aesop, Herodotus, Cicero, Vergil and the authors of the Apocryphal Scriptures: specimens have been found in all the literatures of the East. Best of these, perhaps, is the Apocryphal account of Daniel's superb sleuthing in the story of "Bel and the Dragon," in which the prophet is shown to have anticipated Sherlock Holmes by many centuries.

Mediaeval literature also yields relevant tales and legends from the writings of Boccaccio, Chaucer and others, revealing detectival habits of thinking in certain fictive characters; and more pertinent examples are outstanding in the *Arabian Nights.* Most striking of modern prototypes is a famous chapter in Voltaire's *Žadig,* an 18th century romance in which the philosopher-hero accurately describes a lost horse and dog, although he has seen neither, by pure Holmesian deduction.

Nevertheless, the detective story as we know it was born in the pages of *Graham's Magazine,* a Philadelphia journal, in April 1841, with the publication of a short story, "The Murders in the Rue Morgue," by Edgar Allan Poe. Of this story, Dorothy L. Sayers[3] has observed that "it constitutes in itself almost a complete manual of detective theory and practice." A sequel, "The Mystery of Marie Rogêt," appeared in *Snowden's Ladies' Companion,* of New York, in the issues of November and December 1842, and February 1843. Poe's third and last pure detective story, "The Purloined Letter," was published in a Philadelphia annual, *The Gift,* for the year 1845, in which year all three stories, with others, were brought together in a book called simply, *Tales,* the most important volume in the history of the detective story. Each of the three tales celebrated an exploit of the Chevalier C. Auguste Dupin, who must be called the first fictional detective, and this for a good reason: the profession of detective had only recently been invented, and until there were detectives in the world to write about, no stories about them were possible.

If anybody preceded the American, it was Eugène François Vidocq, the reformed French thief, who established the world's first official detective bureau, at Paris in 1817, and published his *Mémoires* in 1828–29. There is no doubt that Poe read this book and was influenced by it; but presumably—and ostensibly—Vidocq's volume was a factual record of his own experience, not a fictional detective story. And if Poe drew somewhat of his inspiration from the French book—the background of his tales was the Paris of Vidocq's *Brigade de Sureté*—Dupin was no Vidocq: he was Poe, himself, in a new rôle invented for the occasion, that of the perfect reasoner, the divine amateur, later to find world popularity in the epic figure of Sherlock Holmes. It may be noted, however, that Poe did not use the word *detective* in any of his stories: that was to come later.

With Poe's three tales of ratiocination, almost miraculously the detective story sprang into flower full blown. "The extraordinary thing," says H. Douglas Thomson, in *Masters of Mystery,* "is that at its very inception the principles and canons of detective fiction writing were brilliantly conceived, even with a touch of finality." It is not known why Poe stopped at the third story: he may have tired of his creation or, as is more likely, the public response may have been lukewarm. Two other mysteries by this author, "The Gold Bug" and "Thou Art the Man," are sometimes called detective stories, but strictly speaking they are outside the canon.

Poe was ahead of his public. Twenty years were to elapse before the infant he had laboured and then deserted was adopted; and then it was by a parent from another land. The year was 1866 when Emile Gaboriau, who had been contributing stories of military and fashionable life to the Parisian newspapers, began to publish his *L'Affaire Lerouge* in *Le Pays,* and woke up one morning to find himself famous. Thereafter until his death in 1873 he was a busy man, for he had invented the *long* detective story and it was a spectacular success. Other detective novels flowed from his pen—*Le Dossier 113, Le Crime d'Orcival, Monsieur Lecoq*—and his detective creations, Père Tabaret and Lecoq, now stand with Dupin on the shelf of illustrious practitioners. Less clever than Dupin, they were more humorously alive—more recognizably human, indeed: Tabaret, the bibliomaniac amateur, Lecoq, the brilliant professional. With Dupin they are the forerunners, the immediate ancestry, of Sherlock Holmes. It is possible that Gaboriau was familiar with Poe's *Tales,* in the translation of Baudelaire (1856–57), but more likely that he was directly influenced by Vidocq, whose *Mémoires* were looted by scores of French writers of the period, among them Balzac, Hugo and Dumas. These masters, however, never wrote a detective story. Gaboriau's only relevant contemporary was his successor and imitator, Fortuné du Boisgobey, author of a line of sensational police romances, of which the first, *Le Forçat Colonel,* was published in 1872.

But before Gaboriau had ceased to write, the movement had crossed the Channel; the next landmark in detective fiction was English. In 1868, within a year of the appearance of *L'Affaire Lerouge,* a famous book was published in London—*The Moonstone,* by Wilkie Collins. An earlier masterpiece by Collins, *The Woman in White,* had appeared in 1860, but, although an excellent mystery, it was not a detective story. In *The Moonstone,* Collins wrote what many critics have called the greatest detective story of them all. However that may be—and the detection in the book is not exhibitional, but a device to catalyze the elaborate ingredients—it was the first full-length detective novel in English, and is properly a classic. With Sergeant Cuff, the professional detective who raised roses in his unprofessional moments, says Mr. Thomson,[4] "the paradox was born, the detective with a sensibility greater than his sense." With Sergeant Cuff also, it has been said, "character began to raise its head."

Throughout all these years, Charles Dickens had been writing voluminously in England, without producing a detective novel. He was, however, interested in police work and had watched the growth of England's protective system with alert appreciation of its possibilities for literature. In 1829, Sir Robert Peel had established the London metropolitan police force, with a back door opening on a spot called Scotland Yard; and in 1842 a detective branch had been added, with headquarters in the Yard itself. Thus the scene was set; and it may be said that Dickens in a sense inaugurated the long literature that followed those momentous events when, in 1853, he made his friend Inspector Field a character in *Bleak House.* However, *Bleak House* is not a detective novel. Suddenly, in the last year of his life, and probably under the influence of Collins, he began to write *The Mystery of Edwin Drood* but died with the novel half finished on his desk. The fragment was published in 1870 and remains to this day the most exasperating detective story in the world. Hundreds of literary detectives have tried to penetrate its mystery and none has succeeded. There can be little doubt, though, that the book is another landmark in this history.

In America, meanwhile, a young woman named Anna Katherine Green was getting ready to write *The Leavenworth Case,* first of a long line of melodramatic novels of crime and detection from the same hand. The book appeared in 1878 and is still its author's most famous story, although possibly not her best. It is an American classic, however, the first detective *novel* by an American and the first by a woman in any language. Stilted and old-fashioned as Miss Green's books now seem, her plots, says Howard Haycraft, in *Murder for Pleasure,* are "models of careful construction that can still hold their own against today's competition."

Two remarkable events occurred in 1887 to make that year memorable in the history of the detective story. Out of Australia came a sensational thriller, *The Mystery of a Hansom Cab,* by Fergus Hume, to become the greatest commercial success in the annals of literary crime. Issued in paper wrappers at a small figure, it is said that its first London edition of 25,000 copies was exhausted in three days. When Hume died, in 1932, more than half a million copies had gone over the counter, and all without profit to the author, who had sold the book outright for £50. This famous tale is scarcely readable today, but historically it is important; and with it survives the name of its author. Although Hume wrote more than a hundred other books after his first great triumph, he was never able to repeat his success.

That was the first event. The second was the appearance of Sherlock Holmes, still the greatest name in detective literature. His creator, Arthur Conan Doyle, was a young Scotch-Irish physician, who had been inspired by an insufficiency of patients to try his hand at writing: *A Study in Scarlet,* first of the Holmes stories, was a potboiler that brought him only £25. It appeared just before Christmas, 1887, and there was no sequel until 1890, when *The Sign of Four* was written for an American magazine. Neither story set England on fire, but both were widely pirated in America, in the absence of an international copyright act. The widespread popularity of the detective dates from July 1891, when "A Scandal in Bohemia," first of the shorter *Adventures of Sherlock Holmes,* was published in the *Strand Magazine,* to be followed by 23 others over the next two years. The last 12 became the *Memoirs of Sherlock Holmes,* and in the final story Holmes was killed off by his creator, a deed of violence that shocked the world. By that time, however, the doctor's future had been assured; he had given up medicine, and was—as he confessed—heartily tired of his famous puppet, who was obscuring his more important work in the historical field.

But public indignation harassed him until he was forced to bring Holmes back to life. In 1902 he yielded to supplication and published *The Hound of the Baskervilles,* a "reminiscence" of Sherlock Holmes; in 1905 he surrendered unconditionally, in *The Return of Sherlock Holmes,* in which he resurrected the detective with great ingenuity.

Three other volumes followed, *The Valley of Fear* in 1915, *His Last Bow* in 1917, and *The Case-Book of Sherlock Holmes* in 1927. Sir Arthur Conan Doyle died in 1930, leaving behind him the greatest reputation in the history of detective fiction, and a detective whose name bids fair to remain a permanent part of the English language.

For the inspiration that led Conan Doyle to write the tales of Sherlock Holmes we have to thank, first, his unemployment; second, his admiration for the work of Poe and Gaboriau; and last, his happy recollection of the methods and mannerisms of his old teacher, Dr. Joseph Bell of Edinburgh, who was the living prototype of the detective. Most of the stories are told by the amiable and obtuse Doctor Watson, a fictional character almost as famous and well-loved as Holmes himself. In Watson, it is fair to assume, we have a self-portrait of Dr. Conan Doyle, the impecunious Portsmouth physician who contributed them both to the gallery of immortals.

Thus, says Dorothy L. Sayers,[3] "the ball—the original nucleus deposited by Edgar Allan Poe nearly 40 years earlier—was at last set rolling. As it went, it swelled into a vast mass—it set off others—it became a spate—a torrent—an avalanche of mystery fiction." In England and America writers were quick to try their talents at the popular game, and for the most part the Sherlock model prevailed. Best of immediate imitations was *Martin Hewitt, Investigator* (1894), by Arthur Morrison, and its several sequels. Simultaneously, pseudo-scientific detection made its appearance in the tales of Mrs. L. T. Meade and her collaborators, Clifford Halifax and Robert Eustace, a series that began with *Stories from the Diary of a Doctor,* in 1894. The aestheticism of the 1890s was reflected in the genre, to some extent, in M. P. Shiel's *Prince Zaleski* (1895); and Grant Allen closed the decade with three excellent volumes, of which the best was *Hilda Wade,* published in 1900.

The 20th century opened with the Baroness Orczy's anonymous detective, *The Old Man in the Corner,* functioning brilliantly in the magazines (book publication was delayed), and between the years 1907 and 1911 three detectives of the first water appeared in covers: Dr. John Thorndyke, in R. Austin Freeman's *The Red Thumb Mark* (1907), A. E. W. Mason's Hanaud, in *At the Villa Rose* (1910) and G. K. Chesterton's Father Brown, in *The Innocence of Father Brown* (1911). Father Brown, the little English Catholic priest, has been called one of the immortals, and Thorndyke is indubitably great, a scientific investigator whose science is as sound as it is fascinating. In 1913 *Trent's Last Case,* by E. C. Bentley, was hailed by critics as one of the great masterpieces of the genre. The Sherlock Holmes period may be said to have ended, in England, with Ernest Bramah's *Max Carrados* (1914), a volume of notable short stories introducing the first *blind* detective.

The American scene, in the early years of the century, produced detective stories in number, but only a few that were important. Still remembered is the work of Jacques Futrelle, best viewed in *The Thinking Machine* (1907), and Arthur B. Reeve, whose stories in *The Silent Bullet* (1912) introduced the long series about Craig Kennedy. More important are Mary Roberts Rinehart and, perhaps, Carolyn Wells. Mrs. Rinehart's *The Circular Staircase* (1908) was the first of several books—on the borderline between detection and mystery—that helped to make her for a time the most popular of American storytellers. Miss Wells, with less talent, wrote more than 70 detective novels, most of them starring her Sherlockian creation, Fleming Stone. "High spots" of the period were *In the Fog* (1901) by Richard Harding Davis, Cleveland Moffett's *Through the Wall* (1909), *The Mystery of the Boule Cabinet* (1912) by Burton E. Stevenson and *The Achievements of Luther Trant* (1910) by William MacHarg and Edwin Balmer. In the latter book the methods of the psychological laboratory were used for the first time in fictional crime detection.

America's outstanding contribution to detective fiction, after Poe's Dupin stories, was *Uncle Abner, Master of Mysteries,* by Melville Davisson Post, which was not published until 1918; but as early as 1896 Post had begun his career in crime literature. His first attempts were stories of legal chicanery, but by 1909 his tricksy lawyers had gone over to the side of law and order and this superlative technician was moving into the field of pure detection. In the Uncle Abner stories, tales of early Virginia, he produced an American classic and added the first great American investigator to the gallery of illustrious detectives. Post's only comparable contemporary was Frederick Irving Anderson, who published just three books between 1914 and 1930, and was in consequence forgotten between volumes: his best-known work is *The Book of Murder* (1930).

Of the years between the first and second world conflicts it is difficult to write briefly. For a time, the most popular writer of detective fiction in the world probably was J. S. Fletcher, whose excellent novels were given a tremendous impetus by President Wilson's publicized pleasure in *The Middle Temple Murder* (1918). Then, in 1920, another great landmark made its appearance in England: this was *The Cask,* by Freeman Wills Crofts, a book of remarkable quality that has influenced profoundly the modern detective story as a whole. "Mr. Crofts," says John Carter,[5] "combined the elaboration of Gaboriau with an integrity of method which set an altogether new standard for the many police detectives who have followed [his] Inspector French." And the years from 1920 onward introduce, one after another, names that today are household words among readers of detective fiction: Poirot, in Agatha Christie's *Mysterious Affair at Styles* (1920); Reggie Fortune, in H. C. Bailey's *Call Mr. Fortune* (1920); Lord Peter Wimsey, in Dorothy L. Sayers' *Whose Body?* (1923); Anthony Gethryn, in Philip MacDonald's *The Rasp* (1924); Dr. Priestley, in "John Rhode's" *Paddington Mystery* (1925); Roger Sheringham, in Anthony Berkeley's *Layton Court Mystery* (1925); J. G. Reeder, in Edgar Wallace's *The Mind of Mr. J. G. Reeder* (1926).

Others who contributed notable volumes of detection in this period were Eden Phillpotts and A. A. Milne, authors more widely known in other fields. In *Enter Sir John* (1928), Clemence Dane and Helen Simpson created a popular actor-detective. Albert Campion, languid hero of a dozen distinguished books by Margery Allingham, although he made his first appearance in 1928, did not reach his peak until 1934. All in all, the third decade of the century was memorable—a golden age of the detective story.

In America also, in this decade, important deeds were accomplished: at least four fictional detectives of stature were added to the records. Chronologically, Charlie Chan was first: a new and appealing figure in the world of fantasy, he made his bow in *The House Without a Key* (1925), by Earl Derr Biggers. Five other novels now celebrate his exploits and, aided by the motion pictures, the aphoristic little Chinese-American lives in the affection of readers more surely than many better detectives.

Philo Vance, his immediate successor, is still the best American detective in the English tradition. With Vance, according to Howard Haycraft,[6] "overnight, American crime fiction came of age." Introduced in *The Benson Murder Case* (1926), by S. S. Van Dine, his later appearances broke records for detective fiction and made him for some years the most famous fictional sleuth in the world. Van Dine, his reputed creator, was in reality Willard Huntington Wright, a well-known critic of the arts—and, like his hero, a dilettante—who brought all his imposing erudition in several fields to the task of making Vance one of the immortals of detective fiction. In spite of considerable pretentiousness, and some lack of humour, it may be admitted that he succeeded.

Ellery Queen, as writer and detective, entered the field in 1929: the name is a pseudonym concealing the identities of Frederic Dannay and Manfred B. Lee; but Queen also is the central figure in the stories written under that name. Since his appearance in *The Roman Hat Mystery,* his adventures have been increasingly popular: his name is the trademark of a reliable brand of entertainment.

Last and most important of the four leading American writers of the period is Dashiell Hammett, ex-Pinkertonian and graduate of the pulp magazines, whose unsentimental narratives have established new standards of realism in the detective story field. In five novels of startling originality, backgrounded largely by the underworld of American gangsterdom, Hammett invented what has been called the hard-boiled school of crime fiction; but he did more than that—he created a definitely American *style,* separate and distinct from the English pattern which had been slavishly followed by American writers for generations. As character studies alone, it is claimed, his stories approximate capitalized Literature. His influence, however, while enormous, has not been altogether good: it has been the more meretricious of Hammett's spectacular bag of tricks that have been exploited by his less talented imitators, in particular his not infrequent salaciousness. First of the Hammett novels was *Red Harvest* (1929). His masterpiece is generally believed to be *The Maltese Falcon* (1930), one of the all-time high points in its field. His most sensationally successful story, *The Thin Man* (1932), was the last of an extraordinary quintette. As summing up his short and brilliant career—for the indications are that Hammett has stopped writing detective stories—critical opinion today finds that no other writer of modern times has so basically changed and influenced the detective story form.

Most popular of American writers since Hammett have been Erle Stanley Gardner, author of the persistent Perry Mason novels, and Rex Stout, whose fat, orchid-raising Nero Wolfe seems to have become a permanent part of the new mythology. In England, the best traditions of Holmes, Thorndyke, *et al.,* have been carried on in the literate entertainments of such writers as Nicholas Blake and Michael Innes, to mention only two. But the current scene is too speculative and too congested for discussion in a paragraph.

On the continent of Europe, except in France, few detective stories of distinction were published at any time. Germany's efforts along the years have been abortive and ponderous; and examples of Scandinavian detective literature, although readable, are unexceptional and not strictly canonical. In France, two writers of high importance must be noted in Gaston Leroux and Maurice Leblanc. Leroux's *Le Mystère de la Chambre Jaune* (1908) has been called the masterpiece of French detective fiction. In Arsène Lupin, in the same period, Leblanc created a romantic rogue, half detective, who ranks with E. W. Hornung's Raffles in popular esteem. It was not until 1930 that a writer came to stand with Gaboriau, Leroux and Leblanc: then there appeared a figure of international interest, Georges Simenon. His masterful and masterly Inspector Maigret is now popular in 17 languages and recently has taken England and America by storm. Introduced to the English-speaking world in *The Patience of Maigret* (1940), he is the newest of the "immortals"; in the opinion of a critic, "the greatest character in detective fiction since Sherlock Holmes."

Thus the detective story's climb to the world popularity it now

enjoys is seen to have been slow until recent times. Figures indicate that from its beginnings with Poe, in 1841, up to and including the year 1920, approximately only 1300 new titles were published in English-speaking countries; whereas, from 1921 to the end of 1940 more than 8,000 new titles were published. In this summary, "dime novel" figures are included; *i.e.*, the statistics of such series as the Nick Carter and Sexton Blake libraries. The greater activity began in 1929, in which year, and the next, as many books were published as in the preceding 8 years. The most extraordinary gain was in the years 1931–40 inclusive, when some 6,000 titles were published. The peak year was 1938, a year that produced 2 volumes a day throughout its course. In the years 1931–40 some 1100 new writers of detective stories made their appearance, as against an approximate 600 in the previous decade, and as against only some 300 in all the preceding 80 years.

BIBLIOGRAPHY.—[3]Dorothy L. Sayers (ed.), *Great Short Stories of Detection, Mystery and Horror* (1928); [4]H. Douglas Thomson, *Masters of Mystery* (1931); [5]John Carter, *Collecting Detective Fiction;* [6]Howard Haycraft, *Murder for Pleasure* (1941); Vincent Starrett, *The Private Life of Sherlock Holmes* (1933); W. H. Wright (ed.), *The Great Detective Stories* (1927). (V. STA.)

**MYSTICISM,** a phase of thought, or rather perhaps of feeling, which from its very nature is hardly susceptible of exact definition. It appears in connection with the endeavour of the human mind to grasp the divine essence or the ultimate reality of things, and to enjoy the blessedness of actual communion with the Highest. The first is the philosophic side of mysticism; the second, its religious side. The first effort is theoretical or speculative; the second, practical. The thought that is most intensely present with the mystic is that of a supreme, all-pervading, and indwelling power, in whom all things are one. Hence the speculative utterances of mysticism are always more or less pantheistic in character. On the practical side, mysticism maintains the possibility of direct intercourse with this Being of beings—intercourse, not through any external media such as an historical revelation, oracles, answers to prayer, and the like, but by a species of transfusion or identification, in which the individual becomes in very truth "partaker of the divine nature." God ceases to be an object to him, and becomes an experience.

**Universality.**—In the writings of the mystics, ingenuity exhausts itself in the invention of phrases to express the closeness of this union. Mysticism differs, therefore, from ordinary pantheism in that its inmost motive is religious; but, whereas religion is ordinarily occupied by a practical problem and develops its theory in an ethical reference, mysticism displays a predominatingly speculative bent, starting from the divine nature rather than from man and his surroundings, taking the symbolism of religious feeling as literally or metaphysically true, and straining after the present realization of an ineffable union. The union which sound religious teaching represents as realized in the submission of the will and the ethical harmony of the whole life is then reduced to a passive experience, to something which comes and goes in time, and which may be of only momentary duration. Mysticism, it will be seen, is not a name applicable to any particular system. It may be the outgrowth of many differing modes of thought and feeling. Most frequently it appears historically, in relation to some definite system of belief, as a reaction of the spirit against the letter. When a religion begins to ossify into a system of formulas and observances, those who protest in the name of heart-religion are not unfrequently known by the name of mystics. At times they merely bring into prominence again the ever-fresh fact of personal religious experience; at other times mysticism develops itself as a powerful solvent of definite dogmas. Mysticism appears in various phases in all the higher religions known to history. Its distinctive characteristics emerge in the religions of India and Persia as well as in the faith of Islam. These subjects are dealt with elsewhere; but its relation to Judaism and the religions of Greece requires special mention here. For opposite reasons, neither the Greek nor the Jewish mind lent itself readily to mysticism: the Greek, because of its clear and sunny naturalism; the Jewish, because of its rigid monotheism and its turn towards worldly realism and statutory observance. It is only with the exhaustion of Greek and Jewish civilization that mysticism becomes a prominent factor in Western thought. It appears, therefore, contemporaneously with Christianity, and is a sign of the world-weariness and deep religious need that mark the decay of the old world. Whereas Plato's main problem had been the organization of the perfect state, and Aristotle's intellect had ranged with fresh interest over all departments of the knowable, political speculation had become a mockery with the extinction of free political life, and knowledge as such had lost its freshness for the Greeks of the Roman Empire. Knowledge is nothing to these men if it does not show them the infinite reality which is able to fill the aching void within. Accordingly, the last age of Greek philosophy is theosophical in character, and its ultimate end is a practical satisfaction. Neoplatonism seeks this in the ecstatic intuition of the ineffable One. The systematic theosophy of Plotinus and his successors does not belong to the present article, except so far as it is the presupposition of their mysticism; but, inasmuch as the mysticism of the mediaeval Church is directly derived from Neoplatonism through the speculations of the pseudo-Dionysius, Neoplatonic mysticism fills an important section in any historical review of the subject.

**Neoplatonism.**—Neoplatonism appears in the first half of the 3rd century, and has its greatest representative in Plotinus. He develops the Platonic philosophy into an elaborate system by means of the doctrine of emanation. The One, the Good, and the Idea of the Good were identical in Plato's mind, and the Good was therefore not deprived of intelligible essence. It was not separated from the world of ideas, of which it was represented as either the crown or the sum. By Plotinus, on the contrary, the One is explicitly exalted above the νοῦς and the "ideas"; it transcends existence altogether (ἐπέκεινα τῆς οὐσίας), and is not cognizable by reason. Remaining itself in repose, it rays out, as it were, from its own fullness an image of itself, which is called νοῦς, and which constitutes the system of ideas of the intelligible world. The soul is in turn the image or product of the νοῦς, and the soul by its motion begets corporeal matter. The soul thus faces two ways—towards the νοῦς, from which it springs, and towards the material life, which is its own product. Ethical endeavour consists in the repudiation of the sensible; material existence is itself estrangement from God. (Porphyry tells us that Plotinus was unwilling to name his parents or his birthplace, and seemed ashamed of being in the body.) Beyond the καθάρσεις, or virtues which purify from sin, lies the further stage of complete identification with God (οὐκ ἔξω ἁμαρτίας εἶναι, ἀλλὰ θεὸν εἶναι). To reach the ultimate goal, thought itself must be left behind; for thought is a form of motion, and the desire of the soul is for the motionless rest which belongs to the One. The union with transcendent deity is not so much knowledge or vision as ecstasy, coalescence, *contact* (ἔκστασις, ἅπλωσις, ἁφή, *Ennead.*, vi. 9. 8–9). But in our present state of existence the moments of this ecstatic union must be few and short.

It will be seen from the above that Neoplatonism is not mystical as regards the faculty by which it claims to apprehend philosophic truth. It is first of all a system of complete rationalism; it is assumed, in other words, that reason is capable of mapping out the whole system of things. But, inasmuch as a God is affirmed beyond reason, the mysticism becomes in a sense the necessary complement of the would-be all-embracing rationalism. The system culminates in a mystical act, and in the sequel, especially with Iamblichus and the Syrian Neoplatonists, mystical practice tended more and more to overshadow the theoretical groundwork.

**Dionysius the Areopagite.**—It was probably about the end of the 5th century, just as ancient philosophy was dying out in the schools of Athens, that the speculative mysticism of Neoplatonism made a definite lodgment in Christian thought through the literary forgeries of the pseudo-Dionysius (*see* DIONYSIUS THE AREOPAGITE). The doctrines of Christianity were by that time so firmly established that the Church could look upon a symbolical or mystical interpretation of them without anxiety. The author of the *Theologia mystica* and the other works ascribed to the Areopagite proceeds, therefore, to develop the doctrines of Proclus with very little modification into a system of esoteric Christianity. God is the nameless and supra-essential One, elevated above goodness itself. Hence "negative theology," which ascends from the creature to God by dropping one after another

every determinate predicate, leads us nearest to the truth. The return to God (ἕνωσις, θέωσις) is the consummation of all things and the goal indicated by Christian teaching. The same doctrines were preached with more of churchly fervour by Maximus the Confessor (580–622).

**The West.**—St. Maximus represents almost the last speculative activity of the Greek Church, but the influence of the pseudo-Dionysian writings were transmitted to the West in the 9th century by Erigena, in whose speculative spirit both the scholasticism and the mysticism of the middle ages have their rise. Erigena translated Dionysius into Latin along with the commentaries of Maximus, and his system is essentially based upon theirs. In Erigena mysticism has not yet separated itself in any way from the dogma of the Church. There is no revulsion, as later, from dogma as such, nor is more stress laid upon one dogma than upon another; all are treated upon the same footing, and the whole dogmatic system is held, as it were, in solution by the philosophic medium in which it is presented. No distinction is drawn, indeed, between what is reached by reason and what is given by authority; the two are immediately identical for Erigena. In this he agrees with the speculative mystics everywhere, and differentiates himself from the scholastics who followed him. The chief representatives of scholasticism aim at demonstrating that the content of revelation and the teaching of reason are identical, but this is only an equation of two things which have been dealt with on the supposition that they are separate. Mysticism, on the other hand, is marked on its speculative side by even an overweening confidence in human reason; and this is pre-eminently visible in the work of Erigena. Nor need this be wondered at if we consider that the unity of the human mind with the divine is its underlying presupposition. Hence where reason is discarded by the mystic it is merely reason overleaping itself; it occurs at the end and not at the beginning of his speculations. Even then there is no appeal to authority; nothing is accepted from without. The appeal is still to the individual, who, if not by reason then by some higher faculty, claims to realize absolute truth and to taste absolute blessedness.

**Anti-dialectical.**—Mysticism first appears in the mediaeval Church as the protest of practical religion against the predominance of the dialectical spirit. It is so with Bernard of Clairvaux (1090–1153), who condemns Abelard's distinctions and reasonings as externalizing and degrading the faith. St. Bernard's mysticism is of a practical cast, dealing mainly with the means by which man may attain to the knowledge and enjoyment of God. Reason has three stages, in the highest of which the mind is able, by abstraction from earthly things, to rise to *contemplatio* or the vision of the divine. More exalted still, however, is the sudden *ecstatic* vision, such as was granted, for example, to Paul. This is the reward of those who are dead to the body and the world. Asceticism is thus the counterpart of medieval mysticism; and, by his example as well as by his teaching in such passages, St. Bernard unhappily encouraged practices which necessarily resulted in self-delusion. Love grows with the knowledge of its object, he proceeds, and at the highest stage self-love is so merged in love to God that we love ourselves only for God's sake or because God has loved us. "As the little water-drop poured into a large measure of wine seems to lose its own nature entirely and to take on both the taste and the colour of the wine; or as iron heated red-hot loses its own appearance and glows like fire; or as air filled with sunlight is transformed into the same brightness so that it does not so much appear to be illuminated as to be itself light—so must all human feeling towards the Holy One be self-dissolved in unspeakable wise, and wholly transfused into the will of God. For how shall God be all in all if anything of man remains in man? The substance will indeed remain, but in another form, another glory, another power" (*De diligendo Deo*, c. 10).

Mysticism was more systematically developed by Bernard's contemporary Hugh of St. Victor (1096–1141). The Augustinian monastery of St. Victor near Paris became the headquarters of mysticism during the 12th century. It had a wide influence in awakening popular piety, and the works that issued from it formed the textbooks of mystical and pietistic minds in the centuries that followed. Hugh's pupil, Richard of St. Victor, declares, in opposition to dialectic scholasticism, that the objects of mystic contemplation are partly above reason, and partly, as in the intuition of the Trinity, contrary to reason. He enters at length into the conditions of ecstasy and the yearnings that precede it. Bonaventura (1221–1274) was a diligent student of the Victorines, and in his *Itinerarium mentis ad Deum* maps out the human faculties in a similar fashion. He introduces the terms "apex mentis" and "scintilla" (also "synderesis" or συντήρησις) to describe the faculty of mystic intuition. Bonaventura runs riot in phrases to describe the union with God, and his devotional works were much drawn upon by mystical preachers.

**Theology of the Heart.**—From the 12th and 13th centuries onward there is observable in the different countries of Europe a widespread reaction against the growing formalism and worldliness of the Church and the scandalous lives of many of the clergy. Men began to feel a desire for a theology of the heart and an unworldly simplicity of life. In the beginning of the 13th century the foundation of the Dominican and Franciscan orders furnished an ecclesiastical and regular means of supplying the same wants, and numerous convents sprang up at once throughout Germany. The German mind was a peculiarly fruitful soil for mysticism, and a number of women appear about this time, combining a spirit of mystical piety and asceticism with sturdy reformatory zeal directed against the abuses of the time. Even before this we hear of the prophetic visions of Hildegard of Bingen (a contemporary of St. Bernard) and Elizabeth of Schönau. In the 13th century Elizabeth of Hungary, the pious landgravine of Thuringia, assisted in the foundation of many convents in the north of Germany. (For an account of the chief of these female saints *see* the first volume of W. Preger's *Geschichte der deutschen Mystik*.) Mechthild of Magdeburg appears to have been the most influential, and her book *Das fliessende Licht der Gottheit* is important as the oldest work of its kind in German. It proves that much of the terminology of German mysticism was current before Eckhart's time. Mechthild's clerico-political utterances show that she was acquainted with the "eternal gospel" of Joachim of Floris. Joachim had proclaimed the doctrine of three world-ages—the kingdom of the Father, of the Son, and of the Spirit. The reign of the Spirit was to begin with the year 1260, when the abuses of the world and the Church were to be effectually cured by the general adoption of the monastic life of contemplation.

Very similar to this in appearance is the teaching of Amalric of Bena (d. 1207); but, while the movements just mentioned were reformatory without being heretical, this is very far from being the case with the mystical pantheism derived by Amalric from the writings of Erigena. His followers held a progressive revelation of God in the ages of the Father, Son and Holy Spirit. Just as the Mosaic dispensation came to an end with the appearance of Christ, so the sacraments of the new dispensation have lost their meaning and efficacy since the incarnation of God as Holy Spirit in the Amalricans. With this opposition to the Church they combine a complete antinomianism, through the identification of all their desires with the impulses of the divine Spirit. Amalric's teaching was condemned by the Church, and his heresies led to the public burning of Erigena's *De divisione naturae* in 1225.

**Eckhart.**—In Meister Eckhart (? 1260–1327) the German mind definitively asserts its pre-eminence in the sphere of speculative mysticism. Eckhart was a distinguished son of the Church; but in reading his works we feel at once that we have passed into quite a different sphere of thought from that of the churchly mystics; we seem to leave the cloister behind and to breathe a freer atmosphere. The scholastic mysticism was, for the most part, practical and psychological in character. It was largely a devotional aid to the realization of present union with God; and, so far as it was theoretical, it was a theory of the faculties by which such a union is attainable. But in Eckhart the attitude of the churchman and traditionalist is entirely abandoned. His system enables him to give a profound significance to the doctrines

of the Church; but, instead of the system being accommodated to the doctrines, the doctrines—and especially the historical facts—acquire a new sense in the system, and often become only a mythical representation of speculative truth.

The political circumstances of Germany in the first half of the 14th century were in the last degree disastrous. The war between the rival emperors, Frederick of Austria and Louis of Bavaria, and the interdict under which the latter was placed in 1324 inflicted extreme misery upon the unhappy people. From some places the interdict was not removed for twenty-six years. Men's minds were pained and disquieted by the conflict of duties and the absence of spiritual consolation. The country was also visited by a succession of famines and floods, and in 1348 the Black Death swept over Europe like a terrible scourge. In the midst of these unhappy surroundings religion became more inward in men of real piety and the desire grew among them to draw closer the bonds that united them to one another. Thus arose the society of the Friends of God (*Gottesfreunde*) in the south and west of Germany, spreading as far as Switzerland on the one side and the Netherlands on the other. They formed no exclusive sect. They often took opposite sides in politics and they also differed in the type of their religious life; but they uniformly desired to strengthen one another in living intercourse with God. Among them chiefly the followers of Eckhart were to be found. Such were Heinrich Suso of Constance (1295–1366) and Johann Tauler of Strasbourg (1300–1361), the two most celebrated of his immediate disciples. It was doubtless one of the Friends who sent forth anonymously from the house of the Teutonic Order in Frankfort the famous handbook of mystical devotion called *Eine deutsche Theologie,* first published in 1516 by Luther.

**Jan van Ruysbroeck** (1294–1381), the father of mysticism in the Netherlands, stood in connection with the Friends of God, and Tauler is said to have visited him in his seclusion at Groenendal near Brussels. He was decisively influenced by Eckhart, though there is noticeable occasionally a shrinking back from some of Eckhart's phraseology. Ruysbroeck's mysticism is more of a practical than a speculative cast. He is chiefly occupied with the means whereby the *unio mystica* is to be attained, whereas Eckhart dwells on the union as an ever-present fact, and dilates on its metaphysical implications. Towards the end of Ruysbroeck's life, in 1378, he was visited by the fervid lay-preacher Gerhard Groot (1340–1384), who was so impressed by the life of the community at Groenendal that he conceived the idea of founding a Christian brotherhood, bound by no monastic vows, but living together in simplicity and piety with all things in common, after the apostolic pattern. This was the origin of the Brethren of the Common Lot (or Common Life). The first house of the Brethren was founded at Deventer by Gerhard Groot and his youthful friend Florentius Radewyn; and here Thomas à Kempis (*q.v.*) received his training. Similar brother-houses soon sprang up in different places throughout the Low Countries and Westphalia, and even Saxony.

**Mystics and the Reformation.**—It has been customary for Protestant writers to represent the mystics of Germany and Holland as precursors of the Reformation. In a sense this is true. But it would be false to say that these men protested against the doctrines of the Church in the way the Reformers felt themselves called upon to do. There is no sign that Tauler, for example, or Ruysbroeck, or Thomas à Kempis had felt the dogmatic teaching of the Church jar in any single point upon their religious consciousness. Nevertheless, mysticism did prepare men in a very real way for a break with the traditional system. Mysticism instinctively recedes from formulas that have become stereotyped and mechanical. On the other hand its claim for spiritual freedom was soon to be found in opposition also to the Reformers. The wild doctrines of Thomas Münzer and the Zwickau prophets, merging eventually into the excesses of the Peasants' War and the doings of the Anabaptists in Münster, first roused Luther to the dangerous possibilities of mysticism as a disintegrating force. He was also called upon to do battle for his principle against men like Caspar Schwenkfeld (1490–1561) and Sebastian Franck (*c.* 1499–*c.* 1543), the latter of whom developed a system of pantheistic mysticism, and went so far in his opposition to the letter as to declare the whole of the historical element in Scripture to be but a mythical representation of eternal truth. Valentin Weigel (1533–1588), who stands under manifold obligations to Franck, represents also the influence of the semi-mystical speculation that marked the transition from scholasticism to modern times. The final breakdown of scholasticism as a rationalized system of dogma may be seen in Nicolas (or Nicolaus) of Cusa (1401–1464), who insists that all real apprehension of God is by way of a "knowledge above knowledge." The influence of later mediaeval mysticism is seen in Jacob Boehme (1575–1624).

**Other Forms of Mysticism.**—Mysticism did not cease within the Catholic Church at the Reformation. In St. Theresa (1515–1582) and John of the Cross the counter-reformation can boast of saints second to none in the calendar for the austerity of their mortifications and the rapture of the visions to which they were admitted. But, as was to be expected, their mysticism moves in that comparatively narrow round, and consists simply in the heaping up of these sensuous experiences. The speculative character has entirely faded out of it, or rather has been crushed out by the tightness with which the directors of the Roman Church now held the reins of discipline. The gloom and harshness of these Spanish mystics are absent from the tender, contemplative spirit of François de Sales (1567–1622); and in the quietism of Mme. Guyon (1648–1717) and Miguel de Molinos (1627–1696) there is again a sufficient implication of mystical doctrine to rouse the suspicion of the ecclesiastical authorities.

In the 17th century mysticism is represented in the philosophical field by the so-called Cambridge Platonists, and especially by Henry More (1614–1687), in whom the influence of the Kabbalah is combined with a species of Christianized Neoplatonism. Pierre Poiret (1646–1719), an ardent student of Tauler and Thomas à Kempis, exhibits a violent reaction against the mechanical philosophy of Descartes, and especially against its consequences in Spinoza. The first influence of Boehme was in the direction of an obscure religious mysticism. J. G. Gichtel (1638–1710), the first editor of his complete works, became the founder of a sect called the Angel-Brethren. All Boehme's works were translated into English in the time of the Commonwealth, and regular societies of Boehmenists were formed in England and Holland. Later in the century he was much studied by the members of the Philadelphian Society, John Pordage, Thomas Bromley, Jane Lead, and others. The mysticism of William Law (1686–1761) and of Louis Claude de Saint Martin in France (1743–1803), who were also students of Boehme, is of a much more elevated and spiritual type. The "Cherubic Wanderer," and other poems, of Johann Scheffler (1624–1677), known as Angelus Silesius, are more closely related in style and thought to Eckhart than to Boehme.

The religiosity of the Quakers, with their doctrines of the "inner light" and the influence of the Spirit, has decided affinities with mysticism; and the autobiography of George Fox (1624–1691), the founder of the sect, proceeds throughout on the assumption of supernatural guidance. Stripped of its definitely miraculous character, the doctrine of the inner light may be regarded as the familiar mystical protest against formalism, liberalism, and scripture-worship. Swedenborg, though selected by Emerson in his *Representative Men* as the typical mystic, belongs rather to the history of spiritualism than to that of mysticism as understood in this article. He possesses the cool temperament of the man of science rather than the fervid Godward aspiration of the mystic proper; and the speculative impulse which lies at the root of this form of thought is almost entirely absent from his writings. Accordingly, his supernatural revelations resemble a course of lessons in celestial geography more than a description of the beatific vision.

**Analysis.**—The term mysticism is often extended by popular usage and philosophical partisanship to the whole activity of the German idealistic thinkers who followed Kant; but this looseness of phraseology only serves to blur important distinctions. However absolute a philosopher's idealism may be, he is erroneously styled a mystic if he moves towards his conclusions only by the

patient labour of the reason. Hegel therefore, to take an instance, can no more fitly be classed as a mystic than Spinoza can. It would be much nearer the truth to take both as types of a thoroughgoing rationalism. In either case it is of course open to anyone to maintain that the apparent completeness of synthesis really rests on the subtle intrusion of elements of feeling into the rational process. But in that case it might be difficult to find a systematic philosopher who would escape the charge of mysticism; and it is better to remain by long-established and serviceable distinctions.

So, again, when Récéjac defines mysticism as "the tendency to draw near to the Absolute in moral union by symbolic means," the definition, as developed by him, is one which would apply to the philosophy of Kant. Récéjac's interesting work, *Les Fondements de la connaissance mystique* (Eng. trans. 1899), though it touches mysticism at various points, and quotes from mystic writers, is in fact a protest against the limitations of experience to the data of the senses and the pure reason to the exclusion of the moral consciousness and the deliverances of "the heart." But such a position is not describable as mysticism in any recognized sense. On the other hand, the term is in place where the movement of revulsion from a mechanical philosophy takes the form rather of immediate assertion than of reasoned demonstration, and where the writers, after insisting generally on the spiritual basis of phenomena, either leave the position without further definition or expressly declare that the ultimate problems of philosophy cannot be reduced to articulate formulas. Examples of this are men like Novalis, Carlyle and Emerson, in whom philosophy may be said to be impatient of its own task.

**Modern Studies.**—Study of the subject may be said to begin with Dean Inge's Bampton Lectures on Christian Mysticism (1899). It has since been pursued along the parallel routes of psychology, history and philosophy of religion, with the result that the claim of mysticism to be regarded as a genuine form of human experience is justified. These aspects of mysticism cannot rigidly be separated, or indeed understood in isolation, each being of vital importance to the rest.

**William James,** in his epoch-making Gifford Lectures on *The Varieties of Religious Experience* (1902), originated the serious study of mysticism, especially from the psychological point of view, and attempted to discover its relation to other forms of consciousness. Although based on material chosen from too restricted a field, the publication of this book revolutionised the attitude of students towards religious psychology. The conception of the subconscious was now first used to provide an explanation and sanction for the ecstatic and other abnormal phenomena found in connection with mysticism, and an attempt was made to distinguish the accompaniments of genuine religious apprehension from their pathological imitations.

These researches have continued vigorously, especially in America and France. Pratt's *Religious Consciousness* (1921) represents the matured result of the movement started by James. Considerable advance has been made towards the correlation and better understanding of such types as the prophet, visionary and religious revivalist, in all of whom a strong mystical impulse is commonly at work. The hostile study of mysticism from the psychological standpoint has its chief exponent in J. H. Leuba, and to some extent in the work of experimental psychologists such as P. Janet, whilst an approach midway between the philosophical and psychological is provided by Bucke's *Cosmic Consciousness,* a curious work which has exercised considerable influence. Delacroix's sympathetic but penetrating analyses of the evolution of the great mystics have shed much light on the psychological characteristics of religious genius. Valuable studies of the nature of mystical contemplation, and restatement in modern terms of its processes, have been produced by Roman Catholic scholars, the best being those of Père Poulain, S.J.

**Influence of Psychology.**—The psychological study of mystical phenomena has illuminated many historical problems, especially those connected with prophecy and the origins of religious movements. The treatment of the subject in such works as Heiler's *Das Gebet* and *Der Katholizismus* or Brémond's monumental *Histoire du Sentiment religieux en France,* is symptomatic of the changed outlook. Material available for students of historical mysticism has been much enriched. Good texts and translations of many masterpieces of European mysticism have appeared, with valuable studies such as those of Abbot Butler and Rufus Jones, based on the historical method.

The changed outlook of physical science, the new understanding of its limitations and the marked revolt from 19th-century materialism, have brought about a *rapprochement* between mysticism and philosophy. Inge's *Philosophy of Plotinus* (1918) and Otto's widely discussed essay *Das Heilige* (The Idea of the Holy, 1924) show different aspects of the reaction of philosophy to mysticism. But this is also felt in the pure metaphysics of Wittgenstein, and in the inimical attitude of Croce and his school. The greatest and ultimately most influential expositions of the place of mysticism in theistic philosophy, and its limitations and rightful relation with other aspects of knowledge, are Von Hügel's *Mystical Element of Religion* and *Eternal Life.* These books have affected all modern religious thinkers, and may provide the starting-point of a critical realism harmonising the mystical, moral and intellectual approaches to reality. In America, Hocking's *Meaning of God in Human Experience* is probably the most important philosophic contribution to this subject.

**Modern Practical Mysticism.**—The first quarter of the 20th century saw, especially in France, a revival of genuine Christian mysticism; possibly the beginning of what later historians may recognise as a "mystical epoch." Its most impressive document is the *Spiritual Journal* of the lady known as Lucie-Christine (1844–1908), a record which bears comparison with the historical classics of mysticism. Its most striking product is the career of the hermit saint of the Sahara, Charles de Foucauld (1858–1916). These stand out among a number of more obscure personalities, such as Elizabeth de la Trinité (1880–1906) and Madeleine Sémer (1874–1921), all of whom claim and describe with a conviction and sobriety compelling respect the characteristic mystical experience and certitude. From India, the autobiography of the saintly Hindu theist Maharshi Devendranath Tagore (1817–1905), and the experiences of the Christian convert Sadhu Sundar Singh (born 1889), whose career and personality have made a widespread impression, provide unspoilt examples of first-hand mysticism, and deepen the sense of unity in the spiritual intuitions.

The revived interest in mysticism has had popular results in several directions. It has seemed to endorse the shallow eclecticism in which many escape the difficulties of belief. Its superficial peculiarities have been exploited by theosophists and other apostles of eccentric religiosity. It has produced numerous bastard cults, mostly hailing from America though often wearing Oriental disguise; cults mainly compounded of pantheism, quietism and crude autosuggestion, and offering a "mystical religion" to those seeking a spiritual home full of modern conveniences and devoid of discipline. On the other hand, its spirit has affected for good the literature and activity of the organised Churches; shifting the emphasis from tradition to experience, and bringing back into focus those mysterious realities which religious symbols and institutions seek to express.

BIBLIOGRAPHY.—H. Delacroix, *Etudes d'histoire et de la psychologie du mysticisme* (1908); Rufus M. Jones, *Studies in Mystical Religion* (1909); F. von Hügel, *Eternal Life* (1912); R. A. Nicholson, *Mystics of Islam* (1914); H. Brémond, *Histoire littéraire du sentiment religieux en France,* 6 vol. (1916–23); R. M. Jones and others, art. "Mysticism" in Hastings *Encyclopaedia of Religion and Ethics,* vol. ix. (1917); W. E. Hocking, *The Meaning of God in Human Experience* (1918); W. R. Inge, *The Philosophy of Plotinus,* 2 vol. (1918); F. Heiler, Sections on mysticism in *Das Gebet* (1920); R. A. Nicholson, *Studies in Islamic Mysticism* (Cambridge, 1921); J. B. Pratt, Sections on mysticism in *The Religious Consciousness* (1921); Dom. C. Butler, *Western Mysticism* (1922); A. Poulain, *Des grâces d'Oraison, traité de théologie mystique,* 10th ed. (1922); F. Heiler, Sections on mysticism in *Der Katholizismus* (Munich, 1923); F. von Hügel, *The Mystical Element of Religion,* 2nd ed. (1923); R. Otto, *The Idea of the Holy* (Oxford, 1924); Evelyn Underhill, *Mysticism,* 10th ed. (1924); J. H. Leuba, *The Psychology of Religious Mysticism* (1925); Evelyn Underhill, *The Mystics of the Church* (1925). Among earlier works on the history may be named those of H. Schmid, *Der Mysticismus in seiner Entstehungsperiode* (1824); C. Schmidt, *Les mystiques du 14me siècle* (1836); J. Görres, *Die Christliche Mystik* (1836–42); W. Preger, *Ge-*

*schichte der Deutschen Mystik* (1874–93). *See* also articles on the greater mystical writers named. (A. S. P.-P.; E. Un.; X.)

**MYTH AND RITUAL.** The fundamental association of myth with ritual emerges clearly in the view of Robertson Smith, that in all antique religions mythology takes the place of dogma. He thought that mythology was no essential part of ancient religion for it had no sacred sanction and no binding force on the worshippers. Belief in myths was not obligatory as a part of true religion. He argued that, from the outset, ritual and practical usage were strictly speaking, the sum total of ancient religions. Political institutions are older than political theories and in like manner religious institutions are older than religious theories. Dr. Cook (*Religion of the Semites,* 3rd Edn. 1927) points out that myth and ritual often act upon each other. Some, he thinks, are based upon misunderstandings, are explanations of explanations, are the product of the more intelligent and sophisticated individuals, or have been purified of earlier crudities, while fancy and imagination have transformed them. While myths are specifically of personal interest, in general they appeal to the different types of mind in mixed communities. The views of Robertson Smith have assumed a more precise shape in the argument of Professor Radcliffe-Brown that "it is necessary to take into account the explanations given by the natives themselves. Although these explanations are not of the same kind as the scientific explanations that are the objects of research, yet they are of great importance as data. Like the civilized man of Western Europe, the savage of the Andamans seeks to rationalise his behaviour; being impelled to certain actions by mental dispositions of whose origin and real nature he is unaware, he seeks to formulate reasons for his conduct, or even if he does not when left to himself, he is compelled to when the enquiring ethnologist attacks him with questions. Such a reason as is produced by this process of rationalisation is rarely, if ever, identical with the psychological cause of the action that it justifies, yet it will nearly always help us in our search for the cause. At any rate, the reason given as explaining the action is so intimately connected with the action itself that we cannot regard any hypothesis as to the meaning of a custom as being satisfactory unless it explains, not only the custom, but also the reasons that the natives give for following it. . . . Tales that might seem merely the products of a somewhat childish fancy are very far indeed from being merely fanciful and are the means by which the Andamanese express and systematise their fundamental notions of life and nature and the sentiments attaching to these notions." (A. Radcliffe-Brown, *The Andaman Islanders,* pp. 234 and 330, 1922.)

The process of symbolic thought is of important reference to and criticism of the interpretation of "the beliefs of savages as being the result of attempts to *understand* natural facts such as dreams, death, birth, etc. Such writers assume that the savage is impelled by the same motive that so strongly dominates themselves, the desire to understand—scientific curiosity, and that such beliefs as animism or totemism are in the nature of scientific hypothesis, invented to explain the facts of dreaming and of death on the one hand, and of conception and birth on the other. If this view of the nature of primitive thought were correct it would be impossible to conceive how such inconsistencies as those that were met with among the Andamanese could be permitted. On the view that the myths of primitive society are merely the result of an endeavour to express certain ways of thinking and feeling about the facts of life which are brought into existence by the manner in which life is regulated in society, the presence of such inconsistencies need not in the least surprise us, for the myths satisfactorily fulfil their function, not by any appeal to the reasoning powers but by appealing, through the imagination, to the mind's affective dispositions." (A. Radcliffe-Brown, *The Andaman Islanders,* 1922, p. 397.)

Malinowski insists that "the function of myth, briefly, is to strengthen tradition and endow it with a greater value and prestige by tracing it back to a higher, better, more supernatural reality of ancient events." From myth spring the epic romance and tragedy. Myth, therefore, touches the deepest desires of man—his fears, his hopes, his passions, his sentiments as it validates the social order, justifies the existing social scheme and ranges from expressions of sheer artistry to legalism. (*Myth in Primitive Psychology,* 1927.)

Bibliography.—*See* the bibliographies to Egyptian Religion and Babylonian Religion and to the articles referred to above; also A. B. Keith, *Indian Mythology* (1917). For China *see* J. J. M. de Groot, *Religious Systems of China* (Leyden, 1892, etc.). *See* also A. Radcliffe-Brown, *The Andaman Islanders* (1922); Baldwin Spencer, *The Arunta* (1927); R. H. Codrington, *The Melanesians* (1891); J. H. Hutton, *The Angami Nagas* (1921), *The Sema Nagas* (1921); J. P. Mills, *The Ao Nagas* (1916), *The Lhota Nagas* (1922); J. Shakespeare, *The Lushai-Kuki Clans* (1912); R. E. Enthoven, *The Folklore of Bombay* (1924); W. Crooke, *Folklore and Popular Religion of Northern India* (edit. R. E. Enthoven, 1926); E. Thurston, *Omens and Superstitions of Southern India* (1912); G. Lindblom, *The Akamba* (2nd enlarged ed., 1920); J. Roscoe, *The Baganda* (1911); E. W. Smith and A. M. Dale, *The Ila-speaking Peoples of Northern Nigeria* (1920); C. K. Meek, *The Northern Tribes of Nigeria* (2 vols., 1925); L. Tauxier, *Le Noir de Giunée* (1908), *Le Noir du Soudan* (1912), *Le Noir de Yatenga* (1917), *Le Noir de Bondoukou* (1921); W. C. Willoughby, *The Soul of the Bantu* (1928); James Frazer, *The Golden Bough* (3rd ed., 12 vols., 1907–15).

**MYTHOLOGY,** the science which examines μῦθοι, myths or legends of cosmogony and of gods and heroes. Mythology is also used as a term for these legends themselves. Thus when we speak of "the mythology of Greece" we mean the whole body of Greek divine and heroic and cosmogonic legends. When we speak of the "science of mythology" we refer to the various attempts which have been made to explain these ancient narratives. Very early indeed in the history of human thought men awoke to the consciousness that their religious stories were much in want of explanation. The myths of civilized peoples, as of the Aryans of India and the Greeks, contain two elements, the rational and what to modern minds seems the irrational. The rational myths are those which represent the gods as beautiful and wise. The real difficulties of mythology spring from the irrational element, which to modern minds appears senseless or repellent.

Classical mythology is discussed under Greek Religion; Roman Religion and such articles as Odysseus; Theseus; Orpheus. For other mythology consult Animism; Totemism; Lycanthropy; Metempsychosis and similar articles; *see* Religion, Articles on.

**MYXINE,** a genus of hag-fishes, containing a single species, *M. glutinosa* of the north Atlantic. (*See* Hag-Fish; Cyclostomata.)

**MYXOEDEMA,** the medical term for a constitutional disease (*see* Metabolic Diseases) due to the degeneration of the thyroid gland, and occurring in adults; cretinism is essentially the same condition appearing in early childhood. There are two forms, myxoedema proper and operative myxoedema (*cachexia strumipriva*). (1) Myxoedema has been termed "Gull's Disease" from Sir William Gull's observations in 1873. Women are more often the victims than men, in a ratio of six to one. It frequently affects members of the same family and may be transmitted through the mother; it has been observed sometimes to follow exophthalmic goitre. The symptoms are a marked increase in bulk and weight of the body, puffy appearance of skin which does not pit on pressure, the line of the features becoming obliterated and getting coarse and broad, the lips thick and nostrils enlarged, with loss of hair, subnormal temperature and marked mental changes. There is striking slowness of thought and action, the memory becomes defective, and the patient becomes irritable and suspicious. In some instances the condition progresses to that of dementia. The thyroid gland itself is diminished in size, and may become completely atrophied and converted into a fibrous mass. The untreated disease is progressive, but the course is slow and the symptoms may extend over 12 to 15 years, death from asthenia or tuberculosis being the most frequent ending. (2) Symptoms similar to the above may follow complete removal of the thyroid gland. Kocher of Berne found that, in the total removal of the gland by operation, out of 408 cases operative myxoedema occurred in 69, but it is thought that if a small portion of the gland is left, or if accessory glands are present, these symptoms will not develop. The treatment of myxoedema, like that of cretinism, is by administration of thyroid extract. (*See* Animal Extracts.)

N in all known alphabets the letter N has stood in close connection with M, the particular form of one being generally reflected in the other. Semitic 𐤍 (*nun*) and Greek Ν (*nu*) are its predecessors. In the inscriptions from Thera the form was consistently Ν. Other forms were Ν from Corinth and N in the Ionic alphabet of Abu-Simbel. In the Lydian alphabet the form was 𐤍, Etruscan has sometimes the curious form Ϻ corresponding to its five-stroked Μ (M). In the Italic alphabets the form of the letter followed that of M, being found in Umbrian as Ν, in Oscan as Ν and in Faliscan as Ν. The Latin forms were N and Ν.

The minuscule cursive form of the 6th century was 𝔑, probably accounted for by the writing of the letter without taking the pen from the paper commencing at the top of the left-hand

| NAME OF FORM | APPROXIMATE DATE | FORM OF LETTER |
|---|---|---|
| PHOENICIAN | B.C. 1,200 | 𐤍 |
| CRETAN | 1,100-900 | 𐌍 |
| THERAEAN | 700-600 | 𐌍 |
| ARCHAIC LATIN | 700-500 | Ν |
| ATTIC | 600 | 𐌍 |
| CORINTHIAN | 600 | 𐌍 |
| CHALCIDIAN | 600 | Ν |
| IONIC | 403 | 𐌍 |
| ROMAN COLONIAL | PRE-CLASSICAL AND CLASSICAL TIMES | Ν |
| URBAN ROMAN | | N |
| FALISCAN | | Ν |
| OSCAN | | Ν N |
| UMBRIAN | | Ν ᴎ |
| CLASSICAL LATIN AND ONWARDS | | N |

DEVELOPMENT OF THE LETTER "N" FROM THE EARLIEST TIMES TO THE PRESENT DAY

vertical stroke. This would cause the oblique stroke to rise from left to right instead of being downward in direction. The Carolingian hand developed the rounded minuscule form 𝔫. From this derives the modern minuscule. The sound that the letter has represented throughout its history is the dental nasal, the nasals being of all sounds the least liable to change. (B. F. C. A.)

**NABATAEANS,** a people of ancient Arabia, whose settlements gave the name of Nabatene to the border-land between Syria and Arabia from the Euphrates to the Red sea. The history of the Nabataeans cannot be carried back beyond 312 B.C., at which date they were attacked without success by Antigonus I. (*Cyclops*) in their mountain fortress of Petra.

The Nabataeans were Arabs—as their proper names show—who came under Aramaic influence. They wrote a letter to Antigonus "in Syriac letters," and Aramaic continued to be the language of their coins and inscriptions when the tribe grew into a kingdom, and profited by the decay of the Seleucids to extend its borders northward over the more fertile country east of the Jordan. They occupied Haurān, and about 85 B.C. their king Aretas (Ḥārīthath) became lord of Damascus and Coele-Syria. Allies of the first Hasmonaeans in their struggles against the Greeks (i. Macc. v. 25, ix. 35; 2 Macc. v. 8), they became the rivals of the Judaean dynasty in the period of its splendour, and a chief element in the disorders which invited Pompey's intervention in Palestine. The Roman arms were not very successful, and King Aretas retained his whole possessions, including Damascus, as a Roman vassal. (*cf.* 2 Cor. xi. 32). As "allies" of the Romans the Nabataeans continued to flourish throughout the first Christian century. Their power extended far into Arabia, particularly along the Red sea; and Petra was a meeting-place of many nations, though its commerce was diminished by the rise of the Eastern trade-route from Myoshormus to Coptos on the Nile. A sober, acquisitive, orderly people, wholly intent on trade and agriculture (Strabo, xvi. 4), they might have long been a bulwark between Rome and the wild hordes of the desert but for the short-sighted cupidity of Trajan, who reduced Petra and broke up the Nabataean nationality (A.D. 105). (*See* SEMITIC LANGUAGES.) (W. R. S.; S. A. C.)

**NABBES, THOMAS** (b. 1605), English dramatist, was born in humble circumstances in Worcestershire. He entered Exeter College, Oxford, in 1621, but left the university without taking a degree, and about 1630 began a career in London as a dramatist.

Nabbes's plays were collected in 1639; and *Microcosmus* was printed in Dodsley's *Old Plays* (1744). All his works, with the exception of his continuation of Knolles's history, were reprinted by A. H. Bullen in his *Old English Plays* (second series, 1887). *See* also F. G. Fleay, *Biog. Chron. of the English Drama* (1891).

**NABHA,** an Indian state, within the Punjab. Area 947 sq.mi. Pop. (1941) 340,044. Its territories are scattered; one section with twelve separate tracts, lies among the territories of Patiala and Jind, in the east and south of the Punjab; the other section is in the extreme southeast. Nabha is one of the Sikh states, founded by a member of the Phulkian family, which established its independence about 1763. In 1807–1808, the raja obtained British protection against threatened encroachments of Ranjit Singh. During the Mutiny in 1857 the raja showed distinguished loyalty, and was rewarded by grants of territory to the value of over £10,000. The state also did good service during World War I. The ruler in 1944 was Maharaja Pratap Singh Malvendra Bahadur (born 1919), who succeeded in 1928. He has a salute of 13 guns. The average revenue is £212,000.

The town of Nabha, founded in 1755, has a station on the North-Western railway. Population (1941) 12,704.

**NÁBIGHA DHUBYÁNÍ** [Ziyād ibn Mu'awīyya] (6th and 7th centuries), Arabian poet, was one of the last pre-Islamic poets.

He lived at the courts of Hira and Ghassān. In Hira he remained under Mondhir (Mundhir) III., and his successor. After a sojourn at the court of Ghassān, he returned to Hira under Nu'mān. He was compelled to flee to Ghassān, but returned again about 600. About 605 he withdrew to his own tribe. The date of his death is uncertain. He wrote mainly eulogies and satires concerned with the strife of Hira and Ghassān, and of the Bani Abs and the Bani Dhubyān. He is one of the six pre-Islamic poets whose poems were collected before the middle of the 2nd century of Islam.

His poems have been edited by W. Ahlwardt in the *Diwans of the six ancient Arabic Poets* (London, 1870), and separately by H. Derenbourg (Paris, 1869, a reprint from the *Journal asiatique* for 1868). (G. W. T.)

**NABIS,** tyrant of Sparta, seized the throne after Sparta's heavy defeat by the Achaean League in 207 B.C. He seems to have put into practice the "four points" of the revolutionary programme of the day, abolition of debt, division of land, confiscation of personal property and liberation of slaves, though he does not appear to have tackled the Helot problem very completely. Whether he was the monster of cruelty represented by Polybius it is difficult to say. No revolutionary leader gets fair play from contemporary historians as a rule, and few revolutionary leaders can afford very gentle measures. In any case, he carried out more thoroughly the aims of Agis and Cleomenes, and extended his system to Argos, which was put into his hands by Philip V. in 198. The Achaeans under Philopoemen first attacked him in 201, and defeated him at Scotitas. Later in 195 B.C. after the conclusion of the war with Philip the Romans under Flamininus turned their attention to the affairs of Greece. The League was unanimous for war against Nabis, and Flamininus duly undertook it. Nabis organized a vigorous defence, and raised an army of 10,000 from Sparta with the help of the enfranchised Helots. After some desultory fighting and a good deal of negotiation, Nabis obtained peace at the price of losing Argos and some harbours, and the internal affairs of Sparta were left undisturbed. As soon as the Romans had gone Nabis was embroiled with the Achaeans again. He was eventually murdered by some Aetolian auxiliaries, and Philopoemen ruthlessly suppressed one of the few whole-hearted attempts at social revolution in Greek history.

*See* Plutarch, *Philopoemen;* Polyb. xiii.–xx.; Paus. iv. viii.; Liv. 31–35; W. W. Tarn, in *The Hellenistic Age* (Cambridge, 1923), and *Hellenistic Civilization* (1927).

**NABOB,** a corruption of word *nawab,* a native Indian ruler. In the 18th century, it was sarcastically applied to Anglo-Indians who returned with fortunes from the East.

**NABUA,** a municipality (with administrative centre and 17 *barrios* or districts) in the extreme south of the province of Camarines Sur, Luzon, Philippine Islands, on the Bikol river, a short distance north of Lake Bato. Pop. (1939) 29,433; one was white. The surrounding country produces palay (rice), maize (corn), sugar and pepper. The town is reached by road from Iriga on the railway. Bikol is the vernacular. Of the inhabitants aged 6 to 19 inclusive, 31·2% in 1939 attended school; 49·2% of the population 10 years old and over was literate.

**NACHTIGAL, GUSTAV** (1834–1885), German explorer in Central Africa, son of a Lutheran pastor, was born at Eichstedt in the Mark of Brandenburg, on Feb. 23, 1834. After studying medicine at the universities of Halle, Würzburg and Greifswald he practised for some years as a military surgeon. He went to Algiers and Tunis in search of health, and took part, as a surgeon, in several expeditions into the interior. The king of Prussia sent him on a mission to the sultan of Bornu in 1869. He visited Tibesti and Borku, regions of the central Sahara then unknown to Europeans. From Bornu he went to Bagirmi, and, proceeding by way of Wadai and Kordofan, arrived at Khartum in the winter of 1874. His journey, graphically described in his *Sahara und Sudan* (3 vols., 1879–89), placed the intrepid explorer in the front rank of discoverers. Nachtigal was consul-general for the German empire at Tunis until 1884, when he was sent by Bismarck to West Africa as special commissioner, ostensibly to enquire into the condition of German commerce, but really to annex territories to the German flag. As the result of his mission Togoland and Cameroon were added to the German empire. On his return voyage he died at sea off Cape Palmas on April 20, 1885.

Nachtigal's travels are summarized in *Gustav Nachtigal's Reisen in der Sahara und im Sudan,* by Dr. Albert Frankel (Leipzig, 1887).

**NADEN, CONSTANCE CAROLINE WOODHILL** (1858–1889), English author, was born at Edgbaston, Birmingham, on Jan. 24, 1858, her father being an architect. In 1881 she published *Songs and Sonnets of Springtime;* in 1887, *A Modern Apostle, and other Poems.* W. E. Gladstone included her, in an article in the *Speaker,* among the foremost English poetesses of the day. She died on Dec. 23, 1889. After 1876 she had paid increasing attention to philosophy, with her friend Dr. Robert Lewins, and the two had formulated a system of their own, which they called "Hylo-Idealism." Her main ideas on the subject are contained in a posthumous volume of her essays (*Induction and Deduction,* 1890), edited by Dr. Lewins.

**NADIA,** a district of British India, in the Presidency division of Bengal. Area, 2,879 sq.mi.; pop. (1941) 1,759,846. Standing at the head of the Gangetic delta, Nadia is an alluvial plain, the level of which has been raised by deposits of silt, so that it is subject to inundation only in years of high flood. Along the north-eastern boundary flows the main stream of the Ganges or Padma, of which the remaining rivers of the district are offshoots. The Bhagirathi on the eastern border, and the Jalangi and the Matabhanga meandering through the centre of the district, are the chief of those offshoots, called distinctively the "Nadia rivers." In former times the Nadia rivers afforded a regular means of communication between the Ganges and the seaboard; but the levels of the river beds have risen and, except in the rains, the rivers have diminished into shallow streams. The land no longer receiving a fertilizing deposit of silt, the productiveness of the soil has been reduced; this, with obstructed drainage and consequent epidemics of fever, has caused a gradual loss of population. Rice is the staple crop; but the district is not as a whole fertile, the soil being sandy. The manufacture of molasses from the juice of date palms is the principal industry.

The headquarters of the district are at Krishnagar (pop. 24,284), which contains the residence of the Maharajah of Nadia.

NADIA or NABADWIP was formerly situated on the east bank of the Bhagirathi, which has since changed its course. Population, 19,000. It is celebrated for its capture by the Mohammedans in the 12th century, for the sanctity and learning of its pundits, and as the birthplace of Chaitanya, the Vaishnava reformer.

**NADIR,** a term used in astronomy for the point in the heavens exactly opposite to the zenith, the zenith and nadir being the two poles of the horizon; that is, the zenith is directly overhead, the nadir directly under foot. It is also used figuratively of the lowest point in a career.

**NADIR SHAH GHAZI, MOHAMMED** (1880–1933), King of Afghanistan, born Apr. 10, 1880. After abdication of Amanullah (*q.v.*) in 1929, Nadir Shah defeated Habibullah, a brigand who had seized the throne, and became king. In 1933 he was assassinated. His son, Mohammed Zahir Shah, succeeded him.

**NAEGELI, KARL WILHELM VON** (1817–1891), Swiss botanist, was born on March 26, 1817, near Zürich. He studied botany under A. P. de Candolle at Geneva, graduated at Zürich in 1840, then devoted himself to the microscopical study of plants. Soon after graduation he became *Privatdozent* and subsequently professor extraordinary, in the University of Zürich. He was later called to fill the chair of botany in the universities of Freiburg (1852), and Munich (1858), where he died on May 10, 1891.

Naegeli made many important and varied discoveries. He extended Robert Brown's discovery of the nucleus to the principal families of Cryptogams and asserted that it is present in all plants. He investigated the "mucous layer" (*Schleimschicht*) in cells and showed this to be the living matter of the cell. This discovery was made independently and at the same time by Hugo von Mohl, who called the living substance "protoplasm." Naegeli also investigated the mode of growth in a large number of plants belonging to the algae, mosses, liverworts and angiosperms. He discovered the spermatozoids and antheridia of ferns. He also wrote papers on the anatomy of vascular plants and on the structure,

development and various forms of starch grains. In his last book he introduced the idea of a substance which he called "idioplasm" as the definite material basis of heredity.

Among his more important contributions to science were a series of papers in the *Zeitschrift für wissenschaftliche Botanik* (1844–46); *Die neuern Algensysteme* (1847); *Gattungen einzelliger Algen* (1849); *Pflanzenphysiologische Untersuchungen* (1855–58), with C. E. Cramer; *Beiträge zur wissenschaftlichen Botanik* (1858–68); a number of papers contributed to the Royal Bavarian academy of sciences, forming three volumes of *Botanische Mitteilungen* (1861–81); and, finally, his volume, *Mechanisch-physiologische Theorie der Abstammungslehre,* published in 1884.

Biographies of Naegeli are to be found in *Nature,* Oct. 16, 1891, and in *Proc. Roy. Soc.,* vol. li; see also C.-Ed. Cramer, *Leben und Wirken von Carl von Naegeli* (1896).

**NAEVIUS, GNAEUS** (*c.* 264–? 194 B.C.), Latin epic poet and dramatist. From a phrase in Gellius (i. 24. 1.) it has been inferred that he was born in a colony in Campania, but it seems just as probable that he was a Roman citizen. He served in the First Punic War. His career as a dramatic author began with the exhibition of a drama in or about the year 235, and continued for 30 years. Towards the close he incurred the hostility of some of the nobility, especially, it is said, of the Metelli, by the attacks which he made upon them on the stage, and at their instance he was imprisoned (Plautus, *Mil. Glor.* 211). After writing two plays during his imprisonment, in which he is said to have apologized for his former rudeness (Gellius iii. 3. 15), he was liberated through the interference of the tribunes of the commons; but he had shortly afterwards to retire from Rome (in or about 204) to Utica. His epic may have been written during his exile. Probably his latest composition was the epitaph already referred to, written like the epic in Saturnian verse:—

"Immortales mortales si foret fas flere,
Flerent divae Camenae Naevium poetam;
Itaque postquam est Orci traditus thesauro
Obliti sunt Romai loquier lingua Latina"[1]

Like Livius, Naevius professed to adapt Greek tragedies and comedies to the Roman stage. Among the titles of his tragedies are *Aegisthus, Lycurgus, Andromache* or *Hector Proficiscens, Equus Trojanus,* the last named being performed at the opening of Pompey's theatre (55). But he also produced at least two specimens of the *fabula praetexta* (national drama) one founded on the childhood of Romulus and Remus (*Lupus* or *Alimonium Romuli et Remi*), the other called *Clastidium,* which celebrated the victory of M. Claudius Marcellus over the Celts (222). But it was as a writer of comedy that he was most famous. He is placed in the canon of the grammarian Volcacius Sedigitus third (immediately after Caecilius and Plautus) in the rank of Roman comic authors. He is there characterized as ardent and impetuous in character and style. He is also appealed to as a master of his art in one of the prologues of Terence. His comedy, like that of Plautus, seems to have been rather a free adaptation of his originals than a rude copy of them, as those of Livius probably were, while the titles of most of them, like those of Plautus, are Latin. He used the stage, as it had been used at Athens, as a political arena, and his sympathies are strongly popular and anti-Senatorial. Among the few lines still remaining from his lost comedies, we seem to recognize the idiomatic force and rapidity of movement characteristic of the style of Plautus. There is also found that love of alliteration which is a marked feature in all the older Latin poets. In one considerable comic fragment attributed to him—the description of a coquette—there is great truth and shrewdness of observation. But we find no trace of the exuberant comic power and geniality of his great contemporary.

He was not only the oldest native dramatist, but the first author of an epic poem (*Bellum Punicum*)—which, by combining the representation of actual contemporary history with a mythical background, may be said to have created the Roman type of epic poetry. The earlier part of it treated of the mythical adventures of Aeneas, and the later part of the events of the First Punic War in the style of a metrical chronicle. This poem is the first appearance in Roman literature of the belief in the foundation of Rome by Aeneas. The few remaining fragments produce the impression of vivid and rapid narrative, to which the flow of the native Saturnian verse, in contradistinction to the weighty and complex structure of the hexameter, was naturally adapted.

[1]"If it were permitted that immortals should weep for mortals, the divine Camenae would weep for Naevius the poet; for since he hath passed into the treasure-house of death men have forgotten at Rome how to speak in the Latin tongue."

Fragments (dramas) in L. Müller, *Livi Andronici et Cn. Naevi Fabularum Reliquiae* (1885), and (*Bellum Punicum*) in his edition of Ennius (1884); monographs by E. Klussmann (1843); M. J. Berchem (1861); D. de Moor (1877); F. Marx, *Naevius* (Leipzig, 1911); Mommsen, *History of Rome,* bk. iii., ch. 14. On Virgil's indebtedness to Naevius and Ennius, *see* V. Crivellari, *Quae praecipue hausit Vergilius ex Naevio et Ennio* (1889).

**NAEVUS,** in medicine, a non-malignant tumour composed of newly-formed blood channels. Three varieties, capillary, venous, and arterial, are described, but the walls of the blood channels differ widely in their microscopic appearances from the corresponding normal vessels. The capillary naevus consists of tortuous small channels, often with relatively thick walls; it may be slightly raised above the surface of the skin (and then bleeds readily on slight injury) or flat and purple in colour, when it constitutes the "port-wine stain" or "mother's mark." The venous naevus consists of large irregular channels with very thin walls and is usually found in the subcutaneous tissue or the liver. Capillary and venous naevi are common on the face and may extend in size rapidly. The arterial naevus is rare; it pulsates and the channels may be emptied by pressure. Most naevi are so small as to call for no special treatment; if they take on growth or are initially so large as to cause disfigurement they may be treated by electro-puncture or by application of radium or carbonic-acid snow. The object desired is coagulation of the contained blood and replacement of the tumour by scar tissue. In the case of a large naevus, especially if venous, treatment may take weeks but great cosmetic improvement is usually possible.

**NAGA,** a municipality (with administrative centre and 11 *barrios* or districts), capital of the province of Camarines Sur, Luzon, Philippine Islands, a short distance south of San Miguel bay, on the Bikol river. Pop. (1939) 22,505; 74 were white. As early as 1573 Juan de Salcedo reached the vicinity and shortly afterward, by order of Gov. Francisco de Sande, the town of Nueva Cáceres was founded on or near the site of the native settlement which had existed there long before. The new town became the capital of Camarines province which, in 1919 was divided into Camarines Norte and Camarines Sur, Naga becoming the latter's capital. It is on the railway from Manila to the southeast and is reached on the river by small steamers from Manila and elsewhere. The surrounding region is fertile, and there are various household industries.

Bikol is the vernacular. Of the inhabitants aged 6 to 19 inclusive, 46·5% in 1939 attended school, while 63·8% of the population 10 years old and over was literate.

**NAGA HILLS,** a district of British India in the Surma Valley and Hill Districts division of Assam. It forms part of the mountainous borderland lying between the Brahmaputra valley and Upper Burma. Area, 4,289 sq.mi.; pop. (1941) 189,641. The whole country forms a wild expanse of forest, mountain and stream: Japvo (9,890 ft.), south of Kohima, is the highest mountain in Assam. Coal is known to exist in many localities, as well as iron ore and petroleum; a coal mine is worked by the Nazira Coal Company. The administrative headquarters of the district are at Kohima, at which is stationed a battalion of the Assam Rifles. When the British first came into contact with them, the Nagas were blood thirsty savages with a passion for head-hunting. The necessity of protecting British subjects from their ferocious raids led to punitive expeditions and the gradual occupation of the hills. A frontier district was first formed in 1866; the twelfth and last expedition came to a successful issue in 1880, after which it was decided that the Naga Hills should be administered as British territory. In 1904 some territory of the eastern Angamis, the most warlike tribe, was annexed, and during the operations of 1917–19 against the Kukis of Manipur a further tract was occupied, bringing the boundary up to Burma, north of Manipur. Since 1880 the Nagas have given no serious trouble and have been pacified and to some extent civilized. (X.)

**The Nagas.**—This name is used for a group of tribes inhabiting the northern part of the hills dividing Assam from Burma. Within the group are tribes of mixed origin, varying cultures, and very different physique and appearance, but having enough in common to make it generally possible to say, within the area indicated, whether a given tribe is Naga (as distinct from Kachin, Kuki, Kachari, etc.) or not.

Every sort of political organization is found from the autocracy of tabued chiefs (Konyak tribes) though gerontocracy (Ao tribe) to purest democracy (Angami tribe). Socially patrilineal exogamy is everywhere the rule, but there are indications of the pre-existence of matrilineal and perhaps totemistic systems and of leviritical polyandry. Dual organization (*q.v.*) is found and communal houses for the unmarried. Some tribes (*e.g.*, Sema, Chang) practice polygyny; monogamy is more common, divorce being easy and frequent. Inheritance of land always passes in the male line.

Agriculture is practised by all tribes, some growing rice on elaborately built up and irrigated terraces (Angami, Tangkhul), others growing it dry, and others using millet, *Coix lachryma* or taro as the staple crop, with maize, sorghum, yams and sago as subsidiary. Millet is often grown on dry terraces among pollarded alders; cotton is grown, cattle are kept and numbers of mithun (*bos frontalis*), which has generally but not everywhere displaced the buffalo. Dogs are reared for food (*see* CYNOTHERAPY) as well as hunting. Fishing is practised, particularly with the use of intoxicants which kill or incapacitate the fish. Manufactures and the arts include weaving (on simple tension looms), dyeing, pot-making, blacksmith's work and rough wood-carving. Material culture shows many links with Indonesia and Melanesia, and the northern tribes make huge wooden xylophones, membraneless "drums" often suggestive of dug-out canoes with carved figure-heads, which are beaten to raise an alarm or celebrate important events. The prevailing weapon is the throwing-spear, but cross-bows are used by some tribes, also guns. Music and dancing are most highly developed in the southern tribes, but are everywhere popular. The languages, which belong to the Tibeto-Burmese family, are diverse and excessively numerous, nearly every village having its own dialect. All dialects are tonal and agglutinative.

*See* Mills, *The Ao Nagas* (1926, bibl.). (J. H. H.)

**NAGASAKI,** a town on the south-west of the island of Kyushu, Japan, in 32° 44′ N., 129° 51′ E., with 252,630 (1940) inhabitants. The first port of entry for ships coming from the south or the west to Japan, it lies at the head of a beautiful inlet some 3 mi. long, which forms a splendid anchorage, and is largely used by ships coming to coal and by warships. The most important industries of the town are represented by the engine works of Aka-no-ura, three large docks and a patent slip, the property of the Mitsubishi Company.

Nagasaki is a noted shipbuilding port and coaling station. The coal is obtained chiefly from Takashima, an islet 8 mi. S.E. of the entrance to the harbour, and in lesser quantities from two other islets, Naka-no-shima and Ha-shima, which lie about 1 mi. farther out.

Nagasaki owed its earliest importance to foreign intercourse. Originally called Fukae-no-ura (Fukae Bay), it was included in the fief of Nagasaki Kotaro in the 12th century, and from him it took its name. But it remained an insignificant village until the 16th century, when, becoming the headquarters of Japanese Christianity, and subsequently the sole emporium of foreign trade in the hands of the Dutch and the Chinese, it developed considerable prosperity. The opening of the port of Moji (*q.v.*) deprived Nagasaki of its monopoly as a coaling station and in general diminished its importance in foreign trade, since the industrial portions of Kyushu are nearer to Moji and Shimonoseki.

**NAGAUR,** a town in India, in Jodhpur state of Rajputana. Pop. (1941) 14,714. Nagaur is surrounded by a wall more than 4 mi. in circuit. It has given its name to a famous breed of cattle.

**NAGINA,** a town of British India, in Bijnor district of the United Provinces, 48 mi. N.W. of Moradabad. Pop. (1941) 26,077. There is considerable trade in sugar, besides manufactures of guns, glassware (especially bottles for the use of pilgrims carrying the sacred water of the Ganges from Hardwar) and ebony wares.

**NAGOYA,** the capital of the province of Owari, Japan, on the great trunk railway of Japan, 235 mi. from Tokyo and 94 mi. from Kioto. Pop. (1940) 1,328,084. It is the third of the chief cities in Japan. It lies near the head of the shallow Isenumi bay, about 30 mi. from the port of Yokkaichi, with which it communicates by light-draught steamers and by rail. The castle of Nagoya, erected in 1610, never suffered in war, but in modern times became a military depôt; the interior contains much splendid decoration. The religious buildings of Nagoya include a very fine Buddhist temple, Higashi Hongwanji. Nagoya is one of the great seats of the pottery trade; 13½ mi. distant are the potteries of Seto, where the first glazed pottery made in Japan was produced by Kato Shirozaemon, after a visit to China in 1229.

Nagoya is an important weaving and spinning centre, but in recent years the relative importance of its textiles has declined, and by 1940 it ranked only below Tokyo and Osaka as an industrial centre, manufacturing light and heavy machinery, including aircraft engines.

**NAGPUR,** a city, district and division of British India in the Central Provinces, of which it is the capital. The old capital of the Bhonsla dynasty has expanded out of all recognition between 1852, when it came under British rule, and the present day. Its population, 84,000 in 1872, had expanded to 301,957 at the census of 1941. From being the terminus of a branch line it has become an important railway centre, nearly half way between Bombay and Calcutta and on the new north and south railway route between Madras and Delhi. It is also connected by a 2 ft. 6 in. gauge railway with Chindwara and Chanda. It is the commercial, as well as the administrative capital of the Province and the centre of education, being the seat of the university and the headquarters of both the Anglican and Roman Catholic dioceses and of important Protestant missions.

The whole area is dominated by the hill and fort of Sitabaldi, overlooking the civil station on the west, the city proper on the east and north, and the suburbs of Sitabaldi and Craddock Town to the south. This hill is the scene of the famous battle of Nov. 1817 where a small British force of less than 1,500 strong repulsed the Mahratta army of 20,000. The only regular troops in Nagpur now are those stationed in this fort, but it is the headquarters of the auxiliary force. Besides the mills, there is an important hand-weaving industry carried on by Koshtis, producing fine fabrics and silk-bordered cloths. There is also a large community of Momins or Mohammedan weavers.

The DISTRICT OF NAGPUR has an area of 3,836 square miles and a population of (1941) 1,059,989 as compared with 630,346 in 1872. It contains in all 12 towns and is situated on an extension of the Berar plain eastwards of the Wardha river. In the western portion Deccan trap overlies sandstone formation. In the eastern portion the sandstone is broken up by granite and the juxtaposition of these formations, which meet at Sitabaldi, makes the geology of the district interesting. In the north and north-east there are valuable deposits of manganese ore which are worked by three large companies and several individual concessionaires. The sacred hill of Ramtek in the north-east, with its gleaming white temples, is a landmark for miles around. The drainage of the east is to the Wainganga in Bhandara, and of the west to the Wunna and Wardha rivers. The plain is broken up in the west by ranges of flat-topped hills, but there are many plains, fertile valleys and pockets of rich land.

Agriculture is varied, Kunbis being the great cultivating Mahratta caste, but Raghvis and Kirars, immigrants from Upper India, are also excellent cultivators. To the west the cropping is mainly cotton and *juar,* in the centre and south wheat, linseed, and pulses are the chief staples. On the north-east and south-east there is a considerable area of rice. There are fine betel leaf plantations and the district is famous for its orange gardens. Government forests cover 500 square miles, mostly concentrated in the reserves along the Pench river on the north, but isolated blocks of not much value are scattered over the rest of the district.

**NAGYKANIZSA** (nŏd'ĭ-kăn-ĭts'ah), a town of west Hungary, county Zala, a railway junction and agricultural market town. It has large flour-mills, distilleries, breweries and vegetable-preserving works, manufactures bricks and trades in cereals and cattle. It was once a powerful fortress, important during the attacks of the Turks who held it 1600–90. Pop. (1930) 34,217.

**NAGYSZOMBAT:** *see* TRNAVA.

**NAHUATL.** The Nahua or Nahuatl language was that spoken in and about Anahuac—the high valley of Mexico. It forms, with Shoshonean and Piman, the Uto-Aztecan speech family. The centre of the Nahuan peoples was on the south-east end of the great central mesa of Mexico, where the Toltecs were the most important prehistoric and the Aztecs the best known historic representatives. Nahuan groups also extended southward into Morelos and Guerrero, eastward along the coast to Colima, and northward again into Jalisco, where they abutted on Piman-Sonoran peoples. Except at this point, the related Piman and Nahuan groups were not in contact, but were separated by the alien Tarasca and Otomi. South-east of Mexico and Puebla, the Atlantic lowlands from Vera Cruz to Tabasco were Nahuan; here were the Olmecs and others, north of the Zapotec and Mixe-Zoque, and bordering in the east on Mayan peoples. The Nahua territory is continuous thus far. Beyond, there were detached areas in Chiapas, Guatemala, San Salvador, Nicaragua, and even Panama. These represented dispersal migrations, some early, some later. Nahuan speech seems to have been fairly uniform, but was further standardized to the dominant Aztec by Spanish influence. It is still the mother tongue of over half a million Mexican Indians, while probably as many more, and many whites, are partially acquainted with it. Through the Toltecs and Aztecs, the Nahuan peoples share with the Maya the distinction of having been the bearers of highest culture in aboriginal America.

**NAHUM** (Hebrew for "rich in comfort [is God]"), an Old Testament Prophet. Of the Prophet himself, all that is known is the statement of the title that he was an Alkoshite. But the locality denoted by the designation is quite uncertain. The original heading of Nahum's prophecy is contained in the second part of the superscription: "(the book of) the vision of Nahum the Alkoshite." The first part ("Oracle concerning Nineveh") is a late editorial insertion, but correctly describes the main contents of the little book.

**Contents.**—Chapters i. and ii. The prophecy against Nineveh in its present form really begins with chapter ii. 1, followed immediately by v. 3, and readily falls into three parts, viz. (*a*) ii. 1, 3–10; (*b*) ii. 11–13; and (*c*) iii. Here (*a*) describes the assault on Nineveh. The city is mentioned by name in ii. 8 (9 Heb. text), its capture and sack; (*b*) contains an oracle of Yahweh directed against the king of Assyria; (*c*) again gives a vivid picture of war and desolation which are to overtake and humiliate Nineveh, as they have already overtaken No-Amon (*i.e.*, Egyptian Thebes, vv. 8–10). The absence of distinctly religious motive is remarkable.

Chapter i. forms the exordium of the prophecy of doom against Nineveh. Its tone is exalted, and a fine picture is given of Yahweh appearing in judgment: The effects of the divine anger on the physical universe are forcibly described (vv. 3–6); on the other hand, God cares for those "that put their trust in Him" (v. 7), but overwhelms His enemies (vv. 8–12*a*). In the following verses (12*b*–15) the joyful news is conveyed to Judah of the fall of the oppressor.

Regarding Chapter i. and ii. 2 (=i. and ii. 1, 3, Heb. Text) there has been much discussion in recent years. It was long ago noticed that traces of an alphabetic acrostic survive in this section of the book. In vv. 12*b*, 13 and (certainly) v. 15 (=ii. 1 Heb.) Judah appears to be addressed. The text of i. 1–15, ii. 1–2 has been reconstructed by H. Gunkel and G. Bickell so as to form a complete alphabetic psalm with contents of an eschatological character, and is regarded by them as a later addition to the book. It is generally held by scholars that i. 1–8, 13, 15, and ii. 2 certainly do not proceed from Nahum (i. 9–12 may, however, belong to the prophet). No satisfactory solution has been reached.

**Date.**—The date of the composition of Nahum's prophecy must lie between 612, when Nineveh was captured and destroyed by the Babylonians and Medes, and the capture of Thebes (No-Amon), which is alluded to in iii. 8–10, in 663 B.C. On the whole a date somewhat near 612 is more probable. The poetry of the book is of a high order.

BIBLIOGRAPHY.—The *Commentaries* on the Minor Prophets, especially those of J. Wellhausen, D. W. Nowack and K. Marti (all German); G. A. Smith, *The Book of the Twelve Prophets* (2 vols.); A. B. Davidson, *Nahum, Habakkuk and Zephaniah* (Camb. Bible, 1896).

(G. H. B.)

**NAIADS,** in Greek mythology the nymphs of wells, mountains and the sea, taking their name from the sphere of nature they represented. *See* NYMPHS.

**NAIDU, SAROJINI** (1879– ), Indian poet and feminist leader, eldest child of Dr. Aghorenath Chattopadhyay, a noted Bengali Brahman educationist and principal of the Nizam's college, Hyderabad, was born there on Feb. 13, 1879. Passing the matriculation examination of the Madras university at 12 she began writing English verse in her early teens. Sent to England in 1895 she studied at King's college, London, and Girton college, Cambridge. Her first volume of verse, "The Golden Threshold," was sponsored by Arthur Symons, and the second, "The Bird of Time," by Edmund Gosse. "The Broken Wing" followed. These volumes have been translated into most of the Indian vernaculars and some into Continental languages, while portions of her verse have been set to music. Her marriage in 1898 to Dr. M. G. Naidu, a Rajput in the Nizam's service, caused some sensation and resentment in orthodox Hindu circles. Her address at the all-India Social Conference at Calcutta in 1905 marked the beginning of an active career as a most eloquent speaker on social and political questions, and as a leader in the women's movement in India. She gained the enthusiastic admiration of Indian students by her sympathy with their outlook and her power of thrilling presentation. She had some share in the militant women's suffrage movement in England before the World War, and this experience tended in later years to draw her to Gandhi's non-cooperation movement. A tour in South Africa in 1924, on behalf of the Indian settlers there, deepened her strong criticism of British rule in her own land. In 1925 she was the first Indian woman to preside over the annual Indian National Congress at Cawnpore. Her acute mental equipment was linked with a certain attractive mischievousness, but her eloquence was inspired and deepened by a strong burning patriotism. In 1928 she visited England and America, to lecture upon Indian affairs. (F. H. BR.)

**NAIK** or **NAYAK,** from a Sanskrit word meaning a leader, a title used in India in various senses. In the army it denotes a rank corresponding to that of corporal, and Hyder Ali of Mysore was proud of being called Haidar Naik, analogous to "le petit caporal" for Napoleon. It was also the title of the petty dynasties that arose in S. India on the downfall of the Hindu empire of Vijayanagar in the 16th century.

**NAIL MANUFACTURE.** Iron nails were commonly in use during the Roman occupation of Britain, large numbers having been found in places where they were wrought by the Romans. There is a striking similarity between the forged Roman nail (fig. 1) and the type of nail which is manufactured at the present time. The forging of nails was an industry of some importance in Great Britain up to the end of the 17th century, and only gave way before the advent of machinery and the cut and machine-headed nail. During the year 1927, 20,000 tons of wire nails were manufactured in Great Britain, whilst another 60,000 tons were imported.

**Wire Nails.**—The use of wire for nail making has completely revolutionized the method of manufacture; nails made from drawn wire are produced so cheaply that they can be purchased at almost the same price as the wire from which they are made. Cut nails, sheared from plates or flat stock, are produced, but the quantities in which these nails are used are so small, compared to the production of round wire nails, that cut nails are now negligible items.

Catalogues of prominent nail manufacturers show nearly 100 different types of nails or fasteners made of round wire, but the

number of items, by gauges and sizes, run over 400. Figure 1 shows many common types of wire nails, (*a*) common nail, (*b*) barbed car nail, (*c*) finishing nail, (*d*) clinch nail, (*e*) slating nail, (*f*) countersunk head, (*g*) double-head form nail, (*h*) flooring brad, (*i*) broom nail, (*j*) roofing nail, (*k*) fine nail.

Screw type (*m*) nails have been developed and are used to some extent, principally as roofing nails. This type of nail tends to drive more easily, rotates as it enters the wood and retains greater holding power than does a similar nail of round wire. One method in common use for the manufacture of this type of nail is to produce it as a round wire nail and then pass the nail between two rolls and roll into the shank four or five spiral flutes. Another type of nail, developed to increase holding power, has annular serrations or saw-tooth ridges around the shank that are designed to bite into the grain of the wood when forces tend to withdraw the nail. This particular type of nail is used to some extent for fastening composition type shingles and siding.

Forming wire nails is a typical cold heading operation. Stresses and pressures in various parts of the nail machine are great and nail machines are relatively massive. There are principally four component parts in a nail machine; a hammer mounted in a cross-head to which is imparted reciprocating motion through a connecting-rod and a crankshaft, a set of cam-actuated slides which hold case-hardened tools that form the point and cut the nail after it is headed, another set of cam-actuated slides which hold the dies that grip the round wire and act as an anvil for the hammer forming the head, and a reciprocating feed table which straightens the wire as it unwinds from the coil and feeds through the heading dies the proper amount of wire stock for the nail. In operation, the feed table straightens and forces wire through the header dies in sufficient amount to provide stock for the head, the header

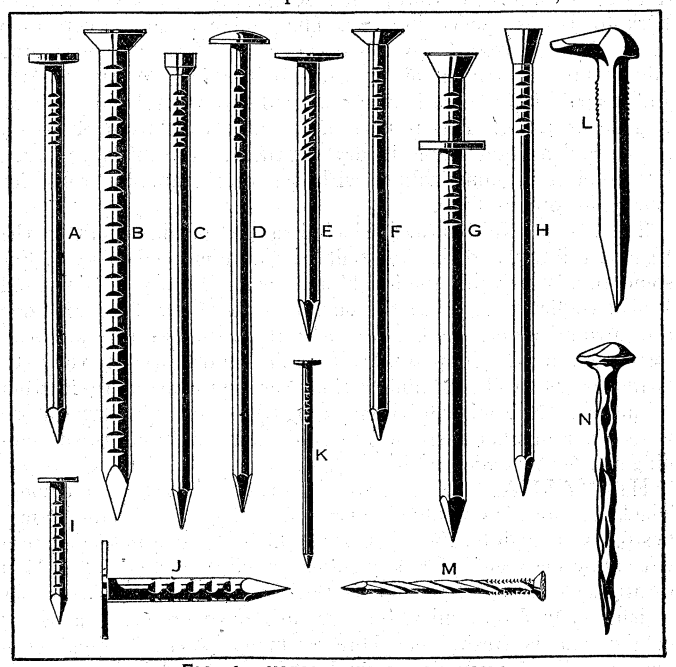



FIG. 1.—VARIOUS KINDS OF NAILS
(A) Common, (B) barbed car, (C) finishing, (D) clinch, (E) slating, (F) countersunk, (G) double-head form, (H) flooring brad, (I) broom, (J) roofing, (K) fine nail, (L) dog spike, (M) screw nail, (N) Roman

dies then grip the wire and the hammer moves forward to form the head. During the forward travel of the hammer, the feed table is retracted, ready to feed material into the machine for the next nail. After the head is formed, the hammer is withdrawn and the feed table moves forward with wire for another nail. After the feed table has completed its forward travel and the header dies have gripped the wire, the cutting and pointing tools move together, form the point and cut off the nail and the cycle is repeated, for each nail, at every revolution of the crankshaft.

Nail machines operate at speeds varying from 150 12″ spikes to over 600 cigar-box nails per minute. After nails are "cut," they are placed in rumblers, with a small amount of sawdust, and rumbled 15 or 20 minutes to remove "whiskers" and be polished and are then dumped into kegs for shipment.

**Staples.**—As staples are a form of nail, their manufacture is usually carried on with that of nails. They are made both from bright and galvanized wire, and in all kinds of sizes. The three different forms of points on staples are illustrated (fig. 2), the names themselves indicating the difference in the style of point. The term "presser point" simply means that the point is so sharp and fine that the staple can be stuck into the wood by simple pressure previous to being hammered down.

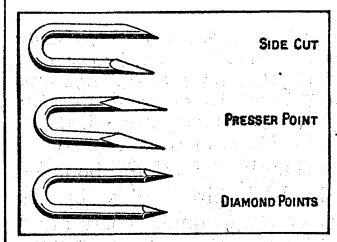



FIG. 2.—FENCING STAPLES
The points are selected according to the kinds of wood used

The several types of machines used in the making of staples follow the same principle as in the making of the straight nail, the wire being automatically fed forward from the swift, and the operation of cutting and pointing being immediately followed by the bending of the wire into its required shape to form the staple.

(R. M. Hu.)

**NAIL VIOLIN,** a musical curiosity invented by Johann Wilde, a musician in the imperial orchestra at St. Petersburg. It consisted of a wooden soundboard about 1½ft. long and 1ft. wide, bent into a semicircle. In this soundboard were fixed a number of iron or brass nails of different lengths, tuned to give a chromatic scale, and the sound was produced by friction with a strong bow, strung with black horsehair.

**NAINI TAL,** a town and district of British India, in the Kumaon division of the United Provinces. The town is 6,400 ft. above sea level. Pop. (1941) 9,539. Naini Tal is a popular sanatorium for the residents in the plains, and the summer headquarters of the government of the province. It is situated on a lake, surrounded by high mountains, and is subject to landslides; a serious catastrophe of this kind occurred in September 1880. There are several European schools, besides barracks and convalescent depôt for European soldiers.

The DISTRICT OF NAINI TAL comprises the lower hills of Kumaon and the adjoining Tarai or submontane strip. Area, 2,627 sq.mi. Pop. (1941) 291,861. The district includes the Gagar and other foothills of the Himalayas, which reach an extreme height of nearly 9,000 ft. The Bhabar tract at their base consists of boulders from the mountains, among which the hill streams are swallowed up. Forests cover vast tracts of the hill-country and the Bhabar. Beyond this is the Tarai, moist and extremely unhealthful. Here the principal crops are rice and wheat. In the hills a small amount of tea is grown, and a considerable quantity of fruit.

**NAINSOOK,** a light and fine cotton fabric of the plain calico weave, and of texture similar to that of lawn and cambric. It is usually bleached and sometimes striped and checked and finished with a very soft feel for use as lingerie and underwear.

**NAIRN,** a royal and small burgh and the county town of Nairnshire, Scotland, on the Moray Firth, at the mouth of the Nairn, 15¼ mi. N.E. of Inverness by L.M.S.R. Pop. (est. 1938) 4,333. The town shows no signs of its great age. It attracts many summer visitors by its good sea bathing and golf course. Salmon and deep-sea fishing are carried on. There is a good harbour constructed by Telford in 1820. Nairn (originally Invernarne), was made a royal burgh by Alexander I (d. 1124); but his charter, having been lost, was confirmed by James VI in 1589.

**NAIRNE, CAROLINA,** BARONESS (1766–1845), Scottish song writer, was born in the "auld hoose" of Gask, Perthshire, on Aug. 16, 1766. She was descended from an old family settled in Perthshire in the 13th century, and could boast of kinship with the royal race of Scotland. Her father, Laurence Oliphant, was one of the foremost supporters of the Jacobite cause, and she was named Carolina in memory of Prince Charles Edward. In 1806 she married W. M. Nairne, who became Baron Nairne in the year 1824. She brought out a collection of national airs set to appropriate words. To this collection, *The Scottish Minstrel* (1821–24), she contributed a large number of original

songs, adopting the signature "B. B."—"Mrs. Bogan of Bogan." The music was edited by R. A. Smith. She died at Gask on Oct. 26, 1845. Among her most famous songs are: "The Laird o' Cockpen," "The Fife Laird," "John Tod," "Charlie is my darling," "Caller Herrin'" and the "Land o' the Leal." For vivacity, genuine pathos and bright wit her songs are surpassed only by those of Burns.

For Lady Nairne's songs, see *Lays from Strathearn, arranged with Symphonies and Accompaniments for the Pianoforte by Finlay Dun* (1846); vol. i. of the *Modern Scottish Minstrel* (1857); *Life and Songs of the Baroness Nairne, with a Memoir and Poems of Caroline Oliphant the Younger,* edited by Charles Rogers (1869, new ed. 1886). *See* also T. L. Kington-Oliphant, *Jacobite Lairds of Gask* (1870).

**NAIRNSHIRE,** a northeastern county of Scotland, bounded W. and S. by Inverness-shire, E. by Elginshire and N. by the Moray Firth. Land area 104,252 ac. or 162.9 sq.mi. There are 9 mi. of coast. It is the fourth smallest county in Scotland. The seaboard, skirted by sandbanks dangerous to navigation, is lined by low dunes extending into Elginshire. Traces of old marine terraces are seen at elevations of 100, 50 and 25 ft. above present sea level. Parallel with the coast there is a deposit of blown sand and gravel about 90 ft. high stretching inland for 4 or 5 mi. This and the undulating plain behind are a continuation westward of the fertile Laigh of Moray. The lowland rocks are Old Red Sandstone, widely covered with glacial deposits consisting of lower and upper boulder clays, with later gravels forming ridges on the moorland between the rivers Findhorn and Nairn. From this region southward the land rises rapidly to the confines of Inverness-shire, where the chief heights occur. This higher land consists of the eastern, Dalriadan, or younger Highland schists, with associated granite masses. Several border hills exceed 2,000 ft. in elevation. The only rivers of importance are the Findhorn and the Nairn, both rising in Inverness-shire. The Findhorn after it leaves that county takes a northeasterly direction down Strathdearn for 17 mi. and enters the sea to the north of Forres in Elginshire after a total course of 70 mi. The Nairn, shortly after issuing from Strathnairn, flows to the northeast for 12 mi. out of its complete course of 38 mi. and falls into the Moray Firth at the county town. There are eight lochs, all small: that of Clans contains crannogs, or ancient lake dwellings.

**History.**—The country was originally peopled by the Gaelic or northern Picts. Stone circles believed to have been raised by them are found at several places, particularly in the valley of the Nairn. To the north of Dulsie Bridge is a monolith called the Princess Stone. Mote hills and stones with cup markings are also common. Beyond the occasional finding of Roman coins, there is little evidence of effective Roman occupation. Columba and his successors made valiant efforts to Christianize the Picts, but it was long before their labours began to tell, although the saint's name was preserved late in the 19th century in the annual fair at Auldearn called "St. Colm's Market," while to his biographer Adamnan—corrupted into Evan or Wean—was dedicated the church at Cawdor, where an old Celtic bell also bears this name. By the 10th century the Picts had been subdued with the help of the Norsemen, and Nairn, which was one of the districts colonized by the Scandinavians, as part of the ancient province of Moray, soon became an integral portion of the kingdom of Scotland. Hardmuir, between Brodie and Nairn, is the heath where Macbeth is reputed to have met the witches. Territorially Moray was greatly contracted in the reign of David I, and thenceforward the history of Nairn merges in the main in that of the bishopric and earldom of Moray. (*See* ELGIN.) The thane of Cawdor was constable of the king's castle at Nairn, and when the heritable sheriffdom was established towards the close of the 14th century this office was also filled by the thane of the time.

**Industries.**—The soil of the alluvial plain, or Laigh, is light and porous and careful cultivation has rendered it very fertile, and there is some rich land on the Findhorn. Although advanced methods of agriculture are in use, but a small proportion of the surface is capable of tillage, and little more than one-fifth of the whole area was under crops in 1938, oats (5,869 ac.) and turnips and swedes (3,350 ac.) predominating. Of the 328 holdings nearly two-thirds were of 15 ac. or less. The hills are mostly covered with heath and pasture, suitable for sheep, and cattle are kept on the lower-lying ground. A little sandstone quarrying and the sea and salmon fisheries of the Nairn are the only industries of the shire. The L.M.S. railway from Forres to Inverness crosses the north of the shire.

**Population and Government.**—The population was estimated (1938) 8,303. In 1931 Gaelic and English were spoken by 410 persons. Nairn (est. 1938 pop. 4,333), the county town, is the only royal burgh and only small burgh. Nairn and Moray shires combine to return one member to parliament. There are no county districts. The shire forms a sheriffdom with Moray and a sheriff-substitute from Elgin sits also at Nairn.

**NAIROBI,** the capital of Kenya Colony, British East Africa, 330 mi. by railway from Mombasa. It is built on the Athi plains, at the foot of the Kikuyu hills and is 5,452 ft. above sea level. It commands magnificent views of Kilimanjaro and Mt. Kenya. Pop. (1935) estimated at 50,000, of whom about 5,500 were Europeans. Nairobi is the seat of the Kenya legislature and the headquarters of most of the European organizations in the colony. Nearly all the whites are British, and the town has most of the amenities of a European city. Both the standard and the cost of living are high. Laid out on a large scale, Nairobi has many fine private and public buildings, though still in a transitional stage (1929). The main thoroughfares are government road, where numbers of shops and offices are owned by Indians, and Sixth avenue. The churches include an Anglican cathedral. In Sixth avenue are a cenotaph to the European soldiers who fell in World War I and opposite it a striking memorial, three figures on a single base, to the African troops and carriers who fell in the war. The African memorial was erected in 1928. Parklands is a residential suburb for Europeans. A natural history museum, in Kirk road, was opened in 1922. The Indian bazaar covers nine acres. The natives occupy a separate location with some 20,000 inhabitants. A branch railway runs to the foot of Mt. Kenya, and from Nairobi there is a motor road to the navigable Nile at Nimule or Rejaf. This is part of a motor road from Rhodesia to the Sudan (practicable in dry weather). Nairobi is governed by an elected municipality, with separate franchise rolls for Europeans and Indians.

The site of Nairobi was selected as the headquarters of the Uganda railway, and the first buildings were erected in 1899. For some time nearly all its inhabitants were railway officials and Indian coolies engaged in the construction of the line. In 1902 the surrounding highlands were found to be suitable for European settlement and Nairobi speedily grew in importance; in 1907 the headquarters of the administration were transferred to it from Mombasa. Nairobi had then 350 white inhabitants; in 20 years their number increased tenfold. An ambitious town-planning scheme was adopted in 1927.

**NAIVASHA,** a lake, town and province, in Kenya colony. The lake, which is roughly circular with a diameter of some 13 mi., lies 6,135 ft. high on the crest of the highest ridge in the eastern rift-valley between the Kikuyu escarpment (east) and the Mau escarpment (west). It is fed by the rivers Gilgal and Morendat which run in deep gullies, but has no known outlet. The water of the lake is fresh; the shore in many places is lined with papyrus. North and northwest the lake is closed in by the volcanic Buru hills; to the south towers the extinct volcano of Longonot. Hippopotami and otters frequent the lake, and on an island about 1 mi. from the shore are large numbers of antelopes and other game. Naivasha was discovered in 1883 by Gustav Adolf Fischer (1848–86), and visited in the same year by Joseph Thomson, the Scottish explorer. The railway from Mombasa to Victoria Nyanza skirts the eastern side of the lake, and on the railway close to the lake is built the town of Naivasha, 6,230 ft. above the sea, 395 mi. N. by rail from Mombasa. Naivasha province contains much land suitable for colonization by white men, and large areas have been leased to Europeans. The land is specially suitable for cattle and sheep rearing.

**NAIYADIS.** The Naiyadis, or hunters, of Malabar are the dog eaters and the lowest of the Hindu castes. Miserable specimens of humanity, they used to be excellent shots but the Arms

Act deprived them of their weapons and they now manufacture ropes, slings, mats and so on, with occasional cultivation. They have succession in the male line and adultery is abhorrent to them. Some have been converted to Christianity and others to Islam, the latter maintain themselves by begging from Mohammedans. Their chief priest, Muppon, is hereditary. He enquires into all matters affecting the community and can excommunicate a guilty person.

**NAJARA, ISRAEL BEN MOSES,** Hebrew poet, was born in Damascus and wrote in the latter part of the 16th century (1587–1599). He was inspired by the mystical school, and his poems are marked by their bold, sensuous images, as well as by a depth of feeling unequalled among the Jewish writers of his age. He often adapted his verses to Arabic and Turkish melodies. To tunes which had been associated with light and even ribald themes, Najara wedded words which reveal an intensity of religious emotion which often takes a form indistinguishable from love poetry. Some pietist contemporaries condemned his work for this reason; but this did not prevent many of his poems from attaining wide popularity and from winning their way into the prayer-book.

He published during his lifetime a collection of his poems, *Songs of Israel* (*Zemiroth Israel*), in Safed in 1587; an enlarged edition appeared in Venice (1599–1600). Others of his poems were published at various times, and W. Bacher has described some previously unknown poems of Najara (*Revue des études juives,* Nos. 116 *seq.*).

**NAJIBABAD,** a town of British India, in the Bijnor district of the United Provinces. Pop. (1941) 26,898. It was founded in the middle of the 18th century by a Rohilla chief, and still contains several architectural monuments of Rohilla magnificence. There is considerable trade in timber, sugar and grain, and manufactures of metal-ware, shoes, blankets and cotton cloth.

**NAKHICHEVAN,** an autonomous republic of Russian Transcaucasia created in 1921, and linked administratively with the Azerbaijan S.S.R., from which it is, however, separated by a strip of Armenian territory. It is bordered on the south and south-west by Iran and on the north and east by the Armenian S.S.R. Area 2,085 sq.mi. Pop. 117,000 (1933). Though the republic is small, its relief is varied. In the south-west it consists of the valley on the left bank of the Araxes river, which here forms the boundary between Russia and Iran, and along the left bank of which goes the railway loop from Tiflis on the Black sea–Caspian line, which links Armenia and the south of Azerbaijan with Baku, and from which a branch line goes to Tabriz from Dzhulpha in the Nakhichevan republic. The republic thus forms a centre for trade between Russia and Iran. From the valley of the Araxes the Armenian or Transcaucasian plateau rises to a height of about 10,000 feet.

The industries of the region are mainly silk weaving, cotton cleaning and wine production. In 1926 of the 16 former silk factories in Ordubat only 6 were working. The numerous small cotton-cleaning enterprises were re-organised after the revolution into two large government factories which produce 16,000 tons of cotton per annum. The former brandy distilling industry has not revived. A jam factory is under construction at Ordubat which provides for an output of 800 tons per annum. Of the mineral wealth in the republic, salt, lead, sulphur, arsenic, copper, sulphur pyrites and coal, only salt is exploited. In 1926 about 37,000 tons of salt were produced as against 43,000 in 1913. Curative arsenical and sulphur springs have been known to the native shepherds for centuries.

The population consists chiefly of Armenians and Azerbaijan Turks, with some Russians in the towns of Nakhichevan (pop. 11,700) and Ordubat (pop. 3,665). The number of schools and teachers has markedly increased, and there are Turkish, Armenian and Russian schools, but many children still receive no education. Grants from the Central Government of the U.S.S.R. provided for the building of a school, hospital and electric station in the town of Nakhichevan, and a grant was also made for the repair and rebuilding of the small factories, and the irrigation canals, and the development of cotton, silk and salt production. The region was important at an early date because it lay on the route from Teheran and Tabriz to Caucasia. It was laid waste by the Persians in the 4th century, by the Seljuk Turks in the 11th century and by the Mongols in the 13th century. From that time until 1828, when by the peace of Turkman-chai it passed under Russian rule, it was a khanate vassal to Persia and was frequently devastated during the wars between Persia, Armenia, Turkey and Russia. Its importance for trade and its great fertility helped it to recover after each of these disasters and after the more recent 1917–20 period of disorder and struggle.

**NAKHICHEVAN,** a Russian town, the administrative centre of the Nakhichevan S.S.R. in 39° 14′ N., 45° 24′ E., on the Kishchai river and at the terminus of a short line linking it with the railway that runs north of the Araxes river and which is connected with Baku. The town is on a spur of the Karabagh mountains at an altitude of 2,940 ft. Pop. 11,700 (1933), mainly Tatars and Armenians. It has an electric plant, motor-driven flour mills and a leather factory. A little to the south-east of it, a branch railway goes to Tabriz. An ancient site on the Tiflis to Tabriz and Teheran road, the town had much transit trade, especially in salt, between Persia and the north in pre-railway days. Armenian tradition claims Noah as its founder, and a mound of earth as his grave. Ptolemy mentions it as Naxuana. The Persians sacked the town in the 4th century and it did not revive until the 10th century. Alp Arslan, Sultan of the Seljuk Turks, captured it in 1064 and the Mongols raided it in the 13th century. From this period onwards it was a bone of contention between Persians, Armenians and Turks. By the peace of Turkman-chai in 1828 it became Russian. The present houses have for the most part been quarried from ancient ruins. A gateway with a Persian inscription and the 12th century Tower of the Khans remain.

**NAKHICHEVAN-ON-THE-DON,** a town of the Russian S.F.S.R. in the North Caucasian Area on the right bank of the Don, in 47° 18′ N., 39° 45′ E., 6 mi. N.E. of Rostov-on-Don. Pop. 71,321. It shares in the trading prosperity of the latter town, and has smelting, rope and cloth works. It was founded in 1780 by Armenian immigrants, and their descendants still form a large percentage of the population along the banks of the Don.

**NAKSKOV,** a seaport of Denmark, in the *amt* (county) of Maribo, on a wide bay of the Laalands belt at the west end of the island of Laaland, 31 m. by rail W. of Nykjøbing. Pop. (1940) 15,096. A great dike, extending south-east to Rødby (20 m.), protects the coast against inundation. Nakskov possesses a fine harbour and shipyards, and one of the largest sugar factories in Europe.

**NAMAQUALAND,** a region of south-western Africa, extending along the west coast over 600 m. from Damaraland (22° 43′ S.) on the north to 31° S., and stretching inland 80 to 350 miles. It is divided by the lower course of the Orange river into two portions—Little Namaqualand to the south and Great Namaqualand to the north. Little Namaqualand forms part of Cape Colony (*see* CAPE PROVINCE), and Great Namaqualand is the southern portion of German South-West Africa (*q.v.*). The people of Namaqualand are the purest surviving type of Hottentots, and number some twenty to thirty thousand.

**NAMASUDRA,** "low Shudra," the largest caste in Eastern Bengal, India; the older Chandal now divided into several sub-castes. *En masse* it ranks low, but its agricultural sub-castes stand higher. Numbering 2,172,823 in 1921, it shows no tendency to decline.

**NAME.** The distinguishing appellation by which a person, place, thing or class of persons or things is known. (O.Eng. *nama;* the word is common to all Indo-European languages.)

(*a*). **Savage and Barbarian.**—To the savage, and in a lessening but still considerable degree, to the barbarian and the civilized man in his earlier stages, the name shares the essence of the personality. Therefore a savage has a personal name which is seldom or never pronounced, he being referred to in common parlance by some nick-name or by a term of relationship. Not infrequently, to avoid calling the attention of evil spirits to him a savage child is not named at all, being referred to simply as "the child," or he may be given some derogatory name, as "grub," "filth," to deceive hostile powers. Apart from this, we may often distinguish, firstly a birth-name. This is given by the

parents or by some relation, as a rule, and its choice is governed by various considerations. Thus, he may be named from some trifling incident at the time of birth, or from the state of affairs in the country at the time ("Famine" and "War" are known Basuto names); or he may be given a name signifying "child of such a one" (patronymic or matronymic); or frequently among peoples who believe in reincarnation, he may be named after some dead relative supposed to be reborn in him. Very often, at puberty, or on undergoing some ceremony of initiation, he is given a new name, which may be kept secret. Various ceremonies often attend the giving even of the childhood-name.

(*b*). **Civilized.**—Modern surnames include: those derived from a place-name, as Johnston (the *ton* or steading of John); these often occur among noble families, as Dumaresque (*de Mariscis,* "of the marshes"; a plebeian equivalent is Marsh); from an occupation, as Smith, Miller; nicknames, as Longfellow, Campbell ("crooked-lip"); and patronymics, as Dickenson (son of Dicken). The familiar Celtic names of the types Ap Rhys, Bowen (Ap Owain), O'Brian, MacFarlane, are of this kind, the surname proper being of later development among Celts than among Teutonic peoples.

**Roman Names.**—The earliest Italian and Roman names, consisted of a personal name (*praenomen*), as Marcus, followed by an adjective signifying the clan to which the person belonged (*nomen*), as Caecilius, "of the *gens Caecilia.*" All the *praenomina* had originally a meaning, as Gaius, "joyful." It is stated by the author of the little work *de praenominibus* that boys were never given a *praenomen* till they came of age, girls until they married. The latter statement is certainly wrong, since a woman never officially had a *praenomen* at all; the former is contradicted by most of the available evidence. It is possible, however, that a boy's name was not officially given him until he took the *toga virilis* or garb of manhood. Later, a third name was added, originally a personal name or nick-name, as *Pulcher,* "handsome." This was called a *cognomen,* and often became a family name, *i.e.,* one common to all the direct descendants of its original bearer, who formed a section of the clan or *gens.* A man might have any number of these *cognomina,* as Publius Cornelius Scipio Aemilianus Africanus, where Scipio is the *cognomen* of the family into which the bearer had been adopted, Aemilianus an adjective formed from the name of his original clan, the *gens Aemilia*—this was a common, although not invariable, method of indicating adoption—and Africanus an officially bestowed title. (*See* also PLACE-NAMES.)

**Law.**—The Christian name, *i.e.,* the name given to a person on admission to baptism into the Christian Church, dates back to the early history of the Church. In England individuals were for long distinguished by Christian names only, and the surname (*see* below) or family name is still totally ignored by the Church. In process of time the use of surnames became universal, the only exceptions in England being the members of the royal family, who sign by their baptismal names only.

A clergyman of the Church of England is compelled to perform the ceremony of baptism when required by a parishioner, and to give whatever name or names the godparents select, but although the rubrics do not expressly say so he can object to any name on religious or moral grounds.

The freedom enjoyed in England and the United States as to the kind of Christian name which may be given to a child is somewhat limited in France and Germany. In France, by a decree of the 11 Germinal, an XI., the only names permitted to be recorded in the civil register as Christian names (*prénoms*) of children were those of saints in the calendar and the names of personages known in ancient history. Even at the present day an official list is issued (revised from time to time) containing a selection of forenames, and no name of a child will be registered unless it occurs in this list. A limitation more or less similar prevails in Germany and other European countries.

As regards the surname, custom has universally decreed that a man shall be known by the name of his father. But in England and in some of the United States this custom is not legally binding; there is no law preventing a man from taking whatever name he has a fancy for, nor are there any particular formalities required to be observed on the occasion of the adoption of a fresh surname. If a person adopts a new name and wishes to have it publicly notified and recognized in official circles, the method of procedure usually adopted is that by royal licence, which is subject to duty. If granted, the royal licence is given under the sign manual and privy seal of the sovereign, countersigned by the home secretary. Where there is a more formal adoption of a surname it is usual, for purposes of publicity and evidence, to advertise the change of name in the newspapers and to execute a deed poll setting out the change, and enrol the same in the central office of the supreme court. In America statutes in many States prescribe an application to a court of record as the method by which a person may change his name. A record of the change is thus certain to be made, but these statutes do not commonly deny an individual his common law right to change his name without resort to the courts.

Both in France and Germany official authorization must be obtained for any change of name. By the German Code 1900 (s. 12) if the right to a new name is disputed by another or his interest is injured thereby, the person entitled can compel the abandonment of the new name.

In England and the United States, a wife on marriage adopts the surname of her husband, disregarding entirely her maiden surname; in Scotland the practice usually is for the wife to retain her maiden surname for all legal purposes, adding the name of her husband as an alias. On remarriage the rule is for the wife to adopt the name of the new husband, but an exception to this is made in the case of a title acquired by marriage when the holder remarries a commoner. See in *Cowley* v. *Cowley,* 1901, A.C. 450.

In Spain and in her colonies a man takes the surname of his father, followed by the maiden surname of his mother, joined by "and" (*y*), but this conjunction is often omitted in some colonies.

Peers of Great Britain when signing their names use only their surnames or peerage designations. It is merely a privileged custom, which does not go back further than the Stuart period. Peeresses sign by their Christian names or initials followed by their peerage designation. Bishops sign by their initials followed by the name of the see. In Scotland it is very usual for landowners to affix to their names the designation of their lands, and this was expressly sanctioned by an act of 1672.

See *Ency. Eng. Law,* tits. "Christian Name," "Surname"; W. P. W. Phillimore, *Law and Practice of Change of Name* (1905); A. C. Fox-Davies and P. W. P. Carlyon Britton, *Law concerning Names and Changes of Name* (1906).

**NAMPA,** largest city of Canyon county, Idaho, U.S.A., in the southwestern part of the state, at an altitude of 2,492 ft., near the Snake river and 20 mi. W. of Boise. It is the junction point of the Old Oregon trail (now federal highway 30) and a new road (federal 95) connecting southwestern Idaho with California points by the most direct possible route. Pop. (1940) was 12,149, a gain of over 48% in ten years, raising Nampa from seventh to fourth place among the cities of Idaho. Nampa is in the heart of an extensive and highly-productive irrigated section, which in 1940 shipped 64,000 carloads of agricultural products. Dairying is the most lucrative agricultural pursuit. Nampa is a subdivision point of the Union Pacific railroad, with passenger service running in six directions out of Nampa. The railroad also maintains a roundhouse. The Pacific Fruit Express, a Union Pacific subsidiary, has a large shop in Nampa for repair and manufacture of refrigerator cars. An ice plant and icing platform can ice 110 cars at one time in a few minutes. Other industrial plants are a condensary, creameries, chick hatcheries, meat- and produce-packing plants, grain elevators, flour mills, mattress factories, wood-working plant, broom factory, bottling works, butane gas plant.

**NAMUR,** one of the nine provinces of Belgium, between Hainaut on one side and Liége and Luxembourg on the other, extends from Brabant up the Meuse to the French frontier. Area, 1,413 sq.mi.; pop. (1939) 355,554 or 251.5 per sq.mi. It is fertile north of the Meuse and forested in the south. There are a few iron and coal-mines between the Sambre and Meuse, and the quarries are

important. Arboriculture, especially fruit-tree plantation, is increasing. There are three administrative arrondissements, Namur, Dinant and Philippeville, 14 cantons and 366 communes.

**NAMUR** (Flemish, *Namen*), a town of Belgium, capital of the province of Namur. Pop. (est. 1938) 32,831. The town lies on the left bank at the junction of the rivers Sambre and Meuse, while the rocky promontory forming the fork between them is crowned with the old citadel, which occupies the site of the old castle of the counts of Namur. This citadel was abandoned for military purposes, and its hill was converted into a park, while the crest was occupied by a hotel reached by a cogwheel railway. Namur is connected with the citadel by two bridges across the Sambre, and from the east side of the promontory there is a fine stone bridge to the suburb of Jambes. This bridge was constructed in the 11th century and rebuilt in the reign of Charles V. It is the only old bridge in existence over the Belgian Meuse. The cathedral of St. Aubain or Albin was built in the middle of the 18th century. The church of St. Loup is a century older, and is noticeable for its columns of red marble from the quarry at St. Rémy near Rochefort. There is a considerable local industry in cutlery, and there are tanneries and glassmaking factories.

In the feudal period Namur formed a marquisate in the Courtenay family. Jousts on stilts were a mediaeval custom that lasted into recent times there. Don John of Austria made Namur his headquarters in the Netherlands, and died here in 1578. Louis XIV took it in 1692 and Vauban renewed the defences but William III retook it in 1695, though the French held it again from 1702–12. In 1893, under the new scheme of Belgian defense, the citadel and its detached works were abandoned, and in their place nine outlying forts were constructed at a distance of from 3 to 5 mi. Namur was the scene of intense fighting in both World Wars I and II.

**NANAIMO,** a city of British Columbia, on the east coast of Vancouver island, 40 mi. W. of Vancouver and 65 mi. N. of Victoria. The population in 1941 was 6,635. It is connected with Victoria by the Esquimalt and Nanaimo railway, and has a daily steamer service to Vancouver. It is in a fruit-farming, dairying and poultry raising district, and has a good harbour, carrying on trade in coal from the neighbouring mines, and in cured herrings, sent to the east. The industries include sawmills and wood-working shops, breweries, canneries, foundries, brickworks, etc.

**NANA SAHIB,** the common designation of Dandu Panth, an adopted son of the ex-peshwa of the Mahrattas, Baji Rao, who took a leading part in the great Indian Mutiny (*q.v.*) and was proclaimed peshwa by the mutineers. Nana Sahib had a grievance against the British Government because they refused to continue to him the pension of eight lakhs of rupees (£80,000) which was promised to Baji Rao by Sir John Malcolm on his surrender in 1818. This pension, however, was only intended to be a life grant to Baji Rao himself. For this refusal the Nana bore the British a lifelong grudge, which he washed out in the blood of women and children in the massacres at Cawnpore (*q.v.*). In 1859, when the remnants of the rebels disappeared into Nepal, the Nana was among the fugitives. His death was reported some time afterwards, but his real fate remains obscure.

**NAN-CHANG,** the capital of the province of Kiangsi, China, on the Kankiang, and connected by railway with Kiukiang and with the east-west railway from Chuchow to Hangchow. Nan-chang was a centre of commerce for the provincial agricultural products, such as tea, rice, cotton, tobacco, hemp, etc., and had some manufactures. In 1939 Nan-chang fell into Japanese hands. The population was given as 134,394 in 1939.

**NANCY,** a town of north-eastern France, the capital formerly of the province of Lorraine, and now of the department of Meurthe-et-Moselle, 219 mi. E. of Paris on the railway to Strasbourg. Pop. (1936) 121,301.

At the close of the 11th century Odelric of Nancy, brother of Gérard of Alsace, possessed at Nancy a castle which enabled him to defy the united assaults of the bishops of Metz and Trèves and the count of Bar. In the 12th century the town was surrounded with walls, and became the capital of the dukes of Lorraine; and in 1477 Charles the Bold was defeated here by René II. (*See* SWISS WARS.) Refortified by Charles III, it was taken by the French in 1633. After the peace of Ryswick in 1697 it was restored to Duke Leopold. He founded academies, established manufactures and set about the construction of the new town. But it was reserved for Stanislas Leczinski, the last of the dukes of Lorraine, to make Nancy one of the palatial cities of Europe. The city, which became French in 1766, was occupied by the allies in 1814 and 1815 and put to ransom by the Prussians in 1870. After the Franco-German War the population was greatly increased by the immigration of Alsatians and of people from Metz and its district.

Although Nancy remained outside the area of actual fighting during World War I it was bombarded by German aeroplanes and long-range guns, but the damage was not very serious.

Nancy stands on the left bank of the Meurthe 6 mi. above its junction with the Moselle and on the Marne-Rhine canal. The railway from Paris to Strasbourg skirts the city on the southwest side; other railways—to Metz, to Épinal by Mirecourt, to Château Salins—join the main line near Nancy and make it an important junction. The town consists of two portions—the *Ville-Vieille* in the northwest, with narrow and winding streets, and the *Ville-Neuve* (16th–18th centuries) in the southeast, with wide straight streets. Between the two lies the Place Stanislas, and on all sides rise imposing buildings of the 18th century—the town hall, episcopal palace, etc. A fine triumphal arch erected by Stanislas in honour of Louis XV leads from the Place Stanislas to the Place Carrière, which forms a beautiful tree-planted promenade, containing at its further end the government palace (1760) now the residence of the general commanding the XX army corps, and adjoins the so-called Pépinière (nursery) established by Stanislas.

The cathedral in the Ville-Neuve, built in the 18th century, has a wide façade flanked by two dome-surmounted towers. Of particular interest is the church of the Cordeliers, in the old town, built by René II. about 1482 to commemorate his victory over Charles the Bold. Pillaged during the Revolution period, but restored to religious uses in 1825, it contains the tombs of the counts of Vaudémont. Here also is a chapel built at the beginning of the 17th century to receive the tombs of the princes of the house of Lorraine. The church of St. Epvre, rebuilt between 1864 and 1874 on the site of an old church of the 13th, 14th and 15th centuries, has a fine spire and belfry and good stained glass windows. Of the old ducal palace, begun in the 15th century by Duke Raoul and completed by René II., there remains but a single wing, partly rebuilt after a fire in 1871. The entrance to this wing, which contains the archaeological museum of Lorraine, is Gothic of the early 16th century. One of the greatest treasures of the collection is the tapestry found in the tent of Charles the Bold after the battle of Nancy. Of the old gates of Nancy the most ancient and remarkable is the Porte de la Craffe (1463). The town hall contains a museum of painting and sculpture.

Nancy is the seat of a bishop, a prefect, a court of appeal and a court of assizes, headquarters of the XX. army corps, and centre of an *académie* (educational division) with a university comprising faculties of law, medicine, science and letters, and a higher school of pharmacy. There are also tribunals of first instance and of commerce, a board of trade-arbitrators, and a national school of forestry. The industries of Nancy include printing, brewing, cotton- and wool-spinning and the weaving of cotton and woollen goods, and the manufacture of tobacco (by the State), of boots and shoes, straw hats, pottery, casks, embroidery, machinery, motor cars and spare parts, engineering material, farm implements and iron goods.

**NANDI,** an East African tribe of mixed Nilotic, Bantu and Hamitic origin. With them are more or less closely allied the Lumbwa (correctly Kipsikīs), Buret (or Puret) and Sotik (Soot) tribes, as well as the Elgonyi (properly Kony) of Mount Elgon. They have also affinities with the Masai. The Nandi-Lumbwa peoples inhabit the country stretching south from Mount Elgon to about 1° S. and bounded east by the escarpment of the eastern rift-valley and west by the territory of the tribes, such as the

Kavirondo, dwelling round the Victoria Nyanza. They have given their name to the Nandi plateau. They have a double administrative system, the chief medicine man or *Orkoiyot* being supreme chief and regulating war affairs, while representatives of the people, called *Kiruogik,* manage the ordinary affairs of the tribe.

The medicine men are of Masai origin and the office is hereditary. The young men form a separate warrior class to whom is entrusted the care of the country. A period of about $7\frac{1}{2}$ years is spent in this class, and the ceremony of handing over the country from one "age" to the succeeding "age" is of great importance. (*See* AGE GRADES.) The arms of the warriors are a stabbing spear, shield, sword and club. Many also possess rifles. All the Nandi are divided into clans, each having its sacred animal or totem. They have no towns, each family living on the land it cultivates. The huts are of circular pattern. The Nandi believe in a supreme deity—Asis—who takes a benevolent interest in their welfare, and to whom prayers are addressed daily. Their language is Nilotic. The primitive hunting tribe known as the Wandorobo speak a dialect closely resembling Nandi.

BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

LUMBWA WARRIOR EQUIPPED TO SPEAR LIONS

*See* A. C. Hollis, *The Nandi: Their Language and Folk-lore,* with introduction by Sir Charles Eliot (1909), and the works there cited.

**NANDU,** the Brazilian name for the rhea (*q.v.*).

**NANKANA,** a people resembling the Bura and the Mampursi, living in the Navoro district of the Northern Territories, Gold Coast, and across the Upper Volta border in the Leo district. They speak a Mossi dialect.

*See* Cardinal, *The Natives of the Gold Coast.*

**NANKEEN,** a cotton cloth originally made in China, and now imitated in various countries. The name is derived from Nanking, the city in which the cloth is said to have been originally manufactured. The characteristic yellowish colour of nankeen is attributed to the peculiar colour of the cotton from which it was originally made.

**NANKING** ("the southern capital"), the name by which Kiang-ning, the chief city in the province of Kiangsu, China, has been known for several centuries. Pop. (1935) 1,019,148. The city is nearly equidistant between Canton and Peking, on the south bank of the Yangtze Kiang 235 mi. from the sea. It dates only from the beginning of the Ming dynasty (1368), although it is built on the site of a city which for more than two thousand years figured under various names in the history of the empire. The more ancient city was originally known as Kin-ling; under the Han dynasty (206 B.C. to A.D. 25) its name was converted into Tan-yang; by the T'ang emperors (A.D. 618–907) it was styled Kiang-nan and Shêng Chow; by the first sovereign of the Ming dynasty (A.D. 1368–1644) it was created the "southern capital" (Nan-king), and was given the distinctive name of Ying-t'ien; and with the accession to power of the Manchu rulers it was officially known as Kiang-ning, though still popularly called Nan-king. It was the seat of the imperial court only during the reigns of the first two emperors of the Ming dynasty, and was deserted for Shun-t'ien (Peking) by Yung-lo, the third sovereign of that line, who in 1403 captured the town and usurped the crown of his nephew, the reigning emperor. The area is 180 sq.mi.

The T'aip'ing rebels, who carried the town by assault in 1853, swept away all the national monuments and most of the public buildings it contained, and destroyed the greater part of the magnificent wall which surrounded it. The wall, of which only small portions remain, was about 70 ft. in height, measured 30 ft. in thickness at the base, and was probably 20 miles in circumference and pierced by thirteen gates. Encircling the north, east and south sides of the city proper was a second wall which enclosed about double the space of the inner enclosure. In the north-east corner of the town stood the imperial palace reared by Hung-wu, the imperial founder of the modern city. After suffering mutilation at the overthrow of the Ming dynasty, this building was burnt to the ground on the recapture of the city from the T'aip'ing rebels in 1864. The most conspicuous public building at Nanking was the famous porcelain tower, which was designed by the emperor Yung-lo (1403–1428) on a previously sacred site to commemorate the virtues of his mother. The building was begun in 1413. In shape the pagoda was an octagon, and was about 260 ft. in height. The outer walls were cased with bricks of the finest white porcelain, and each of the nine stories into which the building was divided was marked by overhanging eaves composed of green glazed tiles of the same material. Hung on chains which stretched from this apex to the eaves of the roof were five large pearls of good augury for the city's safety from flood, fire, storm and civil disturbance.

Nanking was formerly one of the chief literary centres of the empire. It was taken by the British in 1842 and made a treaty port by the French treaty of 1858, but was not formally opened. Its proximity to Chinkiang, where trade had established itself while Nanking was still in the hands of the rebels, made its opening of little advantage. In 1899 it was voluntarily thrown open to foreign trade by the Chinese government, and in 1909 it was connected by railway with Shanghai, and became the southern terminus of the Tientsin-Pukow railway.

The new nationalist government moved the capital of China to Nanking in 1928 and Nanking remained the legal capital when the government moved to the wartime capital of Chungking after the Japanese invasion. After 1928 Nanking developed rapidly and a number of new buildings such as a modern railway station and several ministries were built by the government and broad boulevards were constructed. Modern airfields and shipping facilities increased the importance of Nanking as a communication centre. Outside the city the famous Sun Yat-sen mausoleum was erected in memory of the founder of the Chinese republic. In Nov. 1937 Nanking fell to the Japanese troops. The "rape of Nanking" which followed was fully authenticated by many neutral witnesses. Several tens of thousands of people were killed.

In 1940 Nanking became the seat of the puppet government of Wang Ching-wei.

**NANNING,** former treaty port in the province of Kwangsi, south China (22° 48′ N., and 108° 15′ E.), and onetime capital of the province, is situated about 30 mi. below the junction of the two branches (Tso-kiang and Yu-kiang) of the south (main) stream of the West river, and about 470 mi. above Canton. Nanning was voluntarily opened to foreign trade by China in 1907 to offset French influence at Lungchow, a treaty port near the Tongking frontier. It is the highest accessible point for steamers on the West river, but the river between Wuchow and Nanning during winter suffers from lack of water so that trade is seriously affected. Numerous small competitive river vessels run between Wuchow and Nanning.

Nanning's economic orientation is towards the Canton delta by the natural route of the Si-kiang, rather than towards the nearer Red river delta of Tongking. The construction, however, of the projected railway from Canton, via Nanning, to connect with the Tongking railway system at Langson (the present terminus) may have the effect of diverting some of the trade of Nanning into Tongking; or again, the construction of a railway may draw much of it to Pakhoi on the Gulf of Tongking, the nearest outlet by sea to Nanning.

The value of the whole trade which was 6,623,437 Hk Taels in 1924, had suffered as a result of the Hongkong boycott of 1926. In 1936 it was $70,780 (U.S.), but rose to over $160,000 (U.S.) in 1938 and 1939.

The chief imports of Nanning, to be distributed in W. Kwangsi, and adjacent Yunnan and Tongking, were cotton piece goods, kerosene, clothing, matches and straw mats, while exports comprised chiefly aniseed, beans, hides, groundnut cake, medicines and antimony (the export of which increased greatly). In 1940 Nanning was temporarily occupied by the Japanese and its trade suffered after that. Two main channels served this trade—the Yu-kiang which is navigable for large junks during the summer

flood season as far as Pose-ting (whence a road leads up to the high plateau of Yünnan), and the Tso-kiang which is navigable for large junks and small launches as far as the treaty port of Lungchow, close to the Tongking border.

The population of Nanning was 80,283 in 1939.

**NANNY-BERRY** (*Viburnum Lentago*), a handsome North American shrub or small tree of the honeysuckle family (Caprifoliaceae), called also black haw, sheep-berry, wild raisin and sweet viburnum, sometimes planted for ornament. It is native to rich soil from Quebec to Hudson bay and southward to New Jersey, Georgia and Colorado. The nanny-berry, though usually a shrub, sometimes grows 30 ft. high, with a trunk diameter of 10 inches. It has slender branches, ovate, long-pointed, finely-toothed leaves and bears small white flowers borne in showy clusters, 2 to 5 in. broad. The oval, bluish-black, sweet, edible fruit ripens in late autumn.

**NANSEN, FRIDTJOF** (1861–1930), Norwegian scientist, explorer and statesman, was born at Fröen near Christiania, where he spent his childhood, on Oct. 10, 1861. In his fifteenth year his parents removed to Christiania, where he went to school. He entered Christiania university in 1880 and studied zoology; in March 1882 he joined the sealing-ship "Viking" for a voyage to Greenland waters. On his return he became curator of the Bergen Museum, under Daniel Cornelius Danielssen (1815–1894). In 1886 he spent a short time at the zoological station at Naples, during which he wrote papers and memoirs on zoological and histological subjects, for one of which, "The Structure and Combination of the Histological Elements of the Central Nervous System" (Bergen, 1887), the Christiania university conferred upon him the degree of doctor of philosophy. But his voyage in the "Viking" had indicated Greenland as a possible field for exploration, and in 1887 he began preparations for a crossing of the great ice-field of the interior of that country. Nansen took with him Otto Sverdrup (b. 1855), Captain O. C. Dietrichson (b. 1856), K. K. Trana (b. *c.* 1864), and two Lapps. The expedition started in May 1888, proceeded from Leith to Iceland, and there joined a sealing-ship bound for the east coast of Greenland. On Aug. 16 began the ascent of the inland ice amid storms, intense cold, and other hardships, they reached the highest point of the journey (8,920 ft.) on Sept. 5, and on the 28th struck the west coast at Ameralik Fjord. They were obliged to winter at the settlement of Godthaab, and Nansen used the opportunity to study the Eskimos and gather material for his book *Eskimo Life* (English translation, London, 1893). The party returned home in May 1889. A report of the scientific results was published in *Petermanns Mitteilungen* (Gotha, 1892). On his return from Greenland Nansen became curator of the Zootomic Museum of Christiania university. In Sept. 1889 he married Eva, daughter of Professor Michael Sars of Christiania university, and a noted singer (d. 1907).

In 1890 he propounded his scheme for a polar expedition before the Norwegian Geographical Society, and in 1892 he laid it before the Royal Geographical Society in London. (*See* "How can the North Polar Region be crossed?" *Geogr. Journal,* vol. i.) His adversely criticized plan succeeded. The Norwegian parliament granted two-thirds of the expenses, and the rest was obtained by subscription from King Oscar and private individuals. His ship, the "Fram" (*i.e.,* "Forward"), was specially built of immense strength and peculiar form, being pointed at bow and stern and having sloping sides, so that the colliding ice-floes would tend, not to crush, but merely to slip beneath and lift her. She sailed from Christiania on June 24, 1893. Otto Sverdrup was master; Sigurd Hansen, a Norwegian naval lieutenant, was in charge of the astronomical and meteorological observations; Henrik Blessing was doctor and botanist. On Sept. 22 the "Fram" was made fast to a floe in 78° 50′ N., 133° 37′ E.; she was frozen in, and the long drift began. She bore the pressure of the ice perfectly. On March 14, 1895, Nansen, being satisfied that the "Fram" would continue to drift safely, left her in 84° N., 101° 55′ E., and started northward on foot with Johansen. On April 8 they turned back from 86° 14′ N., the highest latitude then reached by man; and they shaped their course for Franz Josef Land. They suffered from shortage of food, and were compelled to winter on Frederick Jackson Island (so named by Nansen) in Franz Josef Land from Aug. 26, 1895, to May 19, 1896. They were uncertain as to the locality, but, after having reached 80° N. on the south coast of the islands, they were travelling westward to reach Spitsbergen, when, on June 17, they fell in with Frederick Jackson and his party of the Jackson-Harmsworth expedition, and returned to Norway in his ship, the "Windward," reaching Vardö on Aug. 13. A week later the "Fram" also reached Norway safely, having drifted north to 85° 57′, and returned by the west coast of Spitsbergen. A great welcome awaited Nansen. In England he gave the narrative of his journey at a great meeting in the Albert Hall, London (Feb. 8, 1897), and elsewhere.

In 1896 a professorship of zoology was established for him at the Christiania university; he worked up the results of his expedition and made scientific research in physical geography and oceanography. In the summer of 1900 he took part in an Arctic oceanographic expedition in the S.S. "Michael Sars," headed by Dr. Johan Hjort, and became director of the International Central Laboratory in Christiania for the Research of the Sea. In 1902 he published *The Oceanography of the North Polar Basin,* and in 1904 *The Bathymetrical Features of the North Polar Seas.* In 1905 Nansen took up politics, issuing a manifesto and many articles in connection with the crisis between Norway and Sweden. His attitude may be summarized by the last words of a short work published later in the year: "Any union in which the one people is restrained in exercising its freedom is and will remain a danger" (*Norway and the Union with Sweden,* London, 1905). On the establishment of the Norwegian monarchy Nansen was appointed minister to England (1906), and in the same year was created G.C.V.O. In 1908 he retired from his post and returned to his scientific work as professor of oceanography at Christiania university. In co-operation with Professor Bjorn Helland-Hansen, of the Bergen Museum, he wrote *The Norwegian Sea, its Physical Oceanography* (*Report* on Norwegian Fishery and Marine Investigations, vol. 2, 1909).

In 1910 Nansen made an oceanographic cruise in the "Frithjof" through the northeastern North Atlantic from Ireland to Iceland and back to Norway, and in 1911 published *In Northern Mists* (2 vol.) on the exploration of the northern regions from early times up to the beginning of the 16th century. In 1912 he made a further oceanographic cruise to Spitsbergen and the waters to the north in his yacht the "Veslemoy," and in 1913 he made an expedition through the Arctic and the Kama Seas to the mouth of the Yenisei river and through Siberia and the Amur region.

In 1914, jointly with Helland-Hansen, Nansen made an oceanographic expedition in the eastern North Atlantic to Portugal, Madeira and the Azores and back to Norway. During the World War oceanographic expeditions were impossible. In 1917 Nansen became head of a Norwegian Govt. commission to the United States, and secured a satisfactory agreement with the American Govt. in regard to the import into Norway of essential supplies. After the Armistice (1918) Nansen, as Commissioner of the League of Nations with the executive assistance of the national Red Crosses, was responsible for the repatriation of about 500,000 prisoners of war from Siberia, China and other parts of the world. This work was financed largely by the governments participating in the International Committee for Relief Credits, Paris, of which Lord Bradbury was chairman.

In 1919 Nansen conferred with Hoover on the possibilities of assisting the Russian people, and suggested an organization on the lines of the Belgian Relief Commission. The Supreme Council supported the proposal on the condition that all hostilities in Russia cease. As this was at the time when Kolchak and Denikin were advancing towards Moscow the project was abandoned. In 1921 Nansen was asked by an international conference in Geneva of delegates of 48 Red Cross societies and 12 governments to direct relief work for famine-stricken Russia, and on Aug. 27 he signed an agreement in Moscow with Chicherin, the Soviet Foreign Minister, regarding the method of furnishing relief on a large scale, and visited the famine areas. In Sept. Nansen failed to induce the League of Nations to assist the starving

millions in Russia by raising, under safeguards, an international governmental relief loan. He next visited the chief capitals of Europe, and as a result the European Red Crosses fed and clothed at the peak of the Russian famine over 1,600,000 inhabitants of the Volga and South Ukraine regions. His publicity campaign had great influence in America, which under Hoover's direction fed at one time 10,000,000 Russian sufferers. Nansen's mission in Russia continued to conduct two agricultural demonstration estates in the former famine areas. In 1923 Nansen published *Russia and the Peace* setting out the economic position of soviet Russia. As high commissioner for refugees to the League, he was responsible for the protection and settlement of Russian, Armenian and Greek refugees.

In 1923 Nansen was awarded the Nobel peace prize, which he gave to the furtherance of the Nansen agricultural demonstration estates and model farms in Saratov and Ekaterinoslav governments, Russia. In his early manhood Nansen was a great athlete and the popularity of skiing in the Alps is largely due to him; and evidence of his enthusiasm for sport is his work on *Sport in the Polar Regions* and *Wild Norway* (1925). Nansen, as delegate for Norway to the League of Nations, made an impassioned intervention protesting against the occupation of Corfu by Italy in 1923, and at the Fifth Assembly in 1924 he conducted the first informal negotiations for the entry of Germany into the League of Nations. Nansen's interest in education was evidenced by his campaign in favour of Russian professors and universities. In 1925 he was elected lord rector of St. Andrews, and in 1928 published *Armenia and the Near East*. (*See* ARCTIC REGIONS; REFUGEES AND THE EXCHANGE OF POPULATIONS.) He died of heart failure at Oslo, on May 13, 1930.

Besides works mentioned above, Nansen described his travels in *The First Crossing of Greenland* (Eng. trans., 1893); *Farthest North* (Eng. trans., 1897); *The Waters of the Northeastern North Atlantic* (*Internationale Revue der gesammten Hydrobiologie und Hydrogeographie*, Leipzig, 1913); *En ferd til Spitzbergen* (1912); *Through Siberia, the Land of the Future* (London, 1914). The scientific results of the various expeditions are given in the following works—the 1888 expedition, in *Petermanns Mitteilungen* (Gotha, 1892); the 1893 expedition, in *The Norwegian North Polar Expedition, 1893–96: Scientific Results* (London, etc., 1900 *sqq.*); the 1912 expedition, in *Spitzbergen Waters* (Society of Science, Oslo, 1915); of the 1914 expedition jointly with Helland-Hansen, in *The Eastern North Atlantic* (Geophysic Publication, Academy of Science, Oslo).

**NANTERRE,** a suburb 13 kilometres northwest of Notre Dame de Paris, with a port on the Seine, in the department of Seine, at the foot of Mount Valérien, 8 mi. N.W. of Paris on the railway to St. Germain. Pop. (1936) 46,065. The principal manufactures are chemicals, tallow and aluminum; stone is quarried in the vicinity; the town is noted also for its cakes. Nanterre (the ancient *Nemptodurum* or *Nemetodurum*) owes its origin to the shrine of Ste. Geneviève (420–512), the patron saint of Paris.

**NANTES,** a city of western France, capital of the department of Loire-Inférieure, on the Loire, 35 mi. above its mouth, at the junction of the Orléans, Ouest-état and State railways, 55 mi. W.S.W. of Angers by rail. In population (1936, 190,465), Nantes is the first city of Brittany. The Loire here divides into several west branches forming islands over portions of which the city has spread.

**History.**—Before the Roman occupation Nantes was the chief town of the Namnetes and consisted of *Condovicnum,* lying on the hills away from the river, and of *Portus Namnetum,* on the river. Under the Romans it became a great commercial and administrative centre, though its two parts did not coalesce till the 3rd or 4th century. In the middle of the 3rd century Christianity was introduced by St. Clair. Clotaire I got possession of the city in 560, and placed it under the government of St. Félix, the bishop who caused the Loire to flow under the walls of the castle. After being several times subdued by Charlemagne, Brittany revolted under his successors, and Nominoé, proclaimed king in 842, razed the fortifications of Nantes because it had sided with Charles the Bald. The Normans held the town from 843 to 936. About this time began the rivalry between Nantes and Rennes, whose counts disputed the sovereignty of Brittany. Pierre de Dreux, declared duke of Brittany by Philip Augustus, made Nantes his capital, surrounded it with fortifications and defended it against John of England. During the Breton wars of succession Nantes took part first with Jean de Montfort, but afterward with Charles of Blois, and did not open its gates to Montfort till his success was assured and his English allies had retired. In 1560 Francis II granted Nantes a communal constitution. Averse to Protestantism, it joined the League along with the duke of Mercoeur, governor of Brittany, who helped to raise the country into an independent duchy; and it was not till 1598 that it opened its gates to Henry IV, who here signed on May 2 of that year the famous Edict of Nantes which until its revocation by Louis XIV in 1685 was the charter of Huguenot liberties in France. The city was in 1793 the scene of the *noyades* of J. B. Carrier, envoy of the Committee of Public Safety.

**The Port.**—The maritime port of Nantes is reached by way of the Loire and the ship canal between the island of Carnet and La Martinière (9½ mi.). Vessels drawing as much as 20 ft. 8 in., and at spring tides, 22 ft., can reach the port, which extends over a length of about 1½ mi. The outer port stretches ½ mi. to Chantenay. The principal quays extend along the right bank of the branch which flows past the town and on the western shore of the island of Gloriette. Their total length used for trading purposes is 5 mi., and warehouses cover an area of 17 ac. A slipway facilitates the repairing of ships. The river port occupies the St. Félix and Madeleine branches and has quays extending for half a mile. Finally, on the Erdre is a third port for inland navigation. The quays are bounded by railway lines along the right bank of the river, which the railway to St. Nazaire follows. The older quarter of Nantes is situated to the east of the Erdre.

**Buildings.**—The cathedral, built above a 12th century crypt, was unfinished till the 19th century. There are two interesting monuments in the transept; Michel Colomb's tomb of Francis II, duke of Brittany, and his second wife Marguerite de Foix (1507) and that of Gen. Juchault de Lamoricière, a native of Nantes, by Paul Dubois (1879). Between the cathedral and the Loire stands the castle of Nantes, founded in the 9th or 10th century. Rebuilt by Francis II and the Duchess Anne, it is flanked by huge towers and by a bastion erected by Philip Emmanuel, duke of Mercoeur, in the time of the league. A fine Gothic façade looks into the courtyard. From being the residence of the dukes of Brittany, the castle became a state prison and is now occupied as the artillery headquarters. The chapel in which the marriage of Louis XII with Anne of Brittany was celebrated was destroyed in 1800. Nantes has an archaeological collection in the Dobrée museum, and in the museum of fine arts a splendid collection of paintings, modern French masters being well represented. It is the seat of a prefect, of a bishopric under the archbishop of Tours and a court of assizes and headquarters of the XI army corps; it has tribunals of first instance and of commerce, a board of trade-arbitrators and a chamber of commerce. It has many educational institutions.

**Industries.**—Among the more important industries of Nantes are sugar-refining, rice-husking, the manufacture of oil, soap, flour pastes and biscuits, chocolate and the preparation of tinned provisions (sardines, vegetables, etc.); the manufacture of tin boxes, tiles, chemical manures, acid, leather, paper, rope, boots and shoes, brushes, porcelain and glass; shipbuilding, metal founding and the construction of engineering material; and wool and cotton-spinning and the manufacture of cotton and other fabrics, rubber goods, hosiery and knitted goods. Coal and petroleum, sugar, coffee, cottonseed, copra, hemp, grain, phosphates and pyrites, timber and pulp-wood are imported. Principal exports are machinery, pit-props, iron ore, slate, hoops and provisions. The merchandise handled at the port of Nantes slightly increased after 1913 when the amount of goods handled at the port was 1,964,000 tons (metric). In 1924 it was 2,154,000 and in 1925, 2,086,000 metric tons.

**NANTES, EDICT OF,** the law promulgated in April 1598 by the French king, Henry IV, which secured a large measure of religious liberty to his Protestant subjects, the Huguenots. Its main provisions may be summarized as follows: (1) It gave liberty of conscience to the Protestants throughout the whole

of France. (2) It gave them the right of holding public worship in those places where they had held it in 1576 and the earlier part of 1577; also in places where this freedom had been granted by the edict of Poitiers (1577) and the treaties of Nérac (1579) and of Fleix (1580). The Protestants could also worship in two towns in each *bailliage* and *sénéchaussée*. The greater nobles could hold Protestant services in their houses; the lesser nobles could do the same, but only for gatherings of not more than 30 people. Regarding Paris, the Protestants could conduct worship within five leagues of the city instead of ten leagues as previously. (3) Full civil rights were granted them. They could trade freely, inherit property and enter the universities, colleges and schools. All official positions were open to them. (4) To deal with disputes arising out of the edict, a chamber was established in the parlement of Paris (*le chambre de l'édit*). This group was to be composed of ten Roman Catholic and six Protestant members. Chambers for the same purpose, but consisting of Protestants and Roman Catholics in equal numbers, were established in connexion with the provincial parlements. (5) The Protestant pastors were to be paid by the State and to be freed from certain burdens, their position being made practically equal to that of the Roman Catholic clergy. (6) A hundred places of safety were given to the Protestants for eight years, the expenses of garrisoning them being undertaken by the king.

The edict was greatly disliked by the Roman Catholic clergy, and a few changes were made to conciliate them. The parlement of Paris shared this dislike, but was forced by the king to register the edict on Feb. 25 1599. After similar trouble it was also registered by the provincial parlements, the last being the parlement of Rouen, which delayed the registration until 1609.

That the strong political position thus secured to the French Protestants was a danger to the State was proved by the troubles which arose during the minority of Louis XIII. After Richelieu had succeeded in crushing the quasi-independent power of the Huguenot lords and cities, however, the French Protestants ceased to be a political danger. With the revocation of the Edict of Nantes, on Oct. 18 1685, the French Protestants were deprived of all civil and religious liberty.

BIBLIOGRAPHY.—*See* FRANCE: *History;* and HUGUENOTS. For further details see the papers and documents published as *Le Troisième centenaire de l'édit de Nantes* (1898); N. A. F. Puaux, *Histoire du Protestantisme français* (Paris, 1894); H. M. Baird, *The Huguenots and the Revocation of the Edict of Nantes* (London, 1895); A. Lods, *L'Édit de Nantes devant le parlement de Paris* (1899); and C. Benoist, *La Condition des Protestants sous le régime de l'édit de Nantes et après sa révocation* (Paris, 1900).

**NANTEUIL, ROBERT** (1623–1678), French line-engraver, was born about 1623, or, as other authorities state, in 1630, the son of a merchant of Reims. Having received an excellent classical education, he studied engraving under his brother-in-law, Nicholas Regnesson. He became known by his crayon portraits, and was pensioned by Louis XIV. and appointed designer and engraver of the cabinet to that monarch. It was mainly due to his influence that the king granted the edict of 1660, dated from St. Jean de Luz, by which engraving was pronounced free and distinct from the mechanical arts, and its practitioners were declared entitled to the privileges of other artists. He died at Paris in 1678. The plates of Nanteuil, several of them almost life-size, number about three hundred. In his early practice he imitated the technique of his predecessors, working with straight lines, strengthened, but not crossed, in the shadows, in the style of Claude Mellan, and in other prints cross-hatching like Regnesson, or stippling in the manner of Jean Boulanger. He then gradually acquired an individual style, modelling the faces of his portraits with the utmost precision and completeness, and employing various methods of touch for the draperies and other parts of his plates. Among the finest of his mature works are the portraits of Pomponne de Bellièvre, Gilles Ménage, Jean Loret, the duc de la Meilleraye and the duchess de Nemours.

A list of his works will be found in Dumesnil's *Le Peintre-graveur français*, vol. iv.

**NANTICOKE,** a city of Luzerne county, Pennsylvania, U.S.A., on the Susquehanna river and federal highway 11, 8 mi. W.S.W. of Wilkes-Barre. It is served by the Pennsylvania railroad and (through West Nanticoke) by the Lackawanna, and for freight also by the Central of New Jersey. Pop., 1940, 24,387. It is an important anthracite-mining centre and has a number of factories (making chiefly silk yarn, stockings and cigars). Nanticoke was laid out in 1793 and was incorporated in 1874.

**NANTUCKET,** an island 28 mi. S. of Cape Cod off the southeast coast of Massachusetts, U.S.A., for more than a century a principal seat of the whaling industry. In 1830 the town of Nantucket ranked after Boston and Salem as the third commercial city of the state; in 1842 it was the home port of 86 ships and barks, 2 brigs and 2 schooners, with a total capacity of 36,000 tons. Leadership in the industry passed to New Bedford about 1830, however, and soon after 1840 the decline of whaling began in earnest. Retaining its old atmosphere and a distinctive physical character inherited from years of Quaker dominance and whaling prosperity, Nantucket has become a summer resort. Pop. (1940) 3,401. For the most part the island is sandy and level. It has few trees and few hills, the highest of which is 191 ft. above the sea. Although the length of the island proper is only about 15 mi., and its average width 2½ mi., there are 88 mi. of shore. The climate is profoundly modified by this insular position.

Nantucket was discovered by Bartholomew Gosnold and purchased, with Martha's Vineyard, by Thomas Mayhew of Watertown in 1641. Thomas Macy led the first band of settlers in 1659, founding a settlement near Capaum which was called Sherburne in 1673. The island at that time belonged to the province of New York. In 1692 it became a part of the state of Massachusetts, and in 1710 the town moved from Sherburne to its present site. In 1695 the name was changed to Nantucket, which is the name of the town, county and island. Christopher Hussey took the first sperm whale in 1712, and development of the vessel fishery, succeeding the old shore fishery of whales, was rapid. The American Revolution, the War of 1812 and the American Civil War were the only interruptions to the prosperity based upon whaling until its final decline. Modern Nantucket is described as an "almost perfect record of what our Yankee forefathers considered a seemly town." The island has extensive fisheries.

BIBLIOGRAPHY.—*See* Obed Macy, *History of Nantucket* (1835); N. S. Shaler, "Geology of Nantucket," *Bulletin No. 53, U.S. Geological Survey* (1889); *Bulletins Nantucket Historical Society* (1894, *et seq.*); R. A. D. Lithgow, *Nantucket, A History* (1914); W. F. Macy, *Story of Old Nantucket* (1915); W. F. Macy and R. B. Hussey, *Nantucket Scrap Basket* (1916); A. Starbuck, *History of Nantucket* (1924). (H. B. H.)

**NANTWICH,** a market town and urban district in the Crewe parliamentary division, Cheshire, England, 161 mi. N.W. of London, on the L.M.S. and G.W. railways. Pop. (1938) 8,345. Area 1.83 sq.mi. It lies on the river Weaver, in the upper part of its flat, open valley. The church of St. Mary is a cruciform building in red sandstone, of the Decorated and Perpendicular periods, with a central octagonal tower. The fine old carved stalls are said to have belonged to Vale Royal abbey, near Winsford. Nantwich retains a few old timbered houses (16th and 17th centuries), but the town as a whole is modern in appearance. The grammar school, founded in 1611, is now co-educational. The salt industry was so important here in the time of Henry VIII that there were 300 salt-works. Though this industry has lapsed here, there are now brine baths, and the former mansion of Shrewbridge Hall is converted into a hotel with a spa. Nantwich manufactures clothing and boots and shoes. There is also a tannery and a corn mill.

Remains found in the district indicate a Roman settlement here, probably because of the salt. The Domesday Survey contains a long account of the laws, customs and values of the salt-works. The salt-houses were divided between the king, the earl of Chester and certain resident freemen. The name of the town appears variously as Wych Manbank, Wie Malban, Nantwich, Lache Mauban, Wysmanban, Wiens Malbanus, Namptewiche. About the year 1070 William Malbedeng was created baron of Nantwich, but the barony became subdivided later. The only town charter was granted by Queen Elizabeth (1568). There was a gild merchant and also a town bailiff, but the latter office was

soon dropped. There is documentary evidence of a castle at Nantwich in the 13th century.

**NANTY-GLO,** a coal-mining borough of Cambria county, Pennsylvania, U.S.A., 12 mi. N. of Johnstown; served by the Cambria and Indiana and the Pennsylvania railways. Pop. 5,028 in 1920; 5,598 in 1930; 6,217 in 1940.

**NAOS,** in Greek architecture, the most important portion of the enclosed part, or cella, of a temple. When the cella contains but one room, this is the naos; when it contains two, the naos is the larger of these, in which the statue of the deity is placed.

**NAPA,** a city of California, U.S.A., 11 mi. N. of San Pablo bay and 40 mi. N. by E. of San Francisco, at the head of navigation on the tidal Napa river; the county seat of Napa county. It is served by the Southern Pacific and electric railways, and by steamboats to points on San Francisco bay. Pop. 6,757 in 1920 (82% native white); 7,740 by the federal census of 1940. It is the commercial and industrial centre of the fertile Napa valley, which is famous for its grapes, nuts, prunes, early pears, apples, oats, alfalfa and other ranch products. The city's manufactures include shoes, gloves, shirts, athletic equipment, paper boxes, stone, dried fruits, butter, cheese, mineral water and grape juices. Napa was settled in 1831 and incorporated as a city in 1872.

**NAPERVILLE,** a city of Du Page county, Illinois, U.S.A., on the Burlington Route railway, 28 mi. W. of Chicago. Pop. 5,118 in 1930 and 5,272 in 1940 by the federal census. It has orchid greenhouses, nurseries, poultry farms and several factories, and is the seat of North Central ("North-Western" until 1926) college, founded by the Evangelical church in 1861 at Plainfield (Illinois) and moved to Naperville in 1870, and of the Evangelical Theological seminary (1910). The city was founded about 1831.

**NAPHTALI** was, according to Genesis xxx. 8, a son of Jacob by Rachel's handmaid Bilhah, and full brother of Dan. This may be no more than a reflection of the fact that geographically the tribes of Dan and Naphtali are closely associated. Not only did the land of Naphtali in northern Palestine border on that of Dan, but we find in Deut. xxxiii. 23 an indication that Naphtali dwelt near to Dan in the older seat of the latter tribe in the south-west. The story of the conflict against Sisera, Judges iv. *seq.*, associates Zebulon closely with Naphtali, and informs us that from Kadesh, the old Amorite city which was the chief place in Naphtali's territory, came the hero Barak. Naphtali, because of its exposed situation, suffered at the hands of Syria (1 Kings xv. 20); it was depopulated by Tiglath-Pileser (2 Kings xv. 29). The reference to Naphtali in the Blessing of Jacob, Genesis xlix. 21, is obscure and of uncertain interpretation. (W. L. W.)

**NAPHTHA,** a word originally applied to the more volatile kinds of petroleum, issuing from the ground in the Baku district of Russia and in Persia. It is the *νάφθα* of Dioscorides, and the *naphtha,* or *bitumen liquidum candidum* of Pliny. By the alchemists the word was used principally to distinguish various highly volatile, mobile and inflammable liquids, such as the ethers, sulphuric ether and acetic ether having been known respectively as *naphtha sulphurici* and *naphtha aceti.*

The term is now seldom used, either in commerce or in science, without a distinctive prefix, and we thus have the following:—

1. *Coal-tar Naphtha.*—A volatile commercial product obtained by the distillation of coal-tar. (*See* COAL-TAR.)

2. *Shale Naphtha.*—Obtained by distillation from the oil produced by the destructive distillation of bituminous shale. (*See* PARAFFIN.)

3. *Petroleum Naphtha.*—A name sometimes given (*e.g.,* in the United States) to a portion of the more volatile hydrocarbons distilled from petroleum. (*See* PETROLEUM.)

4. *Wood Naphtha.*—Methyl alcohol (*q.v.*).

**NAPHTHALENE,** a hydrocarbon, $C_{10}H_8$, formed when many organic compounds, *e.g.,* acetylene, ethylene, acetic acid, ether or camphor, are passed as vapours through a red-hot tube. This accounts for its presence in certain fractions of the coal-tar distillate (*see* COAL-TAR), where it was originally observed in 1819 by Garden and independently by Brande. Its composition was first determined by Faraday, in 1826. The amount of naphthalene produced during the manufacture of coal-gas varies with the type of coal used and increases with rising temperature of carbonization; it rarely exceeds 10% of the tar distillate, and the usual amount is about 5%. Its presence among the products obtained by the modern low-temperature carbonization processes has not yet been established. Even when formed in only small amounts, naphthalene is frequently carried by the coal-gas through the various purifying chambers and escapes into the service pipes, where it gradually accumulates to such an extent as to necessitate its removal by mechanical means. Naphthalene also occurs in some natural mineral oils, but derivatives in nature are rare. Juglone (5-hydroxy-1:4-naphthoquinone), occurring in freshly-gathered walnut shells, and santonin and artemisin, the active principles of wormseed, are the chief.

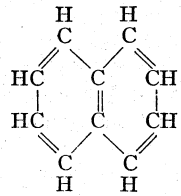
When the "carbolic oil" fraction (boiling point 170°–230° C) of the coal-tar distillate is allowed to cool, the crude naphthalene crystallizes out and is readily purified. The oily impurities are first removed by filtration; the naphthalene crystals are then hot-pressed, washed with hot caustic soda to remove acidic phenols (*see* CARBOLIC ACID) and then heated at 100° C for an hour with 5–10% of strong sulphuric acid to remove basic substances and any residual phenols. After further washings with dilute alkali and hot water, the naphthalene is finally distilled with steam or sublimed.

**Properties and Uses.**—Pure naphthalene crystallizes in white, shining plates, melting at 80° C, and boiling at 218° C. It possesses a characteristic tarry odour, a pungent taste, and is appreciably volatile even at ordinary temperatures. It is sparingly soluble in hot water and in petroleum spirit, but dissolves readily in benzene, alcohol and ether. With picric acid it forms a stable crystalline picrate, $C_{10}H_8$, $C_6H_2(NO_2)_3{\cdot}OH$; this, in the absence of other picrate-forming compounds, provides a method of estimating naphthalene. When heated in acetic acid solution with formaldehyde and a little sulphuric acid, naphthalene gives a resin, which, unlike phenolic resins, does not become infusible when baked. (*See* RESINS, *Synthetic.*) The products obtained on oxidizing naphthalene vary considerably with the type of oxidizing agent employed. Potassium permanganate, in alkaline solution, gives phthalonic acid; but in acid solution phthalic acid is the chief product. Potassium dichromate and sulphuric acid, too, give phthalic acid, but with chromic acid in acetic acid solution, 1:4-naphthoquinone is mainly formed. The action of an excess of 100% sulphuric acid and mercuric sulphate at 200° C produces mainly phthalic acid, which was formerly manufactured by this method.

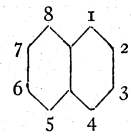
Naphthalene burns with a luminous, smoky flame, and is in consequence used for increasing the illuminating power of coal-gas. It is also utilized as a vermin killer (in the form of the so-called "white carbon" balls), though as its antiseptic properties are slight, it more frequently functions as a solid solvent for other substances, *e.g.,* para-dichlorobenzene, of higher germicidal power. It is also a useful solvent for sulphur, phosphorus, metallic sulphides, and indigo. The value of naphthalene depends most, however, on its extensive employment in the manufacture of dyestuffs, of explosives, and of phthalic acid (*q.v.*), the last-named being manufactured by the oxidation of naphthalene in the vapour phase by air, using vanadium pentoxide or vanadyl chloride as catalyst. The derivatives most important to the dyestuffs manufacturer are the sulphonic acids of the naphthylamines, naphthols, aminonaphthols, and dihydroxynaphthalenes, but not all are of equal value. Indeed, only relatively few form azo-dyes which are completely satisfactory as regards solubility, fastness, tinctorial power and delicacy of shade. The market price of naphthalene varies of course with the degree of purity, but approximates to £14 per ton. Commercial naphthalene has setting point 79° C, and boiling point 217° C; it should volatilize completely, leaving no residue, and be free from phenols and quinoline bases; it should remain white in nitric acid (sp.gr. 1·42) for half an hour.

**Constitution.**—In the empirical formula, $C_{10}H_8$, for naphthalene, there are two more carbon atoms than hydrogen atoms, and from a consideration of its chemical properties, its products on disruption and from various modes of synthesizing it, naphthalene is best represented by formula I., or conventionally by formula

II.; the carbon atoms, except the two "submerged" atoms, are

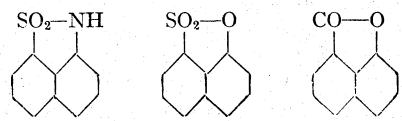


Formula I.



Formula II.

associated with a hydrogen atom each, numbered as shown. Although such a formula would appear to consist merely of two benzene rings, neither ring is in fact benzenoid in character until the unsaturation of the other has been destroyed (*see* below). Positions 1, 4, 5, 8 are termed $\alpha$-positions; 2, 3, 6, 7 are $\beta$-positions. Among di-derivatives, as in the benzene series, the 1:2-position is *ortho*, 1:3-*meta*, and 1:4-*para*; of the heteronucleal di-derivatives, the only important names are those given to the 2:6- and the 1:8-, which are called respectively *amphi*- and *peri*-positions. Peri-substituted compounds react in many respects as though they were true ortho-compounds. For instance, naphthalene-1:8-dicarboxylic acid (naphthalic acid) easily forms an anhydride; the corresponding diketone (acenaphthene-quinone) readily condenses with ortho-diamines; 1:8-naphthylene-diamine combines with suitable organic substances to form another ring; while sultams I. (from peri-amino-sulpho-derivatives), sultones II. (from peri-hydroxy-sulpho-derivatives), and lactones III. (from peri-hydroxy-carboxy-derivatives) may be produced by



I. II. III.

the elimination of water. There are ten possible disubstitution products if the entering groups are the same, but if different, 14. The number of trisubstituted products is much greater.

When naphthalene is nitrated, aminated, chlorinated, brominated or iodinated, the entering group invariably replaces the hydrogen atom in the $\alpha$-position. On sulphonation, however, both $\alpha$- and $\beta$-positions may be occupied by the entering group, the amount of each monosulphonic acid depending on the temperature and duration of the reaction, and also to a lesser extent on the strength and quantity of the acid used. All other monosubstituted $\beta$-derivatives must be prepared by indirect processes. Even with one group already in the nucleus, in either the $\alpha$- or the $\beta$-position, further substitution tends to take place at another $\alpha$-position, though there are exceptions, again more especially on sulphonation.

## NAPHTHALENE DERIVATIVES

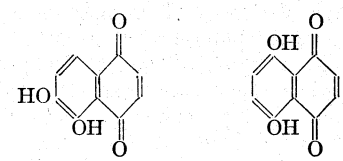
*Homologues.*—The methyl, ethyl and other alkyl derivatives of naphthalene used to be of little importance, but they are now being investigated as low-temperature lubricating oils. $\alpha$-Methylnaphthalene is a liquid which boils at 240° C; $\beta$-methylnaphthalene is a solid, melting at 32° C. Both are present in coal-tar, which also contains at least four dimethylnaphthalenes.

*Chloronaphthalenes.*—During the classical researches of Armstrong and Wynne on the constitution of naphthalene derivatives, the mono-, di- and tri-chloronaphthalenes (all of which—and there are 26—were prepared) were of the greatest scientific importance, in that any naphthalene compound of unknown configuration could be converted into the corresponding chloro- derivative, and its constitution thus established. Only $\alpha$-chloronaphthalene and 1:4-dichloronaphthalene can, however, be produced cheaply; the former is manufactured by passing chlorine into boiling naphthalene in presence of ferric chloride, and is an oil, boiling at 263° C; its chlorine atom is more reactive than that in chlorobenzene. 1:4-Dichloronaphthalene, melting point 68° C, is prepared by heating naphthalene with thionyl chloride at 140–160° C.

*Naphthalene Chlorides.*—Another type of chlorinated naphthalene is known in which the halogen atoms are associated with the carbon atoms of the nucleus without replacing the hydrogen atoms. These "additive" compounds, as they are called, are of little technical value, but their formation serves to show the unsaturated nature of the naphthalene nucleus. Napthalene dichloride, $C_{10}H_8Cl_2$, is a yellow oil formed when the hydrocarbon is treated with potassium chlorate and hydrochloric acid. When heated to 50° C hydrogen chloride is eliminated, leaving $\alpha$-chloronaphthalene. Naphthalene tetrachloride, $C_{10}H_8Cl_4$, formed when chlorine is passed into a chloroform solution of the hydrocarbon, melts at 182° C.

*Nitronaphthalenes.*— $\alpha$-Nitronaphthalene, $C_{10}H_7{\cdot}NO_2$, prepared by the action of strong nitric acid on naphthalene, is readily soluble in benzene, ether and hot alcohol from which it crystallizes in yellow needles, melting point 61° C. It is not volatile in steam. Its technical importance is mainly due to the fact that on vigorous reduction it gives $\alpha$-naphthylamine (*see* below). $\beta$-Nitronaphthalene is commercially unimportant because of its relative inaccessibility. The most convenient method of preparation is that of Vesely and Dvorak (1922), who obtained it in 28% yield by decomposing diazotized $\beta$-naphthylamine sulphate with copper bronze in presence of potassium nitrite. It crystallizes from dilute alcohol in yellow needles, melting point 79° C; unlike the $\alpha$-compound, it is volatile in steam.

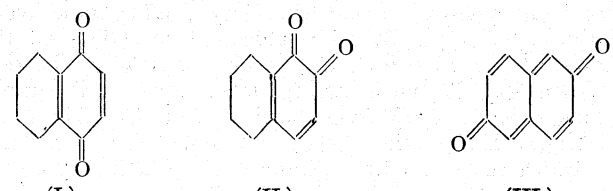
On further nitration with nitric acid in presence of sulphuric acid, $\alpha$-nitronaphthalene yields a mixture of 1:5- and 1:8-dinitronaphthalenes, the former after purification melting at 216° C, and the latter at 170° C. A mixture of the same two components is obtained on dinitrating naphthalene itself. This crude mixture, when heated with sulphur and fuming sulphuric acid, or when dissolved in sulphuric acid and electrolysed at 130° C, furnishes naphthazarin, the bisulphite compound of which is the important black mordant dyestuff Naphthazarin S. For many years naphthazarin was assumed to be 5:6-dihydroxy-$\alpha$-naphthoquinone, I., because of its similarity to alizarin (*q.v.*). In 1925, however, it was proved to possess the constitution II. Several tri- and



I. II.

tetra-nitronaphthalenes have been described; some of them find a limited use in the manufacture of explosives.

*Naphthoquinones.*—Six different naphthoquinones, $C_{10}H_6O_2$, are theoretically possible, three homonucleal, *i.e.*, with the :CO groups in the same ring, and three heteronucleal (in different rings). Of these, only the 1:4-, the 1:2- and the 2:6-, together with a derivative of the 2:3-, have been prepared. 1:4-Naphthoquinone (I.), obtained in yellow plates by the oxidation of various $\alpha$-derivatives of naphthalene with chromic acid, resembles



(I.) (II.) (III.)

benzoquinone in that it has a characteristic odour and is volatile in steam. A hydroxy-derivative of this quinone, juglone, affords a very delicate test of nickel, since in 1% alcoholic solution it gives a distinct violet colour with 0·001% of Ni. 1:2-Naphthoquinone (II.), obtained by oxidizing 2-amino-$\alpha$-naphthol with ferric chloride, differs from the 1:4-quinone in being, like phenanthraquinone, odourless and non-volatile in steam. 2:6-Naphthoquinone (III.), too, is non-volatile and odourless, but similar to

benzoquinone in chemical properties; it is formed by the oxidation of the corresponding dihydroxynaphthalene with lead peroxide in benzene solution. The 1:2- and 2:6-quinones are red.

*Naphthalenesulphonic Acids.*—Naphthalene-$\alpha$-sulphonic acid, $C_{10}H_7 \cdot SO_3H$, predominates when the hydrocarbon is sulphonated below 80° C, the $\beta$-isomeride when the temperature of sulphonation is 160–180° C. Further sulphonation of the former yields 1:5- and 1:6-, and of the latter 2:7- and 2:6-disulphonic acids. Other disulphonic acids are obtainable by synthetic methods, and numerous tri- and tetra-sulphonic acids are also known. All these acids liberate hydrochloric acid from sodium chloride. They and their alkali salts are soluble in water, but the lead, barium and calcium salts often differ widely in solubility, and can occasionally be utilized in the separation of mixtures. The value of these polysulphonic acids depends largely on the ease with which they lose sulphonic groups or exchange them for hydroxyl groups, both changes taking place more readily from $\alpha$- than from $\beta$-positions.

**Naphthylamines** (aminonaphthalenes).—Since sulphonation is the only convenient means of obtaining $\beta$-derivatives directly from the hydrocarbon, the manufacture of $\beta$-naphthylamine and its substitution products (from naphthalene-$\beta$-sulphonic acid *via* $\beta$-naphthol) differs from that of $\alpha$-naphthylamine (which is easily accessible through $\alpha$-nitronaphthalene). The two naphthylamines are the analogues of aniline (*q.v.*), but differ from it in some respects; they may, for instance, be prepared by heating the corresponding naphthol with the ammonia compound of zinc chloride or calcium chloride; aniline cannot easily be so obtained from phenol.

*$\alpha$-Naphthylamine,* $C_{10}H_7 \cdot NH_2$, is made in large quantities by reducing $\alpha$-nitronaphthalene with soft iron borings ("swarf") and dilute hydrochloric acid at 50–70° C; milk of lime is then added to neutralize the acid, and the liberated amine distilled, either with superheated steam, or preferably in a vacuum. Further distillation and crystallization are necessary to obtain the pure product. If naphthalene is heated at 220° C with sodamide in presence of phenol, $\alpha$-naphthylamine is formed, hydrogen being evolved. It may also be prepared by heating $\alpha$-naphthol with ammonium bisulphite under pressure or with ammonia-calcium chloride at 270° C. $\alpha$-Naphthylamine is soluble in most solvents, and crystallizes when quite pure in colourless flat needles or scales, which melt at 51° C, and boil at 300° C. The technical product gradually acquires a greyish-violet colour when exposed to air, owing probably to the presence of easily oxidized 1:8-diaminonaphthalene. $\alpha$-Naphthylamine can be readily distinguished from the $\beta$-isomeride by its faecal odour, by its slight volatility in steam, and by the azure-blue precipitate, soluble in chloroform, which aqueous solutions of its salts give when oxidized with ferric chloride. Diazo-solutions of amines couple with $\alpha$-naphthylamine in the 4-position, or if this is occupied in the 2-position, giving aminoazo-compounds. If both positions are blocked, either one of the intruding substituents is removed, or azo-coupling does not take place.

*$\alpha$-Naphthylaminesulphonic acids* can be prepared in several ways, of which the most important technically are (*a*) sulphonation of $\alpha$-naphthylamine, (*b*) amination of $\alpha$-naphtholsulphonic acids, using ammonia and ammonium sulphite, and (*c*) nitration of naphthalenesulphonic acids, with subsequent reduction. Of the seven possible monosulphonic acids of $\alpha$-naphthylamine, all except the 3- acid are in common use; the most important is 1-naphthylamine-4-sulphonic acid (naphthionic acid), produced by "baking" $\alpha$-naphthylamine acid sulphate at 180–200° C in a vacuum, or by heating the amine with sulphuric acid at 170° C in presence of 3% of oxalic acid. When diazotized it constitutes the first component of many azo-dyes of the fast red series. It also couples with diazotized bases forming ortho-azo-dyes, but in these circumstances the still intact amino-group in the 1-position cannot be further diazotized owing to the proximity of the diazo-complex; one of the best known dyes in this class is Congo red, from diazotized benzidine (*q.v.*) and two molecules of naphthionic acid.

*$\beta$-Naphthylamine* is manufactured in almost quantitative yield by heating in an autoclave under the pressure of 6 atmos. $\beta$-naphthol, 40% ammonium sulphite solution, and 20% ammonia in suitable proportions at 150° C for several hours. (This reaction, named after Bucherer, has an extensive application throughout the naphthalene series.) The crude naphthylamine is removed by filtration, washed with caustic soda to remove unchanged naphthol, and finally distilled in a vacuum to remove $\beta\beta'$-dinaphthylamine, which is always produced in small quantity. When pure, $\beta$-naphthylamine crystallizes from alcohol in colourless, lustrous scales, melts at 112° C, and boils at 294° C. Unlike the $\alpha$-isomeride, it is odourless, moderately volatile in steam, and appreciably soluble in hot water, and solutions of its salts give no colour with ferric chloride or other mild oxidizing agents.

The most important reactions used for the manufacture of *$\beta$-naphthylaminesulphonic acids* are (*a*) sulphonation of naphthylamine, (*b*) amination of naphtholsulphonic acids in presence of ammonium bisulphite, and (*c*) reduction of $\beta$-nitronaphthalenesulphonic acids. As sources of azo-dyes these acids are not so important as the $\alpha$-amino-compounds; many of the dyestuffs derived from them are of little worth and, moreover, once they have coupled (in the $\alpha$-position) with other diazotized amines, the contiguous $\beta$-amino-group cannot be itself diazotized. $\beta$-Naphthylamine-6-sulphonic acid (Brönner acid) and $\beta$-naphthylamine-3:6-disulphonic acid are among the more important. One valuable property, however, which the $\beta$-naphthylamine-di- and tri-sulphonic acids possess is that of exchanging an $\alpha$-sulphonic group for a hydroxyl group when digested with caustic soda, thus producing the valuable aminonaphtholsulphonic acids; $\alpha$-naphthylamine-di- (though not tri-) sulphonic acids under the same conditions exchange the amino-group for a hydroxyl group giving merely naphtholdisulphonic acids. The naphthylaminesulphonic acids of both the $\alpha$- and $\beta$- series may be estimated by titration with diazotized *para*-nitraniline.

An important feature of sulphonic groups, not only in the naphthylamine and naphthol series, but also in naphthalenesulphonic acids, is the frequency with which they "migrate" from one position to another during the sulphonation process. This apparent shifting is due largely to hydrolysis of the sulphonic group, followed by resulphonation in another position under the altered conditions. For example, sulphonation of $\beta$-naphthol at the ordinary temperature gives the 1-, at 60° C the 8-, and at 100° C the 6-sulpho-derivative.

The ten possible *diaminonaphthalenes* have all been prepared, most of them by heating the corresponding aminonaphthol or dihydroxynaphthalene with ammonia under pressure, but reduction of nitronaphthylamines, of dinitronaphthalenes, or of azo-dyes furnishes others which would otherwise be difficult of access. They have found little application in the colour industry. 1:8-Naphthylenediamine, $C_{10}H_6(NH_2)_2$, melting point 67° C, is of interest because, like the true ortho-diamines (1:2- and 2:3-), it readily forms another ring by condensation with such substances as acetone, acetic anhydride, phosgene, ethyl oxalate and nitrous acid. The diaminonaphthalenesulphonic acids are unimportant.

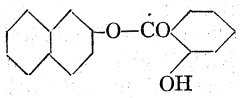
**Naphthols** (hydroxynaphthalenes).—These industrially important substances are the naphthalene analogues of phenol (*see* CARBOLIC ACID), which they resemble in a general way. Nevertheless, there are certain important differences due to the greater reactivity of the hydroxyl group in the naphthols. For instance, the naphthols when heated under pressure with ammonia furnish the corresponding naphthylamines; they can be etherified when heated with alcohol and hydrochloric acid at 150° C; and they are converted into naphthyl ethers (dinaphthyl oxides) by boiling sulphuric acid. Phenol undergoes none of these reactions to any appreciable extent. The naphthols are said to occur in very small amount in high-boiling coal-tar fractions. Many tests have been devised for detecting and estimating traces of $\alpha$- and $\beta$-naphthols in each other. Moreover, certain colour reactions are available: (1) ferric chloride, with which the $\alpha$- isomeride gives an opalescence changing to a violet precipitate of $\alpha\alpha$-dinaphthol, whereas the $\beta$- gives a pale green colour changing to a white precipitate of $\beta\beta'$-dinaphthol; (2) bleaching powder solution, $\alpha$- giving a violet colour, and $\beta$- a pale yellow; (3) sodium hypoiodite ($\alpha$- gives a purple colour, and $\beta$- nil), and (4) titanyl

sulphate ($\alpha$- gives an intense green colour changing to reddish-violet on addition of acetic acid, and $\beta$- nil). Both $\alpha$- and $\beta$-naphthols develop Prussian blue colorations with chloroform and caustic potash solution.

*$\alpha$-Naphthol,* $C_{10}H_7{\cdot}OH$, is usually manufactured by adding sodium naphthalene-$\alpha$-sulphonate to fused caustic soda in an open vessel at about 300° C, or by heating it with strong caustic soda solution in an autoclave at about 280° C for 10–12 hours, whereby the formation of oxidation products attendant upon open pot fusions is avoided. If required quite free from $\beta$-naphthol (which is always present in $\alpha$-naphthol prepared by fusion processes), it may be obtained by heating $\alpha$-naphthylamine sulphate or hydrochloride with water at 200° C under pressure for four hours. Another method consists in heating under pressure $\alpha$-chloronaphthalene, caustic soda and methyl alcohol at 210° C for several hours. $\alpha$-Naphthol crystallizes in white, lustrous prisms, melting point 94° C, boiling point 278–280° C. It is readily soluble in most organic solvents and in caustic alkali solutions, but only sparingly in hot water. Unlike $\beta$-naphthol, it is volatile in steam at 100° C, and possesses a phenolic odour. $\alpha$-Naphthol is more poisonous than $\beta$-naphthol, and finds no medicinal application. Nitrous acid converts it into a mixture of 2- and 4-nitroso-$\alpha$-naphthol, the former preponderating. One chlorine atom can be introduced by using sulphuryl chloride to give 4-chloro-$\alpha$-naphthol, but chlorination with chlorine leads to the formation of the 2:4-dichloro-derivative. Nitration gives, in the same way, not a mononitro-compound, but 2:4-dinitro-$\alpha$-naphthol. The sodium salt of this substance, known variously in commerce as Martius yellow, Manchester yellow, or naphthalene yellow, was formerly used as a golden-yellow dye for silk and wool. It is easily removed from the fibre, however, and has been superseded. A closely related dyestuff of greater importance is naphthol yellow S (2:4-dinitro-$\alpha$-naphthol-7-sulphonic acid).

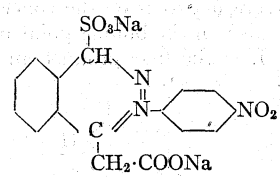
The most important technical methods for the manufacture of *$\alpha$-naphtholsulphonic acids* are (*a*) sulphonation of $\alpha$-naphthol, (*b*) replacement of the amino-group of $\alpha$-naphthylaminesulphonic acids by hydroxyl, through the diazo-reaction, (*c*) conversion of $\alpha$-naphthylaminesulphonic acids by heating with sodium bisulphite solution (*i.e.,* the reverse of Bucherer's reaction for the introduction for an amino-group), (*d*) exchange of one of the $\alpha$-sulphonic groups in naphthalenepolysulphonic acids for hydroxyl by fusion with caustic alkali, and (*e*) similar exchange of the chlorine atom in $\alpha$-chloronaphthalenesulphonic acids. The best known is 1-naphthol-4-sulphonic acid (Neville and Winther's acid) which is used for making a large number of azo-dyes.

*$\beta$-Naphthol* is invariably made technically by fusion of the sodium salt of naphthalene-$\beta$-sulphonic acid with caustic alkali, and is therefore liable to contain a small amount of the $\alpha$-isomeride unless carefully purified. When pure it crystallizes in plates, melting point 122° C, boiling point 285°–286° C. Its solubility in various solvents is similar to that of $\alpha$-naphthol, but it is odourless, and appreciably volatile only in superheated steam. It has marked antiseptic properties, and its salicylate

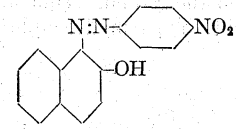



, which is known in pharmacy as betol or naphtholsalol, is useful medicinally. When ortho-aminoazotoluene is diazotized and coupled with $\beta$-naphthol, a dark reddish-brown powder, called scarlet red, is formed. This possesses valuable therapeutic properties, and is also used for stains in microscopy. The alkyl ethers of $\beta$-naphthol find scope as cheap perfumes. With nitrous acid, $\beta$-naphthol yields the 1-nitroso-derivative, which forms insoluble precipitates with certain metallic salts, thus enabling cobalt to be separated from nickel, iron from aluminium, and copper from cadmium, magnesium and zinc. These precipitates are easily converted into metallic oxides by ignition, and so afford a means of estimating cobalt, iron and copper. Chlorination of $\beta$-naphthol gives the 1-chloro-derivative, but on nitration 1:6-dinitro-$\beta$-naphthol is obtained. If $\beta$-naphthol is condensed in alcoholic solution with para-nitrosodimethylaniline hydrochloride, an oxazine, Meldola's blue (dimethylaminonaphthophenoxazonium chloride), is formed (*see* DYES, SYNTHETIC).

The general methods available for the production of *$\beta$-naphtholsulphonic acids* are somewhat limited by the difference in reactivity between $\alpha$- and $\beta$-sulphonic groups in the naphthalene nucleus. For instance, only from those disulphonic acids (and there are but two available, the 2:6- and 2:7-) containing *both* sulphonic groups in $\beta$-positions can a $\beta$-naphthol derivative be obtained by fusion with alkali, for if an $\alpha$-sulphonic group be present it will be replaced preferentially. Furthermore, replacement of the $\beta$-amino-group by hydroxyl is usually impracticable, as the most convenient method of preparing the required $\beta$-naphthylaminesulphonic acids is from the $\beta$-naphtholsulphonic acids themselves. Fortunately a greater number of $\beta$-naphtholsulphonic acids can be obtained by direct sulphonation than in the $\alpha$-series. Of these, $\beta$-naphthol-1-sulphonic acid (oxy-Tobias acid) is of little value for dyestuff purposes, but it is unique among the acids of the naphthalene series in that it undergoes a curious transformation when successively condensed with diazotized para-nitraniline and treated with an excess of sodium hydroxide, a complex phthalazine I. being formed, instead of the usual para red II.$\beta$ -Naphthol-6-sulphonic acid (Schaeffer acid), -8-sulphonic




I.



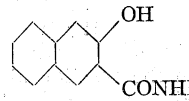

II.

acid (Croceine acid), -3:6-disulphonic acid (R-acid), -6:8-disulphonic acid (G-acid), and -3:6:8-trisulphonic acid, all produced by sulphonation of $\beta$-naphthol under varying conditions, are very important. G-Acid furnishes a series of valuable yellow or orange azo-dyes, hence its name (from Ger. *Gelbsäure* = yellow acid), in contradistinction to R-acid (from *Rotsäure* = red acid) which gives the more common red shades.

The *dihydroxynaphthalenes* and their sulphonic acids are of greater technical importance than the diaminonaphthalenes, especially 1:5-dihydroxynaphthalene, 1:8-dihydroxy-4-sulphonic acid, and 1:8-dihydroxy-3:6-disulphonic acid (chromotropic acid). When coupled with diazotized amines they furnish dyes which form insoluble lakes with iron, aluminium or chromium mordants.

Among the more important *aminonaphtholsulphonic acids* are 2-amino-5-naphthol-7-sulphonic acid (J-acid) (which, unlike its isomerides, endows many dyes of which it is a component with the property of dyeing unmordanted cotton), 2-amino-8-naphthol-6-sulphonic acid ($\gamma$-acid), and 1-amino-8-naphthol-3:6-disulphonic acid (H-acid), the last being one of the most valuable intermediates that the dyestuff industry possesses. H-Acid, as well as other 3:6-naphthalenedisulphonic acids, has also been employed in the synthesis of trypanocides for use in combating sleeping sickness. Several of the aminonaphtholsulphonic acids, *e.g.,* "Eikonogen" and "Diogen," are used in photography.

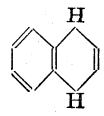
**Carboxylic Acids.**—Only certain hydroxy-derivatives of $\alpha$- and $\beta$-naphthoic acids are technically valuable. Their chief interest, with one exception, lies in one of the methods of preparation, for Kolbe's synthesis (the action of carbon dioxide under pressure on the dry sodium or potassium salt of the naphthol) furnishes from $\alpha$-naphthol the 2-carboxy-acid, and from $\beta$-naphthol the 1-, 3-, or 6-carboxy-acid, according to the temperature. Of these, 2-hydroxy-3-naphthoic acid, melting point 216° C, is most important, since it gives rise to various anilides, toluidides, naphthylamides, etc., when heated in a solution of a tertiary base, such as dimethylaniline, with the appropriate amine in presence of phosphorus trichloride. These substances, of which the simplest,



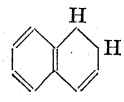

melting point 243°–244° C, has the trade

name "Naphthol AS" (Brenthol AS), possess a strong affinity for both natural and artificial fibres. When the material so impregnated is passed through a diazo-solution from *p*-nitroaniline or other aromatic base, coupling takes place inside rather than on the surface of the fibre, and the colours are much faster to light and washing than those from azo-dyes produced by merely "padding" the fibre with (say) β-naphthol. Various dyestuffs of this series are available for cotton, wool and artificial silks.

**Hydrogenated Derivatives.**—All the hydrogenated products of naphthalene, from dihydronaphthalene, $C_{10}H_{10}$, to decahydronaphthalene, $C_{10}H_{18}$, are known, each member having two hydrogen atoms more than its immediate predecessor. Three general methods are available for their preparation, in all of which, however, the products vary considerably with variations in the conditions. (1) Reduction with hydriodic acid: this method gives mixtures difficult to purify. Two intermediate products in the preparation of decahydronaphthalene by this method have been identified, viz., 1:4-dihydro- and 1:4:5:8-tetrahydro-naphthalene. (2) Reduction with sodium and an alcohol: by this method no more than four hydrogen atoms can be introduced into the naphthalene nucleus, no matter what alcohol is employed. Amyl alcohol and sodium yield 1:2:3:4:-tetrahydronaphthalene, but the product when any other alcohol is used depends to a certain extent on the concentration of the sodium alcoholate, and also on the boiling point of the solvent. 1:4-Dihydronaphthalene I. is the first product and un-

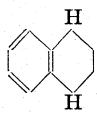
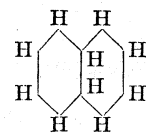


I

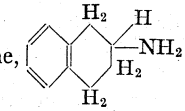
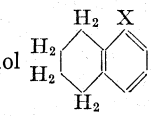


II

less this isomerizes to 1:2-dihydronaphthalene II. hydrogenation can proceed no further. (3) Reduction with hydrogen in presence of a catalyst: the particular hydro-derivative obtained by this method depends upon a variety of conditions. Most important is the nature and oxygen content of the catalyst, but the degree of hydrogenation is dependent also on the temperature, pressure and duration of the reaction, and on whether the naphthalene reacts in the vapour or liquid phase or in solution.

*Tetralin.*—The method adopted for the manufacture of 1:2:3:4-tetrahydronaphthalene  ("Tetralin") by the Tetralin Co. at their works near Rosslau in Germany, where 120 tons per day can be produced, is briefly as follows: Commercially pure naphthalene, which contains sulphur compounds (*e.g.*, thionaphthenes) equivalent to 0·25% of sulphur, is freed from them by heating with fuller's earth, kieselguhr or other absorbent material. If this were not done, the catalyst would be quickly poisoned and unable to function. The purified naphthalene is distilled into the hydrogenating autoclaves, which contain the catalyst (usually finely-divided nickel and copper oxide deposited on an inert medium), and hydrogen (freed from carbon monoxide and sulphur dioxide) is pumped in until at 200° C a pressure of about 220lb. per sq.in. is attained. The agitated molten naphthalene rapidly takes up hydrogen until the tetrahydro-stage is reached, when the rate of absorption diminishes. The product is then distilled under reduced pressure, a fresh charge of molten naphthalene introduced, and the process repeated. As many as 40 hydrogenations can be effected before the catalyst has to be reactivated. If "Decalin" (decahydronaphthalene)  is required, more hydrogen is introduced when the reaction attains the tetrahydro-stage, and the process continued.

Tetralin is a colourless liquid, boiling point 206°–208° C, flash point 78° C. It is insoluble in water and only sparingly soluble in ethyl alcohol (except after long standing, when oxidation products have affected its physical properties), but it mixes freely with amyl alcohol, butyl alcohol or benzene. It is a useful solvent for certain types of synthetic resins, essential and vegetable oils, waxes, rubber, sulphur and many organic substances and dyestuffs; it also finds application as a diluent in boot polishes. Both it and "tetralin extra" (a mixture of decalin and tetralin) are used in the manufacture of lacquers and varnishes; decalin alone has not such a powerful solvent action. Tetralin was used in Germany during the World War as a motor fuel in place of petrol, but under normal conditions its high flash point is a serious objection for such a purpose. When it is treated with concentrated sulphuric acid and the sulphonated oil neutralized with caustic soda, tetralin-soda sulphite, a white soapy substance, soluble in water and possessing a powerful emulsifying action, is formed. "Tetralol" (*ar.*-tetra-hydro-β-naphthol) is used as a disinfecting soap; it is non-poisonous to man and may therefore also be employed for the preservation of fruit-trees.

When the naphthylamines and naphthols are reduced to their tetrahydro-derivatives with sodium in boiling amyl alcohol, two types of compounds are formed: (*a*) those in which the four hydrogen atoms are attached to the same ring as the original substituent, and (*b*) those in which the original substituent is in one ring and the four added hydrogen atoms are in the other. The members of class (*a*) are termed "alicyclic" (or *ac.*-) derivatives, because they have become aliphatic in character; *e.g.*, β-naphthylamine is hydrogenated to *ac.*-tetrahydro-β-naphthylamine,  , in 95% yield; this substance is strongly alkaline, has an ammoniacal odour, absorbs carbon dioxide from the air, and cannot be diazotized. β-Naphthol similarly gives a secondary alcohol. The members of class (*b*) are termed "aromatic" (or *ar.*-) because they still bear a close analogy to the corresponding compounds in the benzene series; *e.g.*, α-naphthylamine and α-naphthol yield on hydrogenation *ar.*-tetrahydro-naphthylamine and -naphthol  (where X is $-NH_2$ or -OH), the properties of which closely resemble those of ortho-xylidine and ortho-xylenol respectively.

BIBLIOGRAPHY.—G. Lunge, *Coal Tar and Ammonia;* J. C. Cain, *The Manufacture of Intermediate Products for Dyes* (1918); T. E. Thorpe, "Naphthalene" and "Tetralin," *Dictionary of Applied Chemistry,* vol. iv. (1922), vol. vi. (1926). (H. A. HA.)

**NAPHTHOLS:** *see* NAPHTHALENE.

**NAPHTHYLAMINES:** *see* NAPHTHALENE.

**NAPIER, SIR CHARLES** (1786–1860), British admiral, second son of the Hon. Charles Napier, R.N., and grandson of the 5th Lord Napier, was born at Merchiston Hall, near Falkirk, on March 6, 1786. He became a midshipman in 1800 and lieutenant in 1805. He was appointed to the "Courageux" (74), serving with her in the West Indies, and later was appointed commander of the "Pultusk" brig (Nov. 30, 1807). In August 1808 he was moved into the "Recruit," and in April 1809 took part in the capture of the "Hautpoult" and was promoted acting post captain. Coming home with a convoy, he was put on half pay and spent some time at the university of Edinburgh, and later visited Portugal. He served in 1811 in the Mediterranean and in 1813 on the coast of America. He spent his leisure in Italy and Paris, but was ruined by speculation in a steamboat company. In 1827 he was appointed to the "Galatea," was at the Azores when they were held by the count de Villa Flor for the queen of Portugal, and accepted the offer of the constitutional leaders to take command of the fleet (February 1833). With it he destroyed

the Miguelite fleet on July 5, and was struck off the English navy list. He commanded the Portuguese land forces in the defence of Lisbon (1834) and was made Count Cape St. Vincent in the peerage of Portugal.

Napier then returned to England, was restored to his former rank in 1836, and received the command of the "Powerful" in 1838. In 1840 he was made K.C.B. for his services as second in command in Syria. He was M.P. for Marylebone from 1842–46. He was promoted rear-admiral in 1846 and commanded the Channel fleet from 1846–48. In the Russian War he received the command of the Baltic fleet, and hoisted his flag in February 1854. He refused to attack Cronstadt, and a great outcry was raised against him for not obeying the orders of the Admiralty. He was not again offered a command. He was M.P. for Southwark from February 1855 until his death on Nov. 6, 1860.

*See* Major-General E. Napier's *Life and Correspondence of Admiral Sir Charles Napier, K.C.B.* (2 vols., 1862); Napier's own *War in Syria* (2 vols., 1842); *The Navy: its past and present state, in a series of letters,* edited by Sir W. F. P. Napier (1851); and *The History of the Baltic Campaign of 1854, from documents and other materials furnished by Vice-Admiral Sir C. Napier, K.C.B.* (1857). *See* also *The Life and Exploits of Commodore Napier* (1841); and *Life of Vice-Admiral Sir C. Napier* (1854).

**NAPIER, SIR CHARLES JAMES** (1782–1853), British soldier and statesman, was born in London, the eldest son of Colonel George Napier (a son of the 5th Lord Napier) and Lady Sarah Lennox, on Aug. 10, 1782. He was lieutenant in 1800 and captain in the staff corps under Sir John Moore. He became major in 1806 and served in the Danish campaign (1807) and in Portugal, but was badly wounded at Coa and Busaco. He took part in the pursuit of Masséna and became lieutenant-colonel (1811) of the 102nd regiment, which he thoroughly reorganized. At Bermuda in 1813 he served against the United States, but returned in 1815 and was made C.B. From 1822 to 1830 he was military resident of Cephalonia, where he met Lord Byron, and was recommended as commander-in-chief of the Greek forces. Napier declined, and, after trouble with Sir Frederick Adams, the high commissioner, he became commanding officer in the north of England during the Chartist riots (1839), although his sympathies were on the popular side. He accepted an Indian commission in 1841, and in September 1842 was ordered to Sind.

His command in Sind lasted until August 1847. He at once determined to seek the first opportunity of conquering the amirs. He was to be accompanied by James Outram (*q.v.*) who had been British resident in Sind during the Afghan War. On Feb. 15, 1843, Outram was treacherously assailed at Hyderabad, and on the 17th Napier attacked the Baluch army 30,000 strong, with but 2,800 men. With these 2,800 men, including the 22nd regiment, he won the brilliant and decisive victory of Miani, one of the most amazing in the history of the British army, in which generals had to fight like privates. In March he finally destroyed the army of the amirs at the battle of Hyderabad, and for this service received the K.C.B. Sind, when it came under British rule, was in a state of anarchy, for the Baluchis had formed a tyrannical military government. The native population was protected by Sir Charles Napier. The difficulties of administration were increased by the necessity of repressing the hill tribes, encouraged to lawless acts by the licence which followed the Afghan War; the later years were made very stormy by attacks in England on the policy of the conquest. Napier left Sind in August 1847 after quarreling with nearly every authority in India. His short stay in England was occupied with incessant struggles with the directors of the East India Company, but the panic in England which followed the news of the indecisive victory of Chillianwalla obliged the company to summon the greatest general of the day to command its armies.

Napier left for India at once, only to find that the victory of Gujrat had been won and the Sikh War was over. He was on good terms with the governor-general, Lord Dalhousie, until, in Dalhousie's absence at sea, Napier took upon himself, in face of a threat of mutiny, to alter the regulations regarding allowances to native troops. On Dalhousie's return he reprimanded the commander-in-chief, and reversed his decision. Napier immediately resigned, and, when Wellington repeated the reprimand, he returned to England.

He has been credited with foreseeing the Mutiny of 1857, and on the whole with justice. On one occasion he wrote that mutiny was "one of the greatest, if not the greatest, danger threatening India—a danger that may come unexpectedly, and if the first symptoms be not carefully treated, with a power to shake Leadenhall." On the mutiny of the 66th native regiment at Govindgarh he disbanded it, and handed its colours over to a Gurkha regiment, thus showing that he distrusted the high-class Brahman, and recognized the necessity of relying upon a more warlike and more disciplined race. His constitution was undermined by the Indian climate, and he died at Portsmouth on Aug. 29, 1853. The bronze statue of him by G. G. Adams, which stands in Trafalgar Square, London, was erected by public subscription, by far the greater number of the subscribers being, as the inscription records, private soldiers.

The chief authority for Sir Charles Napier's life is his *Life and Opinions* by his brother (1857); consult also MacColl, *Career and Character of C. J. Napier* (1857); M'Dougall, *General Sir C. J. Napier, Conqueror and Governor of Scinde* (1860); W. N. Bruce, *Sir Charles Napier* (1855); and T. R. E. Holmes, *Four Famous Soldiers* (1889). His own works are *Memoir on the Roads of Cephalonia* (1825); *The Colonies, treating of their value generally and of the Ionian Islands in particular; Strictures on the Administration of Sir F. Adam* (1833); *Colonization, particularly in Southern Australia* (1835); *Remarks on Military Law and the Punishment of Flogging* (1837); *A Dialogue on the Poor Laws* (1838?); *A Letter on the Defence of England by Corps of Volunteers and Militia* (1852); *Lights and Shadows of Military Life* (trans. from the French, 1840); and *A Letter to the Right Honourable Sir J. C. Hobhouse on the Baggage of the Indian Army* (1849); *Defects, Civil and Military, of the Indian Government* (1853); *William the Conqueror, a Historical Romance,* edited by Sir W. Napier (1858). On Sind, consult primarily Sir W. Napier, *The Conquest of Scinde* (1845); *The Administration of Scinde* (1851); *Compilation of General Orders issued by Sir C. Napier* (1850); and Outram, *The Conquest of Scinde, a Commentary* (1846). For his command-in-chief, and the controversy about his resignation, consult J. Mawson, *Records of the Indian Command of General Sir C. J. Napier* (Calcutta, 1851); *Minutes on the Resignation of the late General Sir C. Napier, by Field-Marshal the Duke of Wellington,* etc. (1854); *Comments by Sir W. Napier on a Memorandum of the Duke of Wellington* (1854); Sir William Napier, *General Sir C. Napier and the Directors of the East India Company* (1857); Sir W. Lee Warner, *Life of Lord Dalhousie* (1904).

**NAPIER, JOHN** (1550–1617), Scottish mathematician, the inventor of logarithms, was born in Merchiston near Edinburgh in 1550, and was the eighth Napier of Merchiston. He matriculated at St. Salvator's college, St. Andrews, in 1563. Very little is known of his life at this time, but it is plain from the "Discourse" which he prefixed to his *Plaine Discovery* that he was already a devoted adherent of the Protestant cause. From St. Andrews he went apparently to study in Paris, and travelled in Italy and Germany. But he was back at Merchiston in 1571, and in the next year married Elizabeth, daughter of Sir James Stirling. The son of this marriage was Archibald, Lord Napier. Elizabeth Napier died in 1579, and soon after Napier married Agnes Chisholm.

Napier was one of the Edinburgh commissioners to the General Assembly in 1588, and on Oct. 17, 1593, was a member of a committee nominated by a convention of delegates to make representations to the king at Jedburgh on the safety of the Church and the punishment of the Roman Catholic earls. He was a member of a similar delegation later in the month. On Jan. 29, 1594, Napier addressed to the king the letter which forms the dedication of his *Plaine Discovery of the whole Revelation of Saint John: set down in two treatises . . .* (Edinburgh, 1593). This book has a great place in the history of theology in Scotland, for it is the first important Scottish work on the interpretation of scripture.

After the publication of the *Plaine Discovery,* Napier seems to have occupied himself with the invention of secret instruments of war, for in the Bacon collection at Lambeth Palace there is a document, dated June 7, 1596, and signed by Napier, giving a list of his inventions for the defence of the country against the anticipated invasion by Philip of Spain. In 1614 appeared *Canonis Descriptio* embodying his invention of logarithms. Their nature is explained by reference to the motion of points in a straight line, and the principle upon which they are based is that of the correspondence of a geometrical and an arithmetical series of numbers.

The table gives the logarithms of sines for every minute to seven figures. This work contains the first announcement of logarithms to the world, the first table of logarithms and the first use of the name logarithm, which was invented by Napier.

In 1617 Napier published his *Rabdologia.* The method which Napier terms "Rabdologia" consists in the use of certain numerating rods for the performance of multiplications and divisions. These rods were commonly called "Napier's bones." The second method, which he calls the "Promptuarium Multiplicationis," involves the use of a number of lamellae or little plates of metal disposed in a box. In an appendix he gives his third method, "local arithmetic," which is performed on a chess-board, and depends, in principle, on the expression of numbers in the scale of radix 2. In the *Rabdologia* he gives the chronological order of his inventions.

John Napier died on April 4, 1617, the same year as that in which the *Rabdologia* was published.

The *Canonis Descriptio* on its publication in 1614 at once attracted the attention of Edward Wright, whose name is known in connection with improvements in navigation, and Henry Briggs, then professor of geometry at Gresham college, London. The former translated the work into English, but he died in 1615, and the translation was published by his son Samuel Wright in 1616. The logarithms introduced by Napier in the *Descriptio* are not the same as those now in common use, nor even the same as those now called Napierian or hyperbolic logarithms. The change from the original logarithms to common or decimal logarithms was made by both Napier and Briggs, and the first tables of decimal logarithms were calculated by Briggs, who published a small table, extending to 1,000, in 1617, and a large work, *Arithmetica Logarithmica,* containing logarithms of numbers to 30,000 and from 90,000 to 100,000, in 1624. (*See* LOGARITHMS.) Napier's *Descriptio* of 1614 contains no explanation of the manner in which he had calculated his table. This account he kept back, as he himself states, in order to see from the reception met with by the *Descriptio* whether it would be acceptable. Though written before the *Descriptio* it had not been prepared for press at the time of his death, but was published by his son Robert in 1619 under the title *Mirifici Logarithmorum Canonis Constructio.* In this treatise (which was written before Napier had invented the name logarithm) logarithms are called "artificial numbers."

Napier's priority in the publication of the logarithms is unquestioned and only one other contemporary mathematician seems to have conceived the idea on which they depend.

An account of the contents of the manuscripts of John Napier in the possession of the family which survived a disastrous fire at the end of the 18th century was given by Mark Napier in the appendix to his *Memoirs of John Napier,* and the manuscripts themselves were edited in their entirety by him in 1839 under the title *De Arte Logistica Joannis Naperi Merchistonii Baronis Libri qui supersunt. Impressum Edinburgi* M.DCCC.XXX.IX., as one of the publications of the Bannatyne club. The *Arithmetica* consists of three books, entitled: (1) De Computationibus Quantitatum omnibus Logisticae speciebus communium; (2) De Logistica Arithmetica; (3) De Logistica Geometrica. At the end of this book occurs the note—"I could find no more of this geometricall pairt among all his fragments." The *Algebra Joannis Naperi Merchistonii Baronis* consists of two books: (1) "De nominata Algebrae parte; (2) De positiva sive cossica Algebrae parte," and concludes with the words, "There is no more of his algebra orderlie sett doun."

Besides the logarithms and the calculating rods or bones, Napier's name is attached to certain rules and formulae in spherical trigonometry. To him also seems to be due the first use of the decimal point in arithmetic. Decimal fractions were first introduced by Stevinus in his tract *La Disme,* published in 1585, but he used cumbrous exponents (numbers enclosed in circles) to distinguish the different denominations, primes, seconds, thirds, etc. In the *Rabdologia* Napier gives an "Admonitio pro Decimali Arithmetica," in which he commends the fractions of Stevinus and gives an example of their use, the division of 861094 by 432. The quotient is written 1993,273 in the work and 1993,2′7″3′″ in the text. The decimal point is, however, used systematically in the *Constructio* (1619), there being perhaps two hundred decimal points altogether in the book.

Napier was in possession of all the conventions and attributes that enable the decimal point to complete so symmetrically our system of notation, viz. (1) he saw that a point or separatrix was quite enough to separate integers from decimals, and that no signs to indicate primes, seconds, etc., were required; (2) he used ciphers after the decimal point and preceding the first significant figure; and (3) he had no objection to a decimal standing by itself without any integer. Napier thus had complete command over decimal fractions and the use of the decimal point.

The bibliography of Napier's work attached to W. R. Macdonald's translation of the *Canonis Constructio* (1889) is complete and valuable. Napier's three mathematical works are reprinted by N. L. W. A. Gravelaar in *Verhandelingen der Kon. Akad. van Wet te Amsterdam* (1899).

**NAPIER, SIR WILLIAM FRANCIS PATRICK** (1785–1860), British soldier and military historian, third son of Colonel George Napier (1751–1804), was born at Celbridge, near Dublin, on Dec. 17, 1785. He became an ensign in the Royal Irish Artillery in 1800, but at once exchanged into the 62nd, and was put on half-pay in 1802. He afterwards became a cornet in the Blues, but he soon exchanged into the 52nd, which was about to be trained at Shorncliffe. Through Sir John Moore he soon obtained a company in the 43rd, joined that regiment at Shorncliffe and became a favourite with Moore. He served in Denmark, and was present at the engagement of Kioge, and, shortly afterwards bore himself nobly through the retreat to Corunna. In 1809 he became aide-de-camp to the duke of Richmond, lord lieutenant of Ireland, but joined the 43rd when that regiment was ordered again to Spain. With the light brigade (the 43rd, 52nd, and 95th), under the command of General Craufurd, he marched to Talavera and had an attack of pleurisy on the way. He refused to leave Spain, was wounded on the Coa, and shot near the spine at Cazal Nova. After he left the lines of Torres Vedras he became brigade major, was present at Fuentes d'Onor, but had an attack of ague and was obliged to return to England. He married Caroline Amelia Fox, daughter of General Henry Fox. Three weeks afterwards he again started for Spain, and was present at the storming of Badajoz, where his great friend Colonel M'Leod was killed. He took command of the 43rd regiment (he was now a substantive major) and commanded it at the battle of Salamanca. At the battle of the Nivelle he secured the most strongly fortified part of Soult's position, practically without orders. He served with his regiment at the battles of the Nive, where he was wounded, Orthes, and Toulouse. For his services he was made brevet lieutenant-colonel, and one of the first C.B.'s. He then entered the military college at Farnham. He commanded his regiment in the invasion of France after Waterloo, and remained in France with the army of occupation until 1819, when he retired on half-pay. As this was not enough for him to live on with a wife and family, he studied with George Jones, the academician to become an artist.

His career was to be great in literature, not in art. The tendency appeared in a review of Jomini's works (*Edinburgh Rev.*) in 1821, and in 1823 Bickersteth (afterwards Lord Langdale) suggested to him writing a history of the Peninsular War. The duke of Wellington gave him much assistance, and handed over to him the whole of Joseph Bonaparte's correspondence which had been taken at the battle of Vittoria; this was all in cipher, but Mrs. Napier, with great patience, discovered the keys. Marshal Soult also took an active interest in the work and arranged for the French translation of Mathieu Dumas. In 1828 the first volume of the *History* appeared. The publisher, John Murray, was disappointed in the sale of the first volume and Napier published the remainder himself. But the excitement which followed the appearance of each volume is proved by the innumerable pamphlets issued by those who believed themselves to be attacked, and by personal altercations with many distinguished officers. This success was due to a combination of qualities which have justly secured for Napier the title of being the greatest military historian England has produced. When in 1840 the last volume of the

*History* was published, his fame was safely established.

His life during these years had been chiefly absorbed in his *History,* but he had warmly sympathized with the movement for political reform which was agitating England. The Radicals of Bath and many other cities and towns pressed him to enter parliament, and Napier was invited to become the military chief of a national guard to obtain reforms by force of arms. He refused the dangerous honour on the ground that he was in bad health and had a family of eight children. In 1830 he had been promoted colonel, and in 1842 he was made a major-general and given the lieutenant-governorship of Guernsey. Here he managed the relations between the soldiers and the inhabitants, and worked out proposals for a complete scheme of reform in the government of the island.

In 1845 he published his *History of the Conquest of Scinde,* and in 1851 the corresponding *History of the Administration of Scinde.* In 1847 he resigned his governorship, and in 1848 was made a K.C.B., and settled at Scinde House, Clapham Park. In 1851 he was promoted lieutenant-general. His time was occupied in defending his brother, and in revising the numerous editions of his *History* which were being called for. His energy is the more astonishing when it is remembered that he never recovered from the effects of the wound he had received at Cazal Nova, and that he often had to lie on his back for months together. His domestic life was shadowed by the incurable affliction of his only son. He devoted himself to writing the life of his brother Charles, which appeared in 1857. He died on Feb. 12, 1860. Four months earlier he had been promoted to the full rank of general.

His brother, SIR GEORGE THOMAS NAPIER (1784–1855), entered the army in 1800, and served with distinction under Moore and Wellington in the Peninsula. He became major-general in 1837, K.C.B. in 1838 and lieutenant-general in 1846. He was governor and commander-in-chief at the Cape from 1839 to 1843. He was offered, but declined, the chief command in India after Chillianwalla, and also that of the Sardinian army in 1849. He became full general in 1854. He died at Geneva on Sept. 16, 1855. His autobiography, *Passages in the Early Military Life of General Sir G. T. Napier,* was published by his son, General W. C. E. Napier in 1885.

The youngest brother, HENRY EDWARD NAPIER (1789–1853), served in the navy during the Napoleonic wars, retired as a captain, and wrote a learned *Florentine History from the earliest authentic Records to the Accession of Ferdinand III. of Tuscany* (1846–1847).

For Sir William Napier's life, *see* his *Life and Letters,* edited by H. A. Bruce (Lord Aberdare) (1862).

**NAPIER AND ETTRICK, FRANCIS NAPIER,** Baron (1819–1898), British diplomatist, descended from the ancient Scottish family of Napier of Merchistoun, was born on Sept. 15, 1819, the son of William John, ninth Lord Napier. He entered the diplomatic service in 1840, and held successive posts at Vienna, Constantinople, Naples, Washington and The Hague. In 1860 he became ambassador at St. Petersburg, and in 1864 at Berlin. In 1866 he was appointed governor of Madras, and was at once confronted with a serious famine in the northern districts. In dealing with this and other problems he showed great activity and practical sense, and he encouraged public works, particularly irrigation. In 1872 he acted for a few months as Viceroy, after Lord Mayo's assassination; and on Lord Northbrook's appointment to the office he returned to England, being created a baron of the United Kingdom (Baron Ettrick of Ettrick) for his services. He was for a time a member of the London School Board, and was chairman of the Crofters' Commission in 1883, the result of which was the appointment of a permanent body to deal with questions affecting the Scottish crofters and cottars. He died at Florence on Dec. 19, 1898.

**NAPIER OF MAGDALA, ROBERT CORNELIS NAPIER,** 1ST BARON (1810–1890), British field-marshal, son of Major Charles Frederick Napier, was born at Colombo, Ceylon, on Dec. 6, 1810. He entered the Bengal Engineers from Addiscombe College in 1826, and after the usual course of instruction at Chatham, arrived in India in November 1828. For some years he was employed in the irrigation branch of the public works department, and in 1838 he laid out the new hill station at Darjeeling. Promoted captain in January 1841, he was appointed to Sirhind, where he laid out cantonments on a new principle—known as the Napier system—for the troops returning from Afghanistan. In December 1845 he joined the army of the Sutlej, and commanded the Engineers at the battle of Mudki, where he had a horse shot under him. At the battle of Ferozeshah on Dec. 31 he again had his horse shot under him, and, joining the 31st Regiment on foot, was severely wounded in storming the entrenched Sikh camp. He was present at the battle of Sobraon on Feb. 10, 1846, and in the advance to Lahore. He was chief engineer at the reduction of Kote-Kangra by Brigadier-General Wheeler in May 1846, and received the thanks of government. He was then appointed consulting engineer to the Punjab resident and council of regency, but was again called to the field to direct the siege of Multan. He was wounded in the attack on the entrenched position in September 1848, but was present at the action of Shujabad, the capture of the suburbs, the successful storm of Multan on Jan. 23, 1849, and the surrender of the fort of Chiniot. He then joined Lord Gough, took part, as commanding engineer of the right wing, in the battle of Gujrat in February 1849, accompanied Sir W. R. Gilbert in his pursuit of the Sikhs and Afghans, and was present at the passage of the Jhelum, the surrender of the Sikh army, and the surprise of Attock. At the close of the war Napier was appointed civil engineer to the board of administration of the annexed Punjab province, and carried out many important public works. In December 1852 he commanded a column in the first Hazara expedition, and in the following year against the Boris. He was appointed military secretary and adjutant-general to Sir James Outram's force for the relief of Lucknow in the Indian Mutiny in 1857, and was engaged in the actions which culminated in the first relief of Lucknow. He directed the defence of Lucknow until the second relief, when he was severely wounded in crossing an open space with Outram and Havelock to meet Colin Campbell. He was chief of the staff to Outram in the defence of the Alambagh position, and drew up the plan of operations for the attack of Lucknow, which was approved by Campbell and carried out by Napier, as brigadier-general commanding the Engineers, in March 1858. On the fall of Lucknow Napier received the C.B. He joined Sir Hugh Rose as second-in-command in his march on Gwalior, and commanded the 2nd brigade at the action of Morar on June 16. On the fall of Gwalior he was entrusted with the task of pursuing the enemy. With only 700 men he came up with Tantia Topi and 12,000 men on the plains of Jaora Alipur and completely defeated him, capturing all his guns (25), ammunition and baggage. On Rose's departure he took command of the Gwalior division, captured Paori in August, routed Ferozeshah, a prince of the house of Delhi, at Ranode in December, and in January 1859, succeeded in securing the surrender of Man Singh and Tantia Topi, which ended the war. For his services Napier received the thanks of parliament and of the Indian government, and was made K.C.B.

In January 1860 Napier was appointed to the command of the 2nd division of the expedition to China under Sir Hope Grant, and took part in the action of Sinho, the storm of the Peiho forts, and the entry to Peking. For the next four years Napier was military member of the council of the governor-general of India and, on the sudden death of Lord Elgin, for a short time acted as governor-general, until the arrival of Sir W. T. Denison from Madras. In January 1865 he was given the command of the Bombay army; in March 1867 he was promoted lieutenant-general, and, later in that year, appointed to command the expedition to Abyssinia, selecting his own troops and making all the preparations for the campaign. He arrived at Annesley Bay in the Red Sea in January 1868, reached Magdala, 420 m. from the coast, in April; stormed the stronghold, freed the captives, razed the place to the ground, returned to the coast, and on the 18th June the last man of the expedition had left Africa. He received for his services the thanks of parliament, a pension, a peerage, the G.C.B., the G.C.S.I., and many academic honors. He held the

command-in-chief in India for six years from 1870, during which he did much to benefit the army and to encourage good shooting. He was promoted general in 1874, and appointed a colonel-commandant of the Royal Engineers. In 1876 he was the guest of the German crown prince at the military manoeuvres, and from that year until 1883 held the government and command of Gibraltar. In the critical state of affairs in 1877 he was nominated commander-in-chief of the force which it was proposed to send to Constantinople. On Jan. 1, 1883 he was promoted to be field-marshal, and in December 1886 appointed Constable of the Tower of London. He died in London on Jan. 14, 1890.

*See* H. D. Napier, *Field Marshal Lord Napier of Magdala* (1927).

**NAPIER,** a seaport of New Zealand, on the east coast of North Island, capital of the provincial district of Hawke's Bay, 200 mi. N.E. of Wellington. Pop. (1936) 15,302 (18,689 with suburbs). The town is on a picturesque peninsula known as Scinde Island. The harbour (Port Ahuriri) is sheltered by a breakwater. Much of the town was destroyed by a severe earthquake in 1931 in which 255 persons lost their lives. The entire business section of the town was rebuilt and Napier became a modern, well-planned and attractive small city. It is the seat of the Anglican bishop of Waiapu. The district is agricultural, and wool, frozen meats and fruits are exported.

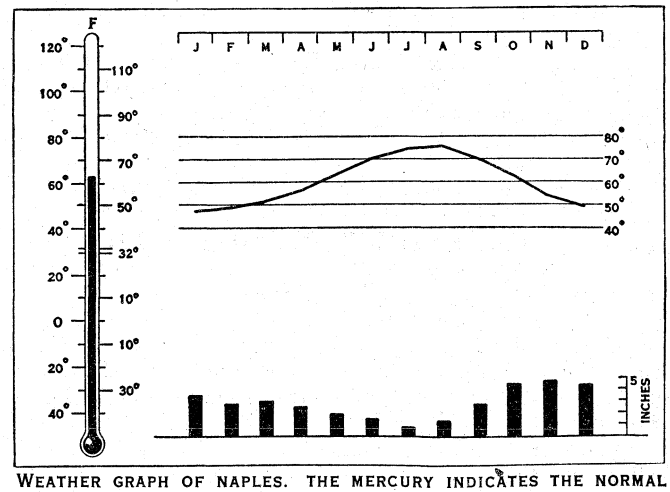
**NAPLES** (Ital. *Napoli,* and Lat. *Neapolis*), formerly the capital of the kingdom of the Two Sicilies, and since 1860 the chief town of the province which bears its name. It was the largest city in the country in 1901, containing 547,503 inhabitants, but was later outstripped by Milan. Its population in 1936 was 739,349 (town), 865,913 (commune). It is the see of a cardinal archbishop; the residence of the general commanding the X Army corps and of the admiral commanding the second Naval department of Italy; and it possesses also an ancient and important university. In World War II it was heavily bombed by U.S. and British air forces, some 30 times from Nov. 1942–July 1943 alone. It was occupied by U.S. and British forces in Oct. 1943.

Naples disputes with Istanbul the claim of occupying the most beautiful site in Europe. It is situated on the northern shore of the Bay of Naples (*Sinus Cumanus*), in 40° 52′ N., 14° 15′ 45″ E., as taken from the lighthouse on the mole. By rail it is distant 135 mi. from Rome, by the direct line, and 155 by the older line via Cassino. The circuit of the bay is about 35 mi. from the capo di Miseno on the northwest to the Punta della Campanella on the southeast, or more than 52 mi. if the islands of Ischia, at the northwest, and of Capri, at the south entrance, be included. At its opening between these two islands it is 14 mi. broad; while another 4 mi. separates Capri from the mainland at the Punta della Campanella, and from the opening to its head at Portici the distance is 15 mi. It affords good anchorage, with nearly 7 fathoms of water, and is well sheltered, except from winds which blow from points between southeast and southwest.

On the north-east shore east of Naples is an extensive flat, forming part of the ancient *Campania Felix,* and watered by the small stream Sebeto and by the Sarno, which last, in classical times, formed the port of Pompeii. From this flat, between the sea and the range of the Apennines, rises Mt. Vesuvius, at the base of which, on or near the sea-shore, are populous villages as well as the classic sites of Herculaneum and Pompeii. At the south-east extremity of the plain, 3 m. beyond the outlet of the Sarno, a great offshoot of the Apennines, branching from the main range near Cava, and projecting as a peninsula more than 12 m. W., divides the Bay of Naples from the Bay of Salerno (*Sinus Paestanus*), and ends in the bold promontory of the Punta della Campanella (Promontorium Minervae), which is separated by a strait of 4 m. from Capri. On the north slope of this peninsula, where the plain ends and the coast abruptly bends to the west, stands the town of Castellammare di Stabia, at the foot of Mt. Sant' Angelo, which rises to a height of 4,722 feet.

The north-west shore to the west of Naples is more broken and irregular. The promontory of Posilipo, which projects due south, divides this part of the bay into two smaller bays—the eastern, with the city of Naples, and the western, or Bay of Baiae, which is sheltered from all winds. A tunnel through the promontory, 2,244 ft. long, 21 ft. broad, and in some places as much as 70 ft. high, possibly constructed by Marcus Agrippa in 27 B.C., forms the so-called grotto of Posilipo; at the Naples end stands the reputed tomb of Virgil, which has recently been restored. Beyond Posilipo is the small island of Nisida (*Nesis*); and at a short distance inland are the extinct craters of Solfatara and Astroni and the lake of Agnano. Farther west, on the coast, and provided with a convenient harbour, stands Pozzuoli (*Puteoli*), containing many Roman remains, and beyond it, round the Bay of Baiae, are Monte Nuovo, a hill thrown up in a single night in Sept. 1538; the classic site of Baiae; the Lucrine lake; Lake Avernus; the Lake of Fusaro (*Acherusia Palus*); and the port and promontory of Misenum. Still farther to the south-west lie the islands of Procida (*Prochyta*) and Ischia (*Pithecusa, Aenaria* or *Inarime*), which divide the Bay of Naples from the extensive Bay of Gaeta. All this country was comprised in classical times under the title of the *Phlegrean Fields,* and was certainly then more actively volcanic than it now is, although the severe shock of earthquake which occurred in the island of Ischia in 1883, completely destroyed Casamicciola, and did serious damage to Forio, Lacco Ameno and Serrara Fontana, shows that there is great seismic activity in the locality. The whole region abounds with fissures, from which steam highly charged with hydrochloric acid is continually issuing, and in many places boiling water is found at a very few feet below the surface.

The city of Naples is built at the base and on the slopes of a range of volcanic hills, and, rising from the shore like a theatre, is seen to best advantage from the sea. From the summit occupied by the castle of St. Elmo a transverse ridge runs south to form the promontory of Pizzofalcone, and divides the city into two natural crescents. The western crescent, known as the Chiaja ward, though merely a long narrow strip between the sea and Vomero hill, is the fashionable quarter most frequented by foreign residents and visitors. A fine broad street, the Riviera di Chiaja, was begun at the close of the 16th century by Count d'Olivares, and completed by the duke de Medina Celi (1695–1700), running for a mile and a half from east to west, ending




WEATHER GRAPH OF NAPLES. THE MERCURY INDICATES THE NORMAL MEAN TEMPERATURE. THE CURVE SHOWS THE NORMAL MONTHLY MEAN TEMPERATURE. THE COLUMNS INDICATE THE NORMAL MONTHLY PRECIPITATION

in the quarter of Mergellina and Piedigrotta, at the foot of the hill of Posilipo. In front lie the public gardens of the Villa Nazionale, the chief promenade of the city, which were first laid out in 1780, and have been successively extended in 1807, in 1834, and again in recent years; and the whole edge of the bay from the Castel dell' Ovo to Mergellina is lined by a massive embankment and carriage-way, the Via Caracciolo, constructed in 1875–81. The eastern crescent includes by far the largest, as well as the oldest, portion of Naples.

The best known thoroughfare is the historic Toledo (officially Via Roma), which runs almost due north from the Piazza del Plebiscito in front of the Palazzo Reale, till, as Via Nuova di Capodimonte, crossing the Ponte della Sanità (constructed by

Murat across the valley between Santa Teresa and Capodimonte), it reaches the gates of the Capodimonte palace, thus dividing the city into two parts. A fine street, the Corso Vittorio Emmanuele, winds along the slopes behind the city from the Mergellina railway station till it reaches the museum by the Via Salvator Rosa. The character of the shore of the eastern crescent has been much altered by the new harbour works, which, with the wharves and warehouses, have absorbed the Villa del Popolo, or People's Park, originally constructed on land reclaimed from the bay. The two crescents have now been united by the construction of a connecting thoroughfare on the seaward side of the Castel Nuovo, the royal palace, and the hill of Pizzofalcone; while a tunnel (the Galleria della Vittoria) has been cut under this hill, thus further uniting the east and west halves of the city. There is also a metropolitan underground railway between the central station at Naples and Pozzuoli.

The streets of Naples are generally well-paved with large blocks of lava or volcanic basalt. In the older districts there is a countless variety of narrow gloomy streets, many of them steep. The houses are mostly five or six storeys high, are covered with stucco made of a kind of pozzolana, which hardens by exposure, and have large balconies and flat roofs. The castle of S. Elmo (S. Erasmus), which dominates the whole city, had its origin in a fort (Belforte) erected by King Robert the Wise in 1329. The present building, with its rock-hewn fosses and massive ramparts, was constructed by Don Pedro de Toledo in 1537–46, and was long considered practically impregnable. It is now a military prison. On a small island (I. del Salvatore, the *Megaris* of Pliny), now joined to the shore at the foot of the Pizzofalcone by an arch-supported causeway, stands the Castel dell' Ovo, restored in the 16th century. Castel Nuovo, a very picturesque building constructed near the harbour in 1279–82 by Charles I. of Anjou, contains between the round towers of its façade the triumphal arch erected in 1455–58 to Alfonso I. In the interior is a fine Gothic hall. The whole building has recently been restored. Castel del Carmine was demolished in 1906. The royal palace, begun in 1600 from designs by Domenico Fontana, partly burned in 1837, and repaired and enlarged by Ferdinand II, is an enormous building with a sea frontage of 800 ft. and a main façade 554 ft. long and 95 ft. high, exhibiting the Doric, Ionic and Composite orders in its three stories. It now contains the important National Library (Biblioteca Nazionale Vittorio Emanuele III) with valuable books and mss., including mss. recovered from Austria after they had been removed to Vienna by Charles V. Another royal palace, that of Capodimonte, contains a gallery of modern pictures and a fine collection of 18th century Neapolitan porcelain.

Naples has 237 churches and 57 chapels. Most of the churches are notable rather for rich internal decoration than for architectural beauty. The cathedral of St. Januarius was erected in 1294–1323. The general plan is that of a basilica with a nave and two (Gothic vaulted) aisles separated by pilasters. The western façade was completed in 1906. Beneath the high altar is a subterranean chapel containing the tomb of St. Januarius (San Gennaro), the patron saint of the city; in the right aisle there is a chapel (Cappella del Tesoro) built between 1608 and 1637 in popular recognition of his having saved Naples in 1527 "from famine, war, plague and the fire of Vesuvius"; and in a silver tabernacle behind the high altar of this chapel are preserved the two phials partially filled with his blood, the periodical liquefaction of which forms a prominent feature in the religious life of the city. Accessible by a door in the left aisle of the cathedral is the church of Sta. Restituta, a basilica of the 4th century. Its baptistery contains important mosaics of that period. Santa Chiara (14th century, richly restored in the baroque style in the 18th) is interesting for a fresco ascribed to Giotto (at one time there were many more), and monuments to Robert the Wise, his son's wife, Mary of Valois, and his daughter Mary, empress of Constantinople.

San Domenico Maggiore, founded by Charles II. in 1289, but completely restored later, has an effective interior particularly rich in Renaissance sculpture. In the neighbouring monastery is shown the cell of S. Thomas Aquinas. San Filippo Neri or dei Gerolomini, erected in 1592–1619, has a white marble façade and contains the tombstone of Giambattista Vico. Sta. Maria del Parto, in the Chiaja, contains the tomb of Sannazaro, and is named after his poem, *De Partu Virginis*. San Francesco di Paola, opposite the royal palace, is an imitation of the Pantheon at Rome, by Pietro Bianchi of Lugano (1815–18). The church of the Certosa (Carthusian monastery) of San Martino, has now become a museum. Dating from the 14th century, and restored in the 17th, it is a building of extraordinary richness of decoration, with paintings and sculpture by Guido Reni, Lanfranco, Caravaggio, D'Arpino, Solimena, Luca Giordano and Ribera. The monastery has been transformed into a mediaeval museum. The view from the south-western balcony is incomparable.

Other churches with interesting monuments are Sant' Anna dei Lombardi (the church of Monte Oliveto), built in 1414, which contains some splendid marble Renaissance sculpture; Sant' Angelo a Nilo, which contains the tomb of Cardinal Brancaccio, the joint work of Donatello and Michelozzo (1426–28), San Giovanni a Carbonara, built in 1343 and enlarged by King Ladislaus in 1400, which contains among much other remarkable sculpture the tomb of the king, the masterpiece of Andrea da Firenze (1428), and that of Gianni Caracciolo, the favourite of Joanna II., who was murdered in 1432 (the chapel in which it stands has one of the earliest majolica pavements in Italy); San Lorenzo (13th century), the Royal Church of the House of Anjou, and S. Maria Donna Regina, with its frescoes by Pietro Cavallini. The catacombs of S. Gennaro (2nd century) are in many respects not inferior to those at Rome.

Of the secular institutions in Naples none is more remarkable than the National Museum, formerly known as the Museo Borbonico. The building was put to its present use in 1790, when Ferdinand IV. placed in it the Farnese collection, which he had inherited from his father, and all the specimens from Herculaneum, Pompeii, Stabiae, Puteoli, Paestum, etc., which till then had been housed in the palace at Portici. Vast numbers of objects have since been added to it, both by purchase and from excavations, and it is now unique as a treasure house of Italo-Greek and Roman antiquities, besides containing important pictures.

The building, as now arranged, contains the large bronzes and statues on the ground floor; a gallery of Pompeian frescoes and mosaics in the entresol; the picture gallery, papyri, terra cottas and small bronzes, on the first floor; and the glass, jewellery, arms, gems, and the collection of Italo-Greek vases, on the second floor. The large bronzes are almost the only ones which have survived from classical times, the most famous of them being the seated Mercury and the dancing Faun; the marbles reckon among their vast number the Psyche, the Capuan Venus, as well as the huge group called the Toro Farnese (Amphion and Zethus tying Dirce to the horns of the bull), the Farnese Hercules, the excellent though late statues of the Balbi on horseback, and a very fine collection of ancient portrait busts.

The Galleria Umberto I. and Galleria Principe di Napoli somewhat resemble the Milan arcade. The Borsa (or exchange) is a fine building in the Piazza of the same name, built over the remains of the very ancient church of Sant' Aspreno, which are still preserved in the crypt. In front of it is the fine 16th century Fontana Medina.

**Educational and Learned Institutions.**—The university of Naples was founded by Frederick II. in 1224, and is well equipped with zoological, mineralogical and geological museums, a physiological institute, a cabinet of anthropology, and botanical gardens. The buildings were originally erected in 1557 for the use of the Jesuits. The new building, completed in 1906, faces the Corso Umberto I. (Rettifilo), the street from the Borsa to the railway station. The famous zoological station at Naples, whose aquarium is the principal building in the Villa Nazionale, was founded by Dr. Dohrn in 1872; the marine flora and fauna of the neighbourhood are more varied than those of any district in Europe. The chief universities of the world pay £100 a year for tables to which they send students. The astronomical observatory is situated on the hill of Capodimonte.

The Royal Society of Naples, dating from 1756, is divided into three academies, namely, moral and political; physical and mathematical; letters, archaeology and fine arts. The famous Accademia Pontaniana, founded by Antonio Becardella and J. J. Pontanus in 1442, was restored in 1808 and still exists.

The Royal School for Oriental Languages owes its existence to Matteo Ripa, who in 1732 established a school for Chinese missionaries.

The Royal Conservatory of Music in S. Pietro a Majella has existed in one form or other since 1760, and has had many famous pupils.

Elementary education has been greatly improved. The higher grade schools are numerous, and there are special foreign schools, established by private enterprise.

The State archives in Vico San Severino e Sossio contain all the records of past Governments; the Notarial archives in Via San Paolo contain all the original notarial acts from 1450 onwards, to the number of 800,000. The Società di Storia Patria, established in 1875 to record all details of the history of the locality, has a good library also.

The San Carlo opera house, with its area of 5,157 sq.yd. and its stalls capable of seating 1,000 spectators, is one of the largest in Europe. It was originally built in 1737 under Charles III., but was destroyed by fire in 1816 and completely rebuilt. The Mercadante dates from 1778.

Charitable institutions are numerous in Naples. The Reclusorio or poorhouse was founded in the 18th century, and besides being a refuge for the indigent poor has a series of industrial schools attached, at which foundling boys are educated and taught trades. There are also several hospitals, the largest being the Incurabili, founded in 1519.

**Harbour.**—At a very early date the original harbour at Naples, now known in its greatly reduced state as Porto Piccolo, and fit only for boats and lighters, became too small. In 1302 Charles II. of Anjou began the construction of the Porto Grande by forming the Molo Grande or San Gennaro, which stretched eastward into the bay, and was terminated by a lighthouse in the 15th century. By the addition of a new pier running north-east from the lighthouse, and protected by a heavily armed battery, Charles III. in 1740 added greatly to the safety of the harbour. In 1826 the open area to the south of the Porto Grande was formed into the Porto Militare by the construction of the Molo San Vincenzo, 1,200 ft. long. The lengthening of the Molo San Vincenzo to a total of more than 5,000 ft., and the construction of curving moles on the east to meet it, has formed a large outer basin, the Avamporto, and an inner harbour (Porto Mercantile). New quays have been made all the way from the old Immacolatella landing-place to the Capitaneria di Porto, close to which is the marine railway station, with piers such that the largest liner can lie alongside the jetty. The depth of this new harbour is from 25 to 30 feet. To the east are dock basins, silos for grain and other warehouses. A modern station for handling passenger traffic was opened Oct. 1, 1936.

In 1937, 9,251 vessels of 13,292,567 tons and with 649,852 passengers arrived, bringing 2,047,548 tons of merchandise; 9,240 ships left with 601,260 tons of merchandise and 615,976 passengers.

Large sections of the harbour were utterly ruined by British and U.S. air raids during World War II.

The specialties of Naples are the manufacture of coral, tortoise-shell, kid gloves and macaroni, but it has been growing also as an industrial centre. The port of Naples is second only to that of Genoa.

**Water Supply.**—Naples has as fine a water supply as any city in Europe, derived from the hills in the neighbourhood of Avellino. It is received in a covered masonry canal, whence it flows in iron pipes till it reaches five enormous reservoirs constructed just opposite to the entrance gates of the royal palace at Capodimonte. Hence it comes by natural gravitation into the town at a pressure of five atmospheres, so that it supplies the highest parts of the town with abundant water. The supply was brought into the town just after the terrible cholera outbreak of 1884. The effect on the health of the city has been extraordinary. Cholera epidemics, which used to be frequent, have become things of the past, and there is now abundant water.

**Modern Growth.**—Naples has increased in modern times at an enormous rate. On the large areas reclaimed from the sea, hotels and mansions let in flats have been erected. The gardens at the west end of the town are all built over. The Vomero is now an important suburb. The commune has been built over in every direction, one great incentive being the creation of an industrial zone to the eastward of the city, set aside for the purpose of industrial development. It now contains a large number of factories for spinning silk, cotton, jute and wool, and the making of railway plant, automobiles, the building of ships, etc.

After the cholera epidemic of 1884, Depretis, then premier, visited Naples, and uttered the famous dictum *"Bisogna sventrare Napoli"*—"Naples must be disembowelled!" The worst slums, which lay between the centre of the town and the railway station, were pulled down and a wide street was constructed from the centre of the town to the eastward. A large working-class quarter was erected to the north and beyond the railway station, known as the Rione Vasto.

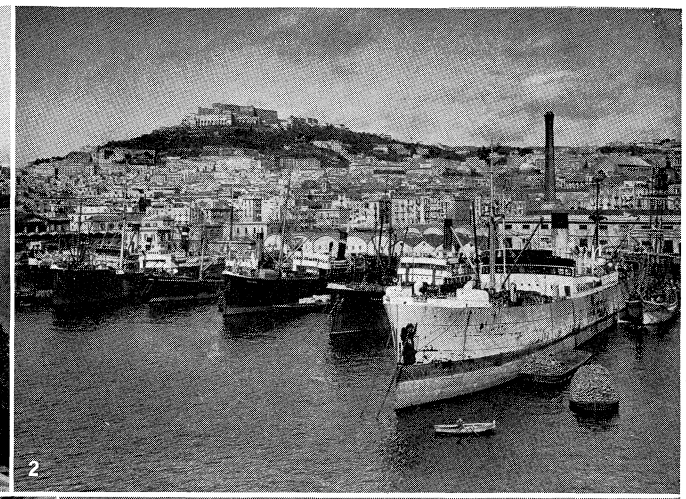
There are also new middle-class quarters at Santa Lucia, Vomero Nuovo and Sant' Efremo, Poggioreale and Fuorigrotta, and better houses on the Riviera di Chiaja, Via Elena and Via Caracciolo at Mergellina, Via Partenope near the Chiatamone, and an aristocratic quarter in the large extensions made in the Rione Amedeo. The narrow alleys of Porto, Pendino and Mercato gradually disappeared, and old Naples vanished day by day.

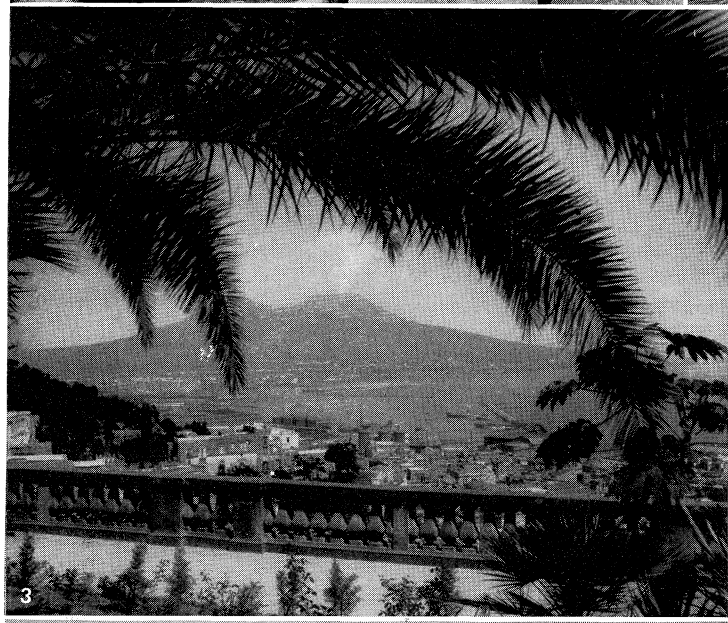
**Folk-lore.**—The charms against the Evil Eye used by the Neapolitans are derived from classical legends. They are: first, the sprig of rue in silver, with sundry emblems attached to it, all of which refer to the worship of Diana, whose shrine at Capua was of considerable importance; secondly, the serpent charms, which formed part of the worship of Aesculapius, and were no doubt derived largely from the ancient eastern ophiolatry; and lastly, charms derived from the legends of the Sirens.

**History.**—All ancient writers agree in representing Naples as a Greek settlement. The earliest Greek settlement in the neighbourhood was at Pithecusa (Ischia), but the colonists, being driven out of the island by the frequent earthquakes, settled on the mainland at Cumae, where they found a natural acropolis of great strategic value. From Cumae they founded Dicearchia (Pozzuoli) and subsequently Parthenope or Palaeopolis, where Naples now stands, upon the splendid natural acropolis formed by the hill of Pizzofalcone, defended on the land side by a fosse which is now the Strada di Chiaja, and a massive wall, of which remains may still be traced at the back of the existing houses. To the colonists of Parthenope there came afterwards a considerable addition from Athens and Chalcis, and they built themselves a town which they called *Neapolis*, or the "new city," in contradistinction to the old settlement, which in consequence was styled Palaeopolis or the "old city."

In 328 B.C. the Palaeopolitans having provoked the hostility of Rome by their incursions upon her Campanian allies, the consul Publilius Philo marched against them, and laid regular siege to Palaeopolis; at length the city was betrayed into the hands of the Romans. Neapolis, perhaps, surrendered without resistance, as it was received on favourable terms, had its liberties secured by a treaty, and obtained the chief authority. From that time Palaeopolis totally disappeared from history, and Neapolis became an allied city (*foederata civitas*)—a dependency of Rome, to which it remained faithful. In 280 B.C. Pyrrhus unsuccessfully attacked its walls; and in the Second Punic War Hannibal was deterred by their strength from attempting to make himself master of the town. During the civil wars of Marius and Sulla a body of partisans of the latter, having entered it by treachery (82 B.C.), massacred the inhabitants; but Neapolis soon recovered, as it was again a flourishing city in the time of Cicero.

Neapolis long retained its Greek culture and institutions; and even at the time of Strabo it had gymnasia and quinquennial games, and was divided into *phratriae* after the Greek fashion.





PHOTOGRAPHS, (1) ACME, (2, 3) EWING GALLOWAY, (4) BURTON HOLMES FROM EWING GALLOWAY, (5) EISENSTAEDT-PIX

## NAPLES, METROPOLIS OF SOUTHERN ITALY

1. A general view of the city as seen from a hill on the outskirts
2. The harbour, and castle of Sant' Elmo on the hill in the distance
3. A view over the bay, looking toward Mt. Vesuvius
4. Modern pier on the bay
5. Drying spaghetti in a suburb of Naples, near Vesuvius

Many of the Romans of the upper classes, from a love of Greek manners and literature, resorted to Neapolis, either for education and the cultivation of gymnastic exercises or for the enjoyment of music and of a soft and luxurious climate. It was the favourite residence of many of the emperors; Nero made his first appearance on the stage in one of its theatres; Titus assumed the office of its archon; and Hadrian became its demarch. It was chiefly at Neapolis that Virgil composed his *Georgics;* and he desired to be buried on the hill of Pausilypon, the modern Posilipo, in its neighbourhood, though his traditional tomb is really a *columbarium* of some family unknown. It was also the favourite residence of the poets Statius (A.D. 61) and Silus Italicus (A.D. 25), the former of whom was a Neapolitan by birth.

After the fall of the Roman empire, Neapolis suffered severely during the Gothic wars. Having espoused the Gothic cause in the year 536, it was taken, after a protracted siege, by Belisarius, who diverted the water of a subterranean aqueduct, marched into the city through it, and put many of the inhabitants to the sword. In 542 Totila besieged it and compelled it to surrender, but after being recovered by Narses, it long remained a dependency of the exarchate of Ravenna, under the immediate government of a duke, appointed by the East Roman emperors. When the Lombards pushed their conquests in the south, the limits of the Neapolitan duchy were considerably narrowed. In the beginning of the 8th century, at the time of the iconoclastic controversy, the Neapolitans, encouraged by Pope Gregory III., threw off their allegiance to the Eastern emperors, and established a republican form of government under a duke of their own appointment. Under this régime Neapolis retained independence for nearly 400 years, though constantly struggling against the powerful Lombard dukes of Benevento. The Normans, in their turn, gradually superseded all powers in the south of Italy, and checked the Saracens in their advances through Apulia.

From that date the history of Naples becomes that of a kingdom, sometimes separate, sometimes merged with the kingdom of Sicily in that of the Two Sicilies. The city of Naples henceforth formed the metropolis of the kingdom to which it gave its name. (*See* NAPLES, KINGDOM OF.)

BIBLIOGRAPHY.—R. T. Günther, *Earth Movements in the Bay of Naples* (Oxford, 1905); Rolfe and Ingleby, *Naples in 1888* (London, 1888); Arthur Norway, *Naples, Past and Present* (London, 1901); G. Daria, *Storia di una capitale* (Naples, 1935).

**NAPLES, BANK OF,** is an autonomous, public utility, non-profit earning foundation, incorporated under a charter granted in 1866. Its origins date back to 1539 when two public-spirited Neapolitans, Aurelio Paparo and Leonardo di Palma, founded in their city a first bank with a capital of 4,000 ducats for granting loans on pledge and without or at a very low rate of interest to free the poorer classes from the evils of usury.

The institution rapidly developed, and survived all the vicissitudes of the kingdom of Naples. After the annexation of Naples to the kingdom of Italy the *Banco di Napoli* remained a bank of issue. Regional interests and the still strong traditions of regional independence maintained this situation until May 6, 1926, when the *Banca d'Italia* became the sole bank of issue.

The *Banco di Napoli* is a foundation organized as a trust, administered by a Board whose members are nominated by the Government, by the province and municipality of Naples, and by the organs representing the commercial activities of the province. Its capital and reserves stood in Dec. 1938 at 1,526 million lire. It affords throughout Italy and colonies every service of a complete bank, and acts as a savings bank, an agricultural credit bank, and a pledge bank for the southern provinces. It also discharges the services connected with emigrant remittances from abroad, for which purposes it has agencies in the U.S.A. Besides it has its own branches and affiliations in New York, Chicago, Buenos Aires and in Albania. Part of its profits are assigned to the purposes of public utility and charity, the bulk going to increase its reserves.

It is now the most powerful instrument for the progress of South Italian agriculture and one of the most effective agencies for economic development. (O. R. A.)

**NAPLES, KINGDOM OF,** the name conventionally given to the kingdom of Sicily on the Italian mainland (Sicily beyond the Faro), to distinguish it from that of Sicily proper (Sicily on this side of the Faro, *i.e.*, Messina).

The leaders of the Norman house of Hauteville, Robert Guiscard and Richard of Aversa, in 1059 did homage to Pope Nicholas II. (*q.v.*) for all the conquests they made both in the island and upon the mainland. In 1130 Roger de Hauteville (Roger II. as "great count" of Sicily) assumed the style of king as Roger I. In this way the south of Italy, together with the island of Sicily, was converted into one political body.

**The Hohenstaufen.**—After the death of Tancred, son of William II., the emperor Henry VI., of the house of Hohenstaufen, who by his marriage with Constance or Costanza d'Altavilla, daughter of Roger I. (d. 1154), laid claims to the kingdoms of Naples and Sicily, descended into Italy in 1194. He easily conquered both the mainland and the island, but died in 1197. Costanza then had her son, Frederick (b. 1194) proclaimed king, and obtained the support of the Holy See on condition that the kingdom should be once more recognized as a fief of the Church. The Hohenstaufen kings afterwards refused to admit this claim; thus provoking the persistent hostility of the popes and many foreign invasions. Costanza died in 1198, leaving Pope Innocent III. regent and tutor to her son. In 1209 Frederick married Costanza, daughter of the king of Aragon, with whose help he succeeded in reducing a large part of Sicily to obedience. Two years later he was elected king of the Romans, and in 1220 he was crowned emperor in Rome by Pope Honorius III., but continued to reside in Sicily. In 1227 Gregory IX. excommunicated him because he delayed the crusade which he had promised to undertake. Frederick sailed for Palestine the following year and on his return defeated the army which the pope had sent into Neapolitan territory, peace being made at San Germano in 1230 and the excommunication withdrawn. In 1231 he issued the celebrated Constitutions of the Sicilian kingdom at the parliament of Melfi. He died in 1250.

His son Conrad IV. succeeded to the empire, while to his illegitimate son Manfred he left the principality of Taranto and the regency of the southern kingdom. Conrad died in 1254, leaving an infant son, Conradin (b. 1252), and Manfred was appointed vicar-general during the latter's minority. In 1258, on a rumour of Conradin's death, Manfred was offered and accepted the crown of Naples and Sicily. The rumour was false, but he retained the crown, promising to leave the kingdom to Conradin at his death and to defend his rights.

**Angevin and Aragonese.**—In 1265 Clement IV., wishing to rid himself of the Hohenstaufen, induced Charles of Anjou, brother of Louis IX. of France, to come to Italy. Agreeing to accept the kingdom of the Two Sicilies as a fief of the Church, Charles, in 1266, marched southward with the privileges of a crusader (*see* CHARLES I., king of Naples and Sicily). Manfred was defeated and killed at Benevento, and Charles was soon master of almost the whole kingdom.

In Sicily, however, Charles's government soon made itself odious by its exactions and the insolence and cruelty of the king's French officials and favourites. The malcontents were led by the Salernitan noble Giovanni da Procida, who had induced Peter III. of Aragon, husband of Manfred's daughter Costanza, to make good his shadowy claims to the crown of Sicily. On Easter day 1282, just as Charles was preparing an expedition to the East, the popular rising known as the Sicilian Vespers broke out at Palermo and resulted in the massacre of nearly all the French in the island. Peter reached Palermo in September. Pope Martin IV. proclaimed a crusade against the Aragonese, and the war continued for many years. The Sicilian fleet under Ruggiero di Lauria defeated that of the Angevins at Malta in 1283, and in 1284 in the Bay of Naples. Charles I. died in 1286; his heir, Charles the Lame, being a prisoner, was not crowned until two years later. (*See* CHARLES II., king of Naples and Sicily, and FREDERICK III., king of Sicily.)

Charles II. died in 1309 and was succeeded by his second son Robert, who became leader of the Guelphs in Italy. War between

Naples and Sicily broke out once more, when Frederick allied himself with the emperor Henry VII. on his descent into Italy and proclaimed his own son Peter heir to the throne. Robert died in 1342; he had been a capable ruler, a scholar, and a friend of Petrarch, but his authority was limited by the rights of a turbulent and rebellious baronage (*see* ROBERT, king of Naples). He was succeeded by his granddaughter Joanna, wife of Andrew of Hungary, who was assassinated in 1345, not without suspicion of Joanna's complicity. Andrew's brother Louis, king of Hungary, attempted to make good his claims on Naples and avenge the murder of Andrew; but as Pope Clement refused to recognize his claims he went back to Hungary in 1348 and Joanna and her second husband Louis of Taranto were crowned at Naples by the pope's legate in 1352, but Niccolò Acciaiuoli, the seneschal, became the real master of the kingdom. Joanna nominated Louis of Anjou her heir, but while the latter was recognized by the anti-pope Clement VII., Pope Urban VI. declared Charles of Durazzo (great-grandson of Charles II.) king of Sicily *al di quà del Faro* (*i.e.* of Naples). Charles conquered the kingdom and took Joanna prisoner in 1381, and had her murdered the following year. Louis failed to drive out Charles, and died in 1384. A period of anarchy followed during the reigns of Charles III. and his son Ladislas, and on the latter's death in 1414 he was succeeded by his sister Joanna II. (*q.v.*), during whose reign the kingdom sank to the lowest depths of degradation. Louis died in 1434 and Joanna in 1435. Alphonso was recognized as king of Naples by Pope Eugene IV. in 1443.

Under Alphonso, surnamed "the Magnanimous," Sicily was once more united to Naples and a new era was inaugurated, for the king was at once a brilliant ruler, a scholar, and a patron of letters. He died in 1458, leaving Naples to his illegitimate son Ferdinand I (*q.v.*) (Don Ferrante), and Sicily, Sardinia, and Aragon to his brother John. Ferdinand died in Jan. 1494, and he was succeeded by Alphonso. In the following September Charles VIII. of France entered Italy and conquered the Neapolitan kingdom without much difficulty. Alphonso abdicated, and his son Ferrandino and his brother Frederick withdrew to Ischia. But Ferrandino, with the help of Ferdinand II. of Spain, was able later to reoccupy his dominions. He died much regretted in 1496 and was succeeded by Frederick. The country was torn by civil war and brigandage, and the French continued to press their claims; until, with Gonzalo de Cordoba's victory on the Garigliano in Dec. 1502, the whole kingdom was in Spanish hands.

**Spanish Rule.**—On Ferdinand's death in 1516, the Habsburg Charles became king of Spain, and three years later was elected emperor as Charles V.; in 1522 he appointed John de Lannoy viceroy of Naples, which became henceforth an integral part of the Spanish dominions. Spanish rule presently provoked several rebellions. On July 7, 1647, tumults occurred at Naples in consequence of a new fruit tax, and the viceroy, Count d'Arcos, was forced to take refuge in the Castelnuovo. The populace, led by an Amalfi fisherman, known as Masaniello (*q.v.*), obtained arms, erected barricades, and, while professing loyalty to the king of Spain, demanded the removal of the oppressive taxes and murdered many of the nobles. D'Arcos came to terms with Masaniello; but in spite of this, and of the subsequent assassination of Masaniello, the disturbances continued.

In 1670 disorders broke out at Messina, which developed into an anti-Spanish movement; and while the inhabitants called in the French, the Spaniards, who could not crush the rising, called in the Dutch. In 1707 an Austrian army conquered the kingdom and Spanish rule came to an end.

**The Bourbons.**—In Sicily the Spaniards held their own till the peace of Utrecht, in 1713, when the island was given over to Duke Victor Amadeus of Savoy, who assumed the title of king. In 1718 he had to hand back his new possession to Spain, which, in 1720, surrendered it to Austria and gave Sardinia to Victor Amadeus. In 1733 the treaty of the Escurial between France, Spain, and Savoy against Austria was signed. Don Carlos of Bourbon, son of Philip V. of Spain, easily conquered both Naples and Sicily, and in 1738 he was recognized as king of the Two Sicilies, Spain renouncing all her claims. Charles was well received and, with the Tuscan Bernardo Tanucci as his minister, introduced many useful reforms. In 1759 Charles III., having succeeded to the Spanish crown, abdicated that of the Two Sicilies in favour of his 8-year-old son Ferdinand, who became Ferdinand IV. of Naples and III. of Sicily, with a regency under Tanucci. The regency ended in 1767, and the following year Ferdinand married the masterful and ambitious Maria Carolina, daughter of the empress Maria Theresa. With the help of John Acton, an Englishman whom she made minister in the place of Tanucci, she secured a *rapprochement* with England and Austria.

On the outbreak of the French Revolution the king and queen were not at first hostile to the new movement; but in 1793 they joined the first coalition against France, instituting severe persecutions against all who were remotely suspected of French sympathies. Republicanism, however, gained ground, especially among the aristocracy. In 1798, during Napoleon's absence in Egypt and after Nelson's victory at Aboukir, Maria Carolina induced Ferdinand to go to war with France. The French marched on Naples, but not until Jan. 20, 1799, were the invaders masters of the city. On the 23rd the Parthenopaean republic was proclaimed. The Republicans were men of culture and high character, but doctrinaire and unpractical, and they knew very little of the lower classes of their own country. Meanwhile the court at Palermo sent Cardinal Fabrizio Ruffo to Calabria, to organize a counter-revolution. He succeeded beyond expectation, and with his "Christian army of the Holy Faith" (*Esercito Cristiano della Santa Fede*), consisting of brigands, convicts, peasants and some soldiers, advanced on the capital, whence the French, save for a small force under Méjean, withdrew. On June 13 Ruffo and his hordes reached Naples and, after a desperate battle at the Ponte della Maddalena, entered the city. The French in Castel Sant' Elmo and the Republicans in Castelnuovo and Castel dell' Uovo still held out and finally an armistice was concluded and a capitulation agreed upon, whereby the castles were to be evacuated and the garrisons free to remain in Naples unmolested or to sail for Toulon.

**Nelson at Naples.**—On June 24 Nelson arrived with his fleet, and on hearing of the capitulation refused to recognize it save in so far as it concerned the French. Ruffo indignantly declared that the treaty had been signed, not only by himself but by the Russian and Turkish commandants and by the British captain, Foote. On the 26th Nelson changed his attitude and informed the cardinal that he would do nothing to break the armistice; while Captains Bell and Troubridge wrote that they had Nelson's authority to state that the latter would not oppose the embarcation of the Republicans, who thereupon embarked on the vessels prepared for them. But on the 28th Nelson, acting on despatches from the court (in reply to his own), held up the vessels and many of the Republicans were arrested. Caracciolo, who commanded the Republican Fleet, was tried by court-martial on board Nelson's flagship, condemned to death, and hanged at the yard arm (*see* CARACCIOLO, FRANCESCO and NELSON, HORATIO NELSON).

On July 8 King Ferdinand arrived from Palermo and the State trials resulted in hundreds of persons being executed, including some of the best men in the country, such as the philosopher Mario Pagano, the scientist Cirillo, Massa, the defender of Castel dell' Uovo, and Ettore Caraffa, the defender of Pescara. After the peace of Amiens in 1802 the court returned to Naples, where it was well received. But when the European war broke out again in the following year King Ferdinand played a double game, appearing to accede to Napoleon's demands while negotiating with Britain. After Austerlitz, Napoleon declared that "the Bourbon dynasty had ceased to reign" and sent an army under his brother Joseph to occupy the kingdom.

**Joseph Bonaparte and Murat.**—Ferdinand and Maria Carolina fled to Palermo in 1805; in Feb. 1806 Joseph Bonaparte entered Naples as king. A cultivated, well-meaning, not very intelligent man, he introduced many useful reforms and abolished feudalism, but the taxes and forced contributions proved very burdensome. Joseph's authority did not exist throughout a large part of the kingdom, where royalist risings, led by brigand chiefs, maintained a state of anarchy, and a British force, under Sir John

Stuart, defeated the French at Maida in Calabria (July 6, 1806).

In 1808 Napoleon conferred the crown of Spain on Joseph and appointed Joachim Murat king of Naples. Murat continued Joseph's reforms and reorganized the army; and although he introduced the French codes and conferred many appointments and estates on Frenchmen, his administration was more or less native and favoured the abler Neapolitans. The king gained many sympathies; he gradually became estranged from Napoleon and secretly opened negotiations with Austria and Great Britain. In Jan. 1814 he signed a treaty with Austria, and the following month proclaimed his separation from Napoleon. But when Napoleon escaped from Elba, Murat suddenly returned to the allegiance of his old chief, marched into northern Italy, and from Rimini issued his famous proclamation in favour of Italian independence (March 30, 1815). He was subsequently defeated by the Austrians several times and on May 18 sailed from Naples for France (*see* MURAT, JOACHIM). On the 23rd the Austrians entered Naples to restore Bourbon rule.

**The Restoration.**—Ferdinand and Maria Carolina had continued to reign in Sicily, where the court's extravagance and the odious Neapolitan system of police espionage rendered their presence a burden instead of a blessing to the island. A bitter conflict broke out between the court and the parliament, and the British minister, Lord William Bentinck, forced Ferdinand to resign his authority and appoint his son regent and introduced many valuable reforms. In 1812 a constitution on British lines was introduced, and the queen, who was perpetually intriguing against Bentinck, was exiled. Bentinck, whose memory is still cherished in the island, departed in 1814. Ferdinand dissolved parliament in May 1815, after concluding a treaty with Austria for the recovery of his mainland dominions by means of an Austrian army. On June 9 Ferdinand re-entered Naples and bound himself in a second treaty with Austria not to introduce a constitutional government. At first he abstained from persecution and received many of Murat's old officers into his army. In Oct. 1815 Murat, believing that he still had a strong party in the kingdom, landed with a few companions at Pizzo di Calabria, but was immediately captured by the police and the peasantry, court-martialled, and shot.

Ferdinand proclaimed himself king of the Two Sicilies at the congress of Vienna, incorporating Naples and Sicily into one state, and abolished the Sicilian constitution (Dec. 1816). In 1818 he concluded a Concordat with the Church, by which the latter renounced its suzerainty over the kingdom, but was given control over education, the censorship, and many other privileges. But there was much disaffection throughout the country, and the Carbonarist lodges had made much progress, especially in the army (*see* CARBONARI). In July 1820 a military mutiny broke out at Caserta, the mutineers demanding a Spanish constitution although professing loyalty to the king. Ferdinand, feeling himself helpless to resist, acceded to the demand. The new government's first difficulty was Sicily, where the people had risen in rebellion demanding their own charter of 1812, and although the Neapolitan troops quelled the outbreak with much bloodshed the division proved fatal to the prospects of liberty.

This outbreak seriously alarmed the Powers responsible for the preservation of the peace in Europe. At the congress of Troppau (Oct. 1820) the famous protocol was issued affirming the right of collective "Europe" to interfere to crush dangerous internal revolutions. Both France and Great Britain protested against this dangerous principle; but by general consent King Ferdinand was invited to attend the adjourned congress, fixed to meet at Laibach in the spring of the following year. Under the new constitution the permission of parliament was necessary before the king could leave Neapolitan territory. This was weakly granted, after Ferdinand had sworn the most solemn oaths to maintain the constitution. He was scarcely beyond the frontiers, however, before he repudiated his engagements, as exacted by force. The powers authorized Austria to march an army into Naples to restore the autocratic monarchy. General Pepe commander of the Constitutional forces, was sent to the frontier at the head of 8,000 men, but was completely defeated by the Austrians at Rieti on March 7. On the 23rd the Austrians entered Naples, followed soon afterwards by the king. Every vestige of freedom was suppressed, and the inevitable State trials instituted with the usual harvest of executions and imprisonment. Pepe saved himself by flight. (*See* FERDINAND IV., king of Naples.)

Ferdinand died in 1825 and was succeeded by his son Francis I., an unbridled libertine, under whom the corruption of the administration assumed unheard-of proportions. (*See* FRANCIS I., king of the Two Sicilies.) He died in 1830 and was succeeded by his son, Ferdinand II., who at first awoke hopes that the conditions of the country would be improved; but on the death of his first wife, Cristina of Savoy, he married Maria Theresa of Austria, who encouraged him in his reactionary tendencies and brought him closer to Austria. The desire for a constitution was by no means dead, and the survivors of the old Carbonari gathered round Carlo Poerio, while the *Giovane Italia* society (independent of Mazzini) promoted a few sporadic outbreaks easily crushed. The following year the Venetian brothers Bandiera, acting in concert with Mazzini, landed in Calabria, believing the whole country to be in a state of revolt; they met with little local support and were quickly captured and shot, but their deaths aroused much sympathy, and the whole episode was highly significant as being the first attempt made by Italians from other parts of the country to promote revolution in the south.

**Revolution of 1848.**—On Jan. 12, 1848, a revolution under the leadership of Ruggiero Settimo broke out in Sicily. These events were followed by demonstrations at Naples, and on Jan. 28 the king granted the constitution. The popular demand was now that Naples should assist the Lombards in their revolt against Austria, for a feeling of Italian solidarity was growing up. Ferdinand declared war against Austria (April 7, 1848); and a Neapolitan army under General Pepe marched towards Lombardy in May, while the fleet sailed for Venice. But a dispute between the king and the parliament concerning the form of the royal oath having arisen, a group of demagogues with criminal folly provoked disturbances and erected barricades (May 14). The king refused to open parliament unless the barricades were removed. A few shots were fired on the 15th, the Swiss regiments stormed the barricades and street fighting lasted all day. By the evening the Swiss and the royalists were masters of the situation. A new ministry under Prince Cariati was appointed. Parliament was dissolved, the National Guard disbanded and the army recalled from the Po.

In Sicily the revolutionists were bitterly hostile to the Neapolitans. The Sicilian assembly met in March 1848, and Settimo in his inaugural speech declared that the Bourbon dynasty had ceased to reign and that Sicily united her destinies to those of Italy; Settimo was elected president of the Government. After the Austrian victories Ferdinand sent a Neapolitan army under Carlo Filangieri (*q.v.*) to subjugate the island. The troops landed at Messina, whose citadel had been held by the royalists throughout, and after three days' desperate fighting the city itself was captured and sacked. Filangieri marched forward, committing many atrocities. In April he reached Palermo while the fleet appeared in the bay, and tumults having broken out within the city the Government surrendered on terms which granted amnesty for all except Settimo and 42 others.

For a few months after the dissolution of the Neapolitan parliament the Government abstained from persecution, but with the crushing of the Sicilian revolution its hands were free; and when the commission on the affair of May 15 had completed its labours thousands of respectable citizens were thrown into prison, such as L. Settembrini, Carlo Poerio, and Silvio Spaventa. The abominable conditions of the prisons in which the best men of the kingdom were immured were made known to the world by the famous letters of W. E. Gladstone, which branded the Bourbon regime as "the negation of God erected into a system of government." In 1857 Carlo Pisacane, an ex-Neapolitan officer who had taken part in the defence of Rome, fitted out an expedition, with Mazzini's approval, from Genoa, and landed at Sapri in Calabria; but the local police assisted by the peasantry attacked the band, killing many, including Pisacane himself, and

capturing most of the rest. The following year, at the instance of Great Britain and France, Ferdinand commuted the sentences of some of the political prisoners to exile. (*See* FERDINAND II., *king of the Two Sicilies.*)

In May 1859 Ferdinand died and was succeeded by his son, Francis II. (*q.v.*). Victor Emmanuel, king of Sardinia, wrote to him proposing an alliance for the division of Italy, but Francis refused. In June part of the Swiss Guard mutinied and were shot down; and this affair resulted in the disbanding of the whole force—the last support of the autocracy. Various proposals were made for an alliance with Sardinia, but Francis rejected them and indeed began to negotiate with Austria.

**Garibaldi.**—In the meantime events in Sicily were reaching a crisis destined to subvert the Bourbon dynasty. Mazzini's emissaries, F. Crispi (*q.v.*) and R. Pilo, had been trying to organize a rising in favour of Italian unity and, although they merely succeeded in raising a few armed bands, they persuaded Garibaldi (*q.v.*) that the revolution, which he knew to be imminent, had broken out. Garibaldi, whose hesitation had been overcome, embarked on May 5, 1860, at Quarto, near Genoa, with 1,000 picked followers on board two steamers, and sailed for Sicily. On the 11th the expedition reached Marsala and landed without opposition. Garibaldi was somewhat coldly received by the astonished population; but he set forth at once for Salemi, where he issued a proclamation assuming the dictatorship of Sicily in the name of Victor Emmanuel, with Crispi as secretary of state. On the 15th he attacked and defeated 3,000 of the enemy under General Landi at Calatafimi; the news of this brilliant victory revived the revolutionary agitation throughout the island, and Garibald was joined by Pilo and his bands. By a cleverly devised ruse he avoided General Colonna's force, which expected him on the Monreale road, and entering Palermo from Misilmeri received an enthusiastic welcome. After three days' street fighting the Bourbonist commander, General Lanza, not knowing that the Garibaldians had scarcely a cartridge left, asked for and obtained a 24 hours' armistice (May 30). Garibaldi went on board the British flagship to confer with the Neapolitan generals Letizia and Chrétien; then he informed the citizens by means of a proclamation of what he had done, and declared that he would renew hostilities on the expiration of the armistice. Although unarmed, the people rallied to him as one man, and Lanza became so alarmed that he asked for an unconditional extension of the armistice, which Garibaldi granted; 15,000 Bourbon troops embarked for Naples on June 7, leaving the revolutionists masters of the situation. The Sardinian Admiral Persano's salute of 19 guns on the occasion of Garibaldi's official call constituted a practical recognition of his dictatorship by the Sardinian (Piedmontese) Government. In July further reinforcements of volunteers under Cosenz and Medici, assisted by Cavour, arrived at Palermo with a good supply of arms furnished by subscription in northern Italy. Garibaldi's forces were now raised to 12,000 men, besides the Sicilian *squadre*. Cavour's attempt to bring about the annexation of Sicily to Sardinia failed, for Garibaldi wished to use the island as a basis for an invasion of the mainland. When the Garibaldians advanced eastward they encountered a force of 4,000 of the enemy under Colonel Bosco at Milazzo; on July 20 a desperate battle took place, resulting in a hard-won Garibaldian victory. The Neapolitan Government then decided on the evacuation of the whole of Sicily except the citadel of Messina, which did not surrender until the next year.

The news of Garibaldi's astonishing successes entirely changed the situation in the capital, and on June 25, 1860, the king granted a constitution, and appointed A. Spinelli prime minister. Disorders having taken place between Liberals and reactionaries, Liborio Romano was made minister of police in the place of Aiossa. The king appealed to Great Britain and France to prevent Garibaldi crossing the Straits of Messina, and only just failed (for this episode *see* under LACAITA, SIR JAMES). On Aug. 19 Garibaldi crossed with 4,500 men and took Reggio by storm. He was soon joined by the rest of his troops, 15,000 in all, the Neapolitan army collapsed before Garibaldi's advance, and the people rose in his favour almost everywhere. On Sept. 6 the king and queen sailed for Gaeta; on the 7th Garibaldi entered Naples alone, although the city was still full of soldiers, and was received with delirious enthusiasm; on the 11th a part of the royalists capitulated and the rest retired on Capua. Cavour now decided that Sardinia must take part in the liberation of southern Italy, for he feared that Garibaldi's followers might induce him to proclaim the republic and attack Rome, which would have provoked French intervention; consequently a Piedmontese army occupied the Marche and Umbria and entered Neapolitan territory with Victor Emmanuel at its head. On Oct. 1 and 2, 1860, a battle was fought on the Volturno and the Garibaldians, although inferior in numbers, were victorious. On the 26th he met Victor Emmanuel at Teano and hailed him king of Italy and subsequently handed over his conquests to him. On Nov. 3 a plebiscite was taken, which resulted in an overwhelming majority in favour of union with Sardinia under Victor Emmanuel. Garibaldi departed for his island home at Caprera, while L. C. Farini was appointed viceroy of Naples and M. Cordero viceroy of Sicily. The last remnant of the Bourbon army was concentrated at Gaeta, the siege of which was begun by Cialdini on Nov. 5; on Jan. 10, 1861, the French fleet, which Napoleon III. had sent to Gaeta to delay the inevitable fall of the dynasty, was withdrawn at the instance of Great Britain; the fortress surrendered on Feb. 13 and the royal family departed by sea. The citadel of Messina capitulated a month later and Civitella del Tronto on March 21. On Feb. 18 the first Italian parliament met at Turin and proclaimed Victor Emmanuel king of Italy. Thus Naples and Sicily ceased to be a separate political entity and were absorbed into the united Italian kingdom.

BIBLIOGRAPHY.—F. Carta, *Storia del regno delle Due Sicilie* (1848); F. Pagano, *Istoria del regno di Napoli* (1832, etc.); J. Albini, *De gestis regum Neapolit. ab Aragonia* (1588); several chapters in the *Storia politica d'Italia* (1875–82); F. Lanzani, *Storia dei comuni Italiani . . . fino al 1313;* C. Cipolla, *Storia delle signorie Italiane dal 1313 al 1530;* Cosci, *L'Italia durante le preponderanze straniere, 1530–1789;* A. Franchetti, *Storia d'Italia dal 1789 al 1799;* G. de Castro, *Storia d' Italia dal 1799 al 1814;* F. Bertolini, *Storia d'Italia dal 1814 al 1878;* G. Pepe, *Mémoires,* new ed. (1906); N. Nisco, *Gli ultimi 36 anni del reame di Napoli* (1889). For a defence of Nelson's action, see *Nelson and the Neapolitan Jacobins* (Navy Records Society, 1903), edited by H. C. Gutteridge, with a bibliography. A. T. Mahan, *Life of Nelson* (2nd ed., 1899), and *English Historical Review* for July 1899 and Oct. 1900. For the other side *see* C. Giglioli, *Naples in 1799* (1903); F. P. Badham, *Nelson at Naples* (1900); P. Villari, "Nelson, Caracciolo e la Repubblica Napolitana" (*Nuova Antologia,* Feb. 16, 1899); A. Maresca, *Gli avvenimenti di Napoli dal 13 giugno al 12 luglio, 1709* (1900); B. Croce, *Studii storici sulla rivoluzione Napoletana del 1799* (1897). For an account of the French period *see* C. Auriol, *La France, l'Angleterre, et Naples* (1906), and R. M. Johnston, *The Napoleonic Empire in South Italy* (1904). For the latest period *see* N. Nisco, *Gli ultimi 36 anni del reame di Napoli* (1889); H. R. Whitehouse, *The Collapse of the Kingdom of Naples* (1899). *See* further G. Bianco, *La Sicilia durante l'occupazione Inglese* (1902); Francesco Guardione's *Il Dominio dei Borboni in Sicilia* (1908); G. Trevelyan, *Garibaldi and the Thousand* (1909) and *Garibaldi and the Making of Italy* (1911).

(L. V.; X.)

**NAPOLEON I.** (1769–1821), emperor of the French. Napoleon Bonaparte was born at Ajaccio on Aug. 15, 1769, the year following the reunion of Corsica with France. His father, Charles Buonaparte—it was not until after 1796 that the spelling Bonaparte was adopted—came of a good family which had been established in the island since the 16th century. The family origins may perhaps be traced to Tuscany, an Italian province, the relations of which with Corsica had always been close. Napoleon himself, in later years, scoffed at the exaggerated tales invented by flatterers and courtiers, of the lordly status formerly held by the family at Treviso and Bologna. Yet his father was undoubtedly of noble birth, and was the delegate of the Corsican nobility at Paris. Charles Buonaparte married Laetitia Ramolino, a woman of strong character and great personal beauty. He was a lawyer by profession and brought up a large family in difficult times. After the Corsicans had, several times, revolted against their Genoese masters, the republic of Genoa, despairing of ever bringing the rebels to submission, ceded its rights to France, against which the Corsicans, led by Paoli (*q.v.*) at first attempted resistance. Charles Buonaparte joined Paoli's party. He even joined him in his campaign, taking with him his wife and children,

lest they should be seized as hostages by the French. When Paoli was beaten and had to fly Charles Buonaparte became reconciled to French rule and benefited by the protection of M. de Marbeuf, the governor, to whom he was able to make himself useful. In 1779, sent on a mission to Versailles, he took with him his second son, Napoleon, for whom M. de Marbeuf had obtained a bursary at the military academy at Brienne.

### EARLY LIFE

These facts enable us to understand the character of Napoleon. He was born a Frenchman, of a family which, unwilling at first to become French, afterwards unreservedly accepted the *fait accompli*. From the age of ten he was educated with other boys of his own class by French people according to French ideas. Though we must make due allowance for heredity, family influence, and the impressions of early childhood, it is an exaggeration to explain Napoleon, as historians since Stendhal have been too much inclined to do, entirely in the light of his Corsican and Tuscan origin, and to see in him the incarnation of a *condottiere*, or of a 14th century Italian city despot, a modern Castruccio Castracani. It is more important to bear in mind that young Bonaparte, born in an island which had only just become part of France, shared neither the traditions nor the prejudices of his new country.

In 1789, at the age of 20, he came into the Revolution with an open mind, feeling neither like nor dislike for many things which other Frenchmen either regretted or frankly detested. If he remained Corsican in temperament he was, by virtue of the instruction he had received, and the books he had read, pre-eminently a man of the 18th century. His occasional early philosophical writings leave no doubt as to this side of his character, which is also illustrated by the life-long habit of epigrammatic, well-turned, often paradoxical expression, a trait which he had in common with Chamfort and Rivarol; witness his celebrated definition of love as *"une sottise faite à deux."* Further, having lost his father in 1785, and having been designated by him as the head of the family, although he was the second and Joseph the eldest son, he had known poverty and the responsibility of helping to provide for his mother, brothers and sisters. Success was more necessary to him than to others, and the upheaval of 1789 favoured the ambitious.

We must realize therefore that he entered the Revolution in rather an unusual frame of mind, occasionally ardent, joining the Jacobins without hesitation, but also capable of coolly judging events as when on June 20, at the capture of the Tuileries, he was moved to scorn by the weakness of Louis XVI. We must also remember that, having begun his studies at the cadet school at Brienne, he completed them at the *Ecole Militaire* in Paris, where (1784–5) he received a solid grounding in the work of an artilleryman and an officer. It would be wrong to look on him as a kind of self-taught genius, a god of war, who might be said to have discovered, taught, and even created strategy and tactics.

**The Artillery Officer.**—He himself acknowledged, modestly and loyally, his debt to his teachers. He had studied the treatises of Bourcet and of Guibert, who had evolved from modern armaments new principles and methods of warfare. As a sub-lieutenant at Auxonne, after leaving the *Ecole Militaire*, he received at first hand instruction from baron du Teil, brother of the author of a remarkably advanced work on the use of modern artillery. He profited by the instruction, and always spoke of it with appreciation. However gifted a man may be, he still needs inspiration and counsel, and learns more from his predecessors than he himself passes on to his contemporaries and to posterity. The genius of Napoleon was not least evident in the way in which he made use of the instruction which he received. Curiously enough, Guibert in his *Système de guerre moderne* had predicted that a great man would arise to put into practice the military theories which were then taking shape. These facts, which place Napoleon in his proper intellectual environment, seem to the writer to throw more light on his mind and his character than would countless anecdotes of his childhood and schooldays, such as that at Brienne he was nicknamed *Paille au nez* by his companions because of the way in which he pronounced *Napolione*.

Between his spells of garrison duty at Valence and at Auxonne as a young artillery officer, a part of his early career of which little is known was passed in the leave which he spent on more than one occasion in Corsica, where the somewhat complicated affairs of his family demanded his presence. At Ajaccio in Sept. 1789, he found his elder brother Joseph deep in the affairs of the democratic party which had inevitably, with the progress of the Revolution, become the party of France. Paoli, who had at first thought that events in France would bring about Corsican independence, had soon been disillusioned, Jacobinism being essentially a unifying and centralising force. He inclined therefore to the counter-revolution and entered the opposite camp.

Napoleon, promoted lieutenant in 1791 on the reorganization of the artillery, was stationed for another three months at Valence, where he continued his studies, and even wrote an essay on a subject set for competition by the academy of Lyons: "What are the principles and institutions most likely to bring about the greatest happiness of mankind?" He treated the subject in the style and according to the principles of Jean Jacques Rousseau. When, years afterwards, Talleyrand showed him the essay, he threw it into the fire.

He was again in Corsica from Sept. 1791 to May 1792. Feeling ran high in the island, as a result of the disestablishment of the Catholic Church. He plunged into political intrigue, outstayed his leave, and became liable to the penalties in force against deserters and émigrés. On April 20, 1792, however, the legislative assembly had declared war on Austria. Officers were needed. Instead of undergoing any penalty, Bonaparte, whose zeal for the Revolution was well known, was made a captain. In this capacity he remained in Paris for several months, and witnessed the great events of the Revolution. After the September massacres, he went to Ajaccio to take home his sister Elisa from the convent of Saint Cyr which had just been closed. This was his last visit to his native country. The break with Paoli was now complete. Bonaparte was on the side of the *"patriotes,"* while the old champion of independence was appealing to the English against the Republic, One and Indivisible. Paoli was victorious. Bonaparte and his family, now entirely ruined, had to fly from the island and take refuge in France. This was the termination of what we may call his "insular" period. As he himself said afterwards, once he had left Ajaccio, more important affairs left him little time to think of Corsica and Paoli.

**Early Military Opportunities.**—In Sept. 1793, Napoleon Bonaparte was still unknown to the world which was to ring with his name. Amazed himself at his extraordinary career, and the incredible swiftness of his rise to power, he said in Saint Helena to Las Cases, "Centuries will pass before the unique combination of events which led to my career recur in the case of another." Favourable circumstances were also required to bring the young artillery officer to the front, and these were not lacking. The republic, which had challenged half Europe, had to face foreign and civil war, under conditions of anarchy. Bonaparte was a Jacobin, with a great reputation as an artillery officer. At Beaucaire, on his way to Paris, he had written a pamphlet, the *Souper de Beaucaire*, in which he had refuted the arguments of three Southern federalists or counter-revolutionaries. It is probable that it reflects a conversation which actually took place in an inn of the little town beside the Rhone. Its publication attested the patriotism of its author. The good word of Robespierre's brother and of Napoleon's compatriot, the deputy Salicetti, were also of assistance. At this juncture it was necessary to recapture Toulon, the inhabitants of which had rebelled against the Convention and called in the assistance of an English squadron. An able officer of artillery was required to direct the siege operations. Bonaparte was chosen.

There has since grown up the legend of "the great Napoleon at the siege of Toulon," though the part which he really played was essentially that of a technical expert. He found in command General Carteaux, formerly an artist, who was too ignorant even to understand that to take Toulon he must capture the position which commanded the roadstead. Things were no better under

his successor, Doppet, and until the arrival of General Dugommier, a soldier of greater experience, who, together with Gasparin, the people's commissary, recognized the knowledge and good sense of the young artillery officer.

On the fall of Toulon in Dec. 1793, Napoleon was promoted general of brigade, and in Feb. 1794 he was given the command of the artillery of the army of Italy. These were still subordinate positions, offering little opportunity for prominence. He spent the next few months—the period of the Terror—in inspecting fortifications and was even for a time "suspect" for having reconstructed an old fort at Marseilles, a town which had also risen against the Convention. He had rejoined the army of Italy, when fresh disaster seemed imminent. After the 9th Thermidor, his relations with the Jacobins became compromising. Accused of having disclosed certain plans to the younger Robespierre, he was arrested, but, in default of evidence, was released on Carnot's instructions. Nevertheless his position at this juncture was extremely precarious. Under the nerveless leadership of Schérer, he had no opportunity of distinguishing himself in the Italian campaign except at Saorgio and on the Roja. He was marking time, in fact. Like a true soldier he detested the campaign in la Vendée, and he refused the command of an infantry brigade which was to be sent against the Western royalists. Aubry, the minister of war, removed him from the active list in consequence.

**Reverses.**—He now experienced real poverty, and had to sell his books and his watch. He thought of taking service with the sultan to re-organize the Turkish army. Madame Tallien, wife of the member of the Convention, whom he met at this time, interested herself in him and made his peace with the authorities. When Kellermann lost the lines of the Apennines it was remembered that Bonaparte knew Italy, he was taken into consultation, and joined the topographical service of the army.

At this time, in the autumn of 1795, Hoche, Marceau and Joubert were already famous; Bonaparte was still unknown. It looked almost as if fortune were definitely against him. The only thing which he had brought back from his campaigns was the itch and, probably, the malaria, which made him very ill. He was obliged to shave his head, which was later on to bring him the nickname of *"le petit tondu."* Small in stature, thin, yellow-faced, badly dressed, his person was unimposing and no one would have seen in him the future emperor of the French.

**The Insurrection of 1795.**—It needed a day of revolution and of civil war to bring him into prominence, by giving him the chance to do the Republican Government a service, the vital service of saving the Republic. In the autumn of 1795 the majority of the people of Paris were chafing against dear food, *assignats* and never-ending war. The Convention, by declaring for a constitution designed to keep its own members in power, provoked an insurrection, which, owing to the weakness of General Menou, very nearly succeeded. The Convention then placed the deputy Barras in command of the home forces. He, having known and learnt to value Bonaparte at the siege of Toulon, asked for, and obtained, his appointment as second in command. The young general at once assumed complete control, issued rapid orders, forestalled the insurgents who were about to capture the artillery parked at Les Sablons, and shot them down in the rue Saint-Honoré, on the steps of the church of Saint-Roch. In less than a day he had subdued a serious royalist rising (*13 Vendémiaire*—Oct. 4, 1795). He had saved the republic and earned the nickname *Général Vendémiaire.*

### ITALIAN AND EGYPTIAN CAMPAIGNS

**Italy.**—His first reward was the hand of Josephine, a beautiful Creole, widow of the viscount de Beauharnais, who had been guillotined during the Terror. Josephine, whose morals were none too strict, was living at this time mainly by her wits. The general was six years younger than she, but he seemed to be on the threshold of a brilliant career, and the marriage freed her from poverty. He had, in fact, as his second reward been appointed commander in chief of the Army of Italy. Like Josephine, the government of the Republic was at the end of its financial resources. At this moment, indeed, there was difficulty enough in feeding the troops; it was hoped they would live on the conquered territory. At the beginning of March 1796 Bonaparte married Josephine. At the end of the month he arrived at his headquarters at Nice.

His army consisted of thirty thousand starving soldiers, in want of everything. He issued to them the famous proclamation:—"You are badly fed and all but naked. . . . I am about to lead you into the most fertile plains in the world. Before you are great cities and rich provinces; there we shall find honour, glory, and riches." He entered Italy on April 10. His plan of campaign—the separation of the Piedmontese from the Austrians—was very simple; he executed it successfully after severe actions at Montenotte, Millesimo and Dego.

While he was conducting the campaign, he did not forget that he was a general of the Revolution, and issued to the Italian people proclamations which, while treating the Catholic religion with respect, spoke the language of liberty. The king of Sardinia took fright, and, on the advice of the Archbishop of Turin, sued for peace to an army "with neither artillery, cavalry, nor shoes to its feet." The pope and the dukes of Parma, Modena and Tuscany were not long in following the example of Victor Amadeus. Great political schemes were taking shape in Bonaparte's mind, but first he had to beat the Austrians. This was, indeed, his first experience of large-scale operations. The crossing of the bridge of Lodi was a bold achievement which made his name known in a day all over France and indeed all over Europe. That day, by an old camp custom, his soldiers dubbed him corporal, and another nick-name, the *"petit caporal,"* stuck to him.

**New Republics.**—In May, some weeks after the setting out of his ragged army, he entered Milan in triumph. He could write to the directory: "The republic holds all Lombardy." At that same moment he received from Paris orders which upset all his plans. Sure that his resignation would not be accepted, he sent it in, and, while waiting for the answer, harried the Austrians, whose generals "faithful to the old system of warfare, scattered their troops in small detachments before a man who practised mass-movement." The further Bonaparte advanced with so small an army, the greater was the need for skill and boldness. At Arcola he suffered in his own person, by falling into a swamp. These "miracles of genius and courage" were crowned by the victory of Rivoli, followed by the preliminary negotiations of Leoben (April 18, 1797). "No other general could show such fourteen months." He had forced Austria to sue for peace. He had founded the Cispadane, the Cisalpine, and the Ligurian republics, which brought a large part of Italy under the same *régime* as France, and preparations were begun for its annexation. He had been able to provide for his army by requisitioning; to conquer without costing the treasury anything, and had even sent money to Paris. Finally when the Republicans, having lost their majority in the Councils, were in need of help, Bonaparte, though he had cause for complaint against the directory, sent them his subordinate Augereau, for the *coup de force* of Fructidor (Sept. 1797) directed against the royalists and the moderates. True, the royalists and moderates wanted peace, while Bonaparte agreed with the Jacobins, and aspired to secure France's "natural frontiers."

He was able to congratulate himself on fulfilling both desires by the Treaty of Campo-Formio (Oct. 17, 1797). By it the emperor ceded to France both Belgium and the left bank of the Rhine. Glorious as it was, however, and in keeping with Revolutionary foreign policy, the treaty, far from ending the war, perpetuated it. To assure the permanence of these conquests the goodwill of England was necessary, and England was not in a position to give it; compulsion was therefore necessary. The whole story of Napoleon up to Waterloo turns on this. Henceforth he was to struggle against England, and in that struggle he was in the end to be vanquished.

**England and Egypt.**—The brusqueness of his manner, and still more his popularity with the masses made him an object of suspicion, in spite of the services which he had rendered the Republic. He, on his side, despised the corrupt government of the directory, "a government of lawyers," whether Jacobin or moderate. He soon realised that their plans for an invasion of England

had no chance whatever of success. In any case he thought it prudent to quit France for a time. The East had always fascinated him. "Only in the East can one do great things," he said. Reading and reflection had convinced him that Egypt was one of the keys of the world. This idea had already emerged in the days of Louis XIV., and was taken up again during the 18th century wars between France and England; there too Napoleon had his forerunners. He planned to strike at the power of England through Egypt and the route to India, and to stir the imagination of his own country-men. The directory accepted the scheme.

The Egyptian expedition was thus indirectly to be the means of forcing the British government to recognise the territorial acquisitions of the Revolution. The weakness of this plan, a weakness inherent in the whole struggle with England, was that France had no navy. Though Bonaparte, by a fortunate combination of circumstances, was able to land his army near Alexandria (July 1, 1798), Nelson, a month later (Aug. 1), destroyed the French fleet at Aboukir. From that moment the Egyptian expedition, instead of being *"le commencement d'une grande chose"* was merely an adventure. In vain Bonaparte executed a brilliant campaign, capturing Cairo, and subduing the country in three weeks. Of the great expedition nothing has endured but famous sayings, such as "Soldiers, from these pyramids forty centuries look down on you"; the Institute of Egyptology; the diffusion of the French language in the valley of the Nile; and, in Bonaparte's own case, a romantic touch of orientalism, symbolised by his faithful mameluke Roustan. Nevertheless, to carry through his great scheme, he undertook the conquest of Syria. Acre, under Admiral Sidney Smith, held out. "That man made me miss my destiny," he said later.

### 18th BRUMAIRE AND THE CONSULATE

**The Coup d'État.**—The expedition was, in fact, a failure. Bonaparte realized that there was nothing to be done in Egypt. At the same time came news which told him that there was work for him in France. The directory was in difficulties both at home and abroad. Disorder was rampant, finance and currency desperate, discontent everywhere. The Government, not knowing which way to turn, swayed one day to the Jacobins, the next to the moderates. In Germany the war continued, and in Italy the Republican armies suffered a series of reverses, and invasion was only checked with difficulty by Brune at Bergen, and by Masséna at Zürich. The restoration of the monarchy seemed inevitable. The republic could be saved only by a military leader.

"I seek a sword," said Sieyès, one of the five directors, racking his brains for a general to whom he could confide the defence of the Republic. At that crucial moment Bonaparte decided to return. He went boldly on board a frigate, slipped through the English cruisers in the Mediterranean, and landed at Fréjus on Oct. 8, 1799. He was greeted with shouts of "Long live the republic." He was the man of the hour for all those who desired an end of anarchy but were opposed to the return of the Bourbons. Without him the Revolution was a lost cause. This consideration is essential to the understanding of the famous *coup d'état* of the *18 Brumaire* (Nov. 9, 1799).

The *coup d'état* was organized, indeed, from within. Not only had Bonaparte accomplices among those in power, he had not even to offer or to impose himself; he was sought out. Baudin, a deputy from the Ardennes, and a staunch Republican, died of joy when he heard of the return of *"Général Vendémiaire,"* who was once more to save the Republic. Of the five directors, Sieyès, though a regicide, had given up hope of saving the country except by a dictatorship, of which he hoped to be the head, with Bonaparte as his strong right hand. Roger-Ducos was of the same opinion. The third, Barras, was corrupt, and would do anything for money. Only the remaining two, Moulin and Gohier, were immovable in their Jacobinism, and had to be silenced. Resistance could come only from political circles, the assemblies, or perhaps from part of the army, where Jacobinism was still strong. The conspirators were assured in advance of the support of public opinion. It is, therefore, essential to note that the *coup d'état* was conceived and organized by Sieyès, who took charge of the parliamentary side, while Bonaparte was an executive agent charged with assuring the support of the army. We must not forget that from its origin to the days of *Fructidor* and *Prairial*, the Revolution had undergone many forcible changes and had violated its different constitutions over and over again.

The pretext for the transference of the two legislative assemblies from Paris to Saint Cloud on the *18 Brumaire* was a terrorist plot invented for the occasion. The plan, though well laid, all but miscarried. On the first day, that of *18 Brumaire*, all went well, and, as the Convention had done in *Vendémiaire*, the assemblies placed Bonaparte in command of their forces. On the morrow at Saint Cloud, affairs took a dangerous turn. The Upper Chamber or Council of the "Ancients" had been won over, but the lower or Council of the Five Hundred, whose Jacobin members had had time to summon their forces, greeted the general with shouts of "Down with the dictator! Outlaw him!" Bonaparte lost the thread of his speech, lost countenance, and for a moment was surrounded by a threatening crowd of deputies. Soldiers came to his assistance; however, the day would have been lost but for his brother Lucien, who had made his way in politics and was president of the assembly. Declaring that the right of free speech had been outraged, he dramatically threw off his insignia and rushed into the court of the Orangery to harangue the still hesitating soldiers. Bonaparte, having recovered from a fainting condition, appeared, his face bleeding where, in his agitation, he had scratched it. This made the soldiers think that he had been wounded. General Leclerc, his brother-in-law, thus charged at the head of his grenadiers and cleared the hall of the refractory deputies. That very evening Bonaparte, Sieyès and Roger-Ducos were elected "consuls" by the Council of the Ancients.

The Revolution was not over. Bonaparte was to continue it under monarchical forms, and to give it at last a government. Sieyès dreamed of giving a constitution to France, but France had worn out so many constitutions during the last ten years! Bonaparte, who had used the "ideologues" as stepping stones to power, now made it clear to them that they had a master; and of Sieyès' constitution, only such portions as suited him remained. Authority was narrowing its limits. Five directors had given place to three consuls.

**First Consul.**—Immediately after, Napoleon became the first, the only one, elected for ten years. Public opinion gave him what was practically unlimited power. Disillusion and anxiety made him master of France. Some were tired of violence and disorder. Others, who had profited by the Revolution to possess themselves of national property, feared the return of the Bourbons and its restoration to its former owners. The mass of the people therefore, desired the consolidation of the new *régime*. Had it not been for the *18 Brumaire*, it is probable that the restoration of the legitimate branch would have taken place much sooner, before the Napoleonic empire had consolidated the results of the revolution by permanent institutions. The great mistake of the royalists was to look upon Bonaparte as another General Monk. He replied with disdain to the overtures of the comte de Provence—the future Louis XVIII. The royalists in their turn hastened to resume the struggle against him, thus definitely marking him as the representative of the "revolution in arms."

The Revolution was further indissolubly bound to its idea of "natural frontiers," and could not surrender the conquests which the rest of Europe refused to recognise. The war had to go on, whether they liked it or not—a fact which entailed government by a soldier. With the rest of his heritage, Bonaparte had to accept the necessity which had made the weak directory as warlike as the Convention. His term of power served merely to postpone the inevitable catastrophe.

**Reforms.**—His first work was to restore order and to regulate the administration of government. Here his lack of prejudice helped the first consul. As has already been said, being of French education, but not of French origin, he neither disliked nor regretted the old *régime*. He was thus able to adopt the strong points of the old monarchical system and reject the weaknesses of revolutionary democracy. The Revolution had made the system of election universal, in the civil service, in the magistracy, and

in the police: a fault which killed successive governments. Bonaparte replaced the elected committees by prefects and sub-prefects, thus re-establishing and multiplying the old *intendants*. Unwilling to restore completely the independence of the magistracy, of which the parlements had availed themselves against the crown, he gave the government the right to nominate magistrates, while making them, in the interests of justice, irremovable. Thus, making use of the experience both of the monarchy and of the revolution, Bonaparte framed the system known as the constitution of the year VIII. based on administrative centralization which subordinated the nation to the State, and which has been so convenient for governments that it has been kept in being by all the succeeding régimes. Altered only in detail, it subsists today.

At the outset Bonaparte justified the hopes aroused by his *coup d'état*. The mass of the people longed for peace at home and abroad. He appeared to fill the rôle of peacemaker. Having rid himself of Sieyès, he associated with himself, for form's sake, two other consuls, Cambacérès and Lebrun, men of ripe age and moderate views, the latter of whom had been secretary to Chancellor Maupeou under Louis XV. When a plebiscite was taken, the First Consul was approved by three million votes. He immediately reassured both the solid middle class, and the revolutionaries who had enriched themselves during the Revolution. He wiped out the last relics of Jacobinism, by suppressing the progressive forced loans, and the law of hostages. He re-opened the churches and pacified the Vendée by putting an end to religious persecution and thus indicating a forthcoming *concordat* with the Pope. With the help of a former official of the monarchy, Gaudin, who became duke of Gaeta, he reorganised the finances, and prepared the way for a return to a stable currency.

**Marengo and Hohenlinden.**—Abroad his task was more difficult. There is no reason to think that Bonaparte was not sincere in trying to put an end to hostilities, though he may have wished to prove to the peace party that peace was unobtainable. The proof, in any case, was quickly forthcoming. The emperor of Russia having retired from the coalition, it remained to deal with England and Austria. The first consul offered a cessation of hostilities. It was a mistake to think that England, so long as she remained mistress of the seas, would ever allow France to retain possession of the mouths of the Scheldt. Pitt refused. Then Bonaparte made another miscalculation. A smashing victory on the Continent would, he thought, compel England to yield. He persisted in this erroneous idea until Waterloo. His history henceforth is a striving for the impossible, *i.e.*, the capitulation of Great Britain on a point she had never admitted—the annexation of Belgium—by a France, which was powerless at sea.

Seven months after the *18 Brumaire*, he boldly crossed the Alps by the Great Saint Bernard to compel Austria to make peace. On June 14, 1800, the hardly won victory of Marengo made him once more master of Italy. Together with Moreau's victory at Hohenlinden in December, it forced the Emperor Francis to sign the treaty of Lunéville, by which Austria recognized all the conquests of the Revolution. The left bank of the Rhine became part of France, and was divided into departments. This was the triumph of Bonaparte and of the revolution. For the first time in history France had regained her "natural frontiers," those of Gaul as known to Caesar.

By the treaty of Lunéville, the British government lost her last Continental ally. The war was costing dear, and many people were weary of it. Trade was severely affected. The first consul, who knew this, resumed in appearance the preparations for invasion, which had been begun in 1797. When, after the fall of Pitt, negotiations were begun with the London cabinet, he strove to drive a bargain, renouncing all claims on Egypt. In March 1802, the treaty of Amiens was signed. It was, and could only be a truce, but the French saw in it definitive peace, and the prestige of the first consul was increased.

**Extensions of Power.**—In the midst of his success there was one seed of anxiety. He was in power only for ten years. Three had already passed, and opposition was beginning to make itself felt. A Jacobin conspiracy was discovered. Soon after he narrowly escaped being killed by an infernal machine. Former terrorists were thought to be responsible, but Fouché, the minister of police, found that the criminals were royalists instigated by the irreconcilable Cadoudal. Then the Tribunate instituted by Sieyès, opposed Bonaparte's favourite ideas; the Concordat with the Pope, the Order of the Legion of Honour, the Civil Code. Their opposition would become more formidable as the ten year period drew to a close. Definitely to establish the Consulate, and to make it safe from attack, permanence was desired. Thus by a natural progression opinion tended towards the revival of the monarchy in favour of the first consul. He himself was silent, asked for nothing, and let his friends work for him. This they did most effectively.

After the triumph of the peace of Amiens, they proposed a national token of gratitude. The Senate accorded only a prolongation of power for a further ten years. This was a discomfiture. Then Cambacérès thought of consulting the people whether Napoleon Bonaparte (his Christian name was beginning to be used officially) should be made consul for life. It was carried by three and a half million to less than ten thousand votes. The first consul also received the right to choose his successor (Aug. 1802). Although he then had no children, there was nothing to prevent him from choosing his son, if he should have one.

Hereditary monarchy was thus on the point of being re-established, after so many solemn protestations to the contrary. From that time the sovereigns of Europe began to regard Bonaparte as one of themselves. They watched him "climbing step by step towards the throne," though there were to be further happenings before he reached it. It would be an error to accuse him of having sought to gain the crown by means of a new war. The establishment of the empire was an indirect consequence of the renewal of hostilities in May 1803, the immediate cause of which was a dispute over Malta and the interpretation of the treaty of Amiens, though for reasons easily understood, and beyond the control of statesmen, peace could never have been more than a truce. Could England allow France to remain in permanent possession of the finest coast line and most valuable ports of the Continent from Rotterdam to Genoa? To put the question is to answer it. And we must remember that Napoleon had received Belgium and Holland in trust for the Revolution.

**Counterplots.**—France and England slowly prepared for a struggle which this time must be carried to the bitter end. The twice abandoned plan of invading Great Britain was again resumed, and a camp was formed at Boulogne. Meanwhile the irreconcilable royalists, encouraged by the first consul's new difficulties, conspired with General Pichegru to assassinate him. Georges Cadoudal, who had landed in France, succeeded in implicating the celebrated Moreau, jealous of the first consul. The discovery of this plot infuriated Bonaparte. He accused the *émigrés* of ingratitude, publicly affirmed his republican sympathies, and declared that the intention was to destroy the revolution in his person. He determined to strike.

A young prince of the house of Condé, the duke of Enghien, one of the Bourbons, was forcibly seized on the territory of the duchy of Baden, summarily tried and shot. Bonaparte has been universally condemned for this judicial murder, which set "a ditch filled with royal blood" between the older dynasty and the throne upon whose steps he stood. His regicide monarchy was no longer suspect even to the fiercest republicans. Just as the infernal machine had contributed to the success of the first plebiscite, the conspiracy of Cadoudal and Pichegru facilitated the proclamation of the empire. The first consul had escaped the conspirators, and the danger helped his cause.

## THE FIRST EMPIRE

The consulate for life seemed too precarious; a Napoleonic dynasty would survive its founder. Since his enemies, who were the enemies of the revolution, wished to destroy him "he must be made king or emperor, so that heredity should reinforce his power by ensuring him of natural and unquestioned successors and, by rendering useless crimes against his person, should remove the temptation to commit them." (Thiers.)

Thus France returned to hereditary monarchy, approved by a

unanimous vote of the Senate, and by a plebiscite. The empire was proclaimed on May 18th, 1804, the title of emperor being chosen because the word king was inseparably connected with the Bourbons, and because it sounded more impressive, more military. It evoked, moreover, memories of Rome and of Charlemagne And, like Charlemagne, Napoleon wished to be crowned by the Pope, not in Rome but in Paris. After some hesitation Pius VII. granted his request. On Dec. 2, at Notre Dame the amazing ceremony took place, and the soldier of the revolution became the anointed of the Lord. Moreover he took the crown from the hands of the Pope, and placed it on his own head. And Josephine the Creole adventuress, became empress. But Napoleon could dare all. He built up a new nobility, he gathered together a court. France approved of everything. When the wife of Marshal Lefebvre (the celebrated *Madame Sans-Gêne,* who had been a washer-woman) became the duchess of Dantzig he dared even ridicule.

**Boulogne, Ulm and Cadiz.**—The empire united the old France with the new; in it revolutionary and monarchical ideas were combined. There was general satisfaction. Prosperity had returned with ordered government. No one troubled about the one weak point. The empire could not be really established, nor the conquests of the revolution assured, without the defeat of the British power. Napoleon did not forget it, and in the midst of his re-organization of home affairs, his thoughts were on the camp at Boulogne. He knew that to settle finally with England he must overcome her on her own ground, and must have therefore, were it only for one day, free passage across the Channel. A third coalition was forming. He could, he was sure, defeat its forces by land, but this new victory would be no more effective than earlier ones, so long as the British navy was undefeated. With the help of Admiral Decrès, Napoleon had laboured since the days of the consulate to re-establish the French navy, ruined by the Revolution. But a navy is not built in a day. Failure at Boulogne was to change the fortunes of the empire.

Yet the plan was bold and simple. France had two squadrons. The destruction of one mattered little if, while it fought, the other could slip into the Channel and for 24 hours assure the transport of the troops gathered at Boulogne. On this strategy everything turned; it failed. Villeneuve failed Napoleon, as Grouchy was to fail him at Waterloo. The admiral was uneasy about his equipment, his officers, and his raw and untrained crews. His anxiety was shared by Decrès, the minister of marine. Napoleon spent the month of Aug. 1805 in cruel suspense. Villeneuve, he learnt at last, had not dared to enter the Channel and instead of bearing towards Brest, was making sail to the south. Once more the invasion of England must be abandoned, or at least postponed. Austria was openly threatening, Russia was arming, Prussia could not be depended upon. Austria must be brought to the knees without delay. Napoleon broke up the camp at Boulogne, marched into Germany with amazing rapidity ("The emperor makes war with our legs," said his soldiers) and forced General Mack to surrender at Ulm on Oct. 19.

Two days later this magnificent victory, with all those which were to follow it, was nullified. Villeneuve, blockaded by Nelson in Cadiz, had tried to escape. The British fleet, though smaller in numbers, had destroyed the Franco-Spanish off Cape Trafalgar. From that day the French empire was doomed. Napoleon was faced with the hopeless task of subduing England, absolute mistress of the seas. All his future was governed by that impossibility.

**Austerlitz and Jena.**—Because he had not crossed the Straits of Dover, he was to go in vain even to Moscow. In vain he sought to triumph first over the Continental powers, hoping then to find the British government discouraged and in a mood for compromise. The Russians having offered battle, he defeated them, and also a fresh Austrian army, in the most brilliant of his victories, that of Austerlitz (Dec. 2, 1805), exactly a year after his coronation. In a few weeks the third coalition was wiped out.

The armies of France, under the single command of a man who was a military genius and an absolute sovereign, seemed invincible. Napoleon, and perhaps he alone, knew that no decision had been reached. He rejected Talleyrand's plan for a reconciliation with Austria, and, returning to the idea which had inspired his Egyptian expedition, planned to strike at England through the East. By the peace of Pressburg he made of a subjugated and diminished Austria a means of communication with Constantinople. The vision was taking shape. To realize it, however, he must dominate all Europe. Within a few years he exhausted the Empire in the attempt. With the conquest of Belgium as a starting point, the revolution urged its successor to vast enterprises, for which neither the military genius of Napoleon nor his political ability would suffice. It was not mania for conquest but the logical development of these schemes which led him to annexations and dangerous territorial adjustments which disquieted all Europe. His brother Joseph became king of Naples, his brother Louis king of Holland. He formed the states of Southern Germany into the Confederation of the Rhine, with himself as president. Prussia, charged with closing the Baltic to the English, was promised Hanover, and the Bourbons, dethroned in Naples, were to have the Balearic isles. After the death of Pitt, he tried to conciliate England by offering secretly to restore Hanover. These diplomatic moves served only to make him two enemies, Prussia, which he had humoured for so long, and Spain, a former ally.

The Prussian campaign saw another of the lightning strokes which he understood so well. The Prussian Army, which had lived on the reputation gained under the great Frederick, was routed at Jena (Oct. 1806). In a few weeks the defence had collapsed, and Napoleon was master of the greater part of Prussia.

**The Subjugation of Europe.**—Since Prussia had refused to lend herself to his schemes, he would make northern Germany another annex to his empire, himself closing the Baltic and eventually all Europe, to English commerce. From Berlin he promulgated the Continental blockade, an idea arising naturally out of the situation, simple, easy to set out on paper, but entailing the suppression of the independence of all the nations of Europe, since the prohibition of trade with England to be effective must be general. The Continental blockade was the consequence of and the counter-strike to Trafalgar.

But Napoleon was caught in a net from which there was no escape. He had set himself an endless task. After Ulm had to come Austerlitz, after Austerlitz, Jena. After Jena he had to complete the conquest of Prussia, and to complete it, to defeat Russia, penetrate further into the East, cross the Vistula. At Eylau (Feb. 8, 1807), three hundred leagues away from France, he fought in the snow a bloody and inconclusive battle. A new effort, the calling up of next year's conscripts was demanded of Frenchmen "that peace might be won." In June at Friedland, the *grande armée* was again victorious.

Once more Napoleon had the illusion that the goal was reached, that he was master of Europe and could hold England to ransom. The tzar Alexander, highly strung and impressionable, was now won over to the idea of an agreement with the emperor of the French for a policy of partition on 18th century lines. This time Turkey was to be divided instead of Poland. Napoleon was convinced that, allied with Russia against England, able to close the Mediterranean against her, threatening her even in India, he would force her to her knees. The meeting at Tilsit, and the conclusion of the pact of friendship between the emperor of the East and the emperor of the West, seemed to justify the costly victories which had led the French army as far as the Niemen.

**Spain, Prussia and Austria.**—The first disappointment was that the Franco-Russian alliance determined England to fight more fiercely than ever; her answer was a declaration of war against Russia, and the bombardment of Copenhagen. The Continental blockade everywhere led to increasing difficulties. Portugal showed no eagerness to shut out English trade. Junot had to be sent there with an army. Spain was also giving trouble, and Napoleon determined to drive the Bourbons from Madrid. As if he were transferring prefects, he placed his brother Joseph on the throne of Charles IV., and succeeded him at Naples by Murat, who had married Caroline Bonaparte. At the same time the occupation of the Papal States by General Miollis, charged with enforcing the blockade, embroiled him with the Pope. The

system drove Napoleon to increasing severity. To hold Germany and Italy, together with the Adriatic coasts, and the Spanish peninsula, would soon require a standing army of a million men, while the patience with which his conquests and his violence were endured would decrease in proportion to the dispersion of his troops.

Spain gave the signal for resistance. The Spanish people refused to recognise Joseph, and a wide spread insurrection broke out. When, in July 1808 General Dupont surrendered at Baylen, the Napoleonic empire suffered its first military reverse. The news resounded all over Europe. At the same time an English army landed in Portugal and Junot succumbed to superior numbers. Napoleon's desire to direct and control Spanish affairs had not only caused the English to be received as liberators, but had committed himself to an endless struggle against a people in arms. The uprising of the Spanish nation was infectious. In Prussia, in Tirol, in Dalmatia, patriotism was extolled, and the idea of a holy war for national independence took root and grew. In later days the emperor realized that Spain had been his first check, and that the limit of his power had been attained. In spite of a fresh interview at Erfurt, at which the two emperors paraded their friendship before an audience of kings, the Franco-Russian alliance languished. The partition of Turkey was hindered by the question of Constantinople, which neither emperor wished to see in the power of the other. Alexander was beginning to doubt the power of his new friend. Napoleon, feeling that the ill-success of his policy in Spain was injuring his prestige, determined himself to cross the Pyrenees, and re-establish Joseph in Madrid.

Incited by England and lavishly supplied with English money, Austria took advantage of his absence to re-enter the struggle. Napoleon had to return in haste from the Ebro to the Danube. The Austrian plans were carefully laid, and their opposition was far from negligible. Essling was a difficult, and Wagram (July 1809) a costly victory, but in both he carried the day.

**Russia.**—From these very successes, however, there arose a further complication. Napoleon had made use of Poniatowski and his Poles against the Austrians. Alexander, who, in any case, had remained neutral, feared that Napoleon was planning the reconstitution of Poland. Abandoning his former ally, he denounced the Continental blockade, and had in his turn to be encountered. The idea of conquering England by Europe and Asia, the sea by the land, had brought about a result which, though it seems at first absurd, was yet the logical conclusion.

It was with no light heart that Napoleon decided to carry the war into Russia. He still hoped that it might not be necessary, if Spain were subdued and if the United States, to whom he had ceded Louisiana and promised Florida, declared war on England, which, attacked in its vital interests by the Continental blockade, would at last sue for peace. There was no doubt that the blockade was having a disastrous effect on British trade; its results on the commerce of other nations were no less serious. Holland refused to enforce it, and Napoleon was obliged to resume control from his brother Louis, who had espoused the cause of his new subjects. He annexed the country, and divided it into departments, thus giving England a fresh reason for remaining under arms. In this way the Continental blockade led either to fresh wars or to expansions of territory which the English inevitably refused to recognise, since they had never recognised those revolutionary conquests which the new ones consolidated.

France was growing uneasy. Common sense made it clear that this extension of territory and of war could not go on indefinitely, and yet no end was in sight. Far-seeing members of the emperor's own circle, such as Talleyrand and Fouché, began to fear that affairs were going wrong. "If it only lasts," said Laetitia Ramolino, *Madame Mère*. Yet the empire never seemed so great, nor the future so secure as in 1810.

**Marie-Louise.**—Already on a level with kings, Napoleon in his second marriage equalled the proudest dynasties. The head of the house of Habsburg gave him the hand of his daughter. Josephine, though she was loved by the people and her dethronement regretted, was growing old and she had given him no heir. He was tired of her, and anxious to ensure the succession. The emperor of Austria must have shared his confidence in the future, since he was willing to accept the "Corsican ogre" as his son-in-law. The marriage contract with the archduchess was modelled on that of Louis XVI. and Marie-Antoinette, into whose family he was now admitted, in one of the most extraordinary episodes of even his life. The following year Marie-Louise bore him a son; the empire had an heir, who was given the title king of Rome, as the heir to the Holy Roman Empire had been named king of the Romans. But in 1811 Rome was but the capital of the department of the Tiber. The pope had been deported to Savona and was about to be imprisoned at Fontainebleau. By the Continental blockade the restorer of Catholicism in France had been led to alienate Catholics all over the world. Nevertheless, excommunicated, having driven the Bourbons from Naples and from Madrid, the man who 20 years before had been an insignificant officer with neither name nor fortune, married a daughter of the Habsburgs. Confident in his star, he carried all before him.

Though his marriage gratified his ambition, Napoleon had decided upon it only after the failure of negotiations for an alliance with a sister of Alexander. He would have preferred a Russian princess, for more than one old veteran of the Revolution, remembering Marie-Antoinette, asked why the "little corporal" should marry another "Austrian." But the Russian emperor was gradually disengaging himself from the alliance, on which Napoleon was ceasing to rely.

**Moscow.**—Realising that the Russians would never consent to the extension of the French empire, which under the necessity of the Continental blockade had ended by annexing the Hansa towns of Bremen and Hamburg, and making them the principal cities of two of its hundred and thirty departments, he saw that war was inevitable. French territory now stretched to the Baltic, and the nearer its boundaries approached those of Russia, the greater was the danger of conflict. Difficulties arose continually over Oldenburg, Poland, the East, and the reluctance of Russia to abandon trade with England. The two allied emperors were arming against each other. These preparations were themselves a further offence. Convinced that this new struggle had been decreed by fate, and that his work would not be accomplished till he had vanquished Russia as he had vanquished Prussia and Austria, Napoleon now assembled for the campaign of 1812 the greatest army which the world had yet seen, an army of "twenty nations" made up of contingents from all the peoples allied to or dependent on France, a sort of Western crusade against Asiatic Russia. By natural inclination, as much as by policy, Napoleon raised again for this crusade the battle cry of the Revolution, the liberation of nationalities, of which the reconstitution of Poland was to be the token. He forgot that the Spaniards were already fighting for their independence, and that the nationalism, awakened by principles of the Revolution, was stirring the people of Germany. Alexander, who could play many parts, also spoke the language of liberalism, invoked justice, enlisted on his side the countries defeated and subjugated by France or in rebellion against her, and prepared for peace with Prussia and Austria by complicity in the partition of the Polish provinces. Napoleon was thus to stake everything on the inevitable Russian campaign. Victorious, he would be master of the East, of Constantinople, of all Europe, and would at last force the English to capitulate. Defeated, he himself would have given the signal for the debacle. The war which began in 1792, having carried the French to the gates of Moscow was to return by a swift and violent revulsion to the gates of Paris.

In June 1812 the *grande armée* crossed the Niemen. According to their custom, the Russians declined battle. Alexander had said that he would retire if necessary beyond Tobolsk, while Napoleon imagined himself dictating peace from Moscow. The Russians set fire to the city, and made no peace. Then began a retreat which after the passage of the Beresina became a disaster. In the month of December, Ney and Gérard arrived at Königsberg almost alone. The *grande armée* had melted away. Realising the extent of the catastrophe, and its probable effects in Europe and in France itself, the emperor had secretly left the army, which was kept in ignorance of his departure. The news of General Malet's

conspiracy, which had reached him in Russia, had shown him how precarious was his position and how much weakened his prestige.

**The Loss of Germany.**—The subsequent history of the Empire is the story of a rapid return to the conditions under which Napoleon had assumed the dictatorship in 1799. The Republicans themselves on the *18th Brumaire* had entrusted him with the task of saving the Revolution and its conquests. To this end France had allowed him to take the crown, to found a dynasty, to overrun three-quarters of Europe and to raise countless armies. All in vain. In a few months he was back at his starting point.

The Spanish insurrection of 1809 had encouraged England to persevere, and had revived the resistance of the conquered peoples. The disasters of the Grand Army in 1813 spurred on his enemies still more. "A few more sacrifices," said the English, "and our end is accomplished." Not even the long hoped for declaration of war by the United States, due not to French diplomacy but to the doctrine of the freedom of the seas as opposed to the English "tyranny at sea," could affect the determination of the British government. Everything pointed to a vast change of fortune in favour of the cause of which England, at one moment, had remained the sole champion. Nationalist propaganda was bearing fruit in Germany. Prussia, while still protesting fidelity to Napoleon, had shifted her allegiance, and secretly reconstituted her army. A Prussian corps in French service, commanded by General York, went over to the Russians. Its defection made a great sensation in Germany and hastened the continued retreat to the Elbe of the remnants of the French army. The Prussian government then unmasked and, obedient to popular opinion, proclaimed a war of liberation and independence.

Napoleon chose to consider his Russian defeat as an accident. In Germany it would always be easy for him, he thought, to beat the Prussians and the Russians; having raised and trained a fresh army he did, in fact, beat them at Lutzen and at Bautzen. The campaign of 1813 opened well. He was, however, justly apprehensive of Austria, and instead of following up these fresh successes he agreed to an armistice, so as to be ready for the third adversary. A coalition of Austria, Prussia and Russia had no terrors for him. He wished to settle with it as quickly as possible, thinking that he held enough cards to secure even from England a favourable peace. The victory of Dresden (Aug. 27) seemed to justify this. But, one after the other, his generals, badly served by their contingents from the Germanic Confederation, were beaten in the field, and his plans were delayed. At Leipzig, where he had returned to prevent the junction of his three opponents, Napoleon fought a three days' battle (Oct. 16–19), during which his Saxon troops went over to the enemy. Having lost this immense battle, and all Germany with it, he had to fall back to the Rhine. In November what had been the *grande armée* entered Mainz, after fighting its way through the Bavarians who in their turn had betrayed him.

Was it possible, on the banks of the Rhine, to secure peace on the basis of "natural frontiers"? The question had been identical under the Revolution. Prussia showed herself at last as the German power most fiercely opposed to France, and England insisted on the renunciation of Antwerp. This was, as it had been during twenty years of war, the question at stake.

**Disintegration.**—Holland had risen against French rule. Belgium was tired of conscription and of taxes, and there also was awaking an old, invincible consciousness of nationality. The British government, well informed on the condition of France, was aware of her exhaustion. Everything, they knew, had been organized for conquest, nothing for defence. The Allies were much superior in numbers. Even within its own boundaries the Napoleonic empire was tottering. Their determination to finish the business once and for all carried even more weight than Prussia's hatred, and the negotiations which took place before the Allied entry into Paris were for that reason insincere. It had been clear since 1798 that, with England undefeated, France could make peace only on returning to her former frontiers.

No one knew better than Napoleon himself that he was, as the Convention and the directory had been, bound hand and foot by the war and its conquests. He must defend those conquests to the end, or perish with them, as the Revolution had perished. The very nature of his power and the conditions on which he had received it, forbade him that honourable and prudent peace which he has been vainly reproached for failing to achieve. First the allies would have none of it, though their unwillingness was veiled to give the impression in France that only the insensate ambition of the emperor stood in the way; secondly, no government of revolutionary origin could accept the former boundaries. The situation was the same as in 1799. "As things are," said Napoleon, "no one but a Bourbon can succeed me."

The Bourbons, however, succeeded him for another reason. When the Allies invaded France in 1814, they were not in agreement on the form of government. They had not made war for the re-establishment of the monarchy before or now. The Austrian emperor preferred the regency of his daughter Marie-Louise, which would have given him control of French policy. The emperor of Russia dreamed of a king of his making, such as Bernadotte, one of the luckiest adventurers of the Revolution, who by an unprecedented combination of circumstances had become crown prince of Sweden and had betrayed Napoleon. Prussia, concerned only with her own aggrandisement, cared little who ruled in France provided that she obtained her share of the spoils.

Thus Castlereagh, who wished to see France smaller, but free and in subjection neither to Austria nor to Russia, became convinced that a Bourbon monarchy alone would fulfil England's conditions, since, according to Albert Sorel, "this government of principles and not of expedients would be neither the debtor nor the client of any of the Allies." Unknown to, or uncomprehended by the French, this was the reason for the restoration, which to them seemed to be arbitrarily imposed by the enemy, though, in accordance with the English theory of the balance of power, it was intended to preserve their national independence.

Napoleon's campaign in France, the most brilliant of them all, was a barren masterpiece. Albert Sorel has compared his victories, Brienne, Champaubert, Montmirail, Montereau, to that of Valmy. The Allies hesitated and wondered whether to negotiate. But just as the Revolution had demanded that the enemy should quit French territory, so Napoleon insisted on the guarantee of "natural frontiers." He could do no less, but the object of the coalition was to deprive France of them. "We must reassume the uniform and the courage of '93," he said in Feb. 1814. He clung instinctively to the Revolution, and welcomed the proffered assistance of Carnot, former comrade of Robespierre, and one of the few revolutionaries who had held aloof from the empire. The allies on their side remembered that when, after Valmy, the invaders had retired behind the Rhine, Revolutionary France had decided to pursue them. This recollection stiffened their determination, and strengthened their alliance. The four powers bound themselves afresh by the pact of Chaumont, and resumed the offensive, determined to dictate terms of peace.

Everything was crumbling around Napoleon. With the last levies which France could give him, scarcely more than children, he again tried to hold back the enemy, then to outflank and defeat them. His plans failed for want of men. On March 30 the Allies were masters of Paris, and a German wrote from Montmartre, "Nine and a half centuries ago our emperor Otto planted his eagles on these hills."

**Abdication.**—On April 11, 1814, at Fontainebleau, Napoleon abdicated. Not only had his Senate, the child of the *Corps Législatif* of *Brumaire,* itself the child of the Convention, deserted him and declared for the Bourbons, but his marshals fiercely urged him to renounce his sovereignty and leave the country. They had returned to the position before the *18 Brumaire*, from which the Directory had sought to escape. It is again Albert Sorel who notes that the empire ended, as the consulate began, by one of those "days" which had overthrown so many revolutionary governments. On May 5, Louis XVIII. entered Paris, while the fallen emperor landed on the island of Elba where his sovereignty was recognized. The former master of Europe now reigned over a few square miles. But he was only forty-five and in the full force

of his powers. A man of such immense energy and such ardent imagination could not resign himself so easily to defeat.

Only 25 years separated the beginning of the revolutionary era from his fall. A quarter of a century, however crowded with events, is a short space of time. What had happened? In the part of its programme which included republican government, and "natural frontiers," the Revolution had doubly failed: first, when to save itself it had had recourse after the 18th *Brumaire* to a dictatorship, to absolute sovereignty, to the empire; and again when after incessant fighting for "natural frontiers," the empire had ended by laying France itself open to invasion. Conditions which the Revolution would never accept even though the refusal involved a military despotism, were now imposed. France was obliged to return to her former boundaries, and this involved the restoration of the Bourbons. It was the only possible solution, and there were few in 1814 who did not accept it. Talleyrand, who was far from being a legitimist, played a principal part in the restoration, simply because he realized that it was the only solution. Any government, whether republican or imperial, which sprang from the revolution, was doomed to war, and France had already waged war to the limit of her strength. The monarchy alone could assume the heavy responsibility of concluding peace on the terms offered. Hence when the French had forgotten the disasters and the despotism of the empire arose the reproach that the Bourbons had "returned in the baggage waggons of the enemy."

The return of Louis XVIII. was accompanied by the grant of the "Charter," and representative government. He did not restore the institutions of pre-revolutionary France, but on the contrary, retained those of Napoleon, of the year VIII., even confirming the greater number of his prefects in their office. It remained to make peace in Europe. Louis XVIII. and Talleyrand, making use of the jealousies which had arisen among the allies, sought to make the general settlement as favourable as possible to France. The Congress of Vienna was still sitting when, early in March 1815, the news came "like a bombshell" that "Bonaparte" had escaped from Elba. It had all to be done over again.

There are few examples in history of such sentimental and passionate episodes as the return from Elba. Though the good sense of the French protested against the adventure, it caught at their hearts. Napoleon brought with him so many memories, and with them the tricolor. The daring of his landing in France recalled the return from Egypt. He had only to appear, and almost all France rushed to support him. Yet moderate men realized that the emperor's new adventure was all but hopeless, and would end in a catastrophe even worse than that of 1814. Liberals regretted the loss of the "Charter." France was sick of war, and the abolition of conscription had been the most insistent demand made on the Bourbons. Napoleon maintained that he had been recalled by the people, universally dissatisfied with the restored monarchy. There was, of course, unavoidable friction between the old émigré society and the new. There were in particular soldiers who had held out alone in Germany, Holland and Italy, and had not returned to France till after the convention of April 23. These had not witnessed the invasion, and felt that the fall of the emperor had been undeserved. There was also to be reckoned with, the discontent of the officers who had been placed on half pay.

None of this was really serious, however. Only the presence of Napoleon himself, escaped from his island prison, could have brought about the flood of popular feeling by which he re-conquered France in three weeks. He had only to appear and all was forgotten, the disasters of yesterday and those which his return implied, the slaughter which had brought curses on his name, the detested conscription. Officers and men rallied round him. He had not lost his power of appealing to them, and he stirred their hearts by memories of past glory. After the first moments of hesitation the detachments first sent against him declared for him. Grenoble, then Lyons opened its gates. Marshal Ney, who had undertaken to apprehend him and to bring him back if necessary in a cage, wavered, was carried away, and fell into his arms.

**The Hundred Days.**—Having landed in the gulf of Juan with a handful of men on March 1, 1815, he was at the Tuileries on the 20th, and Louis XVIII. had fled to Ghent.

A hundred days: the adventure lasted no longer, and was doomed from the outset. Three months' madness. To understand why Napoleon, who, ten months before, had been deserted and denied by all, became the master of France in three weeks in a rush of passionate enthusiasm, we must take into account the change in himself, and the new rôle which he played in opposition to the Bourbons. He was not only a military genius. He was a supremely able politician, and his talents had been perfected during the revolution. He now awoke its memory, talking to the soldiers of glory and to the people of peace and liberty. The former despotic emperor returned a demagogue. Two things menaced him. There was first the fear that the allies would again take up arms, but that he assured the people would be prevented by his father-in-law, the emperor of Austria. Then there was his own despotism. But he told the peasants that they were threatened with the revival of tithes, seigniorial privileges and rights. "I come," he said, "to free you from bondage and serfdom." He who had restored the rights of the Church, and founded a new nobility now incited the mob against the nobles and the priests. To the Liberals he promised representative government, the freedom of the press, everything which Louis XVIII. had already granted, but with a new revolutionary tinge. The idea of a liberal Napoleon conformable with the principles of the Revolution, remained in men's minds. From it dates that alliance of the Bonapartists with the Liberals which disturbed the restoration and the reign of Louis Philippe, and paved the way to the era of Napoleon III.

Abroad the consequences of the return from Elba were no less grave. The allies at Vienna learned the news on March 13. They immediately declared the emperor an outlaw. The pact of Chaumont was renewed. Resumption of the war was certain, and new disasters probable for France. Talleyrand, the French representative at the Congress, was in a cruel position. Foreseeing the event, he associated himself with the allies in order at least to keep the conditions of the Treaty of Paris, and to prevent the next treaty from being made even more severe. It was easy afterwards to pillory this prudent decision, and to assert that the Bourbons had joined with the enemies of the French people. When those who had compromised themselves in the Hundred Days sought for an excuse, they used this treacherous argument.

## DOWNFALL AND CAPTIVITY

**Waterloo.**—Napoleon had never held the illusion that the allies would permit him to reign, nor that he could reign, over a France reduced to its former boundaries. He was still subject to the law which had in the past driven him incessantly to battle. Outlawed by Europe, he prepared to fight. He could still command his followers, but the enthusiasm of the early days had evaporated and there were sinister forebodings. There were many abstentions from the plebiscite held, as before, to approve the supplementary Act to the constitution. The assembly of the *Champ de Mai* resuscitated as the festival of Federation, was gloomy. The spirit of the people was exhausted, their minds disturbed, and Napoleon's supporters uneasy. To prevent a new invasion, the Emperor left for Belgium on June 12 with the intention of separating Wellington and Blücher, who had a hundred thousand men more than he, and defeating them successively. In spite of a success at Ligny, he failed to prevent the junction of the English and the Prussians. This was partly due to what is usually called ill-fortune, but is really the resultant of many forces. Grouchy, a second-rate general to whom Napoleon had given a command in reward for political services, blundered, and remained inactive during the great battle which took place on June 18 at Waterloo—the name of a disaster unparalleled since Trafalgar. On his return to Paris on June 20 no other course but a second abdication was open to Napoleon. All was over. The Napoleonic drama culminated in disaster.

It would appear that in order to strike the imagination of mankind a hero's life should end with a great misfortune. If he had died a natural death in his palace, or fallen on the field of battle, Napoleon would never have become to posterity the figure we know. Lives like his must end in martyrdom, which crowns them with the pity caused by human suffering and the respect due

to misfortune. Saint Helena idealised the emperor's memory, and his gaolers unwittingly prepared for him a sort of poetic immortality. Though his imprisonment in a distant island was a punishment relatively slight as compared with the torture of Joan of Arc, and though the man who placed the imperial crown upon his own head had little in common with the young girl who led her king to his crowning at Reims, there is some similarity in the moral effect and the historical renown of their death. The last phase of Napoleon's life may be regarded as his transfiguration.

After Waterloo, the energy which his presence had re-awakened relaxed. On his return to Paris he felt himself abandoned. The Chamber declared itself against him, and appointed an executive commission to govern with the ministers. He must either forcibly dissolve it, or abdicate. He decided to abdicate in favour of his son, the king of Rome, and made known his intention of going to the United States. The executive commission replied that two frigates, then in waiting at Rochefort, were at his disposal, and requested him to hasten his departure. He remained a week longer at Malmaison, then, as a last despairing throw of the dice, offered his sword against the invaders as a simple general. He then undertook to leave for America. His offer was refused. He left Malmaison on June 29 and arrived at Rochefort on July 3.

The two frigates were there, but the "Bellerophon" and other English ships were cruising before the harbour and blocked the outlet. One hope was left, to slip past and get out to sea. Napoleon would not run the risk of arrest as a fugitive. Thanking all those who offered to help him to escape, he decided on a plan he had had in mind several days, which seemed to him to be the most worthy of him as having an element of greatness, namely to demand asylum from the British government. Maitland, the commander of the "Bellerophon," had let him know that the request would be well received. Thus Napoleon wrote his famous letter to the prince regent:—

"Your Royal Highness, Exposed to the factions which distract my country and to the enmity of the greatest powers of Europe, I have ended my political career, and I come, like Themistocles, to appeal to the hospitality of the British people. I put myself under the protection of their laws, and beg your royal highness, as the most powerful, the most determined and the most generous of my enemies, to grant me this protection."

The allies at this moment were in agreement on only one point of their treatment of Napoleon. There must be no new return from Elba, and it would be perhaps even easier to return from America. The victors, to tell the truth, did not know what to do with him, and every solution presented difficulties. Their secret hope was that he would commit suicide, or perish on his way, the victim of a "White Terror." Or they would have liked Louis XVIII. on his return to Paris to have him summarily tried, condemned and executed. "We wish," wrote Lord Liverpool to Castlereagh, "that the king of France would have Bonaparte shot or hanged. It would be the best end to the business." But no one wished to take the responsibility, and Louis XVIII. less than anyone else. And Alexander I. and Wellington were working to save Napoleon's life. So the fate of the man regarded as an outlaw, "outside human society," *hostis generis humani,* had still to be decided. By his surrender to England the "Corsican ogre" laid on her the task of custody which Lord Liverpool would willingly have left to others.

Louis XVIII., who had returned to Paris on July 9, was anxious for the matter to be settled as quickly as possible, without taking the odium on himself. He ordered the prefect of Rochefort to keep the ex-emperor on the frigate *La Saale,* and to give him up to Commander Maitland, on the latter's requisition. Napoleon thought it more dignified to surrender without waiting for summons or arrest. On July 15 wearing the green coat of the *chasseurs de la garde,* and the small hat, his favourite uniform, and that in which he is always popularly represented he went on board the "Bellerophon."

One wonders if he deceived himself as to his fate and believed that the British government would allow him to go to America, or to remain at liberty in England, which had always welcomed exiles and was looked on as a political asylum. He may have remembered Paoli and Theodore, king of Corsica for a brief period, who had come to London, to die. Strangely enough there has been found among his papers a short literary exercise, an imaginary letter from Theodore asking Walpole for protection. In his school exercise books is also the phrase "Saint Helena, a little island."

**The Voyage.**—If Napoleon had hoped to remain at liberty he was undeceived when the "Bellerophon" arrived at Plymouth. Admiral Keith delivered to him, in the name of the British government a letter which informed "General Bonaparte" that in order to deprive him of further opportunities of disturbing the peace of Europe, it was necessary to restrain his personal liberty, and that to this end Saint Helena had been chosen as his future residence. He might take with him three companions, from among those who had accompanied him to England, and a surgeon. The emperor, on receipt of the letter, protested that he was the guest and not the prisoner of the British government, and that the rights of hospitality were being violated in his person. He then resigned himself, and set an example of stoicism to his followers. He did no more than put into writing the verbal protest which he had made to Admiral Keith.

Napoleon took with him into his captivity General Bertrand, a former grand marshal of the palace, Count Montholon, aide de camp, and General Gourgaud, and a civilian, the count de Las Cases. Countess Bertrand and Countess Montholon were of the party, as well as Las Cases the younger, and several servants. On Aug. 7 they embarked on the "Northumberland," commanded by Admiral Cockburn, and almost immediately set sail. The voyage lasted more than two months. Napoleon preserved his impassibility, even though the officers and crew had been ordered to refrain from paying him marks of respect, and he was addressed merely as "General." On arriving at Saint Helena Cockburn even said to General Bertrand, "I know of no emperor living in this island, nor of any person with a right to that position, having, as you say, travelled with me on the Northumberland."

Reading was Napoleon's chief distraction, during this long and monotonous voyage which was bearing him for ever from France and from his family. He had read to him from the *Encyclopædia Britannica* everything concerning Saint Helena and the countries near which the ship was passing. After a turn on deck he would lean against a gun, which the midshipmen soon called "the emperor's gun," and talk at length of his past life, telling stories of his career. Las Cases, who kept a journal was thus led to begin his *Memorial of Saint Helena.* Soon Napoleon himself decided to dictate his recollections, beginning with his Italian campaign.

**Saint Helena.**—On Sunday, Oct. 15 the "Northumberland" dropped anchor before Saint Helena. Napoleon looked through his glasses at the island which was to be his tomb, without, says Las Cases, showing the slightest emotion, and then worked as usual. They landed the next day. The dwelling intended for the prisoner was called Longwood, and, as it was in bad repair and not ready for his reception he stayed temporarily at the small house "The Briars," of which Las Cases says: "The Emperor Napoleon, who was once so powerful, and master of so many crowns, found himself reduced to a little hovel a few square feet in dimensions, with neither curtains, shutters, nor furniture. He had to sleep, dress, eat, work, live there, and if there was cleaning to be done he had to go out of doors." Napoleon protested more than once against this "infamous treatment," against the fact that he was treated as a prisoner of war, though he had himself taken refuge under the English flag, and against the prohibition of news of his wife and son. In December, Longwood was ready at last, and the little company moved there, together with Doctor O'Meara of the Northumberland who had asked to share Napoleon's exile, since no other doctor was available. He also has written an interesting account of the captivity.

Longwood, which had been a farm, was larger and a little more comfortable than "The Briars." Napoleon remained there till his death, spending his time in talking over his past career, dictating his reminiscences, reading, doing a little gardening, riding in the narrow limits permitted him, and even in learning English, which

he read fairly fluently, but would never speak. His chief troubles were the prohibition of correspondence with his family, and the badness of the food. His imprisonment became still more rigorous when, in April 1816, Admiral Cockburn was replaced by Hudson Lowe. The new Governor, obsessed with the fear of losing his prisoner, and, seeing nothing but espionage and plans of escape, made himself detested. Under his petty persecution Napoleon remembered with regret the régime of Admiral Cockburn. First Las Cases, accused of having organised a correspondence with the outer world, was deported to the Cape; O'Meara, the next to go, was replaced by the Corsican doctor, Antommarchi. In 1818 Gourgaud, who could not agree with his companions, left Saint Helena. Only Bertrand and Montholon stayed till the end.

Napoleon's health was suffering. It is possible that the climate, the food and mental anguish assisted the tendency towards cancer which he inherited from his father. His strength rapidly declined. In March 1821, he took to his bed. In April he dictated his will. "It is my wish" he said "that my ashes shall be laid to rest on the banks of the Seine among the French people whom I have loved so well." He added "I am dying before my time, murdered by the English oligarchy and its hired assassin" (Hudson Lowe). He died on the morning of May 5 in his 52nd year. His body was dressed in his favourite uniform, that of the *chasseurs de la garde,* and covered with the cloak he had worn at Marengo. He was buried in a lonely spot near a spring shaded by two weeping willows. He had often walked there. "Here lies" was on the stone. No name.

**The Napoleonic Legend.**—He had said one day, "What a romance my life has been." Napoleon knew mankind too well, he was in fact too great an artist not to realise that his captivity and his martyrdom gave him a magnificent opportunity of impressing himself upon posterity. On that lonely rock he was seized by an idea as great as were his plans of campaign or the *Code civil.* He would prepare, if not for himself, at least for someone of his race, something better than a return from Elba. He foresaw the nineteenth century, and would catch its imagination. Two thousand leagues away from France he divined the medley of sentiment and emotion forming there:— Austerlitz and Waterloo, the triumph and humiliation of the tricolor, the Revolution of 1789 ending in the return of the Bourbons, all the longings for liberty and for glory which would torture the people of France. Buried desires would rise again, resuscitated by regret and the magic of remembrance. Napoleon had always known how to appeal to the French people. He had not lost the art.

So the *Memorial of Saint Helena* was to become the Gospel of Saint Helena. During the hundred days he had already allied himself with the Liberals and the Republicans. The great Carnot had wept on his shoulder after the second abdication. He spent his years of exile in reviving the Napoleonic legend, in confounding it with liberalism, in "changing the eagle's plumage." He dreamed sometimes that he was working for himself, and that the people aroused by his promises would drive out their Kings and come to deliver him. "We are martyrs to an immortal cause," he said. "We struggle against oppression and the voice of the nations is for us."

In the conversations which were published to the world by his companions in captivity, he made himself the apostle of a new political doctrine, which, inspired by the principles of 1789, had the character and the fascination of a religion. It was a vast idealistic programme, a declaration of the rights and duties of the French people, a reshaping of Europe on the principles of liberty, equality, fraternity and justice. He identified his cause with that of universal freedom. The peoples must be set free, and a holy alliance of nations substituted for a holy alliance of Kings. "There are" he said "strivings for nationhood which must be satisfied sooner or later." No people should be left under the domination of another, and different sections of the same race, which wish to unite, ought not in the future to be separated. "Though they are scattered there are in Europe more than thirty million Frenchmen, fifteen million Spaniards, fifteen million Italians and thirty million Germans. I should like to have made each of these peoples a single united nation." He re-told his own story, giving it a humanitarian and idealistic bias. He represented his dictatorship as that of a liberal, or "crowned Washington," a despot in spite of himself and for the world's good, waging war to found the United States of Europe. He called himself the Messiah of the Revolution whose name would be for the peoples "the emblem of their hopes."

This lofty incarnation triumphed. Popular imagination represented Napoleon at Saint Helena as on a sort of Mount Sinai. Béranger's songs, Victor Hugo's poems added to the glamour. In 1840 the government of Louis-Philippe obeyed the national will by sending the prince de Joinville to bring back the remains of the emperor. The "return of the ashes" was a historic day. Since then, Napoleon rests in the Invalides. Another poet, Lamartine, warned Louis-Philippe that this return foreshadowed another. And, indeed, thanks to the legend woven by his uncle, after the revolution of 1848, Louis Napoleon was elected president of the republic, and then restored the empire, accomplishing in foreign policy, by his support of Italian unity, the programme of nationalities, though the integration of Italy was not yet completed. Thus the Napoleon of Saint Helena survived.

## THE NAPOLEONIC RECORD

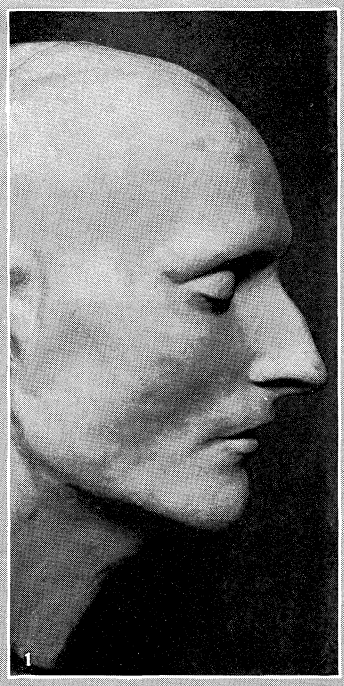
**The Soldier.**—We must now briefly consider this man, whose personality was in every respect far above the mean, as a commander and as a legislator—as soldier and sovereign.

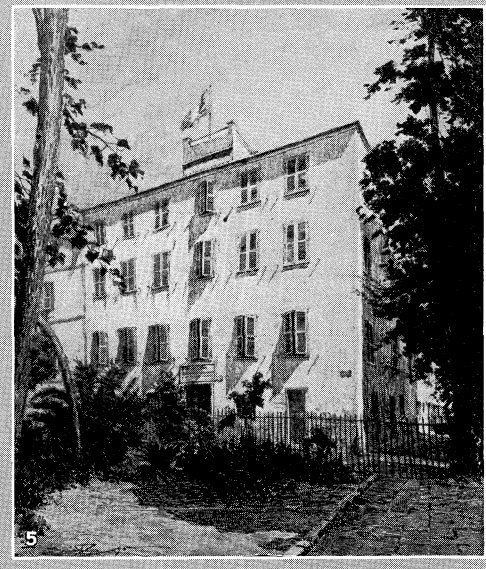
His master concepts may be gathered from his various sayings. "The art of war" he said "is simple and wholly executive. There is nothing ideological about it." And again "The whole art of war consists of a careful and well-thought out defensive, together with a swift and bold offensive." Simplicity and rapidity are the dominating features both of his campaigns and his battles. "The art of war" he said at the beginning of his career "consists, with inferior forces, in always having larger forces than the enemy at the point of attack or defence." To do this rapidity of movement is required. "Energy, rapidity" was his constant admonition to subordinates. One must concentrate one's own forces, keep them together, lead the enemy to give battle in the most unfavourable conditions; then, when his last reserves are engaged, destroy him by a decisive attack and end the war as quickly as possible.

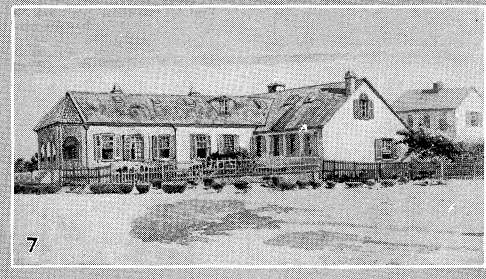
As Napoleon himself said, all these precepts could be compressed in a very small book. He had, in fact, a method, not a system. "One of the characteristic features of Napoleonic strategy," says Marshal Franchet d'Esperey, "is that, the goal once chosen and boldly chosen, the method does not vary, though, being supple, it adapts itself to circumstances." One might just as well say "the measure of the method is the commander's measure." Napoleon's power of rapidly summing up a situation and making his decision, explains his victories. As Clausewitz has well said: "On the field of battle everything depends on a decision made in a few minutes." Napoleon summed up everything, including himself, in the words: "No precise rules can be laid down. Everything depends on the character of the general, his abilities, his weakness, the quality of his troops, the range of their weapons, the weather and a thousand other circumstances which never repeat themselves." Hence before the battle his meticulous study of the position, of alternative suppositions, a keen examination of the psychology of his opponent, and the rigorous use of information, material and moral. The weak point was that everything depended on Napoleon. He saw everything, did everything, took account of the most insignificant details, himself directly gave all the orders. His lieutenants, having the habit of obedience, were merely executants who took no initiative. Berthier, although he held the position of chief of staff, said that he counted for nothing with the army. Therefore, an indisposition of the emperor was sufficient to disorganize the machine.

Then, from 1812 onwards, the number of troops involved became too large, and the commander's vision no longer sufficiently sure. It was a war of armies, not of army corps. The Napoleonic system began to give less favourable results. An exaggerated belief in his "star" and his genius, and his heavy demands on an exhausted France, explain the final catastrophe. He had long profited from the concentration of power in his own person. He

# NAPOLEON I







PHOTOGRAPHS, (1, 4) GIRAUDON, (3, 6) ALINARI, (5, 7) FROM SLOANE, "LIFE OF NAPOLEON" (CENTURY COMPANY AND MACMILLAN, LONDON)

## NAPOLEON BONAPARTE

1. Death Mask of Napoleon, now in the Invalides, Paris
2. Upper left: miniature portrait of Napoleon in 1812, by Isabey. Upper right; miniature portrait of Josephine in 1813, by Isabey. Below: engraving by G. Fiesinger, after a miniature portrait of Napoleon by Guerin, deposited in the National Library, Paris, in 1799
3. "The Last Days of Napoleon," sculpture portrait by V. Vela; now at Versailles
4. "Napoleon I," statue by Philippe-Laurent Roland. In the Paris Institut
5. House in the Place Letizia, Ajaccio, Corsica, in which Napoleon Bonaparte was born. From the drawing by Eric Pape
6. "Napoleon Crossing the Alps," by J. L. David. At Versailles
7. "Longwood," Napoleon's residence at St. Helena. Drawing by Harry Pena, from a photograph belonging to L. C. Billings

himself rejoiced in being almost the only great captain to hold absolute authority over a rich and populous country, and command its resources both of men and money. Yet in spite of his enormous intellectual energy he gave way in the end under the burden. He insisted on regulating the minutest details of his government. Thus the decree which still governs the *Theâtre Français* was signed at Moscow. Moreover his empire was precarious. Founded on victory and success, it could not survive defeat. Remembering after Waterloo Louis XIV. unshaken by misfortune, he said, "If I had been my own grandson, I could have retreated as far as the Pyrenees."

**The Sovereign.**—Yet he did more than win and lose battles. He gave to France laws which for the most part still endure. We have seen that when he became first consul, France had fallen practically into anarchy. The ancient laws, excessively complicated, because they differed from province to province and were customary and traditional, had been wiped out by the revolution. The new laws, so far as they existed at all, were too revolutionary in character and unadapted to normal society. The *code civil* united what in Roman law and in tradition was best suited to France under the conditions engendered by the Revolution. It may be said to be a systemization of good sense, at the same time logical and historical. Napoleon had no legal training, and his share in the work should not be exaggerated, but he intervened continually with the dominating idea that, though the work of the revolution must not be undone, order must be restored in France. Here again he profited by his lack of prejudice and his trained intelligence. He carried out the transition from old to new France. Probably he alone could have re-established the conditions necessary to settled government without being accused of relinquishing the "civil victories of the revolution." He was able to reimpose indirect taxation and in particular food taxes, the most unpopular of all, the abolition of which had made it impossible to place the finances of the Republic on a sound basis.

The council of state, the public accounts office, the courts of justice, the universities, the rights of the *Banque de France*, all these were established, counterbalancing the work of the revolutionary demagogues, and they serve to this day as restraining influences on the occasional over-violence of democracy. On the other side of the picture we see excessive centralization which stifled provincial life and local characteristics, cast the whole country in the same mould, and made the State supreme over the entire people—a system singularly favourable to "étatisme." Thus as a legislator, and as a legendary figure, Napoleon appeared as the restorer of order and authority and the embodiment of progress.

BIBLIOGRAPHY.—(I.) GENERAL. (A) *Sources.* The chief source is the *Correspondance* published by order of Napoleon III. (28 volumes, Paris 1857–59), followed by the *Oeuvres de Napoléon à Sainte Hélène* (1870, 4 vols.). This is incomplete. There should also be consulted: Lecestre, *Lettres inédites de Napoléon Ier* (1897, 2 vol.); de Brotonne, *Idem* (1898) and *Dernières lettres inédites* (1903); A. Chuquet, *Ordres et apostilles* (1911–12, 4 vol.); Picard et Tuetey, *Correspondance inédite* (1912–13, 4 vols.). The most complete itinerary has been given by Schnermans: *Itinéraire général de Napoléon Ier* (1908). For legal documents, see *Bulletin des lois*, 3rd and 4th series; Duvergier, *Collection* (vols. 12 to 18); Dalloz, *Répertoire* (1st ed. 1865–70—48 vols.). (B) *History.* Histories of the Napoleonic period are innumerable. The oldest, such as that of Sir Walter Scott, have little more than antiquarian interest. This is not the case with: Thiers, *Histoire du Consulat et de l'Empire* (1845–1862), 20 volumes with tables and maps. Numerous editions in all languages); Lanfrey, *Histoire de Napoléon Ier* (1867–75, 5 volumes); Oncken, *Das Zeitalter der Revolution des Kaisereiches und der Befreiungskriege* (1880, 2 vol.); Taine, *Les origines de la France contemporaine*, 3rd part, *le Régime moderne* (1891–94—unfinished); A. Fournier: *Napoleon I. Eine Biographie* (Wien und Leipzig, 1886–1893, 3 vols.); Lavisse et Rambaud: *Histoire générale* (Vol. IX. 1893); Masson, *Napoléon et sa famille* (10 vol. 1897–1913); J. Holland Rose, *The Life of Napoleon I.* (1905 2 vols.); *The Cambridge Modern History* (vol. IX., *Napoleon*, 1906); W. M. Sloane, *Life of Napoleon Bonaparte* (1910, bibliog.); Lavisse: *Histoire de la France contemporaine* (Vols. II. and III. by G. Pariset, 1923); E. Ludwig: *Napoleon* (1927); Madelin, *Histoire politique 1515 to 1804* volume 4 of the *Histoire de la nation française*, by G. Hanotaux.

(II.) YOUTH AND TRAINING. (A) *Sources.* Napoleon's early works have been published by Masson and Biagi under the title *Napoléon inconnu* (1895, 2 vols.) but the editors have been charged with correcting the text improperly. (B) *History.* Gadobert, *La jeunesse de Napoléon Ier* (1897); A. Chuquet, *La jeunesse de Napoléon Ier* (3 vol. 1897–99); P. Cottin, *Toulon et les Anglais en 1793* (1898); C. J. Fox, *Napoleon Bonaparte and the Siege of Toulon* (Washington, 1902); J. Colin, *L'éducation militaire de Napoléon Ier* (1902); O. Browning, *Napoleon, the First Phase* (1905); H. F. Hall, *Napoleon's Notes on English History* (1905); H. Zivy, *Le 13 vendémiaire* (1898).

(III.) FROM THE ITALIAN CAMPAIGN TO THE 18TH BRUMAIRE. (A) *Sources.* Here must be cited the memoirs of all the great figures of that time. There are in particular, those of the directors: the memoirs of Barras (ed. Duruy 1895–96 4 vols.); of Barthélemy, ed. Y. de Dampierre (1914); of Carnot, ed. his grandson; of Gohier (1824, 2 vols.); of La Revellière (1895, 3 vols.). *See* also the *Mémoires* of Masséna, ed. Koch (1849–50, 7 volumes). For the expedition to Egypt: *Les Mémoires de Bourrienne* (Vols. II. and III. 1829); the *Lettres de Geoffroy Saint Hilaire*, ed. Hamy (1901); Volume III. of Nelson's *Despatches and Letters.* Under the title: *Paris pendant la réaction thermidorienne et le Directoire* Aulard has published many police reports and extracts from newspapers (5 vols. 1898–1902). (B) *History.* A. Sorel, *L'Europe et la Révolution française* (Vol. V. *Bonaparte et le Directoire*, 1903); Guyot, *Le Directoire et la paix de l'Europe* (1911); Clausewitz, *Der Feldzug von 1796 in Italien* (1883); Colin: *Etude sur la campagne de 1796–1797* (1818); Fabry, *Campagne d'Italie* (1900–01 3 vols.), followed by *Mémoires* (1905) and *Rapports* (1905), the whole edited by the historical section of the French General Staff; Gaffarel: *Bonaparte et les républiques italiennes, 1796–97* (1895); C. Tivaroni, *Storia critica del Risorgimento italiano* (first three vols., Turin 1888–97); Bianchi, *Storia della monarchia piemontese* (Turin 1885 4 vols. Vol. II.). The most recent and much the most satisfactory work on Egypt is La Jonquière, *L'expédition d'Egypte* (1900–07, 5 vols., ed. historical section of the General Staff). For the *coup d'état, see* Vandal, *L'avènement de Bonaparte* (Vol. I. 1903 with a critical indication as to its sources); J. Bainville, *Le 18 Brumaire* (1926); Rocquain, *L'Etat de la France au 18 Brumaire* (1874).

(IV.) THE PRIVATE LIFE OF NAPOLEON. (*A*) *Sources.* The principal memoirs are those of the Duchesse d' Abrantès (1831–37, 18 vols.); of Mme. de Remusat (1879–80, 3 vols.); the *Considérations* and *Dix années d'exil* of Mme. de Stäel; the memoirs of various members of the staff of the palace, such as Beausset (1827–28, 4 vols.), Constant (1830–31, 6 vols.), Baron Fain (1908), General Durand (1819, 2 vols.) and Meneval (1894, 3 vols.) etc. The work entitled *Mémoires et Correspondance de l'impératrice Joséphine* (1820) is apocryphal. *See* also Empress Marie-Louise, *Correspondance* 1799–1847 (Vienna, 1887); Jérôme, *Mémoires et Correspondance*, ed. du Casse (1861–66. 7 vols.); Joseph, *Mémoires et Correspondance*, ed. du Casse (1853–54, 10 vols.); Queen Hortense, *Mémoires* (3 vols. 1927). (B) *History.* Frédéric Masson, *Napoléon et les femmes* (1893); *Napoléon chez lui* (1894); Bouchot, *La toilette à la cour de Napoléon* (1895); A. Lévy, *Napoléon intime* (1893); de Lescure, *Napoléon et sa famille* (1867); Larrey, *Madame Mère* (1892, 2 vols.); Masson: *Joséphine de Beauharnais, Madame Bonaparte, Joséphine impératrice, Joséphine répudiée* (1899–1919. 4 vols.); Rocquain, *Napoléon Ier et le Roi Louis* (1875); Welschinger, *Le divorce de Napoléon* (1899), *Le Mariage de Napoléon* (*Revue révolutionnaire*, 1888. II.); Masson, *Marie-Louise* (1903); Masson, *Napoléon et son fils* (1904). *See* also BONAPARTE (*Family*).

(V.) FOREIGN POLICY AND WARS. (A) *Sources.* Martens, *Recueil général des traités d'alliance et de paix*, with appendices and tables (Göttingen, 1817–76); Talleyrand, *Lettres inédites à Napoléon*, ed. Pallain (1889), and *Mémoires*, ed. de Broglie (1891–92, 5 vols.); Metternich, *Mémoires* (8 vols., Vols. 1 and 2); Hardenberg, *Denkwürdigkeiten* (ed. Ranke, Leipzig, 1877, 5 vols.); Nesselrode, *Lettres et papiers* (Vols. III. to V. 1905–07); Castlereagh, *Memoirs and Correspondence* (1848–53, 12 vols.); Tratchevski, *Documents diplomatiques concernant les relations de la France et de la Russie* (St. Petersburg, 1890–91, 2 vols. in Russian and in French); Bailleul, *Preussen und Frankreich* Dipl. Corr. (Leipzig, 1881–87, 2 vols.). For the details of military events and the actual life of the armies we must have recourse to the memoirs of generals and soldiers, such as:—Bernadotte: *Correspondance* (1819); Davout, *Correspondance* (1887, 4 vols.) Gille, *Mémoires d'un conscrit* (1892); Lavallette: *Mémoires* (1831. 2 vols.); Coignet, *Cahiers* (1883); Marbot, *Mémoires* (1891—3 vols.); Marmont, *Mémoires* (1856–57, 9 vols.); Murat, *Correspondance, Lettres et documents* (1899 and 1908–14); Soult, *Mémoires* (1854, 3 vols.) etc. These memoirs are of unequal value, and should be accepted with considerable reserve. (B) *History.* Bourgeois, *Manuel historique de politique étrangère*, vol. II. (1898); Sorel, *L'Europe et la Révolution française* vols. VI. VII. et VIII. with tables (1903–04); Tramond, *Manuel d'histoire maritime de la France* (1916); A. T. Mahan, *Influences of Sea Power on the French Revolution and Empire* (1892 2 vols.); Driault, *Napoléon et l'Europe* (1910); Pingaud, *Bonaparte, président de la république italienne, La domination française dans l'Italie du Nord* (1914, 2 vols.); H. A. L. Fisher, *Napoleonic Statesmanship: Germany* (1903); Froidevaux, "La politique coloniale de Napoléon" (*Revue des questions historiques*, 1901); A. Lévy, *Napoléon et la paix* (1903); Driault, *La politique orientale de Napoléon* (1904); Marshal Franchet d'Esperey and General Mangin, *Histoire militaire et navale* (Vol. VIII. of the *Histoire de la nation française* of Hanotaux).

For the details of military and diplomatic events:—Roberts: "The negotiations preceding the peace of Amiens" (*Transactions of the Royal Hist. Soc.* 1901 Vol. XX.); H. M. Bowman, *Preliminary Stages of the Peace of Amiens* (Toronto 1900); Philipson, "La Paix d'Amiens" (*Revue historique* 1901); O. Browning, *England and Napoleon in 1803* (1887); J. H. Rose, "Napoleon and English Commerce" (*Engl. Hist. Rev.* 1893); *Select Despatches . . . relating to the Formation of the Third Coalition* (1904); Coquelle, *Napoléon et l'Angleterre* (1904); O. Brandt, *England und die napoleonische Weltpolitik 1800–3* (Heidelberg 1916); Yorck von Wartenburg, *Napoleon als Feldherr* (1885–86 2 vols.); Camon: *La guerre napoléonienne: Précis des campagnes* (1903), *les Systèmes d'opérations* (1907), *les Batailles* (1910), *la Fortification* (1914); and, always interesting Jomini: *Vie politique et militaire de Napoléon Ier* (1827 4 vols. and maps). Mathieu Dumas, *Précis des évènements militaires* (1817–26 19 vols.); Roche, *Die Kontinentalsperre* (Naumbourg 1894); Oman, *History of the Peninsula War* (1902–11 4 vols.); Greillon, *Les guerres d'Espagne* (1902); Fabry, *Campagne de Russie* (1900–03, 5 vols.); Chuquet: *La guerre de Russie* (1912 3 vols.); Clement, *Campagne de 1813* (1904); Houssaye, *1814* (1 vol. 1888), *1815* (3 vols. 1895–1905); Fournier, *Der Kongress von Chatillon* (Leipzig, 1900); P. Gruyer, *Napoléon roi de l'île d'Elbe* (1906).

(VI.) INTERNAL POLITICS. (A) *Sources.* Contemporary memoirs already cited; Aulard, *Paris sous le Consulat* (4 vols.), *Paris sous le premier Empire* (Vols. I. and II.) (unfinished), a collection of police reports and newspaper articles; Gaudin, duke of Gäeta: *Mémoires, Souvenirs, Opinions et Ecrits* (new edition in 3 vols., 1926); Portalis, *Discours et travaux sur le Code Civil* (1844); Pasquier, *Histoire de mon temps* (1893–95 6 vols.); *Boulay de la Meurthe: Documents sur la négociation du Concordat et sur les autres rapports de la France avec le Saint-Siège* (1891–1905 6 vols.); Villemain, *Rapport au roi sur l'instruction secondaire* (1843 in.4°); Cousin, *Défense de l'Université* (Discours, 1844); Pelet de la Lozère, *Opinions de Napoléon sur divers sujets de politique et d'administration* (1833). (B) *History:* Vandal, *L'avènement de Bonaparte* (2 vols. 1905); Esmein, *Précis élémentaires du droit français* (1908); Aucoc: *Le Conseil d'Etat* (1876); L. Madelin, *Fouché* (1901 2 vols.); E. Mousset, *Histoire de l'administration provinciale, départementale et communale* (1885); Régnier, *Les Préfets du Consulat et de l'Empire* (1907); Passy, *Frochot, préfet de la Seine* (1867); Dejean, *Beugnot* (1907); Pingaud, *Jean de Bry, préfet de Besançon* (1909); Levy Schneider, *Jean Bon Saint André, préfet de Mayence* (Vol. II. 1901); Stourm, *Les finances du Consulat* (1902); Marion, *Histoire financière* Vol. IV. (1797, 1925), a first class piece of work; A. Madelin, *Le premier Consul législateur* (1865), *Livre du Centenaire de la Cour des Comptes;* Schmidt, *L'organisation de l'Université Impériale* (Ecole des Hautes Etudes Sociales, 1912, *La lutte scolaire*). (C) *On the Concordat and Religious Questions:* Abbé Mounet, *Histoire générale de l'Eglise,* Vol. VII. (1916); Debidour, *Histoire des rapports de l'Eglise et de l'État* 1898; Rinieri, *La diplomazia pontificale nel secolo XIX. Vol. I.* (Rome 1902 Fr. tr. Verdier 1903); d'Haussonville: *l'Eglise romaine et le premier Empire* (1868–69, 5 vols.). (D) *On the opposition and the various plots:* E. Daudet, *Histoire de l'émigration* (3 vols. 1886–90 and 1904–05) and *La Police et les Chouans sous le premier Empire* (1898); Chassin, *Les pacifications de l'Ouest* (Vol. III. 1899); G. de Cadoudal, *Georges Cadoudal et la Chouannerie* (1887); E. Guillon, *Les complots militaires sous le Consulat et l'Empire* (1894); H. Welschinger, *Le duc d'Enghien* (1888 and 1913); Hamel, *Histoire des deux conspirations du général Malet* (1873).

(VII.) SAINT HELENA. (A) *Sources.* Captain F. L. Maitland, *Narrative of the Surrender of Bonaparte* (1826 and 1904); Gourgaud, *Journal de Sainte Hélène de 1815–1818* (2 vols. 1847); Montholon, *Récit de la captivité de l'empereur Napoléon* (2 vols. 1847); Las Cases, *Mémorial de Sainte Hélène* (4 vols. 1823); Barry O'Meara, *Napoleon in Exile or A Voice from St. Helena* (2 vols. 1823). (B) *History.* Sir T. Ussher, *Napoleon's Last Voyages* (1895–96); Lady Malcolm, *A Diary of St. Helena* (1899); W. Forsyth, *History of the Captivity of Napoleon at St. Helena* (3 vols. 1853); Basil Jackson, *Notes and Reminiscences of a Staff Officer* (1903); Earl of Rosebery, *Napoleon, the Last Phase* (1900); R. C. Seaton, *Napoleon's Captivity in Relation to Sir Hudson Lowe* (1903); J. H. Rose, *Napoleonic Studies* (1904).

(J. BAI.)

**NAPOLEON II.:** *see* REICHSTADT, JOSEPH CHARLES, DUKE OF.

**NAPOLEON III.** [CHARLES LOUIS NAPOLEON BONAPARTE] (1808–1873), emperor of the French, was born on April 20, 1808, in Paris at 8 rue Cerutti (now rue Laffitte), and not at the Tuileries, as the official historians state. He was the third son of Louis Bonaparte (*see* BONAPARTE), brother of Napoleon I., and king of Holland (1806–10), and of HORTENSE DE BEAUHARNAIS (*q.v.*). Of the two other sons of Louis Bonaparte and Hortense, the elder, Napoleon Charles (1802–1807), died in infancy; the second, Napoleon Louis (1804–1831), died in the insurrection of the Romagna, leaving no children.

**Exile of Hortense.**—After Waterloo, Hortense, suspected by the Bourbons of having arranged the return from Elba, had to go into exile. The ex-king Louis, who now lived at Florence, had compelled her by a scandalous law-suit to give up to him the elder of her two children. With her remaining child she wandered, under the name of duchesse de Saint-Leu, from Geneva to Aix, Carlsruhe and Augsburg. In 1817 she bought the castle of Arenenberg, in the canton of Thurgau, on a wooded hill looking over the Lake of Constance. Hortense supervised her son's education in person. The young prince also studied at the gymnasium at Augsburg, and there he acquired his slight German accent.

In 1823 he accompanied his mother to Italy, visiting his father at Florence, and his grandmother Letitia at Rome, and dreaming with Le Bas on the banks of the Rubicon. He returned to Arenenberg to complete his military education under Colonel Armandi and Colonel Dufour, who instructed him in artillery and military engineering. At the age of twenty he was a "Liberal," an enemy of the Bourbons and of the treaties of 1815; but he was dominated by the cult of the emperor, and for him the liberal ideal was confused with the Napoleonic.

**Revolution of 1830.**—The July revolution of 1830, of which he heard in Italy, roused all his young hopes. He could not return to France, for the law of 1816 banishing all his family had not been abrogated. But the liberal revolution knew no frontiers. Italy shared in the agitation. He had already met some of the conspirators at Arenenberg, and it is practically established that he now joined the associations of the Carbonari. Following the advice of his friend the Count Arese and of Menotti, he and his brother were among the revolutionaries who in February 1831 attempted a rising in Romagna and the expulsion of the pope from Rome. They distinguished themselves at Civita Castellana, a little town which they took; but the Austrians arrived in force, and during the retreat Napoleon Louis, the elder son, took cold, followed by measles, of which he died. Hortense hurried to the spot and took steps which enabled her to save her second son from the Austrian prisons. He escaped into France, where his mother, on the plea of his illness, obtained permission from Louis Philippe for him to stay in Paris. But he intrigued with the republicans, and Casimir-Périer insisted on the departure of both mother and son. In May 1831 they went to London, and afterwards returned to Arenenberg.

For a time he thought of responding to the appeal of some of the Polish revolutionaries, but Warsaw succumbed (September 1831) before he could set out. Moreover the plans of this young and visionary *enfant du siècle* were becoming more definite. The duke of Reichstadt died in 1832. His uncle, Joseph, and his father, Louis, showing no desire to claim the inheritance promised them by the constitution of the year XII., Louis Napoleon henceforth considered himself as the accredited representative of the family. He endeavoured to define his ideas, and in 1833 published his *Rêveries politiques, suivies d'un projet de constitution,* and *Considérations politiques et militaires sur la Suisse;* in 1836, as a captain, in the Swiss service, he published a *Manuel d'artillerie,* in order to win popularity with the French army.

**Strasbourg Conspiracy.**—With the aid of his friend Fialin and of Eléonore Gordon, a singer, and of certain officers, such as Colonel Vaudrey, an old soldier of the Empire, commanding the 4th regiment of artillery, and Lieutenant Laity, he tried to bring about a revolt of the garrison of Strasbourg (Oct. 30, 1836). The conspiracy was a failure, and Louis Philippe, fearing lest he might make the pretender popular either by the glory of an acquittal or the aureole of martyrdom, had him taken to Lorient and put on board a ship bound for America, while his accomplices were brought before the court of assizes and acquitted (February 1837). The prince was set free in New York in April; by the aid of a false passport he returned to Switzerland in August, in time to see his mother before her death on Oct. 3, 1837.

At any other time this attempt would have covered its author with ridicule. Such, at least, was the opinion of the whole of the family of Bonaparte. But his confidence was unshaken, and in the woods of Arenenberg the romantic-minded friends who remained faithful to him still honoured him as emperor. And now the government of Louis Philippe, by an evil inspiration, began to

act in such a way as to make him popular. In 1838 it caused his partisan Lieutenant Laity to be condemned by the Court of Peers to five years' imprisonment for a pamphlet which he had written to justify the Strasbourg affair; then it demanded the expulsion of the prince from Switzerland, and when the Swiss government resisted, threatened war. Having allowed the July monarch to commit himself, Louis-Napoleon at the last moment left Switzerland voluntarily. All this served to encourage the mystical adventurer. In London, where he had taken up his abode, together with Arese, Fialin (says Persigny), Doctor Conneau and Vaudrey, he was at first well received in society, being on friendly terms with Count d'Orsay and Disraeli, and frequenting the *salon* of Lady Blessington. He was evolving his programme of government, and in 1839 wrote and published his book: *Des Idées napoléoniennes,* a curious mixture of Bonapartism, socialism and pacificism, which he represented as the tradition of the First Empire. He also noted the fluctuations of French opinion.

**Boulogne Conspiracy.**—The pretender, again thinking that the moment had come, formed a fresh conspiracy in 1840. With a little band of fifty-six followers he attempted to provoke a rising of the 42nd regiment of the line at Boulogne, hoping afterwards to draw General Magnan to Lille and march upon Paris. The attempt was made on Aug. 6, but failed; he saw several of his supporters fall on the shore of Boulogne, and was arrested together with Montholon, Persigny and Conneau. This time he was brought before the Court of Peers with his accomplices; he entrusted his defence to Berryer and Marie, and took advantage of his trial to appeal to the supremacy of the people, which he alleged, had been disregarded, even after 1830. He was condemned to detention for life in a fortress, his friend Aladenize being deported, and Montholon, Parquin, Lombard and Fialin being each condemned to detention for twenty years. On Dec. 15, the very day that Napoleon's ashes were deposited at the Invalides, he was taken to the fortress of Ham. On the whole the régime imposed upon him was mild. He corresponded with Louis Blanc, George Sand and Proudhon, and collaborated with the journalists of the Left, Degorge, Peauger and Souplet. For six years he worked very hard "at his University of Ham," as he said. He wrote some *Fragments historiques,* studies on the sugar-question, on the construction of a canal through Nicaragua, and on the recruiting of the army, and finally, in the *Progrès du Pas-de-Calais,* a series of articles on social questions which were later embodied in his *Extinction du paupérisme* (1844). But the same persistent idea underlay all his efforts. On May 25, 1846, he escaped to London, giving as the reason for his decision the dangerous illness of his father. On July 27 his father died.

**Return to France.**—He was again well received in London and he "made up for his six years of isolation by a furious pursuit of pleasure." The duke of Brunswick and the banker Ferrère interested themselves in his future, and gave him money, as did also Miss Howard, whom he later made comtesse de Beauregard, after restoring to her several millions. At the first symptoms of revolutionary disturbance he returned to France; on Feb. 25, he offered his services to the Provisional Government, but, on being requested by it to depart at once, resigned himself to this course. But Persigny, Mocquard and all his friends devoted themselves to an energetic propaganda in the press, by pictures and by songs. After May 15 had already shaken the strength of the young republic, he was elected in June 1848 by four departments, Seine, Yonne, Charente-Inférieure and Corsica. In spite of the opposition of the executive committee, the Assembly ratified his election. But he had learnt to wait. He sent in his resignation from London, merely hazarding this appeal: "If the people impose duties on me, I shall know how to fulfil them." This time events worked in his favour; the industrial insurrection of June made the middle classes and the mass of the rural population look for a saviour, while it turned the industrial population towards Bonapartism, out of hatred for the republican *bourgeois.*

**Presidency of the Republic.**—On Sept. 26 he was re-elected by the same departments; on Oct. 11 the law decreeing the banishment of the Bonapartes was abrogated; on the 26th he made a speech in the Assembly defending his position as a pretender, and cut such a sorry figure that Antony Thouret contemptuously withdrew the amendment by which he had intended to bar him from rising to the presidency. Thus he was able to be a candidate for this formidable power. The former rebel of the Romagna, the Liberal *Carbonaro,* was henceforth to be the tool of the priests. In his very triumph appeared the ultimate cause of his downfall. On Dec. 10 he was elected president of the Republic by 5,434,226 votes against 1,448,107 given to Cavaignac. On Dec. 20, he took the oath "to remain faithful to the democratic Republic . . . to regard as enemies of the nation all those who may attempt by illegal means to change the form of the established government." From this time onward his history is inseparable from that of France. But, having attained to power, he still endeavoured to realize his cherished project. All his efforts (Dec. 10, 1848 to Dec. 2, 1852) tended towards the acquisition of absolute authority, which he wished to obtain, ostensibly from the people.

It was with this end in view that he co-operated with the party of order in the expedition to Rome for the destruction of the Roman republic and the restoration of the pope (March 31, 1849), and afterwards in all the reactionary measures against the press and the clubs, and for the destruction of the Reds. But in opposition to the party of order, he defined his own personal policy. "The name of Napoleon," he said on this occasion, "is in itself a programme; it stands for order, authority, religion and the welfare of the people in internal affairs, and in foreign affairs for the national dignity."

In spite of this alarming assertion of his personal policy, he still remained in harmony with the Assembly (the Legislative Assembly, elected on May 28, 1849) in order to carry out "a Roman expedition at home," *i.e.,* to clear the administration of all republicans, put down the press, suspend the right of holding meetings and, above all, to hand over education to the Church. But he knew where to stop and how to keep up a show of democracy. When the Assembly, by the law of May 31, 1850, restricted universal suffrage and reduced the number of the electors from 9 to 6 millions, he was able to throw upon it the whole responsibility for this *coup d'état bourgeois.*

In fact, while trying to compass the destruction of the republican movement of the Left, he was taking careful steps to win classes. At his side were his accomplices, men ready for anything, whose only hopes were bound up with his fortunes, such as Morny and Rouher; his paid publicists, such as Romieu, the originator of the "red spectre"; his cudgel-bearers, the "Ratapoils" immortalized by Daumier, who terrorized the republicans.

**Coup d'État.**—He next entered upon that struggle with the Assembly, now discredited, which was to reveal to all the necessity for a change, and a change in his favour. In January 1851 he deprived Changarnier of his command of the garrison of Paris. "The Empire has come," said Thiers. The pretender would have preferred, however, that it should be brought about legally, the first step being his re-election in 1852. The Constitution forbade his re-election; therefore the Constitution must be revised. On the 19th of July the Assembly threw out the proposal for revision, thus signing its own death-warrant, and the *coup d'état* was resolved upon. He prepared for it systematically. The cabinet of Oct. 26, 1851 gave the ministry for war to his creature Saint-Arnaud. All the conspirators were at their posts—Maupas at the prefecture of police, Magnan at the head of the troops in Paris. At the Elysée, Morny, adulterine son of Hortense, a hero of the Bourse and successful gambler, supported his half-brother by his energy and counsels. The ministry proposed to abrogate the electoral law of 1850, and restore universal suffrage; the Assembly by refusing made itself still more unpopular. By proposing to allow the president of the Assembly to call in armed force, the questors revealed the Assembly's plans for defence, and gave the Elysée a weapon against it ("donnent barre contre elle à l'Elysée"). The proposition was rejected (November 17), but Louis-Napoleon saw that it was time to act. On Dec. 2 he carried out his *coup d'état.*

**Proclamation as Emperor.**—But affairs developed in a way which disappointed him. By dismissing the Assembly, by offering the people "a strong government," and re-establishing "a France

regenerated by the Revolution of '89 and organized by the emperor," he had hoped for universal applause. But both in Paris and the provinces he met with the resistance of the Republicans, who had reorganized in view of the elections of 1852. He struck at them by mixed commissions, deportations and the whole range of police measures. The *décrets-lois* of the year 1852 enabled him to prepare the way for the new institutions. On Dec. 2, 1852 he became in name what he was already in deed, and was proclaimed Emperor of the French.

The aim which the emperor had in view was, by a concentration of power which should make him "the beneficent motive force of the whole social order" (constitution of the 14th of January 1852; administrative centralization; subordination of the elected assemblies; control of the machinery of universal suffrage) to unite all classes in "one great national party" attached to the dynasty. His success, from 1852 to 1856, was almost complete. The nation was submissive, and a few scattered plots alone showed that republican ideas persisted among the masses. As "restorer of the overthrown altars," he won over the "men in black," among them Veuillot, editor-in-chief of *l'Univers,* and allowed them to get the University into their hands. By the aid of former Orleanists, such as Billault, Fould and Morny, and Saint-Simonians such as Talabot and the Pereires, he satisfied the industrial classes, extended credit, developed means of communication, and gave a strong impetus to the business of the nation. By various measures, such as subsidies, charitable gifts and foundations, he endeavoured to show that "the idea of improving the lot of those who suffer and struggle against the difficulties of life was constantly present in his mind." His was the government of cheap bread, great public works and holidays. The imperial court was brilliant. The emperor, having failed to obtain the hand of a Vasa or Hohenzollern, married, on Jan. 29, 1853, Eugénie de Montijo, comtesse de Teba, aged twenty-six and at the height of her beauty.

**Foreign Policy.**—France was "satisfied" in the midst of order, prosperity and peace. The foreign policy of the Catholic party, by the question of the Holy Places and the Crimean War (1853–1856), gave him the opportunity of winning the glory which he desired, and the British alliance enabled him to take advantage of it. In January 1856 he had the good fortune to win a diplomatic triumph over the new tsar, Alexander II. It was at Paris (February 25–March 30) that the conditions of peace were settled. The emperor was now at the height of his power. He appeared to the people as the avenger of 1840 and 1815, and the birth to him of a son, Eugène Louis Jean Joseph, on March 16, 1856, assured the future of the dynasty. It was then that, strong in "the esteem and admiration with which he was surrounded," and "foreseeing a future full of hope for France," he dreamed of realizing the Napoleonic ideal in its entirety. This disciple of the German philologists, this crowned *Carbonaro,* the friend of the archaeologists and historians who were to help him to write the *Histoire de César,* dreamed of developing the policy of nationalism, and of assisting the peoples of all countries to enfranchise themselves.

From 1856 to 1858 he devoted his attention to the Rumanian nationality, and supported Alexander Cuza. But it was above all the deliverance of Italy which haunted his imagination. But the Catholics feared that the Italian national movement, when once started, would entail the downfall of the papacy; and in opposition to the emperor's Italian advisers, Arese and Prince Jerome Napoleon, they pitted the empress, who was frivolous and capricious, but an ardent Catholic. Napoleon III. was under his wife's influence, and could not openly combat her resistance. It was the Italian Orsini who, by attempting to assassinate him as a traitor to the Italian nation on Jan. 14, 1858, gave him an opportunity to impose his will indirectly by convincing his wife that in the interests of his own security he must "do something for Italy." Events followed each other in quick succession, and now began the difficulties in which the Empire was to be irrevocably involved. Not only did the Italian enterprise lead to strained relations with Great Britain, the alliance with whom had been the emperor's chief support in Europe, and compromised its credit; but the claims of parties and classes again began to be heard at home.

The Italian war aroused the opposition of the Catholics. After Magenta (June 4, 1859), it was the fears of the Catholics and the messages of the empress which, even more than the threats of Prussia, checked him in his triumph and forced him into the armistice of Villafranca (July 11, 1859). But the spread of the Italian revolution and the movement for annexation forced him again to intervene. He appealed to the Left against the Catholics by the amnesty of April 17, 1859. His consent to the annexation of the Central Italian states, in exchange for Savoy and Nice (Treaty of Turin, March 24, 1860) exposed him to violent attacks on the part of the ultramontanes, whose slave he had practically been since 1848. At the same time, the free-trade treaty with Great Britain (January 5, 1860) aroused a movement against him among the industrial *bourgeoisie.*

From this time onward, in face of a growing opposition, anxiety for the future of his régime paralysed his initiative. Placed between his Italian counsellors and the empress, he was ever of two minds. His plans for remodelling Europe had a certain generosity and grandeur; but internal difficulties forced him into endless manoeuvre and temporization, which led to his ruin. Thus in October 1862, after Garibaldi's attack on Rome, the clerical coterie of the Tuileries triumphed. But the replacing of M. Thouvenel by M. Drouin de Lhuys did not satisfy the more violent Catholics, who in May 1863 joined the united opposition. Thirty-five opposers of the government were appointed, Republicans, Orleanists, Legitimists or Catholics. The emperor dismissed Persigny, and summoned moderate reformers such as Duruy and Béhic. But he was still possessed with the idea of settling his throne on a firm basis, and uniting all France in some glorious enterprise which should appeal to all parties equally, and "group them under the mantle of imperial glory." From January to June 1863 he sought this appearance of glory in Poland, but only succeeded in embroiling himself with Russia. Then, after Syria and China, it was the "great inspiration of his reign," the establishment of a Catholic and Latin empire in Mexico, enthusiasm for which he tried in vain from 1863 to 1867 to communicate to the French.

But while the strength of France was wasting away at Puebla in Mexico, Bismarck was founding German unity. In August 1864 the emperor, held back by French public opinion, which was favourable to Prussia, and by his idea of nationality, allowed Prussia and Austria to seize the duchies of Schleswig and Holstein. After his failure in Poland and Mexico and in face of the alarming presence of Germany, only one alliance remained possible for Napoleon III., namely with Italy. He obtained this by the convention of the 15th of September 1864 (involving the withdrawal of the French troops from Rome). But the Catholic party redoubled its violence, and the pope sent out the encyclical *Quanta Cura* and the *Syllabus,* especially directed against France. In vain the emperor sought in German affairs a definitive solution of the Italian question. At Biarritz he prepared with Bismarck the Franco-Prussian alliance of April 1866; and hoped to become arbiter in the tremendous conflict which was about to begin. But Königgrätz came as a bolt from the blue to ruin his hopes. French interests called for an immediate intervention. But he resigned himself to the annexation by Prussia of northern Germany. "Now," said M. Drouin de Lhuys, "we have nothing left but to weep."

**The Third Party.**—Henceforth the brilliant dream, a moment realized, the realization of which he had thought durable, was at an end. The Empire had still an uncertain and troubled brilliancy at the Exhibition of 1867. But Berezowski's pistol shot, which accentuated the estrangement from the tsar, and the news of the death of Maximilian at Queretaro, cast a gloom over the later fêtes. In the interior the industrial and socialist movement, born of the new industrial development, added fresh strength to the Republican and Liberal opposition. The moderate Imperialists felt that some concessions must be made to public opinion. In opposition to the absolutist "vice-emperor" Rouher, whose influence over Napoleon had become stronger and stronger since the death of Morny, Émile Ollivier grouped the Third Party. Anxious, changeable and distraught, the emperor made the Liberal

concessions of Jan. 19, 1867 (right of interpellation), and then, when Ollivier thought that his triumph was near, he exalted Rouher (July) and did not grant the promised laws concerning the press and public meetings till 1868. The opposition gave him no credit for these tardy concessions. There was an epidemic of violent attacks on the emperor; the publication of the *Lanterne* and the Baudin trial, conducted by Gambetta, were so many death-blows to the régime. The *Internationale* developed its propaganda. The election of May 1869 resulted in 4,438,000 votes given for the government, and 3,355,000 for the opposition, who also gained 90 representatives. The emperor, disappointed and hesitating, was slow to return to a parliamentary régime. It was not till December that he instructed Ollivier to "form a homogeneous cabinet representing the majority of the Corps Législatif" (ministry of the 2nd of January 1870). But, embarrassed between the *Arcadiens,* the partisans of the absolute régime, and the republicans, Ollivier was unable to guide the Empire in a constitutional course. At the Tuileries Rouher's counsel still triumphed. It was he who inspired the ill and wearied emperor, now without confidence or energy, with the idea of resorting to the *plébiscite.* "To do away with the risk of a revolution," "to place order and liberty upon a firm footing," "to ensure the transmission of the crown to his son," Napoleon III. again sought the approbation of the nation. He obtained it with brilliant success, for the last time, by 7,358,786 votes against 1,571,939, and his work now seemed to be consolidated.

**War With Prussia.**—A few weeks later it crumbled irrevocably. Since 1866 he had been pursuing an elusive appearance of glory. Since 1866 France was calling for "revenge." He felt that he could only rally the people to him by procuring them the satisfaction of their national pride. Hence the mishaps and imprudences of which Bismarck made such an insulting use. Hence the negotiations of Nikolsburg, the "note d'aubergiste" (innkeeper's bill) claiming the left bank of the Rhine, which was so scornfully rejected; hence the plan for the invasion of Belgium (August 1866), the Luxemburg affair (March 1867), from which M. de Moustier's diplomacy effected such a skilful retreat; hence the final folly which led his government into the war with Prussia (July 1870).

The war was from the first doomed to disaster. It might perhaps have been averted if France had had any allies. But Austria, a possible ally, could only join France if satisfied as regards Italy; and since Garibaldi had threatened Rome (Mentana, 1867), Napoleon III., yielding to the anger of the Catholics, had again sent troops to Rome. Negotiations had taken place in 1869. The emperor, bound by the Catholics, had refused to withdraw his troops. It was as a distant but inevitable consequence of his agreement of December 1848 with the Catholic party that in 1870 the emperor found himself without an ally.

His energy was now completely exhausted. Successive attacks of stone in the bladder had ruined his physique; while his hesitation and timidity increased with age. The influence of the empress over him became supreme. On leaving the council in which the war was decided upon the emperor threw himself, weeping, into the arms of Princess Mathilde. The empress was delighted at this war, which she thought would secure her son's inheritance.

**Deposition.**—On July 28 father and son set out for the army. They found it in a state of utter disorder, and added to the difficulties by their presence. The emperor was suffering from stone and could hardly sit his horse. After the defeat of Reichshoffen, when Bazaine was thrown back upon Metz, he wished to retreat upon Paris. But the empress represented to him that if he retreated it would mean a revolution. An advance was decided upon which ended in Sedan. On Sept. 2 Napoleon III. surrendered with 80,000 men, and on the 4th of September the Empire fell. He was taken as a prisoner to the castle of Wilhelmshöhe, near Cassel, where he stayed till the end of the war. After the intrigues of Bazaine, of Bismarck, and of the empress, the Germans having held negotiations with the Republic, he was *de facto* deposed. On March 1, the assembly of Bordeaux confirmed this deposition, and declared him "responsible for the ruin, invasion and dismemberment of France."

Restored to liberty, he retired with his wife and son to Chislehurst in England. Unwilling even now to despair of the future, he still sought to rally his friends for a fresh propaganda. He had at his service publicists such as Cassagnac, J. Amigues and Hugelmann. He himself also wrote unsigned pamphlets justifying the campaign of 1870. It may be noted that, true to his ideas, he did not attempt to throw upon others the responsibility which he had always claimed for himself. He dreamed of his son's future. But he no longer occupied himself with any definite plans. He interested himself in pensions for workmen and economical stoves. At the end of 1872 his disease became more acute, and a surgical operation became necessary. He died on Jan. 9, 1873, leaving his son in the charge of the empress and of Rouher. The young prince was educated at Woolwich from 1872 to 1875, and in 1879 took part in the English expedition against the Zulus in South Africa, in which he was killed. By his death vanished all hope of renewing the extraordinary fortune which for twenty years placed the nephew of the great emperor, the *Carbonaro* and dreamer, at once obstinate and yet hesitating, on the throne of France.

BIBLIOGRAPHY.—The *Oeuvres* of Napoleon III. have been published in four volumes (1854–57) and his *Histoire de Jules César* in two volumes (1865–69); this latter work has been translated into English by T. Wright. *See* also Ebeling, *Napoleon III. und sein Hof* (1891–94); H. Thirria, *Napoléon III. avant l'Empire* (1895); Sylvain-Blot, *Napoléon III.* (1899); Giraudeau, *Napoléon III. intime* (1895); Sir W. A. Fraser, *Napoleon III.* (London, 1895); A. Forbes, *Life of Napoleon III.* (1898); A. Lebey, *Les Trois coups d'état de Louis Napoléon Bonaparte* (1906); *Louis Napoléon Bonaparte et la révolution de 1848* (1908); and F. A. Simpson, *The Rise of Louis Napoleon* (1909). General works which may be consulted are Taxile-Delord, *Histoire du second Empire* (1868–75); P. de La Gorce, *Histoire du second Empire* (1894–1905); A. Thomas, *Le Second Empire* (1907); and E. Ollivier, *L'Empire libéral* (14 vols., 1895–1909).

**NAPOLEON,** a village of northwestern Ohio, U.S.A., on the Maumee river and federal highways 6 and 24; 36 mi. S.W. of Toledo; county seat of Henry county; served by the Detroit, Toledo and Ironton and the Wabash railways. Pop. 4,545 in 1930; 4,825 in 1940. It is the trade centre of a grain-growing district, a railway division point, and has a number of factories.

**NAPOLEON,** a round game of cards (known colloquially as "nap"). Any number may play. The cards rank as at whist, and five are dealt to each player. The deal being completed, the player to the dealer's left looks at his hand and declares how many tricks he would play to win against all the rest, the usual rule being that more than one must be declared; in default of declaring he says "I pass," and the next player has a similar option of either declaring to make more tricks or passing, and so on all round. A declaration of five tricks is called "going nap." The player who declares to make most has to try to make them, and the others, but without consultation, to prevent him. The declaring hand has the first lead, and the first card he leads makes the trump suit. The players, in rotation, must follow suit if able. If the declarer succeeds in making at least the number of tricks he stood for he wins whatever stakes are played for; if not he loses. If the player declaring nap wins he receives double stakes all round; if he loses he only pays single stakes all round. Sometimes, however, a player is allowed to go "Wellington" over "nap," and even "Blücher" over "Wellington." In these cases the caller of "Wellington" wins four times the stake and loses twice the stake, the caller of "Blucher" receives six times and loses three times the stake. Sometimes a player is allowed to declare *misère, i.e.,* no tricks. This ranks, as a declaration, between three and four, but the player pays a double stake on three, if he wins a trick, and receives a single on three if he takes none.

**NAPOLEONIC CAMPAIGNS.** The era of the Revolutionary and Napoleonic Wars falls into two main divisions, the first of which (1792–1801) is dealt with under the heading FRENCH REVOLUTIONARY WARS. In the present article are described the campaigns in central and eastern Europe, directed by Napoleon—no longer one amongst many French generals, nor even a simple *primus inter pares,* but "Emperor" in the fullest sense—between the years 1805 and 1814. Napoleon's short

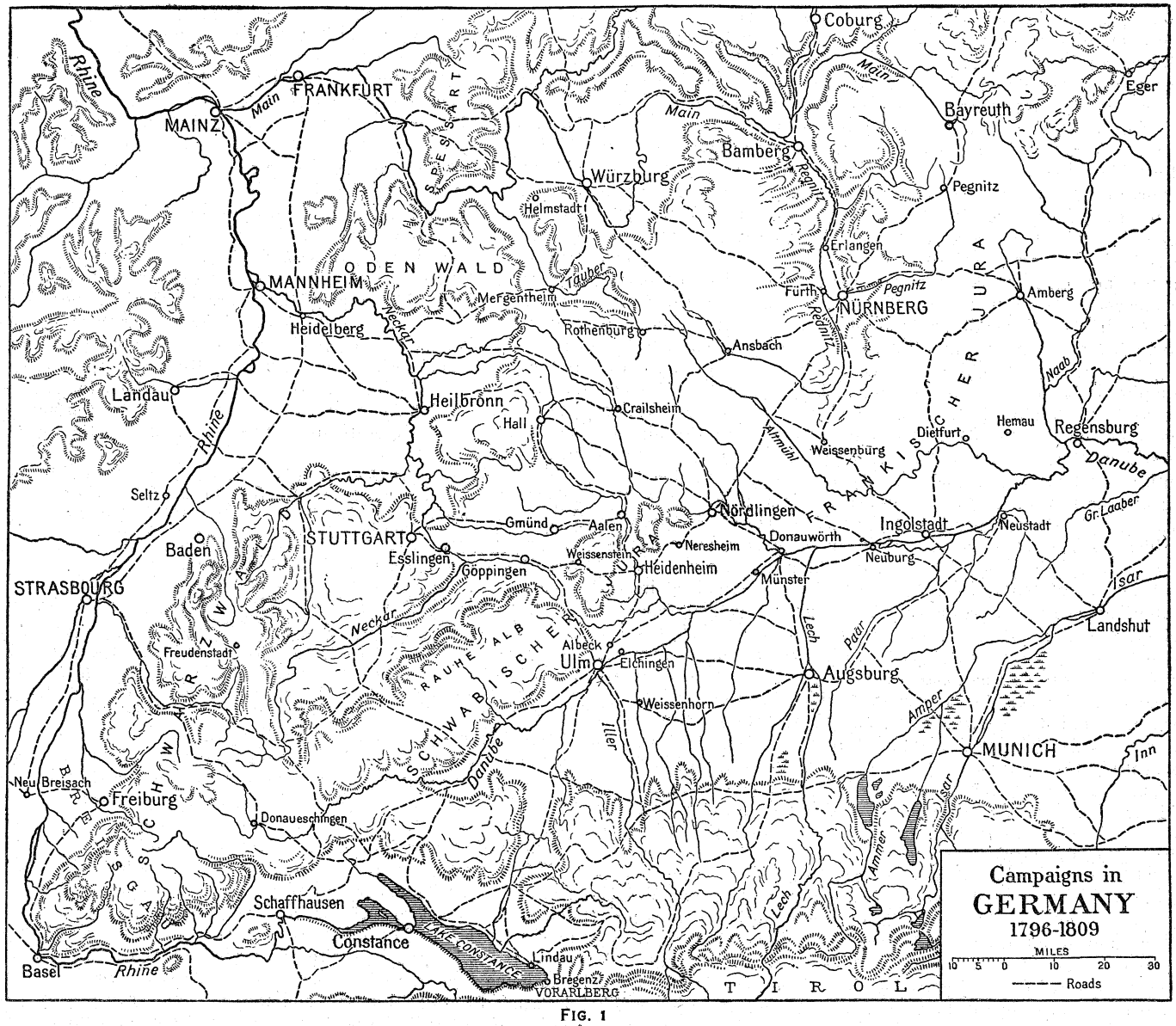



FIG. 1

Spanish Campaign of 1809 is dealt with under PENINSULAR WAR (this article covering the campaigns in Spain, Portugal and southern France 1808–1814), and for a discussion of the events that led to the final drama of Waterloo the reader is referred to WATERLOO CAMPAIGN.

The campaigns described below are therefore—

(*a*) The Austrian War of 1805 (Ulm and Austerlitz).
(*b*) The Conquest of Prussia and the Polish Campaign (Jena, Auerstädt, Eylau and Friedland).
(*c*) The Austrian war of 1809 (Eckmühl, Aspern and Wagram).
(*d*) The Russian War of 1812 (Borodino and the retreat from Moscow).
(*e*) The German "War of Liberation," culminating in the Battle of the Nations around Leipzig.
(*f*) The last campaign in France, 1814.

The naval history of 1803–1815 includes the culmination and the sequel of the struggle for command of the sea which began in 1793 and continued for more than a decade with results increasingly disappointing to the ambitions of Napoleon, finally reaching a decisive climax on the day of Trafalgar.

### THE CAMPAIGN OF 1805

This may be regarded as a measure of self-defence forced upon Napoleon by the alliance of Russia (April 11), Austria (August 9) and other powers with Great Britain. The possibility had long been before the emperor, and his intention in that event to march straight on Vienna by the valley of the Danube is clearly indicated in his reply (November 27, 1803) to a Prussian proposal for the neutralization of the South German states. In this he says, "It is on the road from Strasbourg to Vienna that the French must force peace on Austria, and it is this road which you wish us to renounce." When, therefore, on Aug. 25, 1805, he learnt definitely that Villeneuve (see *Naval Operations* below) had failed in his purpose of securing the command of the Channel, which was the necessary preliminary to the invasion of England, it was but the affair of a few hours to dictate the dispositions necessary to transfer his whole army to the Rhine frontier as the first step in the march which he had determined to make to the Danube. On the date of this decision the army actually lay in the following positions:—

| | | | |
|---|---|---|---|
| I. | Corps | Bernadotte | Hanover (Göttingen) |
| II. | ,, | Marmont | Holland |
| III. | ,, | Davout | Camp of Boulogne and other points on the English Channel |
| IV. | ,, | Soult | |
| V. | ,, | Lannes | |
| VI. | ,, | Ney | |
| VII. | ,, | Augereau | |
| Guard | | Bessières | Paris |

The corps were, however, by no means fit for immediate service. Bernadotte's corps in Hanover was almost in the position of a

beleaguered garrison, and the marshal could only obtain his transport by giving out that he was ordered to withdraw to France. Marmont and Davout were deficient in horses for cavalry and artillery, and the troops in Boulogne, having been drawn together for the invasion of England, had hardly any transport at all, as it was considered this want could be readily supplied on landing. The composition of the army, however, was excellent. The generals were in the prime of life, had not yet learnt to distrust one another, and were accustomed to work under the emperor and with one another. The regimental officers had all acquired their rank before the enemy and knew how to manage their men, and of the men themselves nearly two-thirds had seen active service. The strength of the army lay in its infantry, for both cavalry and artillery were short of horses, and the latter had not yet acquired mobility and skill in manoeuvring. Napoleon's determination to undertake the invasion of England has often been disputed, but it is hard to imagine what other operation he contemplated, for the outbreak of hostilities with his continental enemies found him ill-supplied with intelligence as to the resources of the country he had then to traverse. To remedy this, Murat and other general officers as well as minor agents were sent ahead and instructed to travel through South Germany in plain clothes with a view to collecting information and mastering the topography. The emperor was, moreover, imperfectly acquainted with the degree of preparation of his adversaries' designs, and when he dictated his preliminary orders he was still unaware of the direction that the allies' advance would assume. On Aug. 26, however, he learnt that 100,000 Russians were about to enter Bohemia thence to unite with an Austrian army of 80,000 near the junction of the Inn and Danube, and this information drove him to alter the general direction of his advance so as to traverse the defiles of the Black Forest north of the Neckar, cavalry only observing the passes to the south.

**Austrian Army.**—The Austrians after the defeats of 1800 had endeavoured to reorganize their forces on the French model, but they were soon to learn that in matters of organization the spirit is everything, the letter very little. They had copied the organization of the French corps, but could find no corps commanders fit to assume the responsibility for these commands. As always in such conditions, the actual control of the smallest movements was still centralized in the hands of the army commanders, and thus the rate of marching was incredibly slow. They had decided that in future their troops in the field should live by requisition, and had handed over to the artillery, which needed them badly, a large number of horses thus set free from the transport service, but they had not realized that men accustomed to a regular distribution of rations cannot be transformed into successful marauders and pillagers by a stroke of the pen; and they had sent away the bulk of their army, 120,000 under their best general, the archduke Charles, into Italy, leaving Mack von Leiberich in Germany, nominally as chief of the staff to the young Prince Ferdinand, but virtually in command, to meet the onset of Napoleon at the head of his veterans. Mack had the distinction of having risen from the ranks in the most caste-ridden army in Europe.

**The March on Ulm.**—The outbreak of the campaign was hastened by the desire of the Austrian government to feed their own army and leave a bare country for Napoleon by securing the resources of Bavaria. It was also hoped that the Bavarians with their army of 25,000 men would join the allies. In the latter hope they were deceived, and the Bavarians under General Wrede slipped away to Bamberg in time. In the former, however, they were successful, and the destitution they left in their wake almost wrecked Napoleon's subsequent combinations. Mack's march to Ulm was therefore a necessity of the situation, and his continuance in this exposed position, if foolhardy against such an adversary, was at any rate the outcome of the high resolve that even if beaten he would inflict crippling losses upon the enemy. Mack knew that the Russians would be late at the rendezvous on the Inn. By constructing an entrenched camp at Ulm and concentrating all the available food within it, he expected to compel Napoleon to invest and besiege him, and he anticipated that in the devastated country his adversary would be compelled to separate and thus fall an easy prey to the Russians. For that blow he had determined to make his own army the anvil. But these views obviously could not be published in army orders, hence the discontent and opposition he was destined to encounter.

**Movements of the French.**—It was on Sept. 21 that Napoleon learnt of Mack's presence in Ulm. On that date his army had crossed the Rhine and was entering the defiles of the Black Forest. It was already beginning to suffer. Boots were worn out, greatcoats deficient, transport almost unattainable and, according to modern ideas, the army would have been considered incapable of action.

On Sept. 26 its deployment beyond the mountains was complete, and as Napoleon did not know of Mack's intention to stay at Ulm and had learned that the Russian advance had been delayed, he directed his columns by the following roads on the Danube, between Donauwörth and Ingolstadt, so as to be in a position to intervene between the Austrians and the Russians and beat both in detail.

| | Sept. 28 | Oct. 6 | Oct. 9 | Oct. 16 |
|---|---|---|---|---|
| Bernadotte | Würzburg | Anspach | Nürnberg | Regensburg |
| Marmont | Würzburg | Anspach | Nürnberg | Regensburg |
| Davout | Mannheim | Mergentheim | Anspach | Dietfurt |
| Ney | Selz | Crailsheim | Weissenburg | Ingolstadt |
| Lannes | Strassburg | Gmünd | Nördlingen | Neuburg |
| Soult | Landau | Aalen | Donauwörth | |

On Oct. 7 this movement was completed—the Austrians abandoned the Danube bridges after a show of resistance, retreating westward—and Napoleon, leaving Murat in command of the V. and VI. corps and cavalry to observe the Austrians, pressed on to Augsburg with the others so as to be ready to deal with the Russians. Learning, however, that these were still beyond striking radius, he determined to deal with Mack's army first, having formed the fixed conviction that a threat at the latter's communications would compel him to endeavour to retreat southwards towards Tirol. Bernadotte in his turn became an army of observation, and Napoleon joining Murat with the main body marched rapidly westward from the Lech towards the Iller.

**Austrian Plans.**—Mack's intentions were not what Napoleon supposed. He had meanwhile received (false) information of a British landing at Boulogne, and he was seriously deceived as to the numbers of Napoleon's forces. He was also aware that the exactions of the French had produced deep indignation throughout Germany and especially in Prussia whose neutrality had been violated. All this, and the almost mutinous discontent of his generals and his enemies of the court circle, shook his resolution of acting as anvil for the Russians, of whose delay also he was aware, and about Oct. 8 he determined to march out north-eastward across the French lines of communication and save his sovereign's army by taking refuge if necessary in Saxony. Believing implicitly in the rumours of a descent on Boulogne and of risings in France which also reached him, and knowing the destitution he had left behind him in his movement to Ulm, when he heard of the westward march of French columns from the Lech he told his army, apparently in all good faith, that the French were in full march for their own country.

Actually the French at this moment were suffering the most terrible distress—up to the Danube they had still found sufficient food for existence, but south of it, in the track of the Austrians, they found nothing. All march discipline disappeared, the men dissolved into hordes of marauders and even the sternest of the marshals wrote piteous appeals to the emperor for supplies, and for permission to shoot some of their stragglers. But to all these Berthier in the emperor's name sent the stereotyped reply—"The emperor has ordered you to carry four days' provisions, therefore you can expect nothing further—you know the emperor's method of conducting war."

**Action of Albeck or Haslach.**—Meanwhile Murat, before the emperor joined him, had given Mack the desired opening. The VI. corps (Ney) should have remained on the left bank of the

Danube to close the Austrian exit on that side, but by mistake only Dupont's division had been left at Albeck, the rest being brought over the river. Mack on the 8th had determined to commence his withdrawal, but fortune now favoured the French. The weather during the whole of October had been unusually wet, the swollen Danube overflowed the low ground and the roads had become quagmires. On the south bank, owing to better natural drainage and a drier subsoil, movement was fairly easy, but the Austrians found it almost impossible. On Oct. 11, when they began their march, the road along the Danube was swept into the river, carrying with it several guns and teams, and hours were consumed in passing the shortest distances. At length in the afternoon they suddenly fell upon Dupont's isolated division at Albeck, which was completely surprised and severely handled. The road now lay completely open, but the Austrian columns had so opened out owing to the state of the roads that the leading troops could not pursue their advantage—Dupont rallied and the Austrians had actually to fall back towards Ulm to procure food.

**Elchingen.**—For three more days Mack struggled with an unwilling staff and despondent men to arrange a further advance. During these very three days, through a succession of staff blunders, the French failed to close the gap, and on the morning of Oct. 14 the armies, each renewing its advance, came in contact at the bridge of Elchingen. This bridge, all but a few road-bearers, had been destroyed, but now the French gave an example of that individual gallantry which was characteristic of the old revolutionary armies. Running along the beams under a close fire a few gallant men forced their way across. The floor of the bridge was rapidly relaid, and presently the whole of the VI. corps was deploying with unexampled rapidity on the farther side. The Austrians, still in their quagmire, could not push up reinforcements fast enough, and though Mack subsequently alleged deliberate obstruction and disobedience on the part of his subordinates, the state of the roads alone suffices to explain their defeat. Only the right column of the Austrians was, however, involved; the left under General Werneck, to whom some cavalry and the archduke Ferdinand attached themselves, did indeed succeed in getting away, but without trains or supplies. They continued their march, famished but unmolested, until near Heidenheim they suddenly found themselves confronted by what from the diversity of uniforms they took to be an overwhelming force; at the same time the French cavalry sent in pursuit appeared in their rear. Utterly exhausted by fatigue, Werneck with his infantry, some 8,000 strong, surrendered to what was really a force of dismounted dragoons and foot-sore stragglers improvised by the commanding officer on the spot to protect the French treasure chests, which at that moment lay actually in the path of the Austrians. The young archduke with some cavalry escaped.

**Mack Surrounded.**—The defeat at Elchingen on Oct. 14 sealed the fate of the Austrians, though Mack was still determined to endure a siege. As the French columns coming up from the south and west gradually surrounded him, he drew in his troops under shelter of the fortress and its improvised entrenched camp, and on the 15th he found himself completely surrounded. On the 16th the French field-guns fired into the town, and Mack realized that his troops were no longer under sufficient control to endure a siege. When, therefore, next morning, negotiations were opened by the French, Mack, still feeling certain that the Russians were at hand, agreed to an armistice and undertook to lay down his arms if within the next twenty-one days no relief should arrive. To this Napoleon consented, but hardly had the agreement been signed when he succeeded in introducing a number of individual French soldiers into the fortress, who began rioting with the Austrian soldiery. Then, sending in armed parties to restore order and protect the inhabitants, he caused the guards at the gates to be overpowered, and Mack was thus forced into an unconditional surrender.

On Oct. 22, the day after Trafalgar, the remnant of the Austrian army, 23,000 strong, laid down its arms. About 5,000 men under Jellachich had escaped to Tirol, 2,000 cuirassiers with Prince Ferdinand to Eger in Bohemia, and about 10,000 men under Werneck had surrendered at Heidenheim. The losses in battle having been insignificant, there remain some 30,000 to account for—most of whom probably escaped individually by the help of the inhabitants, who were bitterly hostile to the French. Napoleon now hastened to rejoin the group of corps he had left under Bernadotte in observation towards the Russians, for the latter were nearer at hand than even Mack had assumed. But hearing of his misfortune they retreated before Napoleon's advance along the right bank of the Danube to Krems, where they crossed the river and withdrew to an entrenched camp near Olmütz to pick up fresh Austrian reinforcements. The severe actions of Dürrenstein (near Krems) on Nov. 11, and of Hollabrünn on Nov. 16, in which Napoleon's marshals learned the tenacity of their new opponents, and the surprise of the Vienna bridge (November 14) by the French, were the chief incidents of this period in the campaign.

**Campaign of Austerlitz.**—Napoleon continued down the right bank to Vienna, where he was compelled by the condition of his troops to call a halt to refit his army. After this was done he continued his movement to Brünn. Thither he succeeded in bringing only 55,000 men. He was again forced to give his army rest and shelter, under cover of Murat's cavalry. The allies now confronted him with upwards of 86,000 men, including 16,000 cavalry. About Nov. 20 this force commenced its advance, and Napoleon concentrated in such a manner that within three days he could bring over 80,000 French troops into action around Brünn, besides 17,000 or more Bavarians under Wrede. On the 28th Murat was driven in by the allied columns. That night orders were despatched for a concentration on Brünn in expectation of a collision on the following day; but hearing that the whole allied force was moving towards him he decided to concentrate south-east of Brünn, covering his front by cavalry on the Pratzen heights. Meanwhile he had also prepared a fresh line of retreat towards Bohemia, and, certain now of having his men in hand for the coming battle, he quietly awaited events.

The allies were aware of his position, and still adhering to the old "linear" system, marched to turn his right flank (*see* AUSTERLITZ). As soon as their strategic purpose of cutting him off from Vienna became apparent, the emperor moved his troops into position, and in the afternoon issued his famous proclamation to his troops, pointing out the enemy's mistakes and his plan for defeating them. At the same time he issued his orders for his first great battle as a supreme commander. The battle of Austerlitz began early next morning and closed in the evening with the thorough and decisive defeat of the allies.

## PRUSSIAN AND POLISH CAMPAIGNS

Around the Prussian army, and particularly the cavalry, the prestige of Frederick the Great's glory still lingered; but the younger generation had little experience of actual warfare, and the higher commanders were quite unable to grasp the changes in tactics and in the conduct of operations which had grown out of the necessities of the French Revolution. The individual officers of the executive staff were the most highly trained in Europe, but there was no great leader to co-ordinate their energies. The total number of men assigned to the field army was 110,000 Prussians and Saxons. They were organized in corps, but their leaders were corps commanders only in name, for none were allowed any latitude for individual initiative. Ill-judged economies had undermined the whole efficiency of the Prussian army. Two-thirds of the infantry and one-half of the cavalry were allowed furlough for from ten to eleven months in the year. The men were unprovided with greatcoats. Most of the muskets had actually seen service in the Seven Years' War, and their barrels had worn so thin with constant polishing that the use of full charges at target practice had been forbidden. Above all, the army had drifted entirely out of touch with the civil population. The latter, ground down by feudal tradition and law, and at the same time permeated by the political doctrines of the late 18th century, believed that war concerned the governments only, and formed no part of the business of the "honest citizen." In this idea they were supported by the law itself, which protected the civilian against the soldier, and forbade even in war-time the requisition-

ing of horses, provisions and transport, without payment. Up to the night of the battle of Jena itself, the Prussian troops lay starving in the midst of plenty, whilst the French everywhere took what they wanted. This alone was a sufficient cause for all the misfortunes which followed.

During the campaign of Austerlitz Prussia, furious at the violation of her territory of Anspach, had mobilized, and had sent Haugwitz as ambassador to Napoleon's headquarters. He arrived on Nov. 30, and Napoleon, pleading business, put off his official reception till after the battle of Austerlitz. Of course the ultimatum was never presented, as may be imagined; Haugwitz returned and the king of Prussia demobilized at once. But Napoleon, well knowing the man he had to deal with, had determined to force a quarrel upon Prussia at the earliest convenient opportunity. His troops therefore, when withdrawn from Austria, were cantoned in south Germany in such a way that, whilst suspicion was not aroused in minds unacquainted with Napoleonic methods, they could be concentrated by a few marches behind the Thuringian forest and the upper waters of the Main. Here the Grande Armée was left to itself to recuperate and assimilate its recruits, and it is characteristic of the man and his methods that he did not trouble his corps commanders with a single order during the whole of the spring and summer.

As the diplomatic crisis approached, spies were sent into Prussia, and simultaneously with the orders for preliminary concentration the marshals received private instructions, the pith of which cannot be better expressed than in the following two quotations from Napoleon's correspondence:—

"Mon intention est de concentrer toutes mes forces sur l'extrémité de ma droite en laissant tout l'espace entre le Rhin et Bamberg entièrement dégarni, de manière à avoir près de 200,000 hommes réunis sur un même champ de bataille; mes premières marches menacent le coeur de la monarchie prussienne" (No. 10,920). "Avec cette immense supériorité de forces réunis sur un espace si étroit, vous sentez que je suis dans la volonté de ne rien hasarder et d'attaquer l'ennemi partout où il voudra tenir. Vous pensez bien que ce serait une belle affaire que de se porter sur cette place (Dresden) en *un bataillon carré de* 200,000 *hommes*" (Soult, No. 10,941).

**Advance of the Grande Armée.**—On Oct. 7 the *Grande Armée* lay in three parallel columns along the roads leading over the mountains to Hof, Schleiz and Kronach; on the right lay the IV. corps (Soult) about Bayreuth, with his cavalry in rear, and behind these the VI. corps (Ney) at Pegnitz; in the centre, Bernadotte's I. corps from Nordhalben, with the III. corps (Davout) Lichtenfels; Guard and headquarters, Bamberg. The left column was composed of the V. (Lannes) at Hemmendorf, with the VII. (Augereau) extending south to the Main at Burgebrach.

Napoleon's object being surprise, all the cavalry except a few vedettes were kept back behind the leading infantry columns and these latter were ordered to advance, on the signal being given, in "masses of manoeuvre," so as to crush at once any outpost resistance which was calculated upon the time required for the deployment of ordinary marching columns. This order has never since found an imitator, but deserves attentive study as a masterpiece (*see* H. Bonnal, *Manoeuvre d'Iéna*).

To meet the impending blow the Prussians had been extended in a cordon along the great road leading from Mainz to Dresden, Blücher was at Erfurt, Rüchel at Gotha, Hohenlohe at Weimar, Saxons in Dresden, with outposts along the frontier. An offensive move into Franconia was under discussion, and for this purpose the Prussian staff had commenced a lateral concentration about Weimar, Jena and Naumburg when the storm burst upon them. The emperor gathered little from the confused reports of their purposeless manoeuvres, but, secure in the midst of his "battalion square" of 200,000 men, he remained quite indifferent, well knowing that an advance straight on Berlin must force his enemy to concentrate and fight, and as they would bring at most 127,000 men on to the battlefield the result could hardly be doubtful. On Oct. 9 the cloud burst. Out of the forests which clothe the northern slopes of the Thuringer Wald the French streamed forth, easily overpowering the resistance of the Prussian outposts on the upper Saale, and once the open country was reached the cavalry under Murat trotted to the front, closely followed by Bernadotte's corps as "general advance guard." The result of the cavalry scouting was, however, unsatisfactory. On the night of the 10th, the emperor was still unaware of the position of his principal foe, and Murat with Bernadotte behind him was directed on Gera for the 11th, the remainder of the army continuing along the roads previously assigned to them.

In the meanwhile, however, the Saxons had been moving from Naumburg through Gera on Jena, Hohenlohe was near Weimar, and all the other divisions of the Prussian army had closed in a march eastwards, the idea of an offensive to the southward which Napoleon had himself attributed to them having already disappeared.

Reaching Gera at 9 A.M. Murat reported the movement of the Saxons on the previous day, but omitted to send a strong detachment in pursuit. The traces of the Saxons were lost, and Napoleon, little satisfied with his cavalry, authorized Lasalle to offer up to 6,000 frs. reward for information of the Prussian point of concentration. At 1 A.M. of the 12th Napoleon issued his orders: Murat and Bernadotte via Zeitz to Naumburg; Davout (III. corps and a dragoon division) also to Naumburg; Lannes to Jena, Augereau following; Soult to Gera.

In the meantime the Prussians were effecting their concentration. Rüchel, who with 15,000 men had been sent into the mountains as an advance guard for the projected offensive, was recalled to Weimar, which he reached on the 13th. The main body were between Weimar and Apolda during the 12th, and the Saxons duly effected their junction with Hohenlohe in the vicinity of Vierzehnheiligen, whilst the latter had withdrawn his troops, all but some outposts from Jena, to the plateau about Capellendorf, some 4m. to the N.W. The whole army, of over 120,000 men, could therefore have been concentrated against Lannes and Augereau by the afternoon of the 13th, whilst Soult could

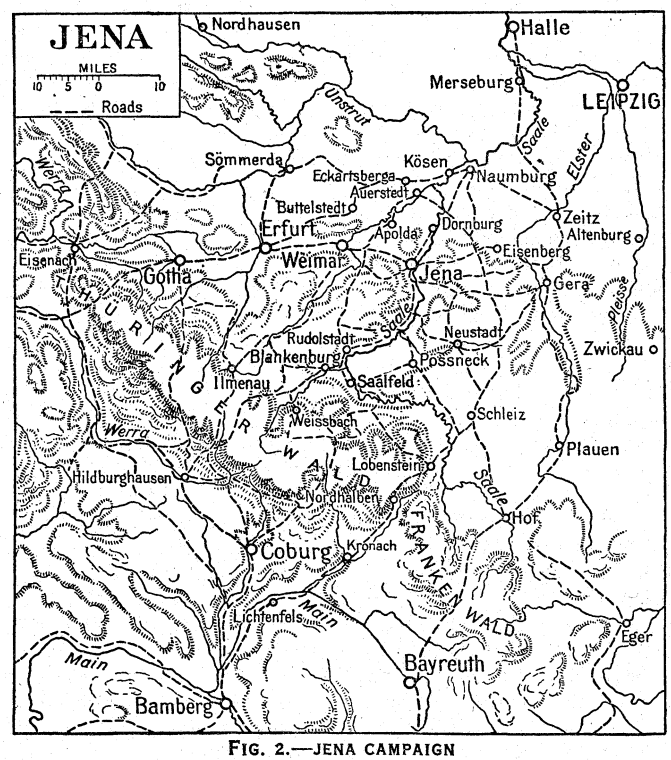



FIG. 2.—JENA CAMPAIGN

only have intervened very late in the day, and Davout and Bernadotte were still too distant to reach the battlefield before the 14th. All the French corps, moreover, were so exhausted by their rapid marches over bad roads that the emperor actually ordered (at 1 A.M. on the 13th) a day of rest for all except Davout, Bernadotte, Lannes and Murat.

The Prussian headquarters, however, spent the 12th and 13th in idle discussion, whilst the troop commanders exerted themselves to obtain some alleviation for the suffering of their starving men. The defeats undergone by their outpost detachment had

profoundly affected the nerves of the troops, and on the afternoon of the 11th, on the false alarm of a French approach, a panic broke out in the streets of Jena, and it took all the energy of Hohenlohe and his staff to restore order. On the morning of the 12th the Saxon commanding officers approached Hohenlohe with a statement of the famishing condition of their men, and threatened to withdraw them again to Saxony. Hohenlohe pointed out that the Prussians were equally badly off, but promised to do his best to help his allies. Urgent messages were sent off to the Commissary von Goethe (the poet), at Weimar for permission to requisition food and firewood. These requests, however, remained unanswered, and the Prussians and Saxons spent the night before the battle shivering in their miserable bivouacs.

**The 13th of October.**—During the early morning of the 13th the reports brought to Napoleon at Gera partially cleared up the situation, though the real truth was very different from what he supposed. However, it was evident that the bulk of the Prussians lay to his left, and instructions were at once despatched to Davout to turn westward from Naumburg towards Kösen and to bring Bernadotte with him if the two were still together. The letter, however, ended with the words "but I hope he is already on his way to Dornburg." Now Bernadotte had neglected to keep the emperor informed as to his whereabouts. He was still with Davout, but, concluding that he had missed an order directing him to Dornburg, he thought to conceal his error by assuming the receipt of the order evidently alluded to in the last words, and as a result he marched towards Dornburg, and his whole corps was lost to the emperor at the crisis of the next day's battle.

On the road from Gera to Jena Napoleon was met by intelligence from Lannes announcing his occupation of Jena and the discovery of Prussian troops to the northward. Knowing the emperor's methods, he wisely restrained the ardour of his subordinates and asked for instructions whether to attack or wait. The emperor rode forward rapidly, reached Jena about 3 P.M., and with Lannes proceeded to the Landgrafenberg to reconnoitre. From this point his view was, however, restricted to the immediate foreground, and he only saw the camps of Hohenlohe's left wing. At this moment the Prussians were actually on parade and ready to move off to attack, but just then the "evil genius" of the Prussian army, Massenbach, an officer of the Headquarters Staff, rode up and claiming to speak with the authority of the king and commander-in-chief, induced Hohenlohe to order his troops back to camp. Of all this Napoleon saw nothing, but from all reports he came to the conclusion that the whole Prussian army was actually in front of him, and at once issued orders for his whole army to concentrate towards Jena, marching all night if need be. Six hours earlier his conclusion would have been correct, but early that morning the Prussian headquarters, alarmed for the safety of their line of retreat on Berlin by the presence of the French in Naumburg, decided to leave Hohenlohe and Rüchel to act as rear-guard, and with the main body to commence their retreat towards the river Unstrutt and the Eckhardtsberge where Massenbach had previously reconnoitred an "ideal" battlefield. This belief in positions was the cardinal principle of Prussian strategy in those days. The troops had accordingly commenced their march on the morning of the 13th, and now at 3 P.M. were settling down into bivouac; they were still but a short march from the decisive field.

**Battle of Jena.**—On the French side, Lannes' men were working their hardest, under Napoleon's personal supervision, to make a practicable road up to the Landgrafenberg, and all night long the remaining corps struggled through darkness towards the rendezvous. By daybreak on the 14th, the anniversary of Elchingen, upwards of 60,000 men stood densely packed on the narrow plateau of the mountain, whilst, below in the ravines on either flank, Soult on the right, and Augereau on the left, were getting into position. Fortunately a dense fog hid the helpless masses on the Landgrafenberg from sight of the Prussian gunners. Hohenlohe had determined to drive the French into the ravine at daybreak, but had no idea as to the numbers in front of him. For want of room, only a few Prussian battalions were sent forward, and these, delaying their advance till the fog had sufficiently lifted, were met by French skirmishers, and small columns, who rapidly overlapped their flanks and drove them back in confusion. Hohenlohe now brought up the remainder of his command, but in the meanwhile the French had poured across the neck between the Landgrafenberg and the main plateau, and the troops of Soult and Augereau were working up the ravines on either hand. In view of these troops the Prussian line, which had advanced faultlessly as if on parade, halted to prepare its bayonet attack by fire, and, once halted, it was found impossible to get them to go on again. The French, who had thrown themselves into houses, copses, etc., picked off the officers, and the flanks of the long Prussian lines swayed and got into confusion. The rival artilleries held each other too thoroughly to be able to spare attention to the infantry, whilst the Prussian cavalry, which had forgotten how to charge in masses of eighty or more squadrons, frittered away their strength in isolated efforts. By 10 A.M. the fourteen battalions which had initiated this attack were outnumbered by three to one, and drifted away from the battlefield. Their places were taken by a fresh body, but this was soon outnumbered and outflanked in its turn. By 2 P.M. the psychological moment had come, and Napoleon launched his guards and cavalry to complete the victory and initiate pursuit. Rüchel's division now arrived and made a most gallant effort to cover the retreat, but their order being broken by the torrent of fugitives, they were soon overwhelmed by the tide of the French victory and all organized resistance had ceased by 4 P.M.

Briefly summarized, the battle came to this—in four successive efforts the Prussians failed because they were locally outnumbered. This was the fault of their leaders solely, for, except for the last attack, local superiority was in each case attainable. Organization and tactics did not affect the issue directly, for the conduct of the men and their junior officers gave abundant proof that in the hands of a competent leader the "linear" principle of delivering one shattering blow would have proved superior to that of a gradual attrition of the enemy here, as on the battlefields of the Peninsula and at Waterloo, and this in spite of other defects in the training of the Prussian infantry which simultaneously caused its defeat on the neighbouring field of Auerstädt.

**Battle of Auerstädt.**—Here the superiority of French mobility showed its value most conclusively. Davout in obedience to his orders of the previous morning was marching over the Saale at Kösen, when his advanced guard and that of the Prussian main army came unexpectedly in contact. The latter with at least 50,000 men was marching in two columns, and ought therefore to have delivered its men into line of battle twice as fast as the French, who had to deploy from a single issue, and whose columns had opened out in the passage of the Kösen defile and the long ascent of the plateau above. But the Prussians attacked at the old regulation speed of seventy-five paces to the minute, and the French manoeuvred at the quick or double of 120 or 150. The consequence was that the French always succeeded in reinforcing their fighting line in time to avert disaster. Nevertheless by mid-day their strength was well-nigh exhausted, whilst the Prussian reserve, eighteen battalions of guards under Kalckreuth, stood intact and ready to engage. But at the critical moment the duke of Brunswick fell mortally wounded, and Scharnhorst, his chief of the staff, was at the time absent on another part of the field. Meanwhile rumours from the battlefield at Jena, magnified as usual, began to reach the staff, and these may possibly have influenced Kalckreuth, for when called upon to attack with his eighteen battalions and win the day, he declined to move without the direct order of the commander-in-chief to do so, alleging that it was the duty of a reserve to cover the retreat and he considered himself personally responsible to the king for the guards entrusted to his care. Even then the day might possibly have been saved had Blücher been able to find even twenty squadrons accustomed to gallop together, but the Prussian cavalry had been dispersed amongst the infantry commands, and at the critical moment it proved impossible for them to deliver a united and decisive attack.

Seeing further efforts hopeless, Scharnhorst in the duke's name initiated the retreat and the troops withdrew north-west towards Buttelstedt, almost unmolested by the French, who this day had

put forth all that was in them, and withstood victoriously the highest average punishment any troops of the new age of warfare had as yet endured. So desperate had been their resistance that the Prussians unanimously stated Davout's strength at double the actual figure. Probably no man but Davout could have got so much out of his men, but why was he left unsupported?

Bernadotte, we have seen, had marched to Dornburg, or rather to a point overlooking the ford across the Saale at the village of

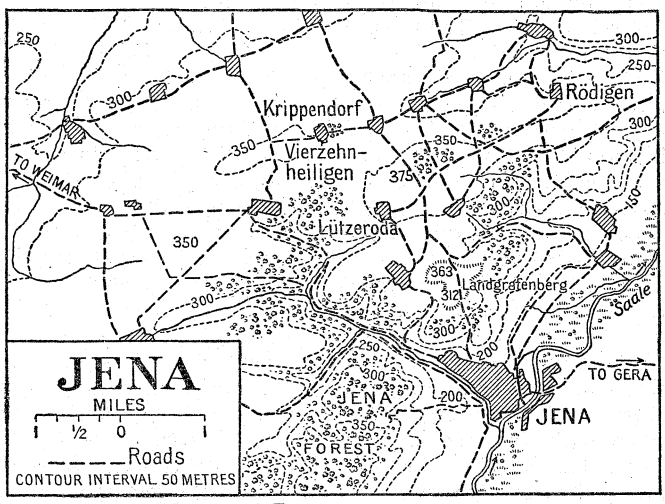



FIG. 3.—JENA

that name, and reached there in ample time to intervene on either field. But with the struggle raging before him he remained undecided, until at Jena the decision had clearly fallen, and then he crossed the river and arrived with fresh troops too late for their services to be required.

**Prussian Retreat.**—During the night the Prussians continued their retreat, the bulk of the main body to Sömmerda, Hohenlohe's corps towards Nordhausen. The troops had got much mixed up, but as the French did not immediately press the pursuit home, order was soon re-established and a combined retreat was begun towards the mouth of the Elbe and Lübeck. Here help was expected to arrive from England, and the tide might ultimately have turned, for the Russian armies were gathering in the east. It was now that the results of a divorce of the army from the nation began to be felt. Instead of seizing all provisions and burning what they could not remove, the Prussian generals enforced on their men the utmost forbearance towards the inhabitants, and the fact that they were obeyed, in spite of the inhumanity the people showed to their sick and wounded countrymen, proves that discipline was by no means so far gone as has generally been believed. The French marching in pursuit were received with open arms, the people even turning their own wounded out of doors to make room for their French guests. Their servility awakened the bitterest contempt of their conquerors and forms the best excuse for the unparalleled severity of the French yoke. On Oct. 26 Davout reached Berlin, having marched 166m. in twelve days including two sharp rearguard actions, Bernadotte with his fresh troops having fallen behind. The inhabitants of Berlin, headed by their mayor, came out to meet him, and the newspapers lavished adulation on the victors and abuse on the beaten army. On the 28th Murat's cavalry overtook the remnant of Prince Hohenlohe's army near Prenzlau (north of Berlin) and invited its capitulation. Unfortunately the prince sent Massenbach to discuss the situation, and the latter completely lost his head. Murat boasted that he had 100,000 men behind him, and on his return Massenbach implored his chief to submit to an unconditional surrender, advice which the prince accepted, though as a fact Murat's horses were completely exhausted and he had no infantry whatever within call. Only Blücher now remained in the field, and he too was driven at length into Lübeck with his back to the sea where he capitulated Nov. 7.

**Campaigns in Poland and East Prussia.**—Hitherto the French had been operating in a rich country, untouched for half a century past by the ravages of war, but as the necessity for a campaign against the Russians confronted the emperor, he realized that his whole supply and transport service must be put on a different footing. After the wants of the cavalry and artillery had been provided for, there remained but little material for transport work. Exhaustive orders to organize the necessary trains were duly issued, but the emperor seems to have had little conception of the difficulties the tracks—there were no metalled roads—of Poland were about to present to him. Moreover, it was one thing to issue orders, but quite another to ensure that they were obeyed, for they entailed a complete transformation in the mental attitude of the French soldier towards all that he had been taught to consider his duties in the field. Experience only can teach the art of packing wagons and the care of draught animals, and throughout the campaign the small ponies of Poland and East Prussia broke down by thousands from over loading and unskilful packing.

The Russian Army formed the most complete contrast to the French that it is possible to imagine. Though clad, armed and organized in European fashion, the soldiers retained in a marked degree the traditions of their Mongolian forerunners, their transport wagons were in type the survival of ages of experience, and their care for their animals equally the result of hereditary habit. The intelligence of the men and regimental officers was very low, but on the other hand service was practically for life, and the regiment the only home the great majority had ever known. Hence obedience was instinctive and initiative almost undreamt of. Moreover, they were essentially a war-trained army, for even in peace time their long marches to and fro within the empire had most thoroughly inured them to hardship and privation. Napoleon might have remembered his own saying, "La misère est l'école du bon soldat." Their artillery was numerous and for the most part of heavy calibre—18- and 24-pounders were common—but the strength of the army lay in its infantry, with its incomparable tenacity in defence and its blind confidence in the bayonet in attack. The traditions of Suvarov and his victories in Italy (*see* FRENCH REVOLUTIONARY WARS) were still fresh, but there was no longer a Suvarov to lead them.

**Advance to the Vistula.**—Napoleon had from the first been aware of the secret alliance between Prussia and Russia, sworn

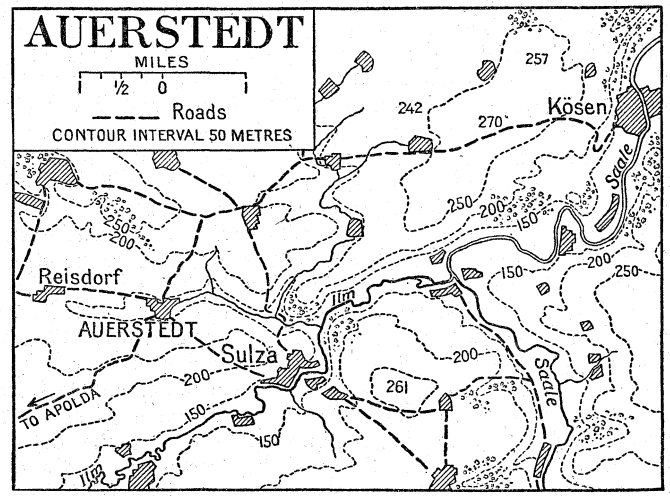



FIG. 4.—AUERSTEDT

by their respective sovereigns over the grave of Frederick the Great, and this knowledge had been his principal reason for precipitating hostilities with the former. He remained, however, in complete ignorance of the degree of preparation attained on the Russian side, and as the seizure of Warsaw together with the control of the resources of Poland in men and material its occupation would afford, was the chief factor in his calculation, he turned at once to the eastward as soon as all further organized resistance in Prussia was ended by the surrender of Prenzlau and Lübeck. Scarcely leaving his troops time to restore their worn-out foot-

gear, or for the cavalry to replace their jaded horses from captured Prussian resources, he set Davout in motion towards Warsaw on Nov. 2, and the remainder of the army followed in successive echelons as rapidly as they could be despatched.

The cavalry, moving well in advance, dispersed the Prussian depots and captured their horses, as far as the line of the Vistula, where at last they encountered organized resistance from the

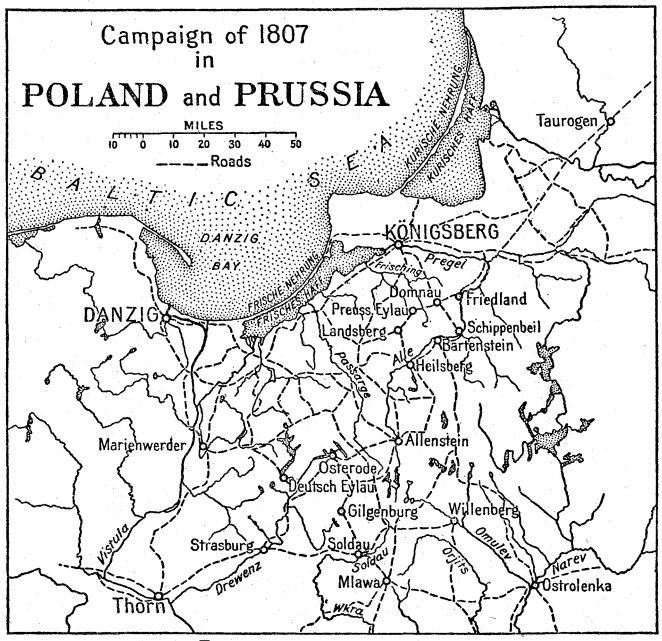



FIG. 5.—CAMPAIGN OF 1807

outposts of Lestocq's little corps of 15,000 men—all that was left of Frederick the Great's army. These, however, gave way before the threat of the advancing French and, after a few trifling skirmishes, Davout entered Warsaw on Nov. 30, being followed by the V., IV., and Guard corps during the succeeding fortnight, whilst the VI. and VII. were echeloned to their left, and the VIII. (Mortier) and IX. (Jerome Napoleon) and X. (Lefebvre), all new formations since the outbreak of the war, followed some marches in the rear. Jerome's corps was composed of the Bavarians, Württembergers and Badensers.

Behind these all Prussia was overrun by newly formed units, (3rd and 4th battalions) raised from depot companies, conscripts for 1807, and old soldiers rejoining after sickness or wounds. Napoleon caused these to be despatched to the front immediately after their formation. He had much territory to occupy, and on the long march of on an average 85 days, he considered that they could be organized, equipped and drilled *en route*.

**Pultusk.**—The Russians meanwhile had been moving slowly forward in two bodies, one under Bennigsen (50,000), the other under Buxhowden (25,000), and the French being at this time in Warsaw, they took up threatening positions about Pultusk, Plock and Prassnitz. From this triangle they harried the French communications with Berlin, and to secure a winter's rest for his men Napoleon determined to bring them to action. On Dec. 23 operations were commenced, but the difficulties of securing information and maintaining communication between the respective columns, so unlike what any of the French had previously encountered, led to a very partial success. The idea had been to induce the Russians to concentrate about Pultusk and, turning their position from its left, ultimately to cut them off from Russia, and if possible to surround them. But in this new and difficult country the emperor found it impossible to time his marches. The troops arrived late at their appointed positions, and after a stubborn rearguard action at Pultusk itself and undecisive fighting elsewhere (Golymin and Soldau) the Russians succeeded in retreating beyond the jaws of the French attack, and Napoleon for the first time found that he had exceeded the limit of endurance of his men. Indeed, the rank and file bluntly told him as much as he rode with the marching columns. Yielding to the inevitable, but not forgetting to announce a brilliant victory in a bulletin, he sent his troops into winter quarters along the Passarge and down the Baltic, enjoining on his corps commanders most strictly to do nothing to disturb their adversary.

**Campaign of Eylau.**—Bennigsen, now commanding the whole Russian army which with Lestocq's Prussians amounted to 100,000, also moved into winter quarters in the area Deutsch Eylau-Osterode-Allenstein, and had every intention of remaining there, for a fresh army was already gathering in Russia, the first corps of which had reached Nur about 50m. distant from the French right.

Unfortunately, Ney with his VI. corps about Gilgenberg had received the most poverty-stricken district in the whole region, and to secure some alleviation for the sufferings of his men he incautiously extended his cantonments till they came in contact with the Russian outposts. Apparently seeing in this movement a recommencement of hostilities, Bennigsen concentrated his troops towards his right and commenced an advance westwards towards Danzig, which was still in Prussian hands. Before his advance both Ney and Bernadotte (the latter, between Ney and the Baltic, covering the siege of Danzig) were compelled to fall back. It then became necessary to disturb the repose of the whole army to counter the enemy's intentions. The latter by this movement, however, uncovered his own communication with Russia, and the emperor was quick to seize his opportunity. He received the information on Jan. 28. His orders were at once issued and complied with so rapidly that by the 31st he stood prepared to advance with the corps of Soult, Ney, Davout and Augereau, the Guard and the reserve cavalry (80,000 men on a front of 60m.) from Myszienec through Willenberg to Gilgenberg; whilst Lannes on his right towards Ostrolenka and Lefebvre (X.) at Thorn covered his outer flanks.

Bernadotte, however, was missing, and this time through no fault of his own. His orders and the despatch conveying Napoleon's instructions fell into the hands of the Cossacks, and just in time Bennigsen's eyes were opened. Rapidly renouncing his previous intentions, he issued orders to concentrate on Allenstein; but this point was chosen too far in advance and he was anticipated by Murat and Soult at that place on Feb 2. He then determined to unite his forces at Joukendorf, but again he was too late. Soult and Murat attacked his rearguard on the 3rd, and Bennigsen, learning from his Cossacks that the French corps were designing to swing round and enclose him, he withdrew by a night march and ultimately succeeded in getting his whole army, with the exception of Lestocq's Prussians, together in the strong position along the Alle, the centre of which is marked by Preussisch-Eylau. The opportunity for this concentration Bennigsen owed to the time gained for him by his rearguard at Joukendorf, for this had stood just long enough to induce the French columns to swing in to surround it, and the next day was thus lost to the emperor as his corps had to extend again to their manoeuvring intervals. The truth is that the days were too short and the roads too bad for Napoleon to carry out the full purpose his "general advance guard" was intended to fulfil. It was designed to hold the enemy in position by the vigour of its attack, thus neutralizing his independent will power and compelling him to expend his reserves in the effort to rescue the troops engaged. But in forests and snowdrifts the French made such slow progress that no sufficient deployment could be made until darkness put a stop to the fighting. Thus, when late on Feb. 7, 1807 Murat and Soult found the enemy's rearguard near Eylau (*q.v.*) the fighting was severe but not prolonged. This time, however, Bennigsen, with over 60,000 men in position and 15,000 Prussians expected to arrive next morning, had no desire to avoid a battle, and deployed for action.

During the night Augereau and the Guards had arrived, and Ney and Davout were expected on either flank in the forenoon. This time the emperor was determined that his enemy should not escape him, and about 8 A.M. ordered Soult and Augereau on the left and right respectively to assail the enemy, Murat and the Guards remaining in the centre as reserve. Napoleon's own forces thus became the "general advance guard" for Ney and

Davout, who were to close in on either side and deliver the decisive stroke. But here too the weather and the state of the roads operated adversely, for Ney came up too late, while Davout, in the full tide of his victorious advance, was checked by the arrival of Lestocq, whose corps Ney had failed to intercept, and the attack of Augereau's corps (VII.), made in a blinding snowstorm, failed with appalling loss. Bennigsen, however, drew off on Ney's arrival, and the French were too much exhausted to pursue him. Again the emperor had to admit that his troops could do no more, and bowing to necessity, he distributed them into winter quarters, where, however, the enterprise of the Cossacks, who were no strangers to snow and to forests, left the outposts but little repose. A protracted period of rest followed, during which the emperor exerted himself unremittingly to re-equip, reinforce and supply his troops. Hitherto he had been based on the entrenched camp of Warsaw, but he had already taken steps to organize a new line of supply and retreat via Thorn, and this was now completed. At the same time Lefebvre was ordered to press the siege of Danzig with all vigour, and on May 5, after a most gallant resistance, Kalckreuth, who redeemed here his failure of Auerstädt, surrendered. English assistance came too late. By the beginning of June the French had more than made good their losses and 210,000 men were available for field service.

**Heilsberg and Friedland.**—Meanwhile Bennigsen had prepared for a fresh undertaking, and leaving Lestocq with 20,000 Prussians and Russians to contain Bernadotte, who lay between Braunsberg and Spandau on the Passarge, he moved southwards on the 2nd, and on June 3 and 4 he fell upon Ney, driving him back towards Guttstadt, whilst with the bulk of his force he moved towards Heilsberg, where he threw up an entrenched position. It was not till the 5th that Napoleon received tidings of his advance, and for the moment these were so vague that he contented himself by warning the remainder of his forces to be prepared to move on the 6th. Next day, however, all doubts were set at rest, and as the Russians advanced south of Heilsberg, he decided to wheel his whole force to the right, pivoting on the III. corps, and cut Bennigsen off from Königsberg and the sea. On the 8th the VI., III., VIII. and Guard corps, together with a new cavalry reserve corps under Lannes, in all 147,000, stood ready for the operation, and with Murat and Soult as general advanced guard the whole moved forward, driving the Russian outposts before them. Bernadotte, who was to have attacked Lestocq, again failed to receive his orders and took no part in the following operations.

Murat attacked the Russians, who had halted in their entrenched position, on the 11th and drove in their outposts, but did not discover the entrenchments. Meanwhile Soult had followed with his infantry in close support, and the emperor himself arriving, ordered him to attack at once. Now the Russians uncovered their entrenchments, and in the absence of artillery preparation Soult's leading troops received most severe punishment. Fresh troops arriving were sent in to his support, but these also proved insufficient, and darkness alone put an end to the struggle, which cost the French 12,000 killed and wounded.

Bennigsen, however, learning that his right was threatened by the III. corps, and not having as yet completed his concentration, retreated in the night to Bartenstein, and the following day turned sharp right towards Schippenbeil. The emperor now pressed on towards Friedland, where he would completely control the Russian communications with Königsberg, their immediate base of supply, but for once the Russians outmarched him and covered their movement so successfully that for the next three days he seems to have completely lost all knowledge of his enemy's whereabouts. Lestocq in the meantime had been forced northwards towards Königsberg, and Soult with Murat was in hot pursuit. The III., VI., VIII. and Guard corps followed the main road towards Königsberg, and the former had reached Mühlhausen, the remainder were about Preussisch-Eylau, when Latour Maubourg's dragoons sent in intelligence which pointed to the presence of Bennigsen about Friedland. This was indeed the case. The Russians after passing Schippenbeil had suddenly turned northwards, and on the evening of the 13th were taking up a strong position on the river Alle with Friedland as a centre.

What followed presents perhaps the finest instance of the Napoleonic method. The enemy lay direct to his right, and Murat, the IV. and III. corps had well overshot the mark. Lannes's reserve corps (cavalry), to whom Latour Maubourg reported, lay at Domnau some 10m. to the right. The latter at once assumed the rôle of advanced guard cavalry and was ordered to observe the enemy at Friedland, Ney following in close support. Davout was turned about and directed on the enemy's right, and the VIII. corps (Mortier), the Guards and the reserve cavalry followed as main body. On the 14th (the anniversary of Marengo) Lannes carried out his rôle of fighting advanced guard or screen, the emperor's main body gradually came up, and the battle of Friedland (*q.v.*), notable chiefly for the first display of the new artillery tactics of the French, ended with a general attack about 5 P.M. and the retreat of the Russians, after severe losses, over the Alle. Lestocq was, meanwhile, driven through Königsberg (which surrendered on the 15th) on Tilsit, and now that he was no longer supported by the Russians, the Prussian commander gave up the struggle.

### THE AUSTRIAN WAR OF 1809

Ever since Austerlitz the Austrian officers had been labouring to reconstitute and reform their army. Much had been done to create an efficient staff, but though the idea of the army corps command was now no new thing, the senior generals entrusted with these commands were far from having acquired the independence and initiative of their French opponents. Hence the extraordinary slowness of their manoeuvres, not because the Austrian infantry were bad marchers, but because the preparation and circulation of orders was still far behind the French standard. The infantry adopted the highly manoeuvrable formations of the French—skirmishers and columns—but it was easier to adopt the formations than to acquire the initiative which gave these their vital energy. The light cavalry had been much improved and the heavy cavalry on the whole proved a fair match for their opponents.

After the peace of Tilsit the Grande Armée was gradually withdrawn behind the Rhine, leaving only three commands, totalling 63,000 men, under Davout in Prussia, Oudinot in west central Germany, and Lefebvre in Bavaria, to assist the princes of the Confederation of the Rhine in the maintenance of order and the enforcement of the French law of conscription, which was rigorously insisted on in all the States comprised in this new federation. In exchange for the subsistence of the French troops of occupation, a corresponding number of these new levies were moved to the south of France, where they commenced to arrive at the moment when the situation in Spain became acute. The Peninsular War (*q.v.*) called for large forces of the old *Grande Armée* and for a brief period Napoleon directed operations in person; and the Austrians took advantage of the dissemination and weakness of the French forces in Germany to push forward their own preparations with renewed energy.

But they reckoned without the resourcefulness of Napoleon. The moment news of their activity reached him, whilst still in pursuit of Sir John Moore, he despatched letters to all the members of the Confederation warning them that their contingents might soon be required, and at the same time issued a series of decrees to General Clarke, his war minister, authorizing him to call up the contingent of 1810 in advance, and directing him in detail to proceed with the formation of 4th and 5th battalions for all the regiments across the Rhine. By these means Davout's, Oudinot's and Lefebvre's commands were augmented, whilst in February and March new corps were formed and rapidly pushed towards the front.

On his return from Spain, seeing war imminent, he issued a series of march orders (which deserve the closest study in detail) by which on April 15 his whole army was to be concentrated for manoeuvres between Regensburg, Landshut, Augsburg and Donauwörth, and sending on the Guard in wagons to Strassburg, he despatched Berthier to act as commander-in-chief until his

own arrival.

**Austrian Offensive.**—The position of assembly was excellently chosen, but unfortunately the Austrians took the initiative. On April 9 their main body of six corps crossed the Inn between Braunau and Passau and simultaneously two additional corps moved from Pilsen in Bohemia on Regensburg. At this moment Davout was entering Regensburg with his leading troops, the remainder still some marches in rear, and it was evident that the whole concentration could no longer be carried out before the Austrians would be in a position to intervene. Berthier received the news while still on his way to the front, and quite failed to grasp the situation. Reaching Donauwörth at 8 P.M. on April 13, he ordered Davout and Oudinot to remain at Regensburg, whilst Lefebvre and Wrede (Bavarians) who had fallen back before the Austrians were directed to reoccupy Landshut. This was in direct contradiction to the instructions Napoleon had given on March 28 in view of this very emergency. Davout obeyed, but remonstrated. On the 16th Berthier went on to Augsburg, where he learned that Lefebvre's advanced troops had been driven out of Landshut, thus opening a great gap seventy-six miles wide between the two wings of the French army. Meanwhile Napoleon, who had left Paris at 4 A.M. on April 13, was hastening towards the front, but remained still in ignorance of Berthier's doings until on the 16th at Stuttgart he received a letter from the Marshal dated the 13th, which threw him into consternation. In reply he immediately wrote: "You do not inform me what has rendered necessary such an extraordinary measure which weakens and divides my troops" —and—"I cannot quite grasp the meaning of your letter yet, I should have preferred to see my army concentrated between Ingolstadt and Augsburg, the Bavarians in the first line, with the duke of Danzig in his old position, until we know what the enemy is going to do. Everything would be excellent if the duke of Auerstädt had been at Ingolstadt and the duke of Rivoli with the Württembergers and Oudinot's corps at Augsburg, . . . so that just the opposite of what should have been done has been done" (C. N. to Berthier, Ludwigsburg, 16th April).

**Napoleon Takes Command.**—Having despatched this severe reprimand he hastened on to Donauwörth, where he arrived at 4 A.M. on the 17th, hoping to find Berthier, but the latter was at Augsburg. Nevertheless, at 10 A.M. he ordered Davout and Oudinot to withdraw at once to Ingolstadt; and Lefebvre and Wrede on the right to support the movement. About noon Berthier returned and after hearing his explanation Masséna received orders to move from Augsburg toward Ingolstadt. "To-morrow will be a day of preparation spent in drawing closer together, and I expect to be able by Wednesday to manoeuvre against the enemy's columns according to circumstances."

Meanwhile the Austrians had approached so near that by a single day's march it would have been possible to fall upon and crush by superior numbers either wing of the French army, but though the Austrian light cavalry successfully covered the operations of the following troops they had not yet risen to a conception of their reconnoitring mission, and the archduke, in ignorance of his opportunity and possessed, moreover, with the preconceived idea of uniting at Regensburg with the two corps coming from Bohemia, moved the bulk of his forces in that direction, leaving only a covering body against Davout altogether insufficient to retain him. Davout, however, had left a garrison of 1,800 men in Regensburg, who delayed the junction of the Austrian wings until the 20th inst., and on the same day the emperor, having now reunited his whole right wing and centre, overwhelmed the covering detachments facing him in a long series of disconnected engagements lasting forty-eight hours, and the archduke now found himself in danger of being forced back into the Danube. But with the Bohemian reinforcements he had still four corps in hand, and Napoleon, whose intelligence service in the difficult and intersected country had lamentably failed him, had weakened his army by detaching a portion of his force in pursuit of the beaten right wing, and against the archduke's communications.

**Eckmühl.**—When, therefore, the latter, on the 22nd, marched southward to reopen his communications by the defeat of the enemy's army, he actually reached the neighbourhood of Eckmühl with a sufficient numerical superority had he only been prompt enough to seize his opportunity. But the French had been beforehand with him. Napoleon, who had personally taken part in the fighting of the previous day, and followed the pursuit as far as Landshut, whence he had despatched Masséna to follow the retreating Austrians along the Isar, seems to have realized about

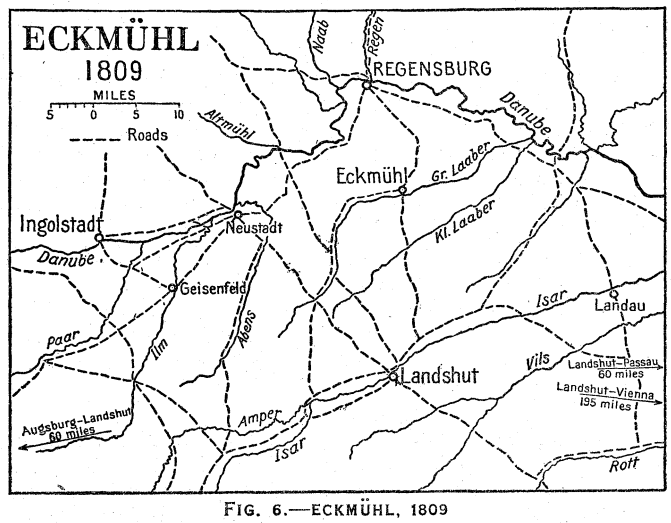



FIG. 6.—ECKMÜHL, 1809

3 A.M. in the morning that it was not the main body of the enemy he had had before him, but only its left wing, and that the main body itself must still be northward towards Regensburg. Issuing orders to Davout, Oudinot and his cavalry to concentrate with all speed towards Eckmühl, he himself rode back along the Regensburg road and reached the battle-field just as the engagement between the advance troops had commenced. Had the Austrians possessed mobility equal to that of the French the latter should have been overwhelmed in detail, but whilst the French covered 17 and 19m. the Austrians only marched 10, and, owing to their defective assimilation of the new tactical training the troops actually on the ground could not hold out long enough for their reserves to arrive. The retreat of the front lines involved the following ones in confusion, and presently the whole mass was driven back in considerable disorder. It seemed as if nothing could save the Austrians from complete disaster, but at the critical moment the emperor, yielding to the protestations of his corps commanders, who represented the excessive fatigue of their troops, stopped the pursuit, and the archduke made the most of his opportunity to restore order amongst his demoralized men and crossed to the north bank of the Danube during the night.

On the following morning the French reached Regensburg and at once proceeded to assault its mediaeval walls, but the Austrian garrison bravely defended it till the last of the stragglers was safely across on the north bank. It was here that, for the only time in his career, Napoleon was slightly wounded. Then, leaving Davout to observe the archduke's retreat, the emperor himself rode after Masséna, who with the major portion of the French army was following the Austrian weaker wing under Hiller. The latter was not so shaken as Napoleon believed, and turning at bay at Ebelsberg inflicted a severe check on its pursuers. Thus covered by his rearguard Hiller gained space and time to pass his troops over to the north bank of the Danube and remove all boats on the river. This left the direct road to Vienna open, and Napoleon, hoping to find peace in the enemy's capital, pushed the whole of his army down the right bank, and with Murat's cavalry entered the city on May 12, after somewhat severe resistance lasting three days. Meanwhile the archduke and Hiller, both now unmolested, effected their junction in the vicinity of Wagram, picketing the whole line of the Danube with their outposts and collecting all the boats.

**Aspern and Wagram.**—The reconnaissance of the river was at once taken in hand by the French upon their arrival in Vienna, and a point opposite the island of Lobau selected for the crossing.

Thanks to the Austrian precautions it took four days to collect the necessary material to span the main branch of the river, here some 2,000yd. across, and though Napoleon personally spurred on all to activity nearly four days more were required for its construction. It was not till the night of May 19 that orders for the passage were finally issued, and during the night the troops commenced to occupy the island of Lobau. Surprise, of course, was out of the question, but the Austrians did not attempt to dispute the passage, their object being to allow as many French as they felt they could deal with to pass over and then to fall on them. Thus on May 21 the battle of Aspern (*q.v.*) or Essling began. It ended on the night of the 22nd with the defeat of Napoleon, the first ever inflicted upon him. The French retreated into the island of Lobau. By nightfall upwards of 100,000 men, encumbered with at least 20,000 wounded, were crowded together on the little island scarcely a mile square, short of provisions and entirely destitute of course of all hospital accessories. The question then arose whether the retreat was to be continued across the main stream or not, and for the second time in his career Napoleon assembled his generals to take their opinion. They counselled retreat, but having heard them all he replied, in substance: "If we leave here at all we may as well retire to Strassburg, for unless the enemy is held by the threat of further operations he will be free to strike at our communications and has a shorter distance to go. We must remain here and renew operations as soon as possible."

Immediate orders were despatched to summon every available body of troops to concentrate for the decisive stroke. Practically the lines of communication along the Danube were denuded of combatants, even Bernadotte being called up from Passau, and the viceroy of Italy, who driving the archduke Johann before him (action of Raab) had brought up 56,000 men through Tirol, was disposed towards Pressburg within easy call. The arsenal of Vienna was ransacked for guns, stores and appliances, and preparations in the island pushed on as fast as possible. By the end of June 200,000 troops were stationed within call, and on July 4 the French began to cross over to the left bank of the Danube. The events which followed are described under WAGRAM. The great battle at this place, fought on July 5 and 6, ended in the retirement of the Austrians. The only other event which occurred before peace was made was an unimportant action at Znaym on July 11.

### THE RUSSIAN WAR OF 1812

Whilst the campaign of 1809 had shaken the faith of the marshals and the higher ranks in the infallibility of the emperor's judgment, and the slaughter of the troops at Aspern and Wagram had still further accentuated the opposition of the French people to conscription, the result on the fighting discipline of the army had, on the whole, been for good. The panics of Wagram had taught men and officers alike a salutary lesson. Aware of the growing feeling against war in France, Napoleon had determined to make his allies not only bear the expenses of the coming campaign, but find the men as well, and he was so far master of Europe that of the 363,000 who on June 24 crossed the Niemen no less than two-thirds were Germans, Austrians, Poles or Italians. But though the battlefield discipline of the men was better, the discipline in camp and on the march was worse, for the troops were no longer eager to reach the battlefield, and marched because they were compelled, not of their own goodwill. The result was apparent in a sudden diminution in mobility, and a general want of punctuality which seriously influenced the course of the campaign. On the other hand, the Russians, once their fatherland was invaded, became dominated by an ever-growing spirit of fanaticism, and they were by nature too obedient to their natural leaders, and too well inured to the hardships of campaigning, to lose their courage in a retreat.

By the middle of June 1812 the emperor had assembled his army along the line of the Niemen. On the extreme right stood the Austrian contingent under Schwarzenberg (34,000 men). Next, centring about Warsaw, a group of three corps (70,000 men) under the chief command of Napoleon's brother Jerome. Then the main army under Napoleon in person (220,000 men; with 80,000 more under the viceroy of Italy on his right rear); and on the extreme left at Tilsit a flanking corps, comprising the Prussian auxiliary corps and other Germans (in all 40,000 strong). The whole army was particularly strong in cavalry; out of the 450,000, 80,000 belonged to that arm, and Napoleon, mindful of the lessons of 1807, had issued the most minute and detailed orders for the supply service in all its branches, and the forwarding of reinforcements, no less than 100,000 men being destined for that purpose in due course of time.

Information about the Russians was very indifferent; it was only known that Prince Bagration (with 43,000 men) lay grouped about Wolkowysk; Barclay de Tolly (who had about 130,000) about Vilna; and on the Austrian frontier lay a small corps under Tormassov (40,000) in process of formation, while far away on the Turkish frontiers hostilities with the sultan retained Tschitschagov with 50,000 more. Of the enemy's plans Napoleon knew nothing, but, in accordance with his usual practice, the dispositions he had chosen met all immediate possible moves.

**Opening of the Campaign.**—On June 24 the passage of the Niemen began in torrid heat which lasted for a few days. The main army, with the emperor in person, covered by Murat and the cavalry, moved on Vilna, whilst Jerome on his right rear at once threatened Bagration and covered the emperor's outer flank. From the very first, however, the inherent weakness of the vast army, and the vicious choice of time for the beginning of the advance, began to make themselves felt. With crops still green, and nothing else available as forage for the horses, an epidemic of colic broke out amongst them, and in ten days the mounted arms had lost upwards of one-third of their strength; men died of sunstroke in numbers, and serious straggling began. Still everything pointed to the concentration of the Russians at Vilna, and Jerome, who on July 5 had reached Grodno, was ordered to push on. But Jerome proved quite inadequate to his position, listening to the complaints of his subordinates as to want of supplies and even of pay; he spent four whole days in absolute inertia, notwithstanding the emperor's reprimands. Meanwhile the Russians covered by stubborn rearguards made good their retreat—Barclay towards the entrenched camp of Drissa on the Dvina, Bagration towards Mohilev.

The emperor's first great *coup* thus failed. Jerome was replaced by Davout, and the army resumed its march, this time in the hope of surrounding and overwhelming Barclay, whilst Davout dealt with Bagration. The want of mobility, particularly in the cavalry,

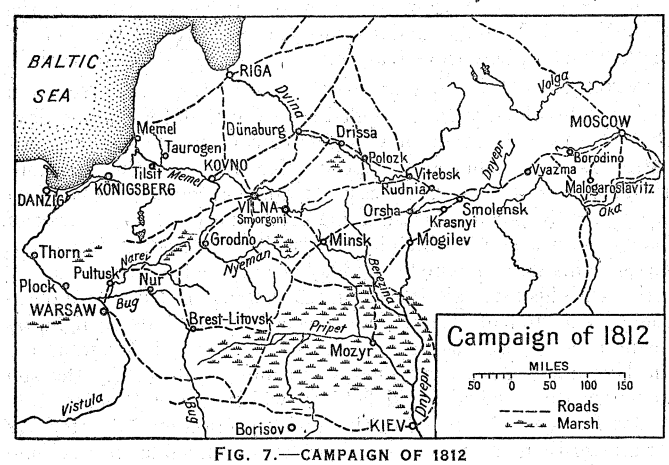



FIG. 7.—CAMPAIGN OF 1812

now began to tell against the French. With horses only just recovering from an epidemic, they proved quite unequal to the task of catching the Cossacks, who swarmed round them in every direction, never accepting an engagement but compelling a constant watchfulness for which nothing in their previous experience had sufficiently prepared the French.

Before their advance, however, the Russian armies steadily retired, Barclay from Vilna via Drissa to Vitebsk, Bagration—narrowly evading Davout—from Wolkowysk to Mohilev. Again arrangements were made for a Napoleonic battle; behind Murat's

cavalry came the "general advanced guard" to attack and hold the enemy, whilst the main body and Davout were held available to swing in on his rear. Napoleon, however, failed to allow for the psychology of his opponents, who refused to be drawn into engagements and steadily withdrew from every position when the French gained touch with them. Thus the manoeuvre against Vitebsk again miscarried, and Napoleon found himself in a far worse position, numerically and materially, than at the outset of the campaign. Then he had stood with 420,000 men on a front of 160m., now he had only 229,000 men on a 135m. front; he had missed three great opportunities of destroying his enemy in detail, and in five weeks, during which time he had only traversed 200m., he had seen his troops reduced numerically at least one-third, and, worse still, his army was now far from being the fighting machine it had been at the outset.

Meanwhile the Russians had not lost a single gun and the *moral* of their men had been improved by the result of the many minor encounters with the enemy; further, the junction of Bagration and Barclay was now assured in the vicinity of Smolensk. Towards this place the French advance was now resumed, and the Russian generals at the head of a united force of 130,000 men marched forward towards Rudnia to meet them. Here, however, the inefficiency of the Russian staff actually saved them from the disaster which must certainly have overtaken them had they realized their intention of fighting the French. The Russians marched in two columns, which lost touch of one another, and as it was quite impossible for either to engage the French single-handed, they both retired again towards Smolensk, where with an advanced guard in the town itself—which possessed an old-fashioned brick *enceinte* not to be breached by field artillery alone—the two columns reunited and deployed for action behind the unfordable Dnieper.

Murat and Ney as "general advanced guard" attacked the town in the morning of Aug. 16, and the main body was swung round to place itself on the Russian rear astride the road to Moscow. The whole of the 17th was required to complete the movement, and as soon as its purpose was sufficiently revealed to the Russians the latter determined to retreat under cover of night. Their manoeuvre was carried out with complete success, and then began a series of rearguard actions and nocturnal retreats which completely accomplished their purpose of wearing down the French army. The Russian government, however, failed to see the matter in its true light, and Marshal Kutusov was sent to the front to assume the chief command. His intention was to occupy a strong position and fight one general action for the possession of Moscow, and to this end he selected the line of the Kalatscha where the stream intersects the great Moscow road.

**Borodino.**—Here he was overtaken by Murat and Ney, but the French columns had straggled so badly that four whole days elapsed before the emperor was able to concentrate his army for battle and then could only oppose 128,000 men to the Russians' 110,000. About 6 A.M. on Sept. 7 the battle (*see* BORODINO) began, but Napoleon was suffering from one of those attacks of illness and depression which henceforth became such an important factor in his fate. Till about midday he followed the course of the action with his usual alertness; then he appears to have been overcome by a kind of stupor and allowed his marshals to fight by themselves. There was no final decisive effort as at Wagram and the Guard was not even called on to move. Ultimately the sun went down on an undecided field on which 38,000 Russians and 25,000 French had fallen, but the moral reaction on the latter was far greater than on the former. Kutusov continued his retreat, and Murat with his now exhausted horsemen followed as best he might. Sebastiani, commanding the advanced guard, overtook the Russians in the act of evacuating Moscow, and agreed with the latter to observe a seven hours' armistice to allow the Russians to clear the town, for experience had shown the French that street fighting in wooden Russian townships always meant fire and the consequent destruction of much-needed shelter and provisions. Towards nightfall Napoleon reached the scene, and the Russians being now clear the troops began to enter, but already fires were observed in the farther part of the city. Napoleon passed the night in a house in the western suburb and next morning rode to the Kremlin, the troops moving to the quarters assigned to them, but in the afternoon a great fire began and, continuing for two days, drove the French out into the country again.

The emperor was now in the direst perplexity. Kutusov was hovering on the outskirts of the city, his main body at Kaluga, some marches to the south-west, where he was in full communication with the richest portion of the empire; and now news arrived that St. Cyr, who had relieved Macdonald on his extreme left, had only 17,000 men left under arms against upwards of 40,000 Russians under Witgenstein; and to the south Tschitschagov's army, being no longer detained on the Turkish frontier, where peace had been made, was marching to join Tormassov about Brest-Litovsk with forces which would bring the total of the two well over 100,000 men. Meanwhile Schwarzenberg's force opposing these had dwindled to a bare 30,000.

The French army was thus disposed almost in an equilateral triangle with sides of about 570m., with 95,000 men at the apex at Moscow opposed to 120,000, 30,000 about Brest opposite 100,000, and 17,000 about Drissa confronted by 40,000, whilst in the centre of the base at Smolensk lay Victor's corps, about 30,000. From Moscow to the Niemen was 550 miles. In view of this situation Napoleon on Oct. 4 sent General Lauriston to the Russian headquarters to treat. While waiting his return Murat was enjoined to skirmish with Kutusov, and the emperor himself worked out a scheme to assume the offensive with his whole army towards St. Petersburg, calling in Victor and St. Cyr on the way. This project was persisted with, until on the 18th Murat was himself attacked and severely handled (action of Tarutino or Vinkovo). On the morning of the 19th the whole army moved out to accept this challenge, and the French were thoroughly worsted on the 24th in the battle of Maloyaroslavetz.

**The Retreat from Moscow.**—Then began the celebrated retreat. It has generally been forgotten that the utter want of march discipline in the French, and not the climatic conditions, was responsible for the appalling disasters which ensued. Actually the frost came later than usual that year, Oct. 27, and the weather was dry and bracing; not till Nov. 8 did the cold at night become sharp. Even when the Beresina was reached on Nov. 26, the cold was far from severe, for the slow and sluggish stream was not frozen over, as is proved by the fact that Eblé's pioneers worked in the water all through that terrible day. But the French army was already completely out of hand, and the degree to which the panic of a crowd can master even the strongest instinct of the individual is shown by the conduct of the fugitives who crowded over the bridges, treading hundreds under foot, whilst all the time the river was easily fordable and mounted men rode backwards and forwards across it.

To return to the actual sequence of events. Kutusov had been very slow in exploiting his success of the 24th and indeed had begun the pursuit in a false direction; but about Nov. 2, headquarters of the French being at Vyazma, the Cossacks became so threatening that the emperor ordered the army to march (as in Egypt) in hollow square. This order, however, appears only to have been obeyed by the Guards, with whom henceforward the emperor marched.

Kutusov had now overtaken the French, but fortunately for them he made no effort to close with them, but hung on their flank, molesting them with Cossacks and picking up stragglers. Thus the wreck of the *Grande Armée,* now not more than fifty thousand strong, reached Smolensk on the 9th and there rested till the 14th. The march was then resumed, the Guard leading and Ney commanding the rearguard. Near Krasnoi on the 16th the Russian advanced guard tried to head the column off. Napoleon halted a whole day to let the army close up; and then attacked with his old vigour and succeeded in clearing the road, but only at the cost of leaving Ney and the rearguard to its fate. By a night march of unexampled daring and difficulty Ney succeeded in breaking through the Russian cordon, but when he regained touch with the main body at Orcha only 800 of his 6,000 men were still with him (21st).

**The Beresina.**—From here Napoleon despatched orders to Victor to join him at Borisov on the Beresina. The cold now gave

way and thaw set in, leaving the country a morass, and information came that Tschitschagov from the south had reached Borisov. He now selected Viesselovo as the point of passage and at 1 A.M. on the 23rd sent orders to Oudinot to march thither and construct bridges. In the execution of these orders Oudinot encountered the Russian advanced guard near Borisov and drove the latter back in confusion, though not before they had destroyed the existing bridge there. This sudden reassumption of the offensive threw Tschitschagov into confusion. Thus time was gained for Victor also to come up and for Oudinot to construct the bridges at Studienka near the above-mentioned place, but a spot in many respects better suited for the purpose. Thither therefore Napoleon sent his pontonniers under General Eblé, but on their arrival they found that no preparations had been made and much time was lost. Meanwhile Victor, in doubt as to the real point of passage, had left the road to Studienka open to Wittgenstein, who had followed hard on his heels.

By 4 P.M. on the 26th the bridges were finished and the passage began, but not without resistance by the Russians, who were gradually closing in. The crossing continued all night, though interrupted from time to time by failures of the bridges. All day during the 27th stragglers continued to cross, covered by such combatants as remained under sufficient discipline to be employed. At 8 A.M. on the 28th, however, Tschitschagov and Wittgenstein moved forward on both banks of the river to the attack, but were held off by the splendid self-sacrifice of the few remaining troops under Ney, Oudinot and Victor, until about 1 P.M. the last body of regular troops passed over the bridges, and only a few thousand stragglers remained beyond the river.

The number of troops engaged by the French that day cannot be given exactly. Oudinot's and Victor's men were relatively fresh and may have totalled 20,000, whilst Ney can hardly have had more than 6,000 of all corps fighting under him. How many were killed can never be known, but three days later the total number of men reported fit for duty had fallen to 8,800 only.

**Final Operations.**—Henceforward the retreat of the army became practically a headlong flight, and on Dec. 8, having reached Smorgoni and seeing that nothing further could be done by him at the front, the emperor handed over the command of what remained to Murat, and left for Paris to organize a fresh army for the following year. Travelling at the fullest speed, he reached the Tuileries on the 18th, after a journey of 312 hours. After the emperor's departure the cold set in with increased severity, the thermometer falling to 23°. On Dec. 8, Murat reached Vilna, whilst Ney with about 400 men and Wrede with 2,000 Bavarians still formed the rearguard; but it was quite impossible to carry out Napoleon's instructions to go into winter quarters about the town, so that the retreat was resumed on the 10th and ultimately Königsberg was attained on Dec. 19 by Murat with 400 Guards and 600 Guard cavalry dismounted. Meanwhile on the extreme French right Schwarzenberg and his Austrians had drifted away towards their own frontier, and the Prussian contingent, which under Yorck formed part of Macdonald's command about Riga, had entered into a convention with the Russians at Tauroggen (Dec. 30) which deprived the French of the last support upon their left. Königsberg thus became untenable, and Murat fell back to Posen, where on Jan. 10 he handed over his command to Eugène Beauharnais and returned to Paris. The Russian pursuit practically ceased at the line of the Niemen, for the Russian troops also had suffered terrible hardships and a period of rest had become an absolute necessity.

**The War of Liberation.**—The Convention of Tauroggen became the starting-point of Prussia's regeneration. As the news of the destruction of the *Grande Armée* spread, and the appearance of countless stragglers convinced the Prussian people of the reality of the disaster, the spirit generated by years of French domination burst out. For the moment the king and his ministers were placed in a position of the greatest anxiety, for they knew the resources of France and the boundless versatility of their arch-enemy far too well to imagine that the end of their sufferings was yet in sight. To disavow the acts and desires of the army and of the secret societies for defence with which all north Germany was honeycombed would be to imperil the very existence of the monarchy, whilst an attack on the wreck of the *Grande Armée* meant the certainty of a terrible retribution from the new armies now rapidly forming on the Rhine.

But the Russians and the soldiers were resolved to continue the campaign, and working in collusion they put pressure on the not unwilling representatives of the civil power to facilitate the supply

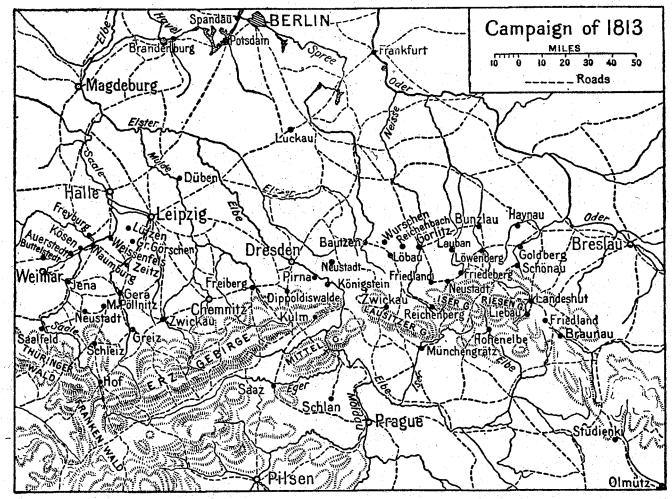



FIG. 8.—CAMPAIGN OF 1813

and equipment of such troops as were still in the field; they could not refuse food and shelter to their starving countrymen or their loyal allies, and thus by degrees the French garrisons scattered about the country either found themselves surrounded or were compelled to retire to avoid that fate. Thus it happened that the viceroy of Italy felt himself compelled to depart from the positive injunctions of the emperor to hold on at all costs to his advanced position at Posen, where about 14,000 men had gradually rallied around him, and to withdraw step by step to Magdeburg, where he met reinforcements and commanded the whole course of the lower Elbe.

**Napoleon's Preparations.**—Meanwhile the emperor in Paris had been organizing a fresh army for the reconquest of Prussia. Thanks to his having compelled his allies to fight his battles for him, he had not as yet drawn very heavily on the fighting resources of France, the actual percentage of men taken by the conscriptions during the years since 1806 being actually lower than that in force in continental armies of the early twentieth century. He had also created in 1811–12 a new National Guard, organized in "cohorts" to distinguish it from the regular army, and for home defence *only*, and these by a skilful appeal to their patriotism and judicious pressure applied through the prefects, became a useful reservoir of half-trained men for new battalions of the active army. Levies were also made with rigorous severity in the states of the Rhine Confederation, and even Italy was called on for fresh sacrifices. In this manner by the end of March upwards of 200,000 men were moving towards the Elbe,[1] and in the first fortnight of April they were duly concentrated in the angle formed by the Elbe and Saale, threatening on the one hand Berlin, on the other Dresden and the east.

The allies, aware of the gradual strengthening of their enemy's forces but themselves as yet unable to put more than 200,000 in the field, had left a small corps of observation opposite Madgeburg and along the Elbe to give timely notice of an advance towards Berlin; and with the bulk of their forces had taken up a position about Dresden, whence they had determined to march down the course of the Elbe and roll up the French from right to left. Both armies were very indifferently supplied with information, as both were without any reliable regular cavalry capable of piercing the screen of outposts with which each endeavoured to conceal his disposition, and Napoleon, operating in a most unfriendly country, suffered more in this respect than his adversaries.

[1]Napoleon always gave their number as 300,000, but this was never attained.

On April 25 Napoleon reached Erfurt and assumed the chief command. On this day his troops stood in the following positions: Eugène, with Lauriston's, Macdonald's and Regnier's corps, on the lower Saale; Ney in front of Weimar, holding the defile of Kösen; the Guard at Erfurt, Marmont at Gotha, Bertrand at Saalfeld, and Oudinot at Coburg, and during the next few days the whole were set in motion towards Merseburg and Leipzig, in the now stereotyped Napoleonic order, a strong advanced guard of all arms leading, the remainder—about two-thirds of the whole—following as *masse de manoeuvre,* this time, owing to the cover afforded by the Elbe on the left, to the right rear of the advanced guard.

Meanwhile the Russians and Prussians had concentrated all available men and were moving on an almost parallel line, but somewhat to the south of the direction taken by the French. On May 1 Napoleon and the advance guard entered Lützen. Wittgenstein, who now commanded the allies in place of Kutusov, hearing of his approach, had decided to attack the French advanced guard, which he took to be their whole force, on its right flank, and during the morning had drawn together the bulk of his forces on his right in the vicinity of Gross-Görschen and Kaya.

**Battle of Lützen.**—About 9 A.M. on May 2 he began an attack on the French advance guard in Lützen, whilst the remainder of his army was directed against Napoleon's right and rear. Just as the latter were moving off the heads of the French main body suddenly appeared, and at 11 A.M. Napoleon, then standing near the Gustavus Adolphus monument on the field of Lützen, heard the roar of a heavy cannonade to his right rear. He realized the situation in a moment, galloped to the new scene of action, and at once grouped his forces for decisive action—the gift in which he was supreme. Leaving the leading troops to repulse as best they might the furious attack of both Russians and Prussians, and caring little whether they lost ground, he rapidly organized for his own control a battle-reserve. At length when both sides were exhausted by their efforts he sent forward nearly a hundred guns which tore asunder by their case-shot fire the enemy's line and marched his reserve right through the gap. Had he possessed an adequate cavalry force the victory would have been decisive. As it was, the allies made good their retreat and the French were too exhausted for infantry pursuit.

Perhaps no battle better exemplifies the inherent strength of the emperor's strategy, and in none was his grasp of the battlefield more brilliantly displayed, for, as he fully recognized, "These Prussians have at last learnt something—they are no longer the wooden toys of Frederick the Great," and, on the other hand, the relative inferiority of his own men as compared with his veterans of Austerlitz called for far more individual effort than on any previous day. He was everywhere, encouraging and compelling his men—it is a legend in the French army that the persuasion even of the imperial boot was used upon some of his reluctant conscripts, and in the result his system was fully justified, as it triumphed even against a great tactical surprise.

**Bautzen.**—As soon as possible the army pressed on in pursuit, Ney being sent across the Elbe to turn the position of the allies at Dresden. This threat forced the latter to evacuate the town and retire over the Elbe, before blowing up the stone bridge across the river. Napoleon entered the town hard on their heels, but the broken bridge caused a delay of four days, there being no pontoon trains with the army. Ultimately on May 18 the march was renewed, but the allies had continued their retreat in leisurely fashion, picking up reinforcements by the way. Arrived at the line of the Spree, they took up and fortified a very formidable position about Bautzen (*q.v.*). Here, on the 20th, they were attacked and fixed by Napoleon; but the intended decisive coup by which Ney was to arrive on their right rear on the 21st missed its mark owing to Ney's want of initiative and rigid adherence to the letter of his orders. As a result the allies were able to break off the action at their own time and retire in such good order that the emperor failed to capture a single trophy as proof of his victory. The enemy's escape annoyed him greatly, the absence of captured guns and prisoners reminded him too much of his Russian experiences, and he redoubled his demands on his corps commanders for greater vigour in the pursuit. This led the latter to push on without due regard to tactical precautions, and Blücher took advantage of their carelessness when at Haynau (May 26), with some twenty squadrons of Landwehr cavalry, he surprised, rode over and almost destroyed Maison's division. The material loss inflicted on the French was not very great, but its effect in raising the *moral* of the raw Prussian cavalry and increasing their confidence in their old commander was enormous.

Still the allies continued their retreat and the French were unable to bring them to action. In view of the doubtful attitude of Austria, Napoleon became alarmed at the gradual lengthening of his lines of communication and opened negotiations. The enemy, having everything to gain and nothing to lose thereby, agreed finally to a six weeks' suspension of arms. This was perhaps the gravest military error of Napoleon's whole career, and his excuse for it, "want of adequate cavalry," was the strongest testimony as to the value of that arm.

As soon as a suspension of arms (to Aug. 15) had been agreed to, Napoleon hastened to withdraw his troops from the dangerous position they occupied with reference to the passes leading over the mountains from Bohemia, for he entertained no doubt now that Austria was also to be considered as an enemy. Finally he decided to group his corps round Görlitz and Bautzen whence they could either meet the enemy advancing from Breslau or fall on his flank over the mountains if he attempted to force his way into Saxony by the valley of the Elbe. This latter manoeuvre depended, however, on his maintenance of Dresden, and to this end he sent the I. Corps up the Elbe to Pirna and Königstein to cover the fortifications of Dresden itself. His instructions on this point deserve the closest study, for he foresaw the inevitable attraction which a complete entrenched camp would exercise even upon himself, and, therefore, limited his engineers to the construction of a strong bridge head on the right bank and a continuous enceinte, broken only by gaps for counter attack, around the town itself.

Then he turned his attention to the plan for the coming campaign. Seeing clearly that his want of an efficient cavalry precluded all ideas of a resolute offensive in his old style, he determined to limit himself to a defence of the line of the Elbe, a position of waiting from which he could make a spring, of not more than a few days' duration, at any target the enemy might present.

Reinforcements had been coming up without ceasing and at the beginning of August he calculated that he would have 300,000 men available about Bautzen and 100,000 along the Elbe from Hamburg via Magdeburg to Torgau. With the latter he determined to strike the first blow, by a concentric advance on Berlin (which he calculated he would reach on the 4th or 5th day), the movement being continued thence to extricate the French garrisons in Küstrin, Stettin and Danzig. The moral effect, he promised himself, would be prodigious, and there was neither room nor food for these 100,000 elsewhere. Towards the close of the armistice he learned the general situation of the allies. The crown prince of Sweden (Bernadotte), with his Swedes and various Prussian levies, 135,000 in all, lay in and around Berlin and Stettin; and knowing his former marshal well, Napoleon considered Oudinot a match for him. Blücher with about 95,000 Russians and Prussians was about Breslau, and Schwarzenberg, with nearly 180,000 Austrians and Russians, lay in Bohemia. In his central position at Bautzen he felt himself equal to all his enemy's combinations.

**Dresden.**—The advance towards Berlin began punctually with the expiration of the armistice, but with the main army he himself waited to see more clearly his adversaries' plans. At length becoming impatient he advanced a portion of his army towards Blücher, who fell back to draw him into a trap. Then the news reached him that Schwarzenberg was pressing down the valley of the Elbe, and, leaving Macdonald to observe Blücher, he hurried back to Bautzen to dispose his troops to cross the Bohemian mountains in the general direction of Königstein, a blow which would have had decisive results. But the news from Dresden, where the construction of the defences was still incomplete, was so alarming that at the last moment he changed his mind, and

sending Vandamme alone over the mountains, he hurried with his whole army to the threatened point. This march remains one of the most extraordinary in history, for the bulk of his forces moved, mainly in mass and across country, 90m. in 72 hours, entering Dresden on the morning of the 27th, only a few hours before the attack of the allies commenced. For the events which followed *see* DRESDEN (*battle*).

Dresden was the last great victory of the First Empire. By noon on Aug. 27 the Austrians and Russians were completely beaten and in full retreat, the French pressing hard behind them, but meanwhile Napoleon himself again succumbed to one of his unaccountable attacks of apparent intellectual paralysis. He seemed unaware of the vital importance of the moment, crouched shivering over a bivouac fire, and finally rode back to Dresden, leaving no specific orders for the further pursuit. The allies, however, continued to retreat, but unfortunately Vandamme, with his single corps and unsupported, issued out of the mountains on their flank, threw himself across their line of retreat near Kulm, and was completely overwhelmed by sheer weight of numbers (29th). In spite of this misfortune, Napoleon could claim a brilliant success for himself, but almost at the same moment news reached him that Oudinot at Grossbeeren near Berlin, and Macdonald on the Katzbach opposed to Blücher, had both been severely defeated.

**Napoleon's Movements.**—During the next two days the emperor examined his situation and, after discussing on paper the respective hypotheses of a spring at Prague or at Berlin, summed up in favour of the second. But his consideration of this project was interrupted by news which indicated that the consequences of Macdonald's defeat had been far more serious to the *moral* of that command than he had imagined. He immediately rode over to establish order, and his manner and violence were so improper that Caulaincourt had the greatest difficulty in concealing the scandal. Blücher, however, hearing of his arrival, at once retreated and the emperor followed, thus uncovering the passes over the Bohemian mountains, a fact of which Schwarzenberg was quick to take advantage. Learning of his approach, Napoleon again withdrew to Bautzen. Then hearing that the Austrians had counter-marched and were again moving towards Dresden, he hastened back there, concentrated as many men as could conveniently be handled, and advanced beyond Pirna and Königstein to meet him. But the Austrians had no intention of attacking him, for time was now working on their side and, leaving his men to starve in the exhausted district, the emperor again returned to Dresden, where for the rest of the month he remained in an extraordinary state of vacillation. On Oct. 4 he again drew up a review of the situation, in which he apparently contemplated giving up his communications with France and wintering in and around Dresden, though at the same time he was aware of the distress amongst his men for want of food.

**Campaign of Leipzig.**—In the meanwhile Blücher, Schwarzenberg and Bernadotte were working round his flanks. Ney, who had joined Oudinot after Grossbeeren, had been defeated at Dennewitz (Sept. 6), the victory, won by Prussian troops solely, giving the greatest encouragement to the enemy. Suddenly Napoleon's plans are again reviewed and completely changed. Calling up St. Cyr, whom he had already warned to remain at Dresden with his command, he decided to fall back towards Erfurt, and go into winter quarters between that place and Magdeburg, pointing out that Dresden was of no use to him as a base and that if he had a battle, he had much better have St. Cyr and his men with him than at Dresden. He then on Oct. 7 drew up a final plan, and this he immediately proceeded to put into execution, for he was now aware of the danger threatening his line of retreat from both Blücher and Schwarzenberg and the North Army; yet only a few hours afterwards the portion of the order relating to St. Cyr and Lobau was cancelled and the two were finally left behind at Dresden. From the 10th to the 13th Napoleon lay at Düben, again a prey to the most extraordinary irresolution, but on that day he thought he saw his opportunity. Blücher was reported near Wittenberg, and Schwarzenberg was moving slowly round to the south of Leipzig. The North Army under Bernadotte, unknown to Napoleon, lay on Blücher's left around Halle. The emperor decided to throw the bulk of his force on Blücher, and, having routed him, turn south on Schwarzenberg and sever his communications with Bohemia. His concentration was effected with his usual sureness and celerity, but whilst the French moved on Wittenberg, Blücher was marching to his right, indifferent to his communications as all Prussia lay behind him. This move on the 14th brought him into touch with Bernadotte, and now a single march forward of all three armies would have absolutely isolated Napoleon from France; but Bernadotte's nerve failed him, for on hearing of Napoleon's threat against Wittenberg he decided to retreat northward, and not all the persuasions of Blücher and Gneisenau could move him. Thus if the French movement momentarily ended in a blow in the air, it was indirectly the cause of their ultimate salvation.

**The "Battle of the Nations."**—On the 15th Napoleon concentrated his forces to the east of Leipzig, with only a weak detachment to the west, and in the evening the allies were prepared to attack him. Schwarzenberg had 180,000 men available at once and 60,000 on the following day; Blücher had about 60,000, but Bernadotte now could not arrive before the 18th.

Napoleon prepared to throw the bulk of his force upon Schwarzenberg and massed his troops south-east of the town, whilst Schwarzenberg marched concentrically against him down the valleys of the Elster and Pleisse, the mass of his troops on the right bank of the latter and a strong column under Giulay on the left working round to join Blücher on the north. The fighting which followed was most obstinate, but the Austrians failed to make any impression on the French positions, and indeed Giulay felt himself compelled to withdraw to his former position. On the other hand, Blücher carried the village of Möckern and came within a mile of the gates of the town. During the 17th there was only indecisive skirmishing, Schwarzenberg waiting for his reinforcements coming up by the Dresden road, Blücher for Bernadotte to come in on his left, and by some extraordinary oversight Giulay was brought closer in to the Austrian centre, thus opening for the French their line of retreat towards Erfurt, and no information of this movement appears to have been conveyed to Blücher. The emperor when he became aware of the movement, sent the IV. corps to Lindenau to keep the road open. On the 18th the fighting was resumed and by about noon Bernadotte came up and closed the gap to the N.E. of the town between Blücher and the Austrians. At 2 P.M. the Saxons, who had remained faithful to Napoleon longer than his other German allies, went over to the enemy. All hope of saving the battle had now to be given up, but the French covered their retreat obstinately and by daybreak next morning one-half of the army was already filing out along the road to Erfurt which had so fortunately been left for them.

It took Blücher time to extricate his troops from the confusion into which the battle had thrown them, and the garrison of Leipzig and the troops left on the right bank of the Elster still resisted obstinately—hence no direct pursuit could be initiated, and the French, still upwards of 100,000 strong, marching rapidly, soon gained distance enough to be reformed. Blücher followed by parallel and inferior roads on their northern flank, but Schwarzenberg knowing that the Bavarians also had forsaken the emperor and were marching under Wrede, 50,000 strong, to intercept his retreat, followed in a most leisurely fashion. Blücher did not succeed in overtaking the French, but the latter, near Hanau, found their way barred by Wrede with 50,000 men and over 100 guns in a strong position. To this fresh emergency Napoleon and his army responded in most brilliant fashion. As at Krasnoi in 1812, they went straight for their enemy and after one of the most brilliant series of artillery movements in history, directed by General Drouot, they marched right over their enemy, practically destroying his whole force. Henceforward their march was unmolested, and they reached Mainz on Nov. 5.

### THE CAMPAIGN IN FRANCE IN 1814

When the last of the French troops had crossed to the western bank of the Rhine, divided counsels made their appearance at the headquarters of the allies. Everyone was weary of the war, and

many felt that it would be unwise to push Napoleon and the French nation to extremes. Hence a prolonged halt arose, utilized by the troops in renewing their equipment and so forth, but ultimately the Young German party, led by Blücher and the principal fighting men of the army, triumphed, and on Jan. 1, 1814, the Silesian army (50,000) began its passage of the Rhine at Kaub. They were to be supported by Schwarzenberg with 200,000 men,

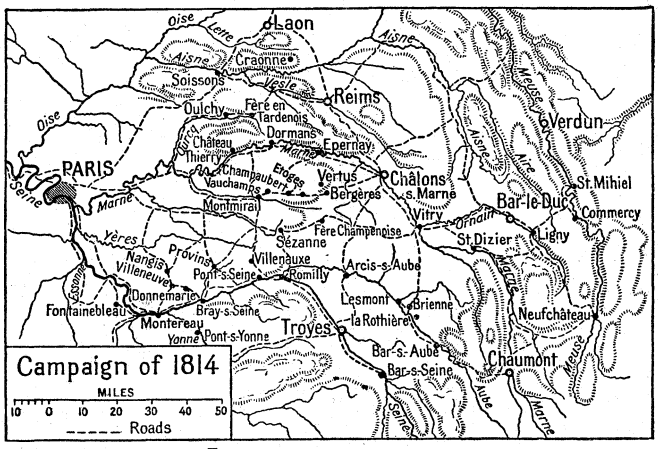



FIG. 9.—CAMPAIGN OF 1814

who was to advance by Basel and Neu Breisach to the south, and Bernadotte with the Northern army, about 120,000, was to move in support on the right flank through the Netherlands and Laon; this force was not yet ready and did not, in fact, reach the latter place till March. To meet these forces the emperor could not collect 200,000 men in all, of whom upwards of 100,000 were held by Wellington on the Spanish frontier, and 20,000 more were required to watch the debouches from the Alps. Hence less than 80,000 remained available for the east and north-eastern frontier. If, however, he was weak in numbers, he was now again operating in a friendly country, able to find food almost everywhere and practically indifferent as to his communications.

On Jan. 25 Blücher entered Nancy, and, moving rapidly up the valley of the Moselle, was in communication with the Austrian advanced guard near La Rothière on the afternoon of the 28th. Here his headquarters were surprised and he himself nearly captured by a sudden rush of French troops, and he learnt at the same time that the emperor in person was at hand. He accordingly fell back a few miles next morning to a strong position covering the exits from the Bar-sur-Aube defile. There he was joined by the Austrian advance guard, and together they decided to accept battle—indeed they had no alternative, as the roads in rear were so choked with traffic that retreat was out of the question. About noon Feb. 2 Napoleon attacked them, but the weather was terrible, and the ground so heavy that his favourite artillery, the mainstay of his whole system of warfare, was useless and in the drifts of snow which at intervals swept across the field, the columns lost their direction and many were severely handled by the Cossacks. At nightfall the fighting ceased and the emperor retired to Lesmont, and thence to Troyes, Marmont being left to observe the enemy.

**Montmirail.**—Owing to the state of the roads, more perhaps to the extraordinary lethargy which always characterized Schwarzenberg's headquarters, no pursuit was attempted. But on Feb. 4 Blücher, chafing at this inaction, obtained the permission of his own sovereign to transfer his line of operations to the valley of the Marne; Pahlen's corps of Cossacks were assigned to him to cover his left and maintain communication with the Austrians. Believing himself secure behind this screen, he advanced from Vitry along the roads leading down the valley of the Marne, with his columns widely separated for convenience of subsistence and shelter—the latter being almost essential in the terrible weather prevailing. Blücher himself on the night of the 7th was at Sézanne, on the exposed flank so as to be nearer to his sources of intelligence, and the rest of his army were distributed in four small corps at or near Épernay, Montmirail and Étoges; reinforcements also were on their way to join him and were then about Vitry.

In the night his headquarters were again surprised, and he learnt that Napoleon himself with his main body was in full march to fall on his scattered detachments. At the same time he heard that Pahlen's Cossacks had been withdrawn forty-eight hours previously, thus completely exposing his flank. He himself retreated towards Étoges endeavouring to rally his scattered detachments, but Napoleon was too quick for him and in three successive days he defeated Sacken at Montmirail, Yorck at Champaubert and Blücher and his main body at Étoges, pursuing the latter towards Vertus. These disasters compelled the retreat of the whole Silesian army, and Napoleon, leaving Mortier and Marmont to deal with them, hurried back to Troyes with his main body to strike the flank of Schwarzenberg's army, which had meanwhile begun its leisurely advance, and again at Mormant on Feb. 17, Montereau the 18th and Méry the 21st, he inflicted such heavy punishment upon his adversaries that they fell back precipitately to Bar-sur-Aube.

In the meantime Blücher had rallied his scattered forces and was driving Marmont and Mortier before him. Napoleon, as soon as he had disembarrassed himself of Schwarzenberg, countermarched his main body and moving again by Sézanne, fell upon Blücher's left and drove him back upon Soissons. This place had been held by a French garrison, but had capitulated only twenty-four hours beforehand, a fact of which Napoleon was naturally unaware. The Silesian army was thus able to escape, and marching northwards combined with Bernadotte at Laon—this reinforcement bringing the forces at Blücher's disposal up to over 100,000 men. On March 7 Napoleon fell upon the advance guard of this force at Craonne and drove it back upon Laon, where a battle took place on the 9th. Napoleon was here defeated, and with only 30,000 men at his back he was compelled to renounce all ideas of a further offensive, and he retired to rest his troops at Reims. Here he remained unmolested for a few days, for Blücher was struck down by sickness, and in his absence nothing was done. On March 14, however, Schwarzenberg, becoming aware of Napoleon's withdrawal to Reims, again began his advance and had reached Arcis-sur-Aube when the news of Napoleon's approach again induced him to retreat to Brienne.

**The Allies March on Paris.**—Thus after six weeks' fighting the allies were hardly more advanced than at the beginning. Now, however, they began to realize the weakness of their opponent, and, still more, the weakening of his political stability. Napoleon, coincidently, aware of the limitations of a strategy of continual parrying, was seized with the idea of a decisive coup against Schwarzenberg's communications. He determined to move eastward to St. Dizier, rally what garrisons he could find, and raise the whole country against the invaders, and had actually started on the execution of this plan when his instructions fell into the enemy's hands and his projects were exposed. The Czar Alexander called a council of war at which General Toll in opposition to his seniors, urged that instead of following Napoleon the allies should disregard the threat to their rear and advance by forced marches on Paris, whose people were reported to be "tired of the war and of Napoleon." His arguments for this moral objective won over the Czar and at his instigation the allies marched straight for the capital. Marmont and Mortier with what troops they could rally took up a position on Montmartre heights to oppose them, but seeing further resistance to be hopeless they gave way on March 31, just as Napoleon, with the wreck of the Guards and a mere handful of other detachments, was hurrying across the rear of the Austrians towards Fontainebleau to join them.

This was the end of the First Empire. The story of the WATERLOO CAMPAIGN is told under its own heading.

BIBLIOGRAPHY.—Among the principal modern works on Napoleon's campaigns 1805–14 are the following: Yorck von Wartenberg, *Napoleon als Feldherr* (1866, English and French translations); H. Camon, *La Guerre napoléonienne* (Paris, 1903); H. Bonnal, *Esprit de la guerre moderne* (a series of works, of which those dealing with 1805–1812 are separately mentioned below). For 1805 *see* Alombert and Colin (French Gen. Staff), *Campagne de 1805 en Allemagne* (Paris, 1898–1910); H. Bonnal, *De Rosbach à Ulm* (Paris, 1903); G. A. Furse, *Ulm, Trafalgar and Austerlitz* (London, 1905). For 1806–1807, Pr. Kraft zu Hohenlohe-Ingelfingen, *Letters on Strategy* (Eng. trans., vol.

i.); Freiherr v. d. Goltz, *Von Rossbach bis Jena und Auerstädt* (Berlin, 1906) and *Von Jena bis Preussisch-Eylau* (Berlin, 1908); H. Bonnal, *La Manoeuvre d'Iéna* (Paris, 1904); *Memoirs of Bennigsen* (trans. by E. Cazalas, French Gen. Staff, 1909); F. N. Maude, *The Jena Campaign* (London, 1909). For 1809, H. Bonnal, *La Manoeuvre de Landshut* (Paris, 1905); Saski, *Campagne de 1809* (Paris, 1899–1902); Ritter v. Angeli, *Erzherzog Karl* (Vienna, 1895–1897); Lieut. Field Marshal von Woinovich (ed.), *Das Kriegsjahr 1809;* Buat, *De Ratisbonne à Znadim* (Paris, 1910). For 1812, G. Fabry (French Gen. Staff), *Campagne de 1812* (Paris, 1904); *La Guerre nationale de 1812* (French translation from the Russian general staff work, Paris, 1904); H. Bonnal, *La Manoeuvre de Vilna* (Paris, 1905); Freiherr v. d. Osten-Sacken, *Feldzug 1812* (Berlin, 1899). For 1813, F. N. Maude, *The Leipzig Campaign* (London, 1908); Lanrezac, *La Manoeuvre de Lützen;* B. v. Quistorp, *Gesch. der Nordarmee 1813* (1894); v. Holleben, *Gesch. des Frühjahrsfeldzug 1813* (Berlin, 1904); Friedrich, *Der Herbstfeldzug 1813* (Berlin, 1903–1906). For 1814, German Gen. Staff, *Kriegsgesch. Einzelschriften,* No. 13; v. Janson, *Der Feldzug 1814 in Frankreich* (Berlin, 1903–1905). *See* also works mentioned under FRENCH REVOLUTIONARY WARS and under biographical headings, as well as the general histories of the time. (F. N. M.)

## NAVAL OPERATIONS

The Peace of Amiens in 1802 was productive of but a brief truce. Napoleon's ambitions and actions were such as quickly to re-awaken European suspicions, and his refusal to evacuate the Netherlands was alone enough to arouse England and cause her to declare war on him as early as May 18, 1803. From then onwards, for over two years, the war took the form of a gigantic scheme, on the part of Napoleon, for an invasion of England—a scheme which led to the movements known as the Trafalgar Campaign which, in its turn, led to the Battle of Trafalgar. Boulogne was chosen as the base for the French operations; along the coast on either side an army of some 150,000 men was encamped, and specially-constructed flat-bottomed boats for their transport were brought from all parts of France. The army was given constant practice in embarkation and disembarkation, and, in the meantime, it proved impossible for the British ships to do much damage to this armament owing to the shallow water on the coastline. In order, however, to carry through his scheme successfully, Napoleon had got to obtain at least a temporary control of the Channel, and this meant either defeating the British fleet on equal terms in action, or, by some means, causing the various parts of it to scatter on some wild-goose chase, so giving himself the chance to bring every available ship to the Channel and overwhelm the British fleet there by sheer weight of numbers. French fleets were stationed at Brest, Rochefort, L'Orient and Toulon; all of them were watched by British blockading squadrons. From the end of 1804, when Spain entered the war on his side, Napoleon was able to add to this total Spanish squadrons at Corunna, Ferrol, Cadiz and Cartagena, all of which the British blockaded. The total number of ships at Napoleon's command was about 60, the English had an approximately equal number employed in blockading them. His plan, then, took the form of attempting to elude these blockading squadrons and make them scatter to various parts of the world in search of his escaped squadrons which would, after concentrating at a given rendez-vous, return to the Channel to crush Cornwallis and the English Channel Fleet, if indeed that had not scattered too, after the presumed escape of the Brest Fleet which it was blockading. In either case Napoleon might hope to achieve his object—control of the Channel for long enough to enable him to take his troops across, while the British squadrons returned from the various parts of the world to which he seemed to think they might sail. The scheme was an exceedingly weak one, and postulated a gross ignorance of naval strategy on the part of that country that had been its greatest exponent. The British Admiralty upset it by a single order. The various blockading squadrons, if they were eluded by the squadrons they were blockading, were to fall back on Cornwallis. Thus if all the French squadrons united at the appointed rendez-vous (which was Martinique) and sailed for the Channel, they would merely find Cornwallis with an equally concentrated fleet, and the extent of the British concentration would depend on, and be equal to, that of the French.

The first move occurred in January 1805 when the Rochefort squadron of five ships escaped and sailed for the West Indies, but it proved an isolated effort. On March 30, however, Admiral Villeneuve used a gale to elude Nelson who was watching him off Toulon, and got clear away with eleven ships which he increased to eighteen by picking up the Cadiz Squadron, reaching Martinique on May 14. He was joined on June 1, by two ships from Rochefort, but no others put in an appearance. He should have waited until nearly the end of the month before sailing back to Europe to try and pick up those squadrons which failed to join him, preliminary to making for Brest, whence Admiral Gantheaume was trying unsuccessfully to emerge from time to time. Only a week later, however, information reached Villeneuve that Nelson was already in the West Indies in search of him, and he decided to make for European waters immediately. Nelson, after having been evaded off Toulon should, according to his orders, have fallen back on Cornwallis, but he preferred, not for the first time, to follow his own course. It has often been said that Villeneuve induced Nelson to follow him and that, in doing so, the latter was playing into Napoleon's hands. The foolishness of this can be seen in the fact that the mere information that Nelson was in the neighbourhood caused Villeneuve to make for home a considerable time before he was due to depart, and any hope of a West Indian concentration was thus lost. When Napoleon hoped that the English blockading squadrons would scatter, he meant to places where the French had not gone. Foiled by false information of his hope of catching Villeneuve, Nelson sent a fast brig home to warn the Admiralty of the former's return, and himself sailed for Gibraltar. The Admiralty despatched Sir Robert Calder to intercept Villeneuve; this he did, off Finisterre, and, in a not very satisfactory action, fought in a fog, deprived him of two Spanish battleships, but let him make Ferrol. Here the French Admiral received reinforcements, and his next move, according to his programme, should have been to make for the Channel in an attempt to unite with the Brest fleet. But he conceived, rightly, that Napoleon's scheme had already been foiled and that his task would be impossible; thus when he left Ferrol he made, not for the Channel, but for Cadiz. Here he was blockaded by Nelson and Collingwood. The Trafalgar Campaign, as a campaign, was over, and the invasion scheme was a failure. Napoleon broke up his camp and marched his troops against Austria. A natural corollary of the Trafalgar Campaign was the battle of Trafalgar, but it must be realised that it was the former that saved England from invasion. In the autumn Napoleon needed a fleet in the Mediterranean and ordered Villeneuve to proceed there. The latter, after a protest, attempted to comply, and was beaten, as all the world knows, on Oct. 21, 1805 with a loss of twenty ships.

The victory of Trafalgar, while it did not end the war, conferred upon England the complete command of the sea. Thereafter naval activity was most pronounced, and the British Navy was employed in numerous undertakings in all parts of the world; but it becomes impossible to trace out any broad policy. It only remains to point out some of the more prominent incidents. Napoleon's operations with Russia produced some naval activity. England attempted to assist that country when in 1807 Napoleon was preparing a final blow against her, by forcing the Dardanelles —Turkey being then allied with France. Admiral Duckworth was selected for the operation, and he actually silenced the batteries in the Straits and appeared off Constantinople. There he was helpless for lack of bombships, and had to retire under a damaging fire. Later in the same year the third coalition against France came to a final end when Napoleon and the Tsar of Russia signed the Treaty of Tilsit, by which they agreed to cease war and both plot for England's overthrow. One scheme they hatched was to seize all the neutral fleets in Europe and employ them against their common enemy. The largest neutral navy was Denmark's, and Canning, having providentially heard of this peculiar arrangement, anticipated a Franco-Russian breach of Danish neutrality by sending Admiral Gambier to "borrow" this fleet for the duration of the war. Gambier bombarded Copenhagen and returned with 70 out of 72 of the Danes' fighting ships.

Napoleon's Berlin and Milan Decrees, by which he hoped to break England's merchant marine, and England's reply with the Orders in Council, also gave the British navy opportunities to

show its command of the sea. Napoleon forbade continental countries to import British goods either in British or foreign ships. England in turn seized neutral ships that called at a continental port without also calling at a British port. The struggle forced England to open new markets in the East and South America, but several countries rebelled against Napoleon's system and England was always ready to help. The revolt of Portugal began in 1808 and produced the Peninsular War which ought to be thought of as partly a naval operation, for the fleet took off the army after Corunna, was always behind Wellington's lines at Torres Vedras, and finally followed, as nearly as possible, his victorious advance. The revolt of Austria in 1809 produced the combined expedition against Antwerp, commanded by Admiral Strachan and Lord Chatham, which hoped to find some sympathy among the Netherlanders for their Austrian ex-rulers. Walcheren and Flushing were captured, but the expedition had to retreat after the collapse of Austria. Finally, England's resistance to Napoleon's decrees involved her in 1812 in war with America who considered herself illtreated in the matter of the seizure of ships. The British lost many single-ship actions with the Americans—their only success being that of the "Shannon" over the "Chesapeake," but America let her very natural jubilation rather blind her to the fact that her coasts were blockaded without serious challenge.

This is but a small selection from the numerous incidents that make up the naval side of the Napoleonic War after Trafalgar. The main point is that British sea supremacy was unchallenged after that battle, and the British Navy remained Napoleon's worst enemy to the end, for it was the British "Bellerophon" which intercepted him when, after Waterloo, he sought to escape to America to carve out an empire in a new world.

BIBLIOGRAPHY.—A. T. Mahan, *Influence of Sea Power on the French Revolution and the Empire*, 1892. G. A. R. Callender, *Sea Kings of Britain*, 1917. W. James, *Naval History of Great Britain*, edition of 1886, and T. A. Brassey's *Index* to the same, 1895. Colonel Cornwallis-West, *Life of Cornwallis*, 1927. Chevalier, *Histoire de la marine française sous le Consulat et l'Empire*, 1886. Desbrière, *Projets et tentatives de débarquement aux Iles Britanniques*, 1901, and *La Campagne Maritime de 1805*, 1907. *The Blockade of Brest*, edited by John Leyland, 1898–1901. *The Barham Papers*, vol. iii., edited by Sir J. Laughton, 1910. *Letters of Lord St. Vincent*, edited by D. B. Smith, 1921–28. *The Keith Papers*, edited by W. G. Perrin, 1927. The last four all edited for the Navy Records Society.

(G. A. R. C.; J. G. B.)

**NAPOLEONITE,** also called corsite, because the stone is found in Corsica, is a variety of diorite characterized by orbicular structure. The grey matrix of the rock has the normal appearance of a diorite, but contains many rounded lumps 1 or 2in. in diam., which show concentric zones of light and dark colours. In these spheroids also a distinct and well-marked radial arrangement of the crystals is apparent. The centre of the spheroid is usually white or pale grey and consists mainly of felspar; the same mineral makes the pale zones while the dark ones are rich in hornblende and pyroxene. The felspar is a basic variety of plagioclase (anorthite or bytownite). Though mostly rounded, the spheroids may be elliptical or subangular; sometimes they are in contact with one another but are usually separated by small areas of massive diorite. When cut and polished the rock makes a beautiful ornamental stone.

Spheroidal structure is found in other diorites and in quite a number of granites in Sweden, Russia, America, Sardinia, Ireland, etc. It is by no means common, however, and usually occurs in only a small part of a granitic or dioritic mass, being sometimes restricted to an area of a few square yards. In most cases it is found near the centre of the outcrop; it arises evidently from intermittent and repeated crystallization of the rock-forming minerals in successive stages, a process which would be favoured by complete rest, allowing of supersaturation of the magma by one of the components. Rapid crystallization would follow, producing deposits on any suitable nuclei, and the crystals then formed might have a radial disposition on the surfaces on which they grew. The magma might then be greatly impoverished in this particular substance, and another deposit of a different kind would follow, producing a zone of different colour. The nucleus for the spheroidal growth is sometimes an early porphyritic crystal, sometimes an enclosure of gneiss, etc., and often does not differ essentially in composition from the surrounding rock. When spheroids are in contact their inner zones may be distinct, while the outer are common to both individuals, having the outlines of a figure eight. This proves that growth was centrifugal, not centripetal. (J. S. F.)

**NAPRAPATHY** is a system of manipulative drugless therapeutics founded in 1907 by Oakley Smith, based on a theory that connective tissue which has become shrunken as the result of injury is the basic cause of disease. A shrunken strand of connective tissue is called a "ligatight" and may occur in the spine, thorax, pelvis, or elsewhere. It is claimed that such tissue can be corrected by naprapathic manipulation which aims at stretching the shrunken strands. Study of a set of charts showing types of "ligatights" and manipulations to correct them are held to be an important part of the practitioner's training.

**NAPRAVNIK, EDWARD** (1839–1915), Czech conductor and composer, was born at Beisht in Bohemia on Aug. 26, 1839. In 1861 he went to Petersburg (Leningrad) as conductor to Prince Youssipov. Through the influence of Liadov he obtained a post at the Marinsky theatre and in 1869 succeeded him as first conductor there. He died Nov. 10, 1915. Napravnik wrote several operas, including *Francesca di Rimini*, op. 71; four symphonies and orchestral, choral and piano pieces.

**NAQUET, ALFRED JOSEPH** (1834–1916), French chemist and politician, was born at Carpentras (Vaucluse) on Oct. 6, 1834. In 1863 he was made professor of medicine in Paris, and of chemistry in Palermo. In 1867 he was imprisoned for 15 months and lost his professorships for his share in a secret society, and in 1869 took refuge in Spain on the prosecution of his book, *Religion, propriété, famille*. He became secretary of the commission of national defence, sitting on the extreme Left in the National Assembly. By his efforts in the Senate, where he sat from 1883, in 1886 divorce became legal after three years of definite separation, on the demand of one of the parties concerned. In 1890 he resigned from the Senate and took his seat with the Boulangist deputies in the Chamber of Deputies. He wrote *Principes de chimie fondés sur les théories modernes* (1865); *Socialisme collectiviste et socialisme libéral; Loi du divorce* (1903).

**NARA,** an important water channel in Sind, India, probably representing a former bed of the Indus, though now traversing the desert far east of the river. A perennial stream 262 m. long, with 631 m. of canals, it irrigates an area of over ¼ million acres.

**NARA,** a town of Japan, in the province of Yamato, 25½ mi. from Osaka by rail. Pop. (1940) 57,273. It lies on the slope of a range of picturesque hills, beautifully wooded with cryptomerias and evergreen oaks. Nara remained the metropolis during seven consecutive reigns (709 to 784), and its 75 years of favoured existence sufficed for the building and furnishing of several imposing shrines and temples, for the laying out of a noble park and for the casting of a colossal image of Buddha. In Nara and its environs there have been preserved important and beautiful remains of architecture dating back to the 7th and 8th centuries, such as parts of the Buddhist monasteries called Hōryūji, Yakushiji, Kōfukuji, and Tōdaiji, together with remarkable examples of sculpture of similar age, notable among which are such celebrated Buddhist images as the Kudara Kwannon, the Chūgūji Kwannon, bronze Shaka trinity of A.D. 623 and many other distinguished works of art. Many articles and ornaments used in the Nara palaces have been preserved for nearly 1,200 years in a storehouse, the Shōsō-in. They give a picture of the court life of those days and show evidence of cultural relations not only with China but with western Asia. The Shinto shrine of Kasuga, doubtless many times rebuilt, still preserves in its shape and decoration features of the primitive style of Japanese architecture. Nara has a fine park, and efforts are made to preserve the ancient characteristics of the town.

**NARBADA,** a river of India. It is traditionally regarded as the boundary between Hindustan proper and the Deccan. It rises on the summit of Amarkantak hill in Rewa state, and for the first 200 mi. of its course winds among the Mandla hills, which

form the head of the Satpura range; then at Jubbulpore, passing through the "Marble Rocks," it enters its proper valley between the Vindhyan and Satpura ranges, and pursues a direct westerly course to the Gulf of Cambay. Its total course through the Central Provinces and Gujarat amounts to about 800 m., and it falls into the sea in the Bombay district of Broach. It receives the drainage of the northern slopes of the Satpuras, but not that of the Vindhyan tableland, the streams from which flow into the Ganges and Jumna. After leaving the Central Provinces, the river widens out in the fertile district of Broach, with an average breadth of ½ m. to 1 m. Below Broach city it forms an estuary which is 13 m. broad where it enters the Gulf of Cambay. The Narbada is nowhere utilized for irrigation, and navigation is confined to the lower section. In the rainy season boats of considerable size sail about 60 m. above Broach city. In sanctity the Narbada ranks only second to the Ganges among the rivers of India, and along its whole course are special places of pilgrimage. The most meritorious act that a pilgrim can perform is to walk from the sea to the source of the river and back along the opposite bank.

The Narbada has given its name to a division of the Central Provinces, comprising the five districts of Narsinghpur, Hoshangabad, Nimar, Betul and Chindwara. Area, 18,534 sq.m.; pop. (1921) 2,013,021.

**NARBONNE,** a city of France, capital of an arrondissement in the department of Aude, in a vine-growing plain 5 mi. from the Mediterranean, 37 mi. E. of Carcassonne. Pop. (1936) 26,519. Narbonne was the capital of the Volcae Tectosages. There the Romans in 118 B.C. founded their first colony in Gaul, named *Narbo Martius;* they built great works to protect the city from inundation and to improve its port, situated on a lake now filled up. The capital of Gallia Narbonensis, the seat of a proconsul and a station for the Roman fleet, Narbo Martius became the rival of Massilia. But the division of Gallia Narbonensis into two provinces lessened its importance. Alans, Suevi, Vandals, each held the city, and at last, in 413, it was occupied by the Visigoths, whose capital it afterwards became. In 719, after a siege of two years, it was captured and extended by the Saracens. Charles Martel, after the battle of Poitiers, and Pippin the Short, in 752, were both repulsed from its walls; but on a new attempt, after an investment of seven years, the Franks again forced their way into Narbonne. Charlemagne made the city the capital of the duchy of Gothia, and divided it into three lordships—one for the bishop, another for a Frankish lord and the third for the Jews. In the 13th century the archbishopric was seized by the pope's legate, Arnaud Amaury, who took the title of viscount of Narbonne. Simon de Montfort, however, deprived him of this dignity, receiving from Philip Augustus the duchy of Narbonne along with the county of Toulouse. By his expulsion of the Jews Philip the Fair hastened the decay of the city; and about the same period the Aude, which had formerly been diverted by the Romans, ceased to flow towards Narbonne and the harbour was silted up. United to the French crown in 1507, Narbonne was enclosed by a new line of walls under Francis I but had the last portions of its ramparts demolished in 1870. The archbishopric was founded about the middle of the 3rd century, its first holder being Sergius Paulus; it was suppressed in 1790. The Robine canal, a branch of the Canal du Midi, divides Narbonne into the *bourg* and the *cité*. The former 13th century cathedral (St. Just), consists only of a choir 130 ft. high and transept. The towers (194 ft. high) at each end of the transept date from 1480. The apse of the cathedral was formerly joined to the fortifications of the archiepiscopal palace, and the two buildings are still connected by a mutilated cloister of the 14th and 15th centuries. Part of the palace now serves as *hôtel de ville,* and the palace garden contains many fragments of Roman work; the Musée Lapidaire in the Lamourguier buildings has similar Roman remains. The church of St. Paul, though partly Romanesque, is for the south of France a rare example of a building of the early 13th century in the Gothic style of the north. It possesses some ancient Christian sarcophagi and fine Renaissance wood carving. Narbonne has a subprefecture, tribunals of first instance and of commerce, a board of trade arbitrators and a chamber of commerce. It has a good trade in wine and spirituous liquors, salt, tartar, almonds and leather. The industries include cooperage, sulphur-refining, brandy-distilling and the manufacture of bricks and tiles.

**NARBOROUGH, SIR JOHN** (d. 1688), English naval commander, was descended from an old Norfolk family. He received his commission in 1664, and in 1666 was promoted lieutenant for gallantry in the action with the Dutch fleet off the Downs in June of that year. After the peace he was chosen to conduct a voyage of exploration in the South Seas. He set sail from Deptford on Nov. 26, 1669, and entered the Straits of Magellan in October 1670 but returned home in June 1671 without accomplishing his original purpose. A narrative of the expedition was published in 1694 under the title *An Account of several late Voyages and Discoveries to the South and North.* During the second Dutch War Narborough was second captain of the lord high-admiral's ship the "Prince," and distinguished himself at Southwold Bay in May 1672. In 1675 he was sent to suppress the Tripoline piracies, and by the bold expedient of despatching gun-boats into the harbour of Tripoli at midnight and burning the ships he induced the bey to agree to a treaty. Shortly after his return he undertook a similar expedition against the Algerines. In 1680 he was appointed commissioner of the navy, an office he held till his death in 1688.

*See* J. Charnock, *Biographia Navalis,* vol. i. (6 vols., 1794–98).

**NARCEINE,** one of the alkaloids (*q.v.*) of opium. It belongs to the meconylisoquinoline group and is closely related to narcotine (*q.v.*), being formed, for example, by the action of caustic soda on narcotine methochloride.

$$C_{22}H_{23}O_7N{\cdot}CH_3Cl + NaHO = C_{23}H_{27}O_8N + NaCl$$

*Narcotinemethochloride* *Narceine.*

**NARCISSUS,** in Greek mythology, son of the river god Cephissus and the nymph Leiriope, distinguished for his beauty. The seer Teiresias told his mother that he would have a long life, provided he never looked upon his own features. His rejection of the love of the nymph Echo (*q.v.*), or of his lover Ameinias, drew upon him the vengeance of the gods. Having fallen in love with his own reflection in the waters of a spring, he pined away (or killed himself) and the flower that bears his name sprang up on the spot where he died. According to Pausanias, Narcissus, to console himself for the death of a favourite twin sister, his exact counterpart, sat gazing into the spring to recall her features by his own.

It is a very plausible suggestion of Frazer (*Golden Bough,* iii. p. 94) that this story is to be connected with the widespread belief that it is unlucky, or even fatal, to see one's own reflection. This superstition existed in Greece, *see* Iamblichus, *Protrept.,* 21; Boehm, *de Symbolis Pythagoreis,* p. 51 (1905); Artemidorus, *Oneirocr.* ii., 7 (p. 91, 1, Hercher).

Hence is derived the term *narcissism,* used by psychologists, especially Freudians, for a morbid condition in which the subject is intensely interested in his own body.

BIBLIOGRAPHY.—*See* Ovid, *Metam.* iii. 341–510; Pausanias ix. 31, 7; Conon, *Narrationes,* 24; F. Wieseler, *Narkissos* (1856); Greve in Roscher's *Lexikon der Mythologie.*

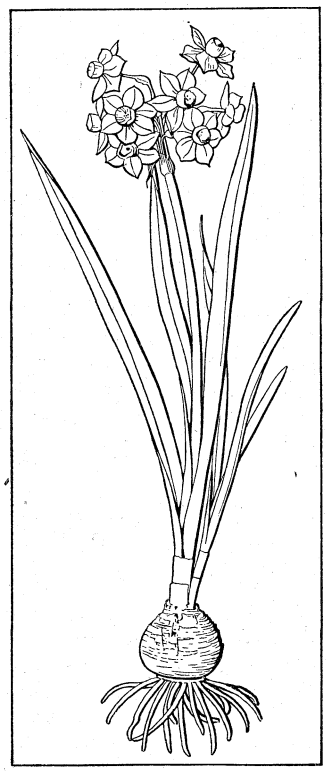
**NARCISSUS** (d. A.D. 54) was a freedman of Claudius, and his secretary *ab epistulis.* Narcissus and Messallina between them exercised an unbounded influence over the emperor, and arranged the execution or exile of their opponents almost at pleasure. Narcissus was sent to Britain to subdue the mutiny of the soldiers of A. Plautius. He was not well received, but the mutiny subsided. Narcissus was almost solely responsible for the ultimate downfall of Messallina in the Silius affair. It was he who made Claudius alarmed for his own safety, who succeeded in hardening him against Messallina's appeals, and who finally gave the order for her execution when Claudius hesitated. For this he received the insignia of praetor. Eventually he made a false move over Claudius' second marriage, for which he supported Aetia Petina, and further antagonized Agrippina by backing the claims of Britannicus to the throne. As a result he was put to death on Nero's accession in A.D. 54. Narcissus' importance is an early example of the power of the freedmen-secretaries of the emperor's household, and represented the first step towards the transforma-

tion of the emperor's personal staff into an imperial civil service. *See* Sac. *Ann.* xi., xii., xiii., 1.; Dio Cass. ix.; Suet. *Claudius.*

**NARCISSUS,** a genus of bulbous plants belonging to the family Amaryllidaceae, natives of central Europe, and the Mediterranean region; one species *N. Tazetta,* extends through Asia to Japan. From some of these, by cultivation and hybridization, have arisen the very numerous modern varieties. The plants have long narrow leaves springing from the bulb and a central scape bearing one or more generally large, white or yellow, drooping or inclined flowers. The flowers are regular, with a perianth springing from above the ovary, tubular below, with spreading segments and a central corona; the six stamens are inserted within the tube. The most interesting feature botanically is the "corona" or "cup," which springs from the base of the flower-segments and this gives the special character to the flower. There are five well-marked sections:

(1) The hoop-petticoat narcissi are not more than from 4 to 12 in. in height and have grassy foliage and yellow or white flowers. These have the corona in the centre of the flower very large in proportion to the other parts, and much expanded, like the old hooped petticoats. They are all regarded as varieties or forms of the common hoop-petticoat, *N. Bulbocodium,* which has comparatively large bright yellow flowers.

(2) A second group is that of the pseudo-narcissi, of which the daffodil, *N. pseudo-narcissus,* is the type. The daffodil is common in woods and thickets in most parts of the north of Europe. Its leaves are about 1 ft. in length and 1 in. in breadth, and have a blunt keel and flat edges. The stem is about 18 in. long and the spathe single-flowered. The flowers are large, yellow, scented and a little drooping, with a corolla deeply cleft into six lobes and a bell-shaped corona which is crisped at the margin; they appear in March or April. In this species the corona is also very large and prominent.



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY)

NARCISSUS (NARCISSUS TAZETTA)

(3) Another group, with coronas of medium size, includes the fine and numerous varieties of *N. incomparabilis,* one of which, with large, double flowers, is known as butter-and-eggs; *N. odorus,* known as the campernelle jonquil, has two to four uniform bright yellow flowers and is considered a hybrid between *N. Jonquilla* and *N. pseudo-narcissus* although it is found wild in France and Spain.

(4) The polyanthus or bunch narcissi form another well-marked group, whose peculiarity of producing many flowers on the stem is indicated by the name. In these the corona is small and shallow as compared with the perianth. *N. Tazetta* is the type of this group. They are general favourites among spring flowers. The "Chinese sacred lily" or joss flower is a variety of *N. Tazetta.* The jonquil, *N. Jonquilla,* with yellow flowers, a native of south Europe and Algeria, is also grown in pots for early flowering, but does well outside in a warm border.

(5) There remains another little group, the poet's or pheasant's-eye narcissi (*N. poeticus*), in which the perianth is large, spreading and conspicuous and the corona very small and shallow. These pheasant's-eye narcissi, of which there are several well-marked varieties, blossom in succession during April and May and all do well in the open borders as permanent hardy bulbs. They are often grown in rock gardens.

*See* F. W. Burbridge, *The Narcissus* (1875); a scientific treatment of the genus will be found in J. G. Baker's *Handbook of Amaryllideae* (1888); *see* also J. Weathers, *Practical Guide to Garden Plants* (1901); Sanders, *Encyclopaedia of Gardening* (1912); L. H. Bailey, *The Standard Cyclopedia of Horticulture* (1933) and the group system adopted by the Royal Horticultural society (1929).

**NARCOTICS,** a general term for substances which in healthy animals produce lethargy or stupor, that may pass into unconsciousness with complete paralysis, and end in death. Certain substances of this class are used in medicine for the relief of pain (anodynes), whilst another group produce profound sleep (hypnotics). In one sense, anaesthetics are narcotics, but, as they are usually volatile substances causing unconsciousness for a short time, they are separated from the true narcotics, the effects of which are more lasting. The same substances are sometimes classed as anodynes and at other times as hypnotics. For example, small doses of opium, or of one or other of its preparations, relieve pain, whilst larger doses act as hypnotics, causing deep sleep passing into coma. Cannabis Indica, belladonna and hyoscyamus, are also anodyne in their action. The chief narcotics are dealt with separately (*see* OPIUM; BHANG; HASHISH; BELLADONNA). Others are:—

*Stramonium.*—The leaves and seed of the *Datura Stramonium* or thorn apple, the alkaloidal constituent being daturine, a variable mixture of hyoscine and atropine. The physiological action is almost identical with belladonna. Poisoning is usually due to children eating the seeds; the lethal dose is unknown.

*Hyoscyamus,* the leaves of the *Hyoscyamus niger* or henbane (*q.v.*). The active principle is hyoscyamine. The physiological action is similar to that of belladonna, but the action of hyoscyamus on the heart is more powerful: $\frac{1}{60}$ gr. of hyoscyamine produces sleepiness and dryness of the mouth; $\frac{1}{3}$ gr. by subcutaneous injection has been fatal. The treatment of hyoscyamus poisoning is similar to that of stramonium.

*Hops* (*Humulus Lupulus*), containing the active principle lupuline, and *Lactucarium,* the juice of *Lactuca virosa* (lettuce), containing an alkaloid lactucine, are very feeble narcotics, causing heaviness and sleep if taken in large doses.

*Chloral Hydrate* is a pure hypnotic which in larger doses is a powerful narcotic, producing prolonged sleep with depression of the cardiac and motor centres. It is an intrinsic cardiac poison, the heart being arrested in diastole, with coincident respiratory failure. Chloral hydrate is not uniform in its action, some people manifesting great susceptibility to the drug. It is safe in small doses of 10 to 20 grs. It is difficult to say what is a lethal dose. Cases are recorded of recovery after 336grs. taken with an equal amount of potassium bromide and even after a dose of 595grs., but in susceptible persons 10 to 15grs. have produced toxic symptoms and death has occurred after doses of from 30 to 45 grs. If seen early, the treatment is an emetic, but if the poison should have been already absorbed, stimulants, hot coffee, strychnine or digitalin hypodermically, with perhaps artificial respiration, may be required.

*Alcohol* in large quantities is a strong narcotic. The treatment is washing out the stomach to prevent the absorption of the poison and the use of strychnine hypodermically.

**NARCOTINE.** Though narcotine is a physiologically active opium alkaloid (*see* ALKALOIDS) and was at one time used as a remedy for malaria, it is no longer of therapeutical importance except as a source of its derivative cotarnine, the hydrochloride of which is used in medicine as an internal styptic. Narcotine, $C_{22}H_{23}O_7N$, was probably obtained by Derosne in 1803, but was first isolated in a pure state by Robiquet in 1817. It crystallizes from alcohol in long colourless needles, melts at 176°–198° C in chloroform, and is nearly insoluble in water, sparingly soluble in cold alcohol, but readily so in benzene or ethyl acetate. It also dissolves in weak alkaline solutions and forms unstable salts with acids: the salts are dextro-rotatory, *i.e.,* the rotation is opposite in kind to that of the base. Narcotine is hydrolysed by dilute nitric acid to opianic acid, $C_{10}H_{10}O_5$, and *cotarnine,* $C_{12}H_{15}O_4N$. The former represents the meconyl residue (*see* ALKALOIDS) of narcotine, whilst cotarnine represents the isoquinoline portion

of the original alkaloid. Cotarnine crystallizes from benzene in small needles, melts at 132° C, is easily soluble in alcohol or ether and sparingly so in cold water. With acids it forms salts, losing a molecule of water at the same time, a circumstance of considerable importance in settling details of the intimate structure of cotarnine. Thus the hydrochloride has the formula $C_{12}H_{13}O_3N,HCl,2H_2O$, melts at 197° C, and crystallizes in pale yellow needles.

**NARDINI, PIETRO** (1722–1793), Italian violinist and composer, was born at Fibiana in Tuscany in 1722. He studied violin and composition at Leghorn and later became a pupil of Tartini at Padua. For 15 years he held an appointment at the court of Stuttgart as solo violinist. In 1767 he settled at Leghorn and was with Tartini in his last illness. He became music director to the duke of Tuscany in 1770 and enjoyed great fame as a performer and composer. He died at Florence on May 7, 1793. Nardini is remembered as Tartini's most famous pupil, and as the composer of many graceful compositions for the violin. His music is melodious and eminently playable, and has an educational value in respect of technique. Modern reprints of the sonatas are found in Alard's *Maîtres classiques,* in David's *Hohe Schule des Violinspiels,* and in Jensen's *Classische Violinmusik.*

**NARES, SIR GEORGE STRONG** (1831–1915), English Arctic explorer, son of a captain in the navy, was educated at the Royal Naval college at New Cross, and entered the navy in 1846. He served on the Australian station, was mate of the "Resolute" in the Arctic expedition of 1852, and then served in the Crimea. He was then employed in surveying work on the north-east coast of Australia and in the Mediterranean. While in command of the "Challenger" (1872–74), in the famous voyage of deep-sea exploration round the world, he was ordered home to take command of the Arctic expedition which set sail in the spring of 1875 in the ships "Alert" and "Discovery." For his services he was made K.C.B. (1876). Two years later he was sent in command of the "Alert" to survey Magellan strait. He retired from active service in 1886, and became a vice-admiral in 1892. He died at Surbiton, Surrey, on Jan. 15, 1915. (*See* POLAR REGIONS.)

He published *Reports on ocean soundings and temperature* (1874–75); and *Narrative of a Voyage to the Polar Sea during 1875–76* (1878, 2 vols.).

**NAREW, BATTLES OF THE.** The battles on the river Narew, north-east of Warsaw, in July and Aug. 1915, were a part of the great offensive planned by Falkenhayn against Russia. During May and June, Mackensen had driven the Russian armies in Galicia from Tarnów on the Dunajec to the east of Lemberg (*see* DUNAJEC SAN; LEMBERG). In July the group of armies under his command was directed north-east towards Brest-Litovsk against the communications of the Russian forces which still held the Warsaw salient (*see* BREST-LITOVSK). Hindenburg, who commanded the group of armies on the northern part of the Eastern Front, was now ordered to strike a blow on the north side of the salient. Falkenhayn hoped thus by driving in the flanks of the salient to cut off large numbers of Russians in its apex about Warsaw. The realization of this hope depended, of course, on the rapidity with which the flanks could be forced.

**Rival German Plans.**—The operation against the Narew line is of interest because of the controversy it provoked between the two men who had most influence on German strategy during the war, Falkenhayn and Ludendorff. The former was at this time chief of the German Great General Staff, and thus responsible for the supreme direction of the war; the latter was chief of staff to Hindenburg. Ludendorff had long cherished the idea of a Napoleonic manoeuvre against the Russian rear by Kovno and Wilno on Minsk, and considered the proposed Narew offensive as timid and ineffectual; Falkenhayn, with heavier responsibilities on his shoulders, mistrusted both the feasibility and the expedience of the Wilno adventure. He could not afford to become so deeply involved in the Eastern theatre as to be unable to withdraw troops to meet the coming offensive in the West. After a discussion of the alternative plans held in the presence of the kaiser, Falkenhayn's views were approved; and Hindenburg was ordered to carry out the Narew attack.

A formidable water barrier protects Russian Poland against invasion from East Prussia, formed by the Niemen, the Bobr, the Narew and the lower course of the Bug, and thence the Vistula to the frontier. The Russians had fortified this river line. Besides the fortresses of Kovno and Grodno, Osoweic, Lomza and Nowa-Georgiewsk, there were fortified bridge-heads on the Narew at Ostroleka, Rozan, Pultusk and Zegrze. Though the river was fordable in the summer at many points, marshes along its length increased its effectiveness as an obstacle.

**The German Attack.**—Gallwitz's army, which was to make the attack, comprised six corps (14 divisions). Opposite to it, on the lower Vistula, lay the Russian I. Army (Litvinov) with three corps and a cavalry corps.

The tactical details of the fighting are not of any special interest. On July 13 Gallwitz delivered his first attack on the approximate line Przasnysz-Ciechanów, aiming at Pultusk. The Russians, over-weighted both in numbers and heavy artillery, at once fell back more than half-way to the Narew line. They were attacked again on July 15, and during July 18 and 19 withdrew across the river, the Russian XII. Army on their right conforming to the movement. Reinforcements had now arrived and resistance stiffened. Though the Germans stormed the bridge-heads of Pultusk and Rozan on July 23, and secured crossings over the river, their further progress was limited by violent Russian counter-attacks, and they were unable to reach the line Wyszków-Ostrów (on the lower Bug), at which they were aiming. An attempt to force a passage further east at Ostroleka on July 30 failed, and it was not until Aug. 4 that this bridge-head fell. Losses were heavy on both sides; but the Russians had secured time and space sufficient to evacuate the Warsaw salient without danger.

Hindenburg and Ludendorff naturally claimed that the result of the battle vindicated their opinion on the mistaken strategy of the Supreme Command. Falkenhayn retorted that the operations would have had the desired effect of intercepting the Russian retreat had Hindenburg used the full force available and given Gallwitz 20 divisions instead of 14. It seems doubtful, however, whether the communications would have allowed the effective employment of so large a force.

BIBLIOGRAPHY.—E. Ludendorff, *My War Memories* (trans., 1919); E. von Falkenhayn, *General Headquarters and its Critical Decisions* (trans., 1919); G. Meyer, *Durchbruch am Narev, Juli-Aug. 1915* (1919); A. Knox, *With the Russian Army, 1914–17* (1921); M. Hoffmann, *The War of Lost Opportunities* (1924); J. Daniloff, *Russland im Weltkriege, 1919–1915* (1925) (*see* also WORLD WAR: *Bibliography*). (A. P. W.)

**NARNI** (anc. Umbrian *Nequinum,* Rom. *Narnia*), a town and episcopal see of the province of Terni, Italy, 65 m. N. of Rome by rail. Pop. (1936) 4,306 (town), 17,660 (commune). It is picturesquely situated on a lofty rock (787 ft.). The cathedral and the portico of S. Maria Impensole are Romanesque; the former has some good Renaissance sculptures. There are other interesting churches and some picturesque Gothic houses and palaces. There are factories of linoleum and calcium carbide.

The Umbrian Nequinum was taken by the Romans in 299 B.C., and a colony planted there against the Umbrians. It was situated on the Via Flaminia, and one of the finest bridges of antiquity crosses the river below the town. The original main road ran to Nuceria by Mevania; a branch by Interamna and Spoletium joined it at Forum Flaminii. According to some authors, the emperor Nerva was born at Narnia. The town played a considerable part in military history. In the middle ages Narni was under the papal power. It was the birthplace of the well-known condottiere Erasmo Gattamelata (d. 1443), whose statue by Donatello is at Padua.

*See* G. Eroli, *Miscellanea Storica Narnese* (2 vols., Narni, 1858–1862), and other works by the same author.

**NAROCZ, BATTLE OF LAKE.** Lake Narocz, in Poland, 62 mi. E.N.E. of Wilno (Vilna), gives its name to a great offensive by the Russian 2nd Army in the spring of 1916. (*See* WORLD WAR I: *From Verdun to the Entry of America.*)

**General Situation on the Eastern Front.**—The river Pripet formed the dividing line between the German and Austrian commands. At the beginning of March there were 42 German and

two Austrian divisions on the front north of the Pripet, the total length of which was about 250 miles. The Russians had organized their armies into three groups: the northern (12th and 5th Armies) on the Dvina, the western (1st, 2nd, 10th, 4th and 3rd Armies) extending to south of the Pinsk marshes and the south-western (8th, 11th, 7th and 9th Armies) up to the Rumanian border. Their main strength was concentrated on the northern and western fronts, where it had been decided that the principal efforts of the year should be made. The losses of 1915 in men and material had been made good; guns and munition were available on a larger scale than previously, though still insufficient for the requirements of trench warfare.

PLAN OF THE BATTLE OF LAKE NAROCZ, MARCH 18, 1916

**Plan of Operations.**—The general idea of the battle was for the 2nd Army to attack on either side of Lake Narocz, where the German line formed a slight salient; the two wings were eventually to join and to continue their advance westwards to Panevežys (some 80m. N. of Wilno [Vilna] and 100m. W. of the original line), where the 5th Army, which was to attack from the Jakobstadt bridgehead on the Dvina, was to join them. The operation seems to have been planned originally to take place later in the year, when all the Allies proposed to attack simultaneously. But on Feb. 21 the German assaults on Verdun began, and the Russians chivalrously hurried on their preparations and attacked to relieve the pressure on the French, at the worst possible time of the year—when the annual thaw, which renders all communications practically impossible for a period, might be expected at any moment.

**Description of the Terrain.**—Lake Narocz (8m. by 6m.) is the largest of a whole series of small lakes in which the tributaries of the Wilia and the Dzisna rise. It drains into the River Narocz, which flows south to join the Wilia east of Smorgonie. The greater part of the trench line between Dvinsk and Smorgonie (over 100m. in a straight line) was protected by lake, stream or marsh, and stretches of dry ground wide enough for a large scale offensive were few. On either side of Lake Narocz, however, were gaps of four miles or so in the water line, where the terrain was comparatively favourable for attack, though communications were poor. The northern gap was ten miles to the north of Lake Narocz; the southern was between the lake itself and Lake Wiszniew.

**Dispositions of the Opposing Forces.**—The 2nd Army was divided into three groups: the right group (under Gen. Plyeshkov), opposite the northern gap, consisted of three corps and a cavalry corps; the centre group (under Gen. Sirelius), of two corps; and the left group (under Gen. Baluev), of three corps. Four corps were available behind these groups to exploit any success gained. The right and left groups were to attack the north and south faces of the salient respectively, while the centre group assisted by minor assaults and demonstrations. The army commander, Smirnov, fell sick just before the battle and his place was taken by Gen. Ragoza.

The 2nd Army was opposed by Von Eichhorn's 10th Army on a front of some 85 miles, comprising 11 divisions and two cavalry divisions. The Germans were aware of the Russian concentration.

**The Russian Attacks.**—A thaw set in on March 17, but the offensive was nevertheless begun on the 18th. After a bombardment of several hours, massed infantry attacks were made both by Plyeshkov's group north of Lake Narocz and by Baluev's group in the south. In the thickly wooded and enclosed terrain the insufficiently trained Russian infantry soon lost cohesion, and their assaults were ill-timed and disjointed. Though the German first-line trenches were in several cases occupied, they could not be held under the concentrated fire of the German artillery, which was extremely skilfully handled. By nightfall the Russians were back in their original positions, having suffered very heavy casualties without result. After two days of further artillery preparation and minor attacks intended to mislead the enemy, renewed heavy assaults were made on the nights of March 19–20 and 20–21.

On Plyeshkov's front no ground was permanently gained in spite of terrible losses, but Baluev's group in the south made an advance of over a mile on a front of about 2½ miles. The weather conditions were by now terrible; it thawed from the 17th to the 22nd, and the whole area of operations became a sea of mud. The battle was, however, continued till March 27, when the Russians at last desisted from their fruitless and costly attacks. In April a German counterstroke retook all the ground gained by Baluev. Meanwhile the attacks of the 5th Army from Jakobstadt, March 21–26, were equally unsuccessful and almost equally wasteful of life.

**Results of the Operations.**—The operations resulted in a complete and disastrous failure for the Russians. Their losses were over 100,000 and they accomplished nothing. The offensive did not cause the Germans to move a single man from the Western Front, and so brought no relief to the French. Both time and place were ill-chosen; the staff work was bad; and the artillery, in spite of a greater concentration of heavy guns on a narrow front and a more liberal expenditure of ammunition than ever before, failed to give proper support to the infantry, who, as usual, paid the price in terrible losses. The result was, in fact, a bitter disillusionment to the Russian high command, to the Russian soldier and to the Russian people.

BIBLIOGRAPHY.—B. Gourko, *Memories and Impressions of War and Revolution in Russia* (1918); A. W. F. Knox, *With the Russian Army, 1914–17* (1921); E. Ludendorff, *My War Memories* (1922). *See* also WORLD WAR: BIBLIOGRAPHY. (A. P. W.)

**NARRA** or **ASANÁ,** the local names (Philippine dialect) applied to some of the best timber trees, *Pterocarpus indicus, P. echinatus* and *P. blancoi* (family Leguminosae) in the Philippine archipelago. The wood is commonly known as "Philippine mahogany," and is in great demand for cabinet-work; it is usually of a beautiful red or rose colour, often variegated with yellow, and is hard and heavy. The trunk is surrounded (or, occasionally, supported) by huge buttresses extending outward and upward for 10 to 20 ft.; these are sometimes made into table-tops, the pattern of the grain and the colouring being hardly equalled by any other timber. The wood-cells contain a peculiar substance: a minute chip placed in a bottle of water soon gives an opalescent colour to the liquid. Narra is known as Burmese rosewood, Andaman redwood and Kiabooca-wood.

**NARRAGANSETT PIER,** a summer resort of Washington county, Rhode Island, U.S.A., on the west shore of Narragansett bay, 30 mi. S. of Providence. It is on federal highway 1, and is served by the Narragansett Pier railroad, connecting at Kingston (9 mi. N.W.) with the New York, New Haven and Hartford. The town of Narragansett, in which it is situated, had a resident population of 1,560, 1940 (federal census). "The Pier" consists of a group of hotels, a casino and a bathing pavilion, on a crescent-shaped beach (one of the finest on the Atlantic coast), and an avenue (lined on both sides with palatial summer "cottages") running down the rocky promontory to Point Judith (5 m. S.), where there is a lighthouse and a country club. Narragansett Pier was so named from the wharves built late in the 18th century to provide a port for southern Rhode Island, but none of them are left. Development as a summer resort began about the middle of the 19th century, and the railroad from Kingston was completed in 1876. It has always had a considerable number of visitors from the South.

**NARSES** (*c.* 478–573), an important officer of Justinian, in the 6th century. He was a eunuch of Persamenia, and apparently born about 478. If the statement that he died at the age of ninety-five be correct, he was probably brought young to Constantinople,

and attained a footing in the *officium* of the grand chamberlain. He rose to be one of the three "chartularii," a position involving the custody of the archives of the household. Hence, probably in middle life, he became "praepositus sacri cubiculi."

In 532 the insurrection known as the Nika broke out in Constantinople, when for some hours the throne of Justinian seemed doomed to overthrow. It was saved partly by the courage of his wife, Theodora, and partly by the timely prodigality of Narses, who with large sums of money bribed the leaders of the "blue" faction, which was aforetime loyal to the emperor, to shout as of old "Justiniane Auguste tu vincas." He defeated Totila in 552, with whom fell the last hopes of the Gothic kingdom of Italy.

**NARSINGARH,** an Indian state in the Bhopal agency of Central India. Area 731 sq.mi.; pop. (1941) 125,178. The chief, whose title is rajah, is a Rajput of the Umat clan. The state was founded about 1681 by a minister of Rajgarh, who compelled the ruler of that state to transfer to him half his territory. The rajah has a salute of 11 guns. The town of Narsingarh had a population in 1931 of 9,241.

**NARTHEX,** in architecture, a long, narrow porch, usually colonnaded or arcaded, at the entrance of a church. In the early days of Christianity it was the only portion of the church to which catechumens and penitents were admitted. Occasionally an additional vestibule exists within the church building proper. In this case, the inner vestibule is called the narthex and the outer porch an exonarthex. The narthex is common in basilican, Byzantine and some Romanesque churches, particularly in Italy; in the Gothic period its use had almost entirely disappeared, but during the Renaissance it is again found, although its ritual usage had entirely died out, and it had become a simple porch or vestibule.

**NARVA,** a seaport of Estonia in 59° 23′ N., 28° 12′ E., on the Narova river, 8 mi. above the entry into Narva bay on the Gulf of Finland. Est. pop. (1939) 24,200. With it is associated Narva-Joesuu (Hungerburg) in 59° 28′ N., 28° 2′ E. Pop. 1,635. Vessels of 15½ to 16 ft. draught can load in its harbour. The chief imports are cotton, rye, salt, herrings and coal, and the exports textiles, timber (pit-props, battens, etc.,) spirits and bricks. Fortress Hermann on the west bank and fortress Ivangorod directly across the river dominate the town. The textile mills just above Narva escaped general destruction in World War I partially because of production for the Tsarist army. The cotton mills were closed for two years but eventually resumed production with only 2,000 workers as against 11,000 in 1914. The woollen, flax and jute mills were similarly reduced because Russia, previously the best customer, ceased buying. Estonia developed as a dairy country, and the textile industry was only partially revived. Founded by the Danes in 1223, the town changed hands among the Teutonic Knights, Danes, Swedes and Russians until its capture by Peter the Great in 1704, after which it remained under Russian rule until Estonia obtained independence in 1918–20. Russia again occupied Narva in 1940–41, and it was captured in 1941 by the Germany army.

**NARVACAN,** a municipality (with administrative centre and 31 *barrios* or districts) of the province of Ilocos Sur, Luzon, Philippine Islands, near the coast and on the main road 13 mi. S.S.E. of Vigan, the provincial capital. Pop. (1939) 22,769; three were white. It lies in a level valley surrounded by mountains, and the soil of the locality produces palay (rice), maize (corn), cotton, tobacco, maguey and sugar. The women weave cotton cloth for trade with the primitive mountaineers. Ilocano is the vernacular. Of the inhabitants aged 6 to 19 inclusive, 42·8% were reported in 1939 as attending school, while 56·2% of the population 10 years old and over was reported as literate.

**NARVAEZ, PÁNFILO DE** (*c.* 1480–1528), Spanish adventurer, born at Valladolid. He helped Velásquez in the reduction of Cuba and was put at the head of the force sent to the Aztec coast to compel Cortes to renounce his command. He was defeated by his compatriot and made prisoner (1520). On his return to Spain he obtained from Charles V. a grant of Florida as far as the river of Palms: landing near Pensacola bay in April 1528, he struck inland with some 300 of his followers and reached "Apalache" on June 25. Disillusioned in their hopes of fabulous wealth, they made for the coast, arriving in July at the Bahia de los Caballos, at or near St. Mark's. Having built rude boats, the much-reduced company sailed on Sept. 22, for Mexico, but the vessel which carried Narvaez perished in the storm. His lieutenant, Cabeza de Vaca, and three others ultimately reached the Gulf of California by way of Texas. (*See* FLORIDA.)

*See* W. H. Prescott, *Conquest of Mexico;* H. H. Bancroft, *Mexico* (1882–90); *Naufragio de Alvaro Nunez Cabeza de Vaca* (Bib. de Autores Esp., xxii.).

**NARVAEZ, RAMÓN MARÍA** (1800–1868), Spanish soldier and statesman, born at Loja, Granada on Aug. 4. 1800. He served under Mina in Catalonia in 1822. As one of the Conservative supporters of Isabella II. he achieved great popularity by his victory over Gomez, the Carlist general, near Arcos, in Nov. 1836, and after clearing La Mancha of brigands in 1838 he was appointed captain-general of Old Castile, and commander-in-chief of the army of reserve. After taking part in the Seville insurrection (1840) against Espartero and the Progresista party, he fled to France and planned with Maria Cristina the expedition of 1843, which led to the overthrow of his adversary. Prime minister, field-marshal, and duke of Valencia in 1844, his reactionary policy culminated in his having to quit office in Feb. 1846. He became ambassador at Paris, returned (1847) to preside over the council of ministers and resigned (1848) through misunderstandings with Maria Cristina. His ministry succeeded O'Donnell's in 1856–57, 1864–65 and in July 1866. He died at Madrid April 23, 1868.

**NARVIK,** an ice-free seaport on the Ofoten fjord of the northwest coast of Norway, in Nordland *amt* (county), 68° 30′ N. Pop. (1936) 10,500. It is wholly modern, developed by the construction and completion (1903) of the Lapland railway, the most northerly in the world. From the extensive quays is shipped the iron ore from the Kiruna-Gellivara region across the mountains in Sweden. Narvik is 167 mi. N.W. of Gellivara, 982 mi. from Stockholm by rail. In the warfare of April and May, 1940 British and French recaptured the city and most of the railway from the Germans, then withdrew because of the threat in France.

**NARWHAL,** a cetacean (*Monodon monoceros*), characterized by the presence in the male of a long horn-like tusk. In the adult of both sexes there are only two teeth, both in the upper jaw, which lie horizontally side by side, and in the female remain throughout life concealed in cavities of the bone. In the male the right tooth usually remains similarly concealed, but the left is immensely developed, attaining a length equal to nearly that of the entire animal. It projects forwards from the head in the form of a cylindrical or slightly tapering, pointed tusk, composed of ivory, with a central cavity reaching almost to the apex, without enamel, and with the surface marked by grooves and ridges running in a left-handed spiral. Occasionally both left and right tusks are developed. In young animals several small additional teeth are present, but these generally disappear soon after birth.

The head is short and rounded; the fore limbs or paddles are small and broad, and (as in the Beluga) a dorsal fin is wanting. The general colour is dark grey variously marbled and spotted with grey.

The narwhal is an Arctic whale rarely seen south of 65° N. lat. Like most cetaceans it is gregarious and usually met with in "schools" of 15 or 20 individuals. Its food appears to be cuttlefishes, small fishes and crustaceans. The purpose served by the tusk is uncertain. The narwhal is extremely playful, individuals frequently elevating their tusks and crossing them with each other as in fencing. They have never been known to charge and pierce the bottom of ships with their weapons as the swordfish does. The ivory of the tusk is of good quality, but owing to the central cavity, only fitted for the manufacture of objects of small size. The entire tusks are sometimes used for decorative purposes. (*See* CETACEA.)

**NASCIMENTO, FRANCISCO MANOEL DE** (1734–1819), Portuguese poet, known as Filinto Elysio, his "Arcadian" name, though he was never a member of the Arcadia and later was a leader of the revolt against it, was born in Lisbon, the son of a lighterman. As a boy he acquired an extensive knowledge

of national literature and folklore, the foundation of his rich Portuguese vocabulary and of a deep and enduring patriotism. He was ordained priest in 1754, and became treasurer of the Chagas church in Lisbon. Nascimento was soon the centre of a literary group which opposed the ruling group of the Arcadia, and fought for the recognition of Camoens as the greatest of Portuguese poets. But in June 1778 an order was issued by the inquisition for the arrest of Nascimento on the ground of heterodoxy and the reading of "modern philosophers who follow natural reason." He escaped to a French ship in the harbour, found his way to Havre and then to Paris, where he spent the rest of his life, with the exception of five years in the house of the Portuguese ambassador at The Hague. Lamartine addressed an ode to him; he enjoyed the esteem of Chateaubriand; and his admirers at home, who imitated him extensively, were called after him *Os Filintistas*. Exile and suffering had enlarged his ideas and given him a sense of reality, making his best poems those he wrote between the ages of 70 and 85, and when he died it was recognized that Portugal had lost her foremost contemporary poet.

Garrett declared that Nascimento was worth an academy in himself by his knowledge of the language, adding that no poet since Camoens had rendered it such valuable services; but his truest title to fame is that he brought literature once more into touch with the life of the nation. By his life, as by his works, Nascimento links the 18th and 19th centuries, the Neo-Classical period with Romanticism. Wieland's *Oberon* and Chateaubriand's *Martyrs* opened a new world to him, and his *contos* or scenes of Portuguese life have a real romantic flavour; they are the most natural of his compositions, though his noble patriotic odes—those "To Neptune speaking to the Portuguese" and "To the liberty and independence of the United States"—are the most quoted and admired. On leaving Portugal, he abandoned the use of rhyme as cramping freedom of thought and expression; nevertheless, his highly-polished verses are generally robust to hardness and overdone with archaisms.

BIBLIOGRAPHY.—The most useful edition of his collected works is that in 22 vols., 1836–40. *See* Innocencio da Silva, *Diccionario bibliographico Portuguez,* ii. 446–457 and ix. 332–336; also Pereira da Silva, *Filinto Elysio e a sua Epoca* (Rio, 1891); and Dr. Theophilo Braga, *Filinto Elysio* (Oporto, 1891).

**NASEBY,** a village of Northamptonshire, England, 7m. S.S.W. of Market Harborough, famous as the scene of the battle of June 14, 1645, which decided the issue of the first Civil War (*see* GREAT REBELLION). The army of King Charles I. was less than 10,000 strong, while the "New Model" army of the parliament, commanded by Sir Thomas Fairfax, numbered some 13,000. Yet it was not without considerable hopes of victory that the Royalists drew up for battle, for although Lieutenant-General Cromwell had made the New Model cavalry formidable indeed, the Royalist foot had become professionalized in several years of war, whereas the Parliamentarian foot was newly organized, and in part at least but half-trained. Fairfax and Cromwell, however, were still more confident, and with better reason. The battlefield lies between Naseby and Sibbertoft (3m. N. of Naseby) and is an undulating ridge which, near the centre of England, forms the "divide" between the Avon and the Welland rivers. Across this ridge the two armies were drawn up, the New Model facing north and the king's army south, the horse on the flanks and the foot in the centre of each army.

At the first shock the Royal foot asserted its superiority over the opposing infantry, four out of five regiments in the first line were broken, and Skippon, the major-general of the foot, was wounded. But Fairfax's regiment held its ground, until the second line of infantry advanced and re-established the front. Meantime the Royalist right wing of horse, led by Prince Rupert, had completely routed the horse of Colonel Ireton which opposed them. But the victors as usual indulged in a disorderly pursuit, and attempted to overpower the baggage guard of the enemy near Naseby village. Their incoherent attack was repulsed, and when Rupert, gathering as many of his men as he could, returned to the battlefield, the decisive stroke had been delivered by Cromwell and the right wing of Parliamentary horse. In front of him, in somewhat broken ground, was Sir Marmaduke Langdale's cavalry, which the lieutenant-general with his own well-trained regiments scattered after a short, fierce encounter. Cromwell's "godly" troopers did not scatter in pursuit. A few squadrons were ordered to keep the fugitives on the run, and with the rest, and such of Ireton's broken troops as he could gather, Cromwell attacked the Royalist centre in rear while Fairfax and his foot pressed it in front. Gradually the Royalist infantry, inferior in numbers, was disintegrated into small groups, which surrendered one after the other. But one brigade, called the "Bluecoats," held out to the last, and was finally broken by a combined charge of Fairfax's regiment of foot, led by Cromwell, and the general's personal escort, led by Fairfax himself, who captured a colour with his own hand. The remnant of the king's army, re-formed by Rupert, stood inactive and irresolute while its infantry was being destroyed and then fled. The spoils included 100 standards and colours and the king's private papers. But more important than trophies was the practical annihilation of the last field army of which the king disposed. Half the Royalists were captured, and about 1,000 fell in the battle and the pursuit which followed it. In addition all the artillery and the muskets (to the number of 8,000) and ammunition without which the king could scarcely create a new army, fell into the hands of the victors.

**NASH, PAUL** (1889- ), British painter, was born in London on May 11, 1889, and educated at St. Paul's School and at the Slade School. His first exhibition was given in 1911, but he was comparatively little known until an exhibition of his western front war pictures (1918), the fruit of his work as an official artist 1917–18; several of these are in the Imperial War Museum, London. He then attracted attention as a landscape painter of individuality and charm, a somewhat mannered technique giving way gradually to a freer expression; he gave an important exhibition in London in 1924. He also produced some interesting woodcuts and book illustrations, such as the wood engravings, "Genesis" (1924). He was instructor of design at the Royal College of Art, South Kensington, from 1924 to 1925.

**NASH, RICHARD** (1674–1762), English dandy, better known as "Beau Nash," was born at Swansea on Oct. 18, 1674. He was educated at Carmarthen grammar school and at Jesus college, Oxford. He obtained a commission in the army, which however, he soon exchanged for the study of law at the Temple. Here among "wits and men of pleasure" he came to be accepted as an authority in regard to dress, manners and style. When the members of the Inns of Court entertained William III. after his accession, Nash conducted the pageant at the Middle Temple. He was offered knighthood, but he declined the honour, unless accompanied by a pension. The pension was not given and Nash turned gamester. In 1705 he succeeded Captain Webster as master of the ceremonies at Bath. Under his régime Bath became the leading fashionable watering-place. He drew up a new code of rules for the regulation of balls and assemblies, abolished the habit of wearing swords in places of public amusement and brought duelling into disrepute, induced gentlemen to adopt shoes and stockings in parades and assemblies instead of boots, reduced refractory chairmen to submission and civility, and introduced a tariff for lodgings. Through his exertions a handsome assembly-room was also erected, and the streets and public buildings were greatly improved. Nash adopted an outward state corresponding to his nominal dignity. He wore an immense white hat as a sign of office, and a dress adorned with rich embroidery, and drove in a chariot with six greys, laced lackeys and French horns. When the act of parliament against gambling was passed in 1745, he was deprived of an easy though uncertain means of subsistence, but the corporation afterwards granted him a pension of six score guineas a year, which, with the sale of his snuff-boxes and other trinkets, enabled him to support a certain faded splendour till his death on Feb. 3, 1762. He was honoured with a public funeral at the expense of the town. He was a man of strong personality, and considerably more able than Beau Brummell, whose prototype he was.

*See* Oliver Goldsmith, *Life of Richard Nash* (1762); Lewis Melville, *Bath under Beau Nash* (1908), with full list of authorities.

**NASHE** (or NASH), **THOMAS** (1567–1601), English poet, playwright and pamphleteer, was born at Lowestoft in 1567. His father belonged to a Herefordshire family, and is vaguely described as a "minister." Nashe spent 6 years, 1582–1588, at St. John's College, Cambridge, taking his B.A. degree in 1586. On leaving the university he tried, like Greene and Marlowe, to make his living in London by literature. It is probable that his first effort was *The Anatomie of Absurditie* (1588) which was perhaps written at Cambridge, although he refers to it as a forthcoming publication in his preface to Greene's *Menaphon* (1589). In this preface, addressed to the gentlemen students of both universities, he makes boisterous ridicule of the bombast of Thomas Kyd and the English hexameters of Richard Stanihurst, but does not forget the praise of many good books. Nashe was really a journalist born out of due time; he boasts of writing "as fast as his hand could trot"; he had a brilliant and picturesque style which, he was careful to explain, was entirely original; and in addition to his keen sense of the ridiculous he had an abundance of miscellaneous learning.

As there was no market for his gifts he fared no better than the other university wits who were trying to live by letters. But he found an opening for his ready wit and keen sarcasm in the famous Martin Marprelate controversy. His share in this war of pamphlets cannot now be accurately determined, but he has been credited, on doubtful evidence, with the following: *A Countercuffe given to Martin Junior* (1589), *Martins Months Minde* (1589), *The Returne of the renowned Cavaliero Pasquill and his Meeting with Marforius* (1589), *The First Parte of Pasquils Apologie* (1590), and *An Almond for a Parrat* (1590). He edited an unauthorized edition of Sidney's poems in 1591, and *A Wonderfull Astrologicall Prognostication,* in ridicule of the almanac-makers, by "Adam Fouleweather," which appeared in the same year, has been attributed to him. *Pierce Penilesse, His Supplication to the Divell,* published in 1592, shows us his power as a humorous critic of national manners, and tells incidentally how hard he found it to live by the pen. It seems to Pierce a monstrous thing that brainless drudges wax fat while "the seven liberal sciences and a good leg will scarce get a scholar bread and cheese."

In this pamphlet, too, Nashe began his attacks upon the Harveys by assailing Richard, who had written contemptuously of his preface to Greene's *Menaphon.* Greene died in September 1592, and Richard's brother, Gabriel Harvey, at once attacked his memory in his *Foure Letters,* at the same time adversely criticizing *Pierce Penilesse.* Nashe replied, both for Greene and for himself, in *Strange Newes of the intercepting certaine Letters,* better known, from the running title, as *Foure Letters Confuted* (1592), in which all the Harveys are violently attacked. The autumn of 1592 Nashe seems to have spent at or near Croydon, where he wrote his satirical masque of *Summers Last Will and Testament* at a safe distance from London and the plague. He afterwards lived for some months in the Isle of Wight under the patronage of Sir George Carey, the governor. In 1593 he wrote *Christs Teares over Jerusalem,* in the first edition of which he made friendly overtures to Gabriel Harvey. These were, however, in a second edition, published in the following year, replaced by a new attack, and two years later appeared the most violent of his tracts against Harvey, *Have with you to Saffron-walden, or, Gabriell Harveys Hunt is up* (1596). In 1599 the controversy was suppressed by the archbishop of Canterbury.

After Marlowe's death Nashe prepared his friend's unfinished tragedy of *Dido* (1596) for the stage. In the next year he was in trouble for a play, now lost, called *The Isle of Dogs,* for only part of which, however, he seems to have been responsible. The "seditious and slanderous matter" contained in this play induced the authorities to close for a time the theatre at which it had been performed, and Ben Jonson (*q.v.*) and others were imprisoned. Apparently Nashe escaped. Besides his pamphlets and his play-writing, Nashe turned his energies to novel-writing. He may be regarded as the pioneer in the English novel of adventure. He published in 1594 *The Unfortunate Traveller, Or the Life of Jack Wilton,* the history of an ingenious page who was present at the siege of Térouenne, and afterwards travelled in Italy with the earl of Surrey. It tells the story of the earl and Fair Geraldine, describes a tournament held by Surrey at Florence, and relates the adventures of Wilton and his mistress Diamante at Rome after the earl's return to England. The detailed, realistic manner in which Nashe relates his improbable fiction resembles that of Defoe.

His last work is entitled *Lenten Stuffe* (1599) and is nominally "in praise of the red herring," but really a description of Yarmouth, to which place he had retired after the trouble over *The Isle of Dogs.* Nashe's death is referred to in Thomas Dekker's *Knight's Conjuring* (1607), a kind of sequel to *Pierce Penilesse.* He is there represented as joining his boon companions in the Elysian fields "still haunted with the sharp and satirical spirit that followed him here upon earth." Had his patrons understood their duty, he would not, he said, have shortened his days by keeping company with pickled herrings. The date of his death is fixed by an elegy on him printed in Fitzgeffrey's *Affaniae* (1601).

The works of Thomas Nashe were edited by Dr. A. B. Grosart in 1883–85, and by Ronald B. McKerrow (1904–1910). *See* also *English Novel in the Time of Shakespeare,* by J. J. Jusserand (Eng. trans., 1890); and F. G. Harman, *Gabriel Harvey and Thomas Nashe* (Ouseley, 1923).

**NASHUA,** a city of southern New Hampshire, U.S.A., on the Merrimack river at the mouth of the Nashua, 15 mi. S. of Manchester and 40 mi. N.W. of Boston; one of the county seats of Hillsboro county. It is on federal highway 3, and is served by several divisions of the Boston and Maine railroad. Pop. (1920) 28,379 (31% foreign-born white, including 4,385 French-Canadians) and in 1940, 32,927. Nashua is beautifully situated in an amphitheatre of hills and mountains. There is abundant water-power, and the city has extensive manufactures (notably of cotton goods, paper, asbestos shingles and refrigerators) with an output in 1937 valued at $47,190,802. A U.S. fish hatchery is near by. A settlement known as Indian Head was established there in 1665. In 1803 it was incorporated as the village of Nashua, and in 1836 the town of Dunstable (in which it was situated) took the same name. The town of Nashville was set off from the town of Nashua in 1842, but the two were reunited in 1853 under a city charter.

**NASHVILLE,** the capital city of Tennessee, U.S.A., a port of entry, and the county seat of Davidson county; on the Cumberland river in the north central part of the state. It is on federal highways 31, 41 and 70; has a municipal airport; and is served by the Louisville and Nashville, the Nashville, Chattanooga and St. Louis and the Tennessee Central railways, motor-bus lines and river packets. Pop. 153,866 in 1930 (27·8% Negroes and 98·8% native-born); in 1940 it was by the federal census 167,402, a gain in that decade of 13,536 or 8·8%. The city covers 22·327 sq.mi., on hills and bluffs averaging 500 ft. above sea level, in a vast undulating elliptical valley of 5,450 square miles. The surrounding country is a blue-grass region of great fertility. Within 25 mi. of the city practically everything is raised that is needed for food and clothing, and most of the necessities of life are manufactured. Seven bridges cross the river. On the highest hill stands the State Capitol, a fine example of pure Greek architecture, with a cupola 205 ft. high. The tomb of President Polk is in the capitol grounds, and 11 mi. east of the city is "The Hermitage," the beautiful plantation home of President Jackson. In Centennial park, where the Tennessee Centennial Exposition was held in 1897, is a copy of the Parthenon. Mt. Olivet cemetery contains a beautiful monument to the Confederate soldiers, surrounded by 2,000 of their graves, and north of the city is a National cemetery where 16,862 Federal soldiers are buried. A memorial to the soldiers and sailors of the World War (covering two blocks and containing a large auditorium) was erected by the city, the county and the state, at a cost of $2,600,000. The Tennessee state fair is held at Nashville annually, and many of the state institutions are situated here, including the Confederate Soldiers' Home, the Industrial school, the school for the blind, the Middle Tennessee hospital for the insane, the penitentiary, and the Training and Agricultural school for boys. The public parks cover 3,587 ac.; the hotels have 1,786 guest-rooms; there are 337 churches, includ-

ing a Roman Catholic cathedral, 49 public schools and 50 under private auspices. The city's assessed valuation for 1940 was $173,840,625. Since 1913 it has operated under a commission form of government.

Nashville is one of the foremost educational centres in the south. Vanderbilt university (founded in 1873 by Commodore Vanderbilt, who contributed $1,000,000 towards its funds, and whose son and grandsons have given over $2,000,000) has grounds and buildings valued at $7,647,000, endowment of $25,043,000 and an enrolment (1939–40) of 1,831. Its medical school has been housed since 1925 in a well equipped and comprehensive plant, built with grants from the General Education board and the Carnegie corporation and earlier gifts from Andrew Carnegie. The George Peabody college for teachers (opened as a normal school in 1875) has an endowment of $4,947,689 and an enrolment (1940) of over 3,000. Fisk university (for Negroes), founded in 1865 by the American Missionary association and the Western Freedmen's Aid commission, has buildings and grounds valued at $1,624,604, endowment funds of nearly $2,772,589, and an annual enrolment of about 500. The Fisk Jubilee Singers, sent out first in 1871 to raise money for a dormitory for women, have sung in most of the large cities of America and Europe. Nashville is also the seat of the Agricultural and Industrial State college and the Meharry Medical college (both for Negroes).

Among the most important manufacturing industries are printing and publishing (especially of religious periodicals and books), coffee-roasting, and the manufacture of stoves and furnaces, hardwood flooring, fertilizers, cloth and paper bags, boots and shoes, self-rising flour, furniture, knit goods, building materials, wooden and paper boxes, work garments, shirts, soft collars, brick, mattresses, tobacco and snuff, steel barges, feather pillows and clinical thermometers; and in the industrial area aeroplanes, rayon and cellophane. Two of the railroads have shops there, employing together over 3,000 persons. The factory output in 1940 was valued at $98,709,870. Nashville is the seat of a branch of the federal reserve bank. Bank debits in 1940 aggregated $1,045,423,134.

**History.**—In Nov. 1779, James Robertson and eight companions, who had set out in February from the Watauga settlements in eastern Tennessee to establish an "advance guard of civilization" in the rich central basin, arrived at the spot where Nashville now stands, and decided to make it the site of the new settlement. They were joined a few months later by their wives and children and other pioneers, under Col. John Donelson. The town (called Nashborough until its incorporation in 1784) was named after either Abner Nash, then governor of North Carolina, or his brother Francis, a Revolutionary general, killed at Germantown. In 1806 it was chartered as a city. From 1812 (except from 1815 to 1826) the legislature met at Nashville, and in 1843 it was made the State capital. On June 3, 1850, it was the scene of the Southern, or Nashville, Convention, attended by 100 delegates from nine States, which denounced the Wilmot Proviso and (at an adjourned meeting in November) expressed disapproval of the Compromise Measures and asserted the right of the South to secede. For the battle of Nashville (1864) *see* below. During the World War the Government established the Old Hickory Powder plant across the river, constructing large factory buildings and a village to accommodate 30,000 persons. (X.)

### BATTLE OF NASHVILLE

During the Civil War Nashville was captured by the Federals (Feb. '62) after the fall of Fort Donelson and remained in their hands till the end. The battle of Nashville was fought (Dec. 15–16, '64) between a Federal army under G. H. Thomas and *Hood's* Army of Tennessee, and resulted in the complete overthrow of the Confederates. *Hood* had reached the Tennessee at Tuscumbia at the end of October, but waited there three weeks to accumulate a stock of supplies and enable *Forrest's* cavalry to join him. This delay proved fatal to his chance of capturing Nashville, before Thomas, whom Sherman had left to meet *Hood's* invasion whilst he himself "marched to sea," could concentrate sufficient forces for its defence. Thomas had under his command two corps and about 5,000 cavalry under Wilson, in addition to the local garrisons dispersed along the lines of communication from Chattanooga to the Ohio. Until a third corps under A. J. Smith reached him from Missouri (Nov. 30), he can hardly be said to have had a field army at all. *Hood* intended, after capturing Nashville, to invade Kentucky and carry the war to the Ohio. He even contemplated the possibility of marching through the Cumberland mountains to *Lee's* help and attacking Grant. He advanced from the Tennessee (Nov. 21) and endeavoured to outflank Schofield, whom Thomas had placed at Pulaski, 80 m. from Nashville, with the IV. Corps and one division of the XXIII., and about 4,000 cavalry to retard *Hood's* advance, and cut him off from Columbia, where the Nashville railway crossed the Duck river. But Cox's division, by a forced march, saved Columbia from capture by *Forrest*. Wishing to preserve the railway bridge for use when the Federals should take the offensive, Schofield, who had been reinforced by two more infantry brigades, tried to hold on to the south bank, but *Forrest* crossed with his cavalry above the town (Nov. 28), and driving Wilson's mounted troops away from the Franklin road, opened the way for *Hood's* infantry to cut off Schofield's retreat. Next day seven Confederate divisions crossed the river and advanced towards Spring Hill, 11 m. in Schofield's rear, where only a single division was covering the movement of the Federal trains. *Hood* here lost the greatest opportunity offered to any general in the war. He allowed Schofield to escape and make good his retreat to Franklin, on the Harpeth. Schofield was obliged to make another stand there to get his trains across the river. *Hood* made a furious and ill-prepared assault on the strong Federal position late in the afternoon (Nov. 30). The battle raged till 9 P.M., when *Hood* called off his troops, which had suffered terrible losses, and Schofield reached Nashville next day. *Hood's* last chance of conducting a successful offensive was gone, but he continued to follow Schofield and appeared before Nashville (Dec. 2). He believed that retreat would be more demoralizing to his troops than an honourable defeat, and the trans-Mississippi reinforcements promised by the President might yet arrive. Thomas was almost ready to take the offensive. Besides Smith's corps he had just received Steedman's "provisional division" from Chattanooga. He could now put into the field a force probably double the size of *Hood's*. But he needed a few more days in order to remount his large cavalry force, which was intended to play a decisive part in *Hood's* annihilation. Grant grew impatient at the delay. He had expected Thomas to stop *Hood* south of the Duck river, but *Hood* had reached the Cumberland. He bombarded Thomas with telegrams, demanding an immediate attack. Just as Thomas was ready, a storm of freezing rain came on, which covered the ground with a sheet of ice and prevented military operations till a thaw came. Grant ordered (Dec. 9) that Thomas should be superseded by Schofield; suspended the order the same day; ordered (Dec. 13) Logan to Nashville to take command, unless Thomas had moved in the meantime; finally, set out himself to Washington (Dec. 15), intending to go on to Nashville. But the thaw came (Dec. 14) and Thomas attacked next day.

*Hood's* line ran from the Chattanooga railway on the right across the Franklin and Granny White turnpikes to the Hillsboro' road. His left was sharply refused, extending 1,000 yards behind a stone wall alongside that road. He had thrown up some redoubts on detached hills beyond his left, and established a strong skirmish line along his front, terminating on Montgomery hill, close to the Hillsboro' road. But the line was too long to be held by his attenuated force, and his left was very much "in the air." Having detached *Forrest* with two cavalry divisions to raid the Chattanooga railway, he had but one division left to watch the wide gap between his left and the river. Thomas's plan of battle was to make a grand left wheel with his right wing, consisting of Wilson's 12,000 cavalry, fighting dismounted, and Smith's corps, which should outflank and crush the enemy left, whilst Steedman's division held their right fast by a vigorous demonstration. The IV. Corps under Wood was to storm Montgomery hill and press in upon the Confederate salient on the Hillsboro' road. Schofield's corps was at first held in reserve,

but was finally thrown in between Wilson's and Smith's corps. Had not the Federal advance been delayed by fog in the early morning, *Hood* would probably have been completely defeated on the 15th. His whole left wing was driven back in great confusion to the Granny White turnpike. Darkness stopped the pursuit, but *Hood,* who dared not retreat because *Forrest* could not rejoin for at least 24 hours, during the night formed a fresh and much shorter line 2 m. further back, each flank resting upon a hill. *Cheatham's* corps was shifted from the right to the left, which again was sharply bent back just beyond the Granny White turnpike, and extended to the Brentwood hills along a line of lesser heights. *S. D. Lee's,* which had scarcely fired a shot the previous day, held the right, and *A. P. Stewart's,* after its heavy defeat, was placed in the centre. But again Wilson's dismounted troopers, fighting their way through the smaller hills, turned the Confederate left, and getting into its rear attacked from behind, whilst Schofield and Smith assaulted its front. Under this double pressure *Cheatham's* corps broke and with its flight *Hood's* resistance collapsed, although earlier in the day an attack by Wood and Steedman on the right had been handsomely repulsed. His army fled down the Franklin turnpike, the only line of retreat left. But two brigades, which retained their organization, and *Chalmers's* cavalry division held the Brentwood hill's passes long enough to enable the larger part of *Hood's* army to escape. The Federals took up the pursuit next day, hoping to intercept the flying enemy on the Duck river, but *Forrest,* who rejoined *Hood* at Columbia, organized a rearguard with his cavalry and eight infantry brigades under *Walthall,* and covered the retreat to the Tennessee, which was recrossed (Dec. 27). Thomas's fighting force at Nashville numbered between 50,000 and 55,000 men; his casualties were just over 3,000. *Hood* estimated his own force at 23,000, but this is almost certainly an understatement; some authorities put it as high as 39,000. He made no return of his casualties, but stated that they were "very small." But Thomas captured nearly 4,500 prisoners in the battle itself, and many more were taken during the ten days' pursuit.

(W. B. Wo.)

**NASI, JOSEPH** (16th century), Jewish statesman and financier, was born in Portugal of a Jewish (Marano) family. Emigrating from his native land, he founded a banking house in Antwerp. Despite his financial and social prosperity there, he felt it irksome to be compelled to wear the guise of Catholicism, and determined to settle in a Mohammedan land. After two troubled years in Venice, Nasi betook himself to Constantinople. Here he proclaimed his Judaism, and married his beautiful cousin Reyna. He rapidly rose to favour, the sultans Suleiman and Selim promoting him to high office. He founded a Jewish colony at Tiberias which was to be an asylum for the Jews of the Roman Campagna. In 1566 when Selim ascended the throne, Nasi was made duke of Naxos. He had deserved well of Turkey, for he had conquered Cyprus for the sultan. Nasi's influence was so great that foreign powers often negotiated through him for concessions which they sought from the sultan. Thus the emperor of Germany, Maximilian II., entered into direct correspondence with Nasi; William of Orange, Sigismund August II., king of Poland, also conferred with him on political questions of moment. On the death of Selim in 1574, Nasi receded from his political position, but retained his wealth and offices, and passed the rest of his life at Belvedere (Constantinople). He died in 1579.

*See* Graetz, *History of the Jews* (Eng. trans.), vol. iv. chs. xvi.–xvii.; *Jewish Encyclopedia,* ix. 172. (I. A.)

**NASIK,** a town and district of British India, in the Central division of Bombay. The town is on the Godavari river, connected by a tramway (6 mi.) with Nasik Road railway station, 107 mi. N.E. of Bombay. Pop. (1941) 52,386. It is a very holy place of Hindu pilgrimage, being 18 mi. from the source of the Godavari, and a large number of Brahman priests live here. Shrines and temples line the river banks, and in the vicinity there are a number of sacred caves, among which those of Pandu Lena are the most noteworthy. They are ancient Buddhist caves dating from the 3rd century before Christ to the 6th century after, with numerous inscriptions of the highest historical value. Nasik has manufactures of brass and copper ware, and there is a government distillery at Nasik Road.

The DISTRICT OF NASIK has an area of 5,922 sq.mi. With the exception of a few villages in the west, the whole district is situated on a tableland from 1,300 to 2,000 ft. above sea-level. The western portion is hilly, and intersected by ravines. The eastern tract is open, fertile and well cultivated. The Sahyadri range stretches from north to south; the watershed is formed by the Chander range, which runs east and west. All the streams to the south of that range are tributaries of the Godavari. To the north of the watershed, the Girna and its tributary the Mosam flow through fertile valleys into the Tapti. The Girna Left Bank Canal, irrigating some 4,000 acres, was opened in 1909. It contains several old hill forts, the scenes of many engagements during the Mahratta wars. Nasik district became British territory in 1818 on the overthrow of the peshwa. The population in 1941 was 1,113,901. The principal crops are millet, wheat, pulse, oil-seeds and cotton and fine grapes and vegetables are grown. There is a trade in copper and brass ware, and sugar cane. There are railway workshops at Igatpuri. At Sharanpur is a Christian village, with an orphanage of the Church Missionary Society. The district is crossed by the main line of the Great Indian Peninsula railway.

**NASMYTH, ALEXANDER** (1758–1840), Scottish portrait and landscape painter, was born in Edinburgh on Sept. 9, 1758. He studied at the Trustees' Academy under Runciman, and became apprenticed as heraldic painter to a coach-builder. At the age of 16 he attracted the attention of Allan Ramsay, who took him to London, and employed him upon the subordinate portions of his works. Nasmyth returned to Edinburgh in 1778, and was soon largely patronized as a portrait painter. He also assisted Mr. Miller of Dalswinton, as draughtsman, in his mechanical researches and experiments; and through his generosity was able to go to Italy, where he remained two years. On his return he painted the portrait of Burns, now in the Scottish National Gallery and well known through Walker's engraving. Nasmyth's pronounced Liberal opinions gave offence to many of his aristocratic patrons, and led to the diminution of his practice as a portraitist. In his later years, accordingly, he worked mainly at landscapes, and occasionally at scene-painting. He has been styled the "father of Scottish landscape art." His subjects are carefully finished and coloured, but are wanting in boldness and freedom.

Nasmyth was also largely employed by noblemen throughout the country in the improving and beautifying of their estates, in which his fine taste rendered him especially skilful. As an architect, he is known for his designs for the Dean Bridge, Edinburgh, and the graceful circular temple covering St. Bernard's Well. Nasmyth died in Edinburgh on April 10, 1840. His youngest son, James, was the well-known inventor of the steam-hammer. His eldest son, Patrick (1787–1831), became a clever landscapist.

For an account of the Nasmyth family *see* James Nasmyth's *Autobiography* (1883).

**NASMYTH, JAMES** (1808–1890), Scottish engineer, inventor of the steam-hammer, was born in Edinburgh on Aug. 19, 1808, and was the youngest son of Alexander Nasmyth, the "father of Scottish landscape art." He started business in Manchester on his own account in 1834, and in a few years he was at the head of the prosperous Bridgewater foundry at Patricroft, from which he was able to retire in 1856 with a fortune. The invention of the steam-hammer, with which his name is associated, was actually made in 1839, a drawing of the device appearing in his note-book, or "scheme-book," as he called it, with the date Nov. 24 of that year. It was designed to meet the difficulty experienced by the builders of the "Great Britain" steamship in finding a firm that would undertake to forge the large paddle-wheel shaft required for that vessel, but no machine of the kind was constructed till 1842. In that year Nasmyth discovered one in Schneiders' Creuzot works, and he found that the design was his own and had been copied from his "scheme-book." Apparently, however, he was anticipated in the idea by James Watt. Nasmyth did much for the improvement of machine-tools, and his inventive genius devised many new appliances—a planing-machine ("Nasmyth steam-arm"), a nut-shaping machine, steam pile-driver, hydraulic machinery for various purposes, etc. On his retirement

he lived at Penshurst in Kent, and amused himself with the study of astronomy, and especially of the moon, on which he published a work, *The Moon considered as a Planet, a World and a Satellite,* in conjunction with James Carpenter in 1874. He died in London on May 7, 1890.

His *Autobiography* (edit. Samuel Smiles) was published in 1883.

**NASR-ED-DIN** [NÁṢIRU'D-DIN] (1829–1896), shah of Persia, was born on April 4, 1829. His mother, a capable princess of the Kajar family, persuaded Shah Mohammed, his father, to appoint him heir apparent, in preference to his elder brothers; and he was accordingly made governor of Azerbaijan. His succession to the throne, Oct. 13, 1848, was vigorously disputed, especially by the followers of the reformer El Bab, upon whom he wreaked terrible vengeance. In 1855 he reestablished friendly relations with France, and coming under the influence of Russia, signed a treaty of amity on Dec. 17 with that power, but remained neutral during the Crimean War. In 1856 he seized Herat, but a British army under Outram landed in the Persian gulf, defeated his forces and compelled him to evacuate the territory. The treaty of peace was signed at Paris, on March 4, 1857, and to the end of his reign he treated Great Britain and Russia with equal friendship. In 1866 the shah authorized the passage of the telegraph to India through his dominions and reminted his currency in the European fashion. In 1873, and again in 1889, he visited England in the course of his three sumptuous journeys to Europe, 1873, 1878, 1889.

The only results of his contact with Western civilization appear to have been the proclamation of religious toleration, the institution of a postal service, accession to the postal union and the establishment of a bank. He gave the monopoly of tobacco to a private company, but was soon compelled to withdraw it in deference to the resistance of his subjects. Abstemious in habits, and devoted to music and poetry, he was a cultured, able and well-meaning ruler, and his reign, already unusually long for an Eastern potentate, might have lasted still longer had it not been for the unpopular sale of the tobacco monopoly, which was probably a factor in his assassination at Teheran on May 1, 1896, by a member of the Babi faction. He was succeeded by his son Muzaffar-ed-din.

**NASRIDES, THE,** of Granada, were the last of the Mohammedan dynasties in Spain. They ruled from 1232 to 1492. The dynasty was of remote Arabic origin, but its immediate source was the mountain range of the Alpujarra, and the founder was Yusuf (or Yahīa) l'Nasr, a chief who was engaged in conflict with the family of Beni-Hud, once kings at Saragossa, who held the fortress of Granada. Yusuf's nephew (or son) Mohammed completed the defeat of the Beni-Hud largely by the help of the king of Castile, to whom he did homage and paid tribute. From Mohammed I., called el Ghalib, *i.e.,* the Conqueror (1238–73), to Mohammed XI., called Boabdil, and also the little king "El Rey Chico" by the Christians, who lost Granada in 1492, there are counted 29 reigns of the Nasrides, giving an average of nine years. But there was not the same number of sultans, for several of them were expelled and restored two or three times. There were also contemporary reigns in different parts, and tribal or local rivalries between plain and hill, and the chief towns, Granada, Malaga and Guadix. The dissensions of the Nasrides reached their greatest pitch of fury during the very years in which the Catholic sovereigns were conquering their territory piecemeal, 1482–92.

*See* M. Lafuente Alcantara, *Historia de Granada* (Granada, 1884); S. Lane-Poole, *The Mohammedan Dynasties* (1894).

**NASSAU,** a territory of Germany, now forming the bulk of the government district of Wiesbaden, in the Prussian province of Hesse-Nassau, but until 1866 an independent and sovereign duchy of Germany. It consists of a territory, 1,830 sq.m. in area, divided into two nearly equal parts by the river Lahn and bounded on the south and west by the Main and Rhine, on the north by Westphalia and on the east by Hesse. The southern half is almost entirely occupied by the Taunus mts., while to the north of the Lahn is the barren Westerwald. The valleys and low-lying districts, especially the Rheingau, are very fertile, producing abundance of grain, flax, hemp and fruit; but by far the most valuable product of the soil is its wine. Nassau is one of the most thickly wooded regions in Germany, and its forests yield good timber and harbour large quantities of game while the rivers abound in fish. There are upwards of a hundred mineral springs in the district; the best known are those of Wiesbaden and Ems. Other mineral wealth of Nassau includes iron, lead, copper, building stone, coals, slate, a little silver and a bed of malachite. Manufactures are unimportant, but brisk trade is carried on by rail and river in wine, timber, grain and fruit. There are few places of importance besides the above-named spas; Höchst is the only manufacturing town. Wiesbaden is the capital. The population of Hesse-Nassau in 1939 was 2,688,922.

**History.**—During the Roman period the whole of the district of Nassau was occupied by the Mattiaci and later by the Alamanni. The latter were subdued by the Franks under Clovis at the end of the 5th century, and at the partition of Verdun in 843 the country became part of the East Frankish or German kingdom. Christianity seems to have been introduced in the 4th century. The founder of the house of Nassau is usually regarded as a certain Drutwin (d. 1076), who built a castle on a hill overlooking the Lahn, near the present town of Nassau. Drutwin's descendant Walram (d. 1198) took the title of count of Nassau, and placed his lands under the immediate suzerainty of the German king; previously he had been a vassal of the archbishop of Trier. Then in 1255 Walram's grandsons, Walram and Otto, divided between them their paternal inheritance, which had been steadily increasing in size. Walram took the part of Nassau lying on the left bank of the Lahn and made Weisbaden his residence; Otto took the part on the right bank of the river and his capital was Siegen. The brothers thus founded the two branches of the house of Nassau.

The fortunes of the Ottonian, or younger line, belong mainly to the history of the Netherlands. William the Silent, the best known of this line, and his descendants were called princes of Orange-Nassau, and this line became extinct when the English king William III. died in 1702. The descendants of Count John, his brother, remained rulers of Nassau until 1806, when the reigning prince, William VI., was deprived of his lands because he refused to join the Confederation of the Rhine. Some of them were given in 1815 to the other main line of the family, the one descended from Count Walram. In 1815 William VI. became king of the Netherlands as William I., and was compensated for this loss by the grant of parts of Luxemburg and the title of grand-duke. When in 1890 William's male line died out Luxemburg, like Nassau, passed to the descendants of Count Walram. In the female line he is now represented by the queen of the Netherlands.

The territories possessed by the other branch of the house of Nassau were partitioned several times, and only in 1816 was the whole of Nassau united under the rule of Frederick William of Nassau-Weilburg as duke of Nassau. In 1866 Duke Adolph espoused the cause of Austria, sent his troops into the field, and asked the landtag for money. This was refused; Adolph was soon a fugitive before the Prussian troops, and on Oct. 3, 1866, Nassau was formally incorporated with the kingdom of Prussia.

For the history of Nassau *see* Hennes, *Geschichte der Grafen von Nassau bis 1255* (Cologne, 1843); von Schütz, *Geschichte des Herzogtums Nassau* (Wiesbaden, 1853); von Witzleben, *Genealogie und Geschichte der Fürstenhauses Nassau* (Stuttgart, 1855); F. W. T. Schliephake and K. Menzel, *Geschichte von Nassau* (Wiesbaden, 1865–89); the *Codex diplomaticus nassoicus,* ed. K. Menzel and W. Sauer (1885–87); and the *Annalen des Vereins für nassauische Altertumskunde und Geschichtsforschung* (1827 f.).

**NAST, THOMAS** (1840–1902), American caricaturist, was born on Sept. 27, 1840, in Landau, Germany. His mother took him to New York in 1846. He studied art there with Theodore Kaufmann and at the school of the National Academy of Design. At the age of 15 he became a draughtsman for *Frank Leslie's Illustrated Newspaper;* three years later for *Harper's Weekly.* In 1860 he went to England for the *New York Illustrated News* and soon afterwards joined Garibaldi in Italy as artist for *The Illustrated London News.* His first serious work was the cartoon "Peace" in 1862, directed against those in the North who opposed the prosecution of the Civil War. This and his other car-

toons during the Civil War and Reconstruction days were published in *Harper's Weekly;* they attracted great attention, and Nast was called by President Lincoln "our best recruiting sergeant." Even more able were Nast's cartoons against the Tweed Ring conspiracy in New York city, his caricature of Tweed being the means of the latter's identification and arrest at Vigo. He had been an ardent Republican in his earlier years; but his advocacy of civil service reform and his distrust of Blaine forced him to become a Mugwump and in 1884 an open supporter of the Democratic Party, from which in 1892 he returned to the Republican Party. He had lost practically all of his earnings by the failure of Grant and Ward, and in May, 1902, was appointed consul general at Guayaquil, Ecuador, where he died on Dec. 7, in the same year. He did some painting in oil and some book illustrations, but his fame rests on his caricatures and political cartoons. Nast introduced the donkey to typify the Democratic Party, the elephant to typify the Republican Party, and the tiger to typify Tammany Hall.

*See* A. B. Paine, *Thomas Nast, his Period and his Pictures* (1904).

**NASTURTIUM** or **INDIAN CRESS,** *Tropaeolum majus,* a perennial climber, native of Peru, but in cultivation treated as a hardy annual. It climbs by means of the long stalk of the peltate leaf which is sensitive to contact like a tendril. The irregular flowers have five sepals united at the base, the dorsal one produced into a spur; of the five petals the two upper are slightly different and stand rather apart from the lower three; the eight stamens are unequal and the pistil consists of three carpels which form a fleshy fruit. The flowers are sometimes eaten in salads, and the leaves and young green fruits are pickled in vinegar as a substitute for capers.

The dwarf form known as Tom Thumb (*T. m. nanum*), is an excellent bedding or border flower, growing about a foot high. Other fine annual tropaeolums are *T. peltophorum* with long spurred orange flowers and numerous varieties; and *T. minus,* a kind of miniature *T. majus* with yellow, scarlet and crimson varieties.

The genus *Tropaeolum* (family Tropaeolaceae), native to South America and Mexico, includes about 50 species of generally climbing annual and perennial herbs with orange, yellow, rarely purple or blue, irregular flowers; *A. peregrinum* is the well-known canary-bird flower. A fine nasturtium with brilliant scarlet blossoms is *T. speciosum* from Chile; it has tuberous roots, as have also such well-known perennials as *T. polyphyllum* and *T. pentaphyllum.* The *Nasturtium* of botanists is a genus of plants of the family Cruciferae; *N. officinale* is the water-cress.

**NATAL,** a province of the Union of South Africa, is bounded by the Indian ocean, by the Umtamvuna and Umzimkulu rivers, which divide it from the Griqualand East division of Cape Colony, by the Drakensberg, which separates it from Basutoland, the Orange Free State, and part of the Transvaal, and by the Pongola river, the Lebombo range, and, for a short distance, a line of latitude, which mark it off from the Transvaal, Swaziland and Portuguese East Africa. Natal, in this extended and official sense, includes Zululand and Amatongaland. The northern boundary of Natal proper for part of the way is the Tugela. The sea board from the mouth of the Umtamvuna to the mouth of the Tugela is 166 m., and from the Tugela to the Portuguese border near Ore Point, 210 miles. Its total area is 35,284 sq.m., or 7·47% of the Union, while it carries a little over 20% of the Union's population. The area of Natal proper is 24,910 sq. miles.

Geologically, the country consists of a monoclinal fold affecting Karroo rocks. Along the axis, which runs more or less north and south, these have been eroded and the underlying rocks of the Swaziland system (granite, schists, etc.) have been exposed along a fairly continuous belt, which can be followed from a point, 5 or 6 m. inland from Port Shipstone, through Inchanga, the Valley of a Thousand Hills, and on into Zululand, where their area broadens out. A great part of the country is formed of horizontal, or gently inclined shales and sandstones, among which numerous sills of dolerite are intercalated. Erosion, attacking these beds, has produced a distinctly terraced topography. The hills are often steep-sided and flat-topped.

Conventially, three zones are distinguished: (*a*) the Coast belt below 1,000 ft., which is about 20 m. wide behind Durban, and which narrows southward, and widens considerably when followed northward and into Zululand. (*b*) The Midlands, between 2,000 and 4,000 feet. (*c*) The Highlands from 4,000 ft. to the foot of the Drakensberg. This classification is over simplified, but may serve as a rough indication of the build of the country. The rivers, owing to rejuvenation, have cut deep valleys in their lower courses, with the result that the topography of the coast belt and part of the midlands is very broken. In their middle, and in part of their upper courses, the rivers flow in broad, open valleys. Owing to their high average gradient, and the numerous waterfalls, due to the outcropping of hard beds of sandstone and dolerite, and also to their low winter level, they are all unnavigable, except for stretches of 3 or 4 m. at the mouths of the Umkomaas and Umzimkulu. The dominant topographical feature is the great barrier of the Drakensberg (*q.v.*), which rises to over 10,000 ft., and from which several secondary ranges run out toward the coast. The Lebombo range, in the north runs from north to south, and is caused by the outcrop of resistant lavas. Rivers, such as the Usutu and the Pongola cut across this escarpment in great "poorts."

**Climate and Vegetation.**—These are described under UNION OF SOUTH AFRICA. Owing to the range of altitude from sea-level to 5,000 or 6,000 ft. at the foot of the Drakensberg, there is a wide range of climate, which is further complicated by the varied topography. Always, however, the sub-tropical coast belt stands out as a distinct natural region, with its humid heat, small temperature ranges and its sub-tropical vegetation and production. Inland, the winter drought becomes more clearly marked and frosts more frequent and severe during the winter nights. The chief rain-bearing wind is from the south-west. A very characteristic feature of the Natal climate is the "hot winds," which are usually most frequent in spring and summer. They appear to be due to the flow of air being drawn toward depressions passing southward along the coast. They blow from the north-west and are heated by compression as they descend the escarpments. The temperature often rises above 90° and the relative humidity may fall to 30. A hot wind may blow for a few hours, or for two or three days. It causes great clouds of dust, and all doors and windows in the houses have to be closed. Usually these winds change suddenly, or are replaced by a cool, moist wind from the south-west, which often brings greatly appreciated rain, or sometimes, in the higher districts, snow.

In addition to the trees, shrubs and grasses, described elsewhere, mention may be made of the flowers, which are often beautiful. Some of these, like the red bush lily, grow in the shade of the patches of bush. Others are more tolerant of light, and are to be found in the open. Among these are the fire lily, which blooms in the early spring before the grasses have grown beyond a few inches, the agapanthus, the arum lily along the streams, the gladioli, etc. A very common grassland flower, and one that blooms late, when the grasses are tall, is the leonotis, which attains a height of 5 or 6 ft., and has terra-cotta to orange-coloured flowers. Many a hillside in early spring is enlivened by the flowers of the aloes, in various shades of red. The delightfully rich crimson of the Kafir boom blossoms is peculiarly characteristic of much of Natal.

**Fauna.**—(*See* also SOUTH AFRICA, UNION OF.) Some of the smaller buck have increased of late years, owing to the cover afforded them by the large wattle plantations. Jackals are undesirably numerous in some of the upland districts, and they often destroy many lambs. Otters occur in some of the rivers. Snakes are common. The chief sporting birds are the quail, partridge and guinea fowl. About 450 sq.m. of country have been set aside as game reserves, in which no animals may be killed at any time. There are several such reserves, one near Giants' Castle, to protect the surviving eland, and one on the Mkusi, in Zululand, where the inyala (buck) still survives, as well as impala, the Zululand suni, etc. Reserves have been established in the Klip River and the Umgeni districts. In addition, several animals and birds have been declared royal game, and cannot be shot

or captured. They include the white, or square-lipped, rhinoceros, which is still found in Zululand, the elephant, female eland, the impala, inyala, roan antelope, springbok, sassaby; crested crane, Stanley crane, etc.

**Population.**—The total population of Natal in 1936 was 1,946,468. The natives (*see* ZULULAND, CAPE PROVINCE) numbered in 1936 approximately 1,553,629, or nearly 80% of the total population. About half of them live under tribal conditions on locations, which are saturated with population, under 20th-century conditions of skill and methods of exploitation. The other half live on farms owned by Europeans, on crown lands, or in the towns. In 1936 the Asiatics were numbered at 183,661. They were largely concentrated in the coastal belt. Originally imported as indentured labourers for the sugar plantations, many of these Indians have become small market gardeners, or have taken employment in hotels and domestic service or industry, where they supply much of the unskilled and semi-skilled labour. The British elements constitute the majority of the white population of 190,549 (1936). The "northern districts," Utrecht and Vryheid, however, are chiefly inhabited by Afrikaans-speaking people of Dutch origin. In recent years the percentage of Europeans of non-British origin in the total population has probably increased, owing to the considerable numbers employed in the government services. In 1936 the "home language" of the Natal European population was reported as follows: English 141,550, Afrikaans 38,301, English and Afrikaans 3,727, German 4,792, other languages 2,179. The German group is centred about New Hanover. Scandinavian settlers about the Umzimkulu, and in Durban, especially connected with the whaling industry, contribute a very valuable element to the population. There is also an appreciable French element, which originally migrated to Natal, largely from Mauritius, in connection with the sugar industry, though it is no longer confined to that industry. The number of "coloured" people in Natal is quite small, the "mixed and others" in 1936 numbering about 18,629.

**Towns.**—Apart from Pietermaritzburg, the capital, and Durban (*qq.v.*), the only port and the largest centre, the towns of Natal are quite small. Only two, in addition to the two just mentioned, had a white population of over 2,000, according to the 1936 census: Ladysmith (whites 3,660, total 9,702), which is now a railway centre of some importance; and Vryheid (whites 3,127, total 6,436). Other towns, with 1936 populations, are: Glencoe (whites 1,256, total 3,339), a railway junction, and near the coal fields; Newcastle (whites 1,908, total 4,945). Vryheid and Newcastle are also near coal mines, and Newcastle is developing an iron and steel industry.

**Communications.**—Railway construction has been greatly handicapped by the varied topography. The main line from Durban to the Transvaal climbs to 1,808 ft. at Krautzkloof (23 mi.), 3,006 ft. at Thornville Junction (61 mi.), drops to 2,218 at Pietermaritzburg (73 mi.), rises to 3,702 at Hilton Road (84 mi.), to 4,807 at Nottingham Road (116 mi.), drops to 3,280 ft. at Colenso (185 mi.), and rises again to 5,429 ft. at Volksrust, just over the Transvaal border, and to 5,520 ft. at Van Reenens, just within the Orange Free State. Electrification of the whole Natal main line from Durban to Volksrust (323 mi.), begun in 1922, was completed in 1937. From the main system a line runs from Durban along the coast southward to Port Shepstone, and northward as far as the Pongola in Zululand to serve the sugar cane area. From Pietermaritzburg a line with two short branches was constructed to Krantzkop through the wattle belt. Another runs southwestward across the grain of the country to open up East Griqualand; from Glencoe Junction a line running through Dundee and Vryheid carries large quantities of coal. There are a few other smaller lines, which can be seen on a map. As in other parts of the world, the railways are feeling the effect of motor competition along some stretches. The journey by road from Pietermaritzburg to Durban is shorter and quicker than by rail.

**Agriculture.**—The coast belt is sharply marked off from the rest of the country. It produces sugar, bananas, pineapples, citrus fruit, etc. Formerly, practically all the cane grown was of the Uba variety, but extensive research was undertaken with a view to the development of new Mosaic-free varieties superior to Uba. In 1940 there were 340,396 ac. under cane, and the production of sugar for the year 1938–39 was 522,732 short tons. The industry now satisfies the requirements of the South African market, and has a surplus for export. Among the by-products are molasses, used for cattle feeding and also exported, motor spirit produced from the molasses, methylated spirits, ether and wax. Approximately 2,000 ac. in the Kearsney-Stanger area are devoted to tea growing. In 1938–39 the production of green leaf was 3,438,532 lb., of manufactured tea, 814,015 lb. The industry shows little sign of growing. The rest of Natal is devoted to mixed farming, with increasing stress being laid on dairying. Maize thrives particularly well in the midlands, but little of this grain is exported because it is often sold by the white farmers to the natives, whose own food production is insufficient. Between 2,000 and 6,000 ft. above sea level the Australian black wattle is grown, especially in the mist belts along the escarpments. From the bark an extract is made which is used in tanning. The poles supply the mines with pit props, and the towns with much of their domestic fuel. There is a wattle belt, fairly well defined in the midlands of Natal, through the middle of which runs the Richmond-Pietermaritzburg-Greytown-Krantzkop railway. The wattle plantations cover 365,000 ac., and in 1939 the quantity of bark exported from the country was over 90,000 tons, Great Britain, Belgium, Germany and Japan being the chief customers. Wattle extract is also exported. Cotton growing appears to have passed the experimental stage. It is being grown in some of the northern and eastern districts of Natal and in Zululand. In 1938–39, 533,588 lb. unginned cotton seed were grown. The growing of tobacco was stimulated by the introduction of a preferential tariff for empire tobacco in Great Britain in 1925.

BY COURTESY OF E. G. MORSE

'RICKSHA "BOY" OF DURBAN, NATAL

The chief mineral produced in the country is coal. The chief coal field is in the Klip river and Newcastle districts, centring about Dundee. Mines are also active in the Vryheid and Utrecht districts. The expense of the long railway journey to the coast, on the average about 240 mi., is partially counterbalanced by the nearness of the coal to the surface. In 1940 the output was over 4,000,000 short tons. At Waschbank the following by-products are being produced: tar, sulphate of ammonia, light creosote oil and naphtha. Tar is also being made.

**Education.**—For higher education *see* SOUTH AFRICA, UNION OF. The direction of public education, other than higher education, rests with the Provincial Education department, subject to the control of the provincial administration. At its head is the superintendent of education. The department has direct management of primary and of some secondary schools, and makes grants to various private schools, which maintain the same standard as the government schools. Fees are charged for pupils in the secondary schools. Special schools are provided for native, coloured and Indian children. Attendance is compulsory for European children between 7 and 15 who live within three miles of a school. A government training college for teachers is situated in Pietermaritzburg in conjunction with Natal University college. There are in Natal five training colleges for natives, Sastri college and four training classes for Indians, and one training centre for coloured teachers. In addition to the government schools, there are several good schools in the province, both for boys and girls, which are modelled on the English public school. An agricultural college, connected with a government experimental farm, was opened in 1906 at Cedara, 14 mi. from Pietermaritzburg. To

meet some of the requirements of the non-European population, there were, in 1939, 739 public primary and 55 secondary schools for natives, and 141 primary and 5 secondary for other non-Europeans (chiefly Asiatics). There were 86,345 native pupils, and 29,097 other non-Europeans in the primary, secondary and industrial schools of Natal in 1939. (*See* also SOUTH AFRICA, UNION OF.) (R. U. S.)

## HISTORY

Vasco da Gama on his voyage to India sighted the bluff at the entrance to the bay now forming the harbour of Durban on Christmas day 1497 and named the country Terra Natalis. Da Gama made no landing there and, like the rest of South Africa, Natal was neglected by the Portuguese, whose nearest settlement was at Delagoa bay. The first detailed accounts of the country were received from mariners. In 1684 an English ship put into Port Natal (as the bay came to be known) and purchased ivory from the natives, who, however, refused to deal in slaves. In May 1685 another English ship the "Good Hope" was wrecked in crossing the bar at Port Natal and in Feb. 1686 the "Stavenisse," a Dutch East Indiaman, was wrecked a little farther south. Survivors of both vessels lived for nearly a year at Port Natal and there built a boat in which they made the voyage to Capetown in 12 days. They brought with them three tons of ivory. This fact, and their reports of the immense herds of elephants which roamed the bush, led Simon van der Stell, then governor at Capetown to dispatch (1689) the ship "Noord" to Port Natal, with instructions to her commander to open up a trade in ivory and to acquire possession of the bay. The bay was "purchased" from the chief of the Amatuli tribe, for about £50 worth of goods. No settlement was then made, and in 1705 the son of the chief repudiated the bargain. In 1721 the Cape government did form a settlement at the bay, but it was soon afterward abandoned. Thereafter for nearly 100 years Natal was again neglected by white men.

From the records of the 17th and 18th centuries it is apparent that the people then inhabiting Natal were Bantu Negroes of the Kafir (Ama Xosa) branch. The most numerous and most powerful tribe appeared to be the Abambo, while the Amatuli occupied a considerable part of the coastland. These Kafirs seem to have been more given to agriculture and more peaceful than their neighbours in Kaffraria and Cape Colony. But the quiet of the country was destroyed by the inroads of Chaka, the chief of the Zulus (*see* ZULULAND). Chaka between 1818 and 1820 ravaged the whole of what is now known as Natal, and after beating his foes in battle, butchered the women, children and old men, incorporating the young men in his impis. The population was greatly reduced and large areas left without a single inhabitant. By right of conquest Chaka became undisputed master of the country.

**First British Settlement.**—Such was the situation when the first British settlement was made in Natal, Cape Colony having passed meanwhile from Dutch to British possession. In 1823 Francis George Farewell, formerly a lieutenant in the British navy, with other merchants of Capetown, formed a company to trade with the natives of the southeast coast. In the brig "Salisbury," commanded by James S. King, who had been a midshipman in the navy, Farewell visited Port Natal, St. Lucia and Delagoa bays. He was so impressed with the possibilities of Natal both for trade and colonization that he resolved to establish himself at the port. He went there with ten companions, among them Henry Francis Fynn. All the rest save Farewell and Fynn speedily repented of their adventure and returned to the Cape, but the two who remained were joined by three sailors, John Cane, Henry Ogle and Thomas Holstead, a lad. Farewell, Fynn and others went to the royal kraal of Chaka and, having cured him of a wound and made him various presents, obtained a document, dated Aug. 7, 1824, ceding to "F. G. Farewell and company entire and full possession in perpetuity" of a tract of land including "the port or harbour of Natal." On the 27th of the same month Farewell hoisted the Union Jack at the port and declared the territory he had acquired a British possession. In 1825 he was joined by King, who had meantime visited England and had obtained from the government a letter of recommendation to Lord Charles Somerset, governor of the Cape, granting King permission to settle at Natal. Farewell, King and Fynn made independent settlements at various parts of the bay, where a few Amatuli still lingered. They lived, practically, as Kafir chiefs, trading with Chaka and gathering round them many refugees from that monarch's tyranny. Early in 1828 King, accompanied by two of Chaka's indunas, voyaged in the "Elizabeth and Susan," a small schooner built by the settlers, to Port Elizabeth. He appears to have been coldly received by the authorities. Soon after his return to Natal, King died, and in the same month (Sept. 1828) Chaka was murdered by his brother Dingaan. In Dec. 1828 Farewell went in the "Elizabeth and Susan" to Port Elizabeth. On this occasion the authorities confiscated the schooner on the ground that it was unregistered and that it came from a foreign port. Farewell was not daunted, and in Sept. 1829 set out to return overland to Port Natal. He was, however, murdered in Pondoland by a chief who was at enmity with the Zulus. Fynn thus became leader of the whites at the port, Dingaan declaring him to be his representative and "great chief of the Natal Kafirs." In 1834, however, Fynn accepted a post under the Cape government and did not return to Natal for many years. It was in this year that a petition from Capetown merchants asking for the creation of a British colony at Natal was met by the statement that the Cape finances would not permit the establishment of a new dependency.

The next step was taken by the settlers at the port, who in 1835 resolved to lay out a town, which they named Durban, after Sir Benjamin d'Urban, then governor of Cape Colony. The settlers, who numbered about 50, sent a memorial to the governor calling attention to the fact that they were acknowledged rulers over a large tract of territory south of the Tugela, and asking that this territory should be proclaimed a British colony under the name of Victoria and that a governor and council be appointed. To all these requests no official answer was returned. The settlers had been joined in the year named (1835) by Captain A. F. Gardiner, a naval officer, whose chief object was the evangelization of the natives. With the support of the traders he founded a mission station in the hills (which he named Berea) overlooking the bay. In 1837 Gardiner was given authority by the British government to exercise jurisdiction over the traders. They, however, refused to acknowledge Gardiner's authority, and from the Cape government he received no support.[1] It was not until their hand was forced by the occupation of the interior by Boer farmers that the Cape authorities at length intervened.

**The Dutch and Dingaan.**—The British settlers had, characteristically, reached Natal mainly by way of the sea; the new tide of immigration was by land—the *voortrekkers* streamed through the passes of the Drakenberg, bringing with them their wives and children and vast herds of cattle. The reasons which caused the exodus from the Cape are discussed elsewhere (*see* SOUTH AFRICA, UNION OF and CAPE PROVINCE); here it is only necessary to point out that those emigrants who entered Natal shared with those who settled elsewhere an intense desire to be free from British control. The first emigrant Boers to enter the country were led by Pieter Retief (*c.* 1780–1838), a man of Huguenot descent and of marked ability, who had suffered severely in the Kafir wars. Passing through the almost deserted upper regions, Retief arrived at the bay in Oct. 1837. He went from there to Dingaan's kraal with the object of securing a formal cession of territory to the Dutch farmers. Dingaan consented on condition that the Boers recover for him certain cattle stolen by another chief; this task Retief accomplished, and with the help of the Rev. F. Owen, an Anglican missionary then living at Dingaan's kraal, a deed of cession was drawn up in English and signed by Dingaan and Retief on Feb. 4, 1838. Two days after the signature of the deed Retief and all of his party, 66 whites,

[1] Captain Allen Francis Gardiner (1794–1851) left Natal in 1838, subsequently devoting himself to missionary work in South America, being known as the missionary to Patagonia. He died of starvation in Tierra del Fuego.

besides Hottentot servants, were treacherously murdered by Dingaan's orders. The Zulu king then commanded his impis to kill all the Boers who had entered Natal. The Zulu forces crossed the Tugela the same day, and the most advanced parties of the Boers were massacred, many at a spot near where the town of Weenen now stands, its name (meaning wailing or weeping) commemorating the event. In one week after the murder of Retief 600 Boers—men, women and children—had been killed by the Zulus. The English settlers at the bay, with a following of some 700 natives, made an attempt to aid the Boers, but in a fight on April 7 they were overwhelmed, and only four Europeans escaped to the bay.

After the Zulus retired, fewer than a dozen Englishmen returned to live at the port; the missionaries, hunters and other traders went back to the Cape. Meanwhile the Boers, who had repelled the Zulu attacks on their laagers, had been joined by others from the Drakenberg, and about 400 men under Hendrik Potgieter and Piet Uys advanced to attack Dingaan. On April 11, however, they fell into a trap and with difficulty cut their way out. Among those slain were Piet Uys and his son Dirk, aged 15, who rode by his side. Toward the end of the year the Boers received reinforcements, and in December 460 men set out under Andries Pretorius to avenge themselves on the Zulus. On Sunday Dec. 16, 1838, while laagered near the Umslatos river, they were attacked by over 10,000 Zulus. The Boers had firearms, the Zulus their assegais only, and after a three hours' fight the Zulus were totally defeated, losing thousands killed, while the farmers' casualties were under a dozen. (This memorable victory is annually commemorated by Afrikaners as Dingaan's day, while the Umslatos, which ran red with the blood of the slain, was renamed Blood river.) Dingaan fled, the victorious Boers entered the royal kraal, gave decent burial to the skeletons of Retief and his party, and regarded themselves as now undisputed masters of Natal.

Returning south, Pretorius and his commando were surprised to learn that Port Natal had been occupied on Dec. 4 by a detachment of the 72nd Highlanders. In sanctioning the occupation of the port the British government of the day had no intention of making Natal a British colony, but wished to prevent the Boers establishing an independent republic upon the coast. After remaining at the port just over a year the Highlanders were withdrawn, on Christmas Eve 1839. Meanwhile the Boers had founded Pietermaritzburg and made it the seat of their volksraad. They rendered their power in Natal absolute, for the time, in the following month, when they joined with Panda, Dingaan's brother, in another attack on the Zulu king. Dingaan was utterly defeated and soon afterward perished, Panda becoming king in his stead by favour of the Boers.

This Boer community was not able to establish an enduring state. But their impatience of control, reflected in the form of government adopted, led to disastrous consequences. Legislative power was vested, nominally, in the volksraad (consisting of 24 members), while the president and executive were changed every three months. But whenever any measure of importance was to be decided a meeting was called of *het publiek,* that is, of all who chose to attend, to sanction or reject it—a procedure which led to confusion and indecision. While such was the domestic state of affairs the settlers cherished large territorial views. They had declared themselves an independent state under the title of "the republic of Port Natal and adjacent countries" (commonly called the republic of Natalia or Natal), and sought (Sept. 1840) from Sir George Napier at the Cape an acknowledgment of their independence by Great Britain. Sir George, being without definite instructions from England, could at first give no decisive answer. Having at length received an intimation from London that the queen "could not acknowledge the independence of her own subjects, but that the trade of the emigrant farmers would be placed on the same footing as that of any other British settlement, upon their receiving a military force to exclude the interference with or possession of the country by any other European power," Sir George communicated this decision to the volksraad in Sept. 1841. The Boers, who strongly resented the contention of the British that they could not shake off British nationality though beyond the bounds of any recognized British possession, after very brief consideration firmly rejected Napier's overtures.

An incident which happened at this time greatly encouraged the Boers to persist in their opposition. In March 1842 a Dutch vessel sent out by G. G. Ohrig, an Amsterdam merchant who sympathized warmly with the cause of the emigrant farmers, reached Port Natal, and its supercargo, J. A. Smellekamp (a man who subsequently played a part in the early history of the Transvaal and Orange Free State), without any authority, concluded a treaty with the volksraad assuring them of the protection of Holland. The Natal Boers were firmly persuaded that Holland would aid them in resisting Great Britain.

**Dick King's Ride.**—On May 4, 1842, Capt. T. C. Smith with a force of 263 men who, at Sir George Napier's orders had marched overland from Cape Colony, reached Durban without opposition, and encamped at the base of the Berea hills. The Boers, cut off from their port, called out a commando of some 300 to 400 men under Andries Pretorius and gathered at Congella at the head of the bay. After repulsing an attack on their camp the Boers captured the harbour and settlement, and on May 31 blockaded the British camp. Meanwhile an old Durban resident, Richard (commonly called Dick) King, had undertaken to convey tidings of the perilous position of the British force to the commandant at Graham's Town. He started on the night of the 25th and, escaping the Boer outposts, rode through the dense bush and across the bridgeless rivers of Kaffraria at peril of his life from hostile natives and wild beasts, and in nine days reached his destination—a distance of nearly 600 mi. by the route to be followed. This remarkable ride was accomplished with one change of mount, obtained from a missionary in Pondoland. A comparatively strong force under Col. A. J. Cloete was at once sent by sea to Port Natal, and on June 26 Capt. Smith was relieved. Within a fortnight Col. Cloete had received the submission of the volksraad at Pietermaritzburg. The burghers represented that they were under the protection of Holland, but this plea was peremptorily rejected by the commander of the British forces.

The British government of the day, the second Peel administration, held that the establishment of a colony in Natal would be attended with little prospect of advantage, but in deference to the strongly urged views of Sir George Napier, Lord Stanley (secretary of state for the colonies), in a dispatch of Dec. 13, received in Capetown on April 23, 1843, consented to its annexation. The institutions adopted were to be as far as possible in accordance with the wishes of the people, but it was a fundamental condition "that there should not be in the eye of the law any distinction or disqualification whatever, founded on mere difference of colour, origin, language or creed"—a condition not kept in later years. Sir George then appointed Henry Cloete (a brother of Col. Cloete) as special commissioner to explain to the Natal volksraad the decision of the government. Cloete, whose task was one of great difficulty and delicacy, behaved with the utmost tact, and on Aug. 8, 1843, the Natal volksraad unanimously agreed to the terms proposed by Lord Stanley. Many of the Boers who would not acknowledge British rule trekked once more over the mountains into what are now the Orange Free State and Transvaal provinces. At the end of 1843 there were not more than 500 Boer families left in Natal.

**A British Colony.**—Although proclaimed a British colony in 1843, and in 1844 declared a part of Cape Colony, it was not until the end of 1845 that an effective administration was installed, with Martin West as lieutenant-governor, and the power of the volksraad finally came to an end.

The new administration found it hard to please the Boer farmers, who among other grievances resented what they considered the undue favour shown to the natives, whose numbers had been greatly augmented by the flight of refugees from Panda. The natives were settled in 1846 in "locations" and placed under the general supervision of Sir Theophilus Shepstone (*q.v.*). Sir Harry Smith, newly appointed governor of the Cape, met, on the banks of the upper Tugela, a body of farmers preparing to

recross the Drakensberg—which had been fixed as the northern frontier—and by remedying their grievances induced many of them to remain in Natal. By the migration of the others the whites were again considerably reduced, but the Boers who remained were contented and loyal, and through the arrival of 4,500 emigrants from England in the years 1848–1851 and by subsequent immigration from overseas the colony became overwhelmingly British in character.

From these years dates the development of trade and agriculture in the colony, followed somewhat later by the exploitation of the mineral resources of the country. At the same time schools were established and various churches began or increased their work in the colony. Dr. Colenso, appointed bishop of Natal, arrived in 1854. In 1856 the dependence of the country on Cape Colony was put to an end and Natal was constituted a distinct colony with a legislative council of 16 members, 12 elected by the inhabitants and 4 nominated by the crown. At the time the white population exceeded 8,000. While dependent on the Cape, ordinances had been passed establishing Roman-Dutch law as the law of Natal and, save where modified by legislation, it remained in force.

**Indian Coolies Introduced.**—The British settlers soon realized that the coastlands were suited to the cultivation of tropical or semitropical products, and from 1852 onward sugar, coffee, cotton and arrowroot were introduced, tea being afterward substituted for coffee. The sugar industry soon became of importance, and the planters were compelled to seek for large numbers of labourers. The natives, at ease in their locations, did not volunteer in sufficient numbers, and recourse was had to coolie labour from India. The first coolies reached Natal in 1860. They came under indentures, but at the expiration of their contract were allowed to settle in the colony. Up to 1869 some 5,000 Indians had come to Natal. Immigration then ceased but was resumed in 1874. This bringing in of Indians proved one of the most momentous steps taken in the history of South Africa, for the Indian population rapidly increased, the "free" Indians becoming market gardeners, farmers, hawkers, traders, and in time serious competitors of the whites. But in 1860 and for many years afterward these consequences were not foreseen, and alone among the South African states Natal offered a welcome to Asiatics.

In 1867 R. W. Keate (1814–73) became lieutenant-governor, a post which he filled until 1872. His administration was notable, not so much for internal affairs but because he twice acted as arbitrator in disputes in which the Boer states were involved. In a dispute between the Transvaal and the Orange Free State he decided (Feb. 1870) that the Klip river and not the upper Vaal was the frontier stream. A more famous decision, that known as the Keate award, was given in Oct. 1871. It concerned the south-western frontiers of the Transvaal, and the award, which was against the Transvaal pretensions, had important effects on the history of South Africa (*see* GRIQUALAND and TRANSVAAL).

During all this time little was done to alter the condition of the natives. There was scarcely an attempt to copy the policy, then followed in Cape Colony, of encouraging the education and civilization of the black man. Neither was Natal faced with the Cape problem of a large half-caste population. While the opportunity of educating and training a docile people was in the main neglected, savage abuse of power by their chiefs was prevented. Under the superintendence of Shepstone the original refugees were quiet and contented. This ideal lot, from the native point of view, drew such numbers of immigrants from disturbed districts that, with the natural increase of population, in 30 years the native inhabitants increased from about 100,000 to fully 350,000. The first serious collision between the natives and the government occurred in 1873. The Amahlubi, one of the highest in rank of the Bantu tribes of South Africa, fleeing from the cruelties of Panda, had been located by the Natal government under their chief Langalibalele (*i.e.*, the great sun which shines and burns) in 1848 at the foot of the Drakensberg with the object of preventing the Bushmen who dwelt in the mountains from plundering the upland farmers. There the Amahlubi prospered, and after the diamond fields had been discovered many of the young men who had been to Kimberley brought back firearms. These Langalibalele refused to register, and entered into negotiations with several tribes with the object of organizing a general revolt. Prompt action by Sir Benjamin Pine, the lieutenant-governor of the colony, together with help from the Cape and Basutoland, prevented the success of Langalibalele's plan, and his own tribe, numbering some 10,000 persons, was the only one which rebelled. The chief was captured, and exiled to Cape Colony (Aug. 1874). Permitted to return to Natal in 1886, he died in 1889.

**The Colenso Affair.**—Meantime the colony had weathered a severe commercial crisis brought on in 1865 through over-speculation and the neglect of agriculture, save along the coast belt. But the trade over the mountains largely developed on the discovery of the Kimberley diamond mines, and the progress of the country was greatly promoted by the substitution of the railway for the ox wagon as a means of transport. On Jan. 1, 1876, Sir Henry Bulwer, who had succeeded Wolseley as governor, turned the first sod of a new state-owned railway which was completed as far as Maritzburg in 1880. At this date the white inhabitants numbered about 20,000. But besides a commercial crisis, the colony had been the scene of an ecclesiastical dispute which attracted widespread attention. Bishop Colenso (*q.v.*), condemned in 1863 on a charge of heresy, ignored the authority of the court of South African bishops and was maintained in his position by decision of the privy council in England. This led to a division among the Anglican community in the colony and the consecration in 1869 of a rival bishop, who took the title of bishop of Maritzburg. (Reunion of the Anglican body in Natal was effected in 1910.) Colenso's bold advocacy of the cause of the natives attracted almost equal attention. His native name was Usobantu (*father of the people*).

For some years Natal, in common with the other countries of South Africa, had been influenced by disturbed conditions in the Transvaal. The annexation of the Transvaal to Great Britain, effected by Sir Theophilus Shepstone in April 1877, would, it was hoped, put a period to the disorders in that country. But the new administration at Pretoria inherited many disputes with the Zulus, disputes which were in large measure the cause of the war of 1879. For years the Zulus had lived in amity with the Natalians, from whom they received substantial favours, and in 1872 Cetywayo (*q.v.*), on succeeding his father Panda, had given assurances of good behaviour. These promises were not kept for long, and by 1878 his attitude had become so hostile toward both the Natal and Transvaal governments that Sir Bartle Frere, then high commissioner for South Africa, determined on his reduction. During the war (*see* ZULULAND) Natal was used as the British base, and the Natal volunteers rendered valuable service in the campaign which, after opening with disasters to the British forces, ended in the breaking of the Zulu power.

**Majuba.**—Scarcely had the colony recovered from the shock of the Zulu War than it was involved in the uprising of the Transvaal Boers (1880–81). The Natalians were intensely British in sentiment, and resented deeply the policy adopted by the Gladstone administration. At Ingogo, Majuba and Laing's Nek, all of them situated within the colony, British forces had been defeated by the Boers; and the treaty of retrocession was regarded in Natal as an unworthy surrender of British rights. The Natalians nevertheless made up their minds to shape their policy in conformity with that settlement. It was not long before their patience was once more severely taxed. Transvaal Boers, taking advantage of the disputes among the petty Zulu chiefs set up by Sir Garnet Wolseley after the war of 1878–79, intervened (in 1883), and as a reward for the assistance they had rendered to one of the combatants, demanded and annexed 8,000 sq.mi. of country, which they styled the "New Republic." This interference by the Transvaal in Zululand affairs gave great offense in Natal. The "New Republic," reduced in area, however, to fewer than 2,000 sq.mi., was nevertheless recognized by the British government in 1886, and in 1888 its consent was given to the territory (the Vryheid district) being incorporated with the Transvaal. Meanwhile, in 1887, the remainder of Zululand had been annexed to Great Britain (*see* ZULULAND).

**Effect of Discovery of Gold.**—In 1884 the discovery of gold in De Kaap valley, and on Moodie's farm in the Transvaal, caused a considerable rush of colonists from Natal to that country. Natal not only sent its own colonists to the new fields, but also offered the nearest route for prospectors from Cape Colony or from Europe. Two years later the Rand gold fields were proclaimed, and the tide of trade which had already set in with the Transvaal steadily increased. In that year (1886) the railway reached Ladysmith, and in 1891 it was completed to the Transvaal frontier at Charlestown, the section from Ladysmith northward opening up the Dundee and Newcastle coal fields. Thus a new industry was added to the resources of the colony.

The demand which the growing trade made upon the one port of Natal, Durban, encouraged the colonists to redouble their efforts to improve their harbour.

Harbour works had been begun in 1857, but it was chiefly due to the energy of one of Natal's most distinguished sons, Harry Escombe, that Durban was transformed into a modern port. From 1881 to 1893 Escombe was chairman of the harbour board.

**Self-Government.**—For many years there had been an agitation among the colonists for self-government. In 1882 the colony was offered self-government coupled with the obligations of self-defense. The offer was declined, but in 1883 the legislative council was remodelled so as to consist of 23 elected and 7 nominated members. In 1890 the elections to the council led to the return of a majority in favour of accepting self-government, and in 1893 a bill in favour of the proposed change was passed and received the sanction of the imperial government. At the time the white inhabitants numbered about 50,000. The electoral law was framed to prevent more than a very few Indians and natives obtaining the franchise. Sir John Robinson (1839–1903), who had gone to Natal in 1850, was a leading journalist in the colony and had been a member of the legislative council after 1863, became the first premier and colonial secretary, with Harry Escombe as attorney-general. The year that witnessed this change in the constitution was also notable for the death of Sir Theophilus Shepstone, Natal's most prominent citizen. Sir John Robinson remained premier until 1897, a year marked by the annexation of Zululand to Natal. In the following year Natal entered the customs union already existing between Cape Colony and the Orange Free State.

**The Anglo-Boer War.**—Natal watched with anxiety the increasing tension between the Transvaal and Cape Colony, and its citizens suffered, equally with other *Uitlanders,* the disabilities imposed by the Pretoria government. As early as May 1899 the Natal ministry officially intimated its belief that the Transvaal would go to war and, while promising every support possible to the imperial government, expressed anxiety for the defense of the frontier. On Oct. 11, 1899, war broke out, and Natal was invaded by the Boers. The story of the war is told elsewhere (*see* SOUTH AFRICAN WAR; SOUTH AFRICA, UNION OF). A small number of the Boer colonists joined the enemy but there was no general rebellion among them, and the promise that Natal would assist the imperial government was amply redeemed.

One result of the war was an addition to the territory of Natal of a small part of the Transvaal, namely the district of Vryheid, the district of Utrecht, and a portion of the district of Wakkerstroom. As to Vryheid, "in handing over this district to the administration which controls the rest of Zululand, his majesty's government," wrote Joseph Chamberlain (then secretary of state for the colonies), under date March 1902, "feel that they are reuniting what ought never to have been separated." A claim by Natal to annex portions of the Harrismith and Vrede districts of the Free State was, however, disallowed. The districts which were added to Natal contained about 6,000 white inhabitants (mostly Dutch), and some 92,000 natives, and had an area of nearly 7,000 sq.mi., so that this annexation meant an addition to the white population of Natal of about one-tenth, to its native population of about one-tenth also, and to its territory of about one-fourth. The territories were formally transferred to Natal in Jan. 1903.

**Native Affairs: The 1906 Revolt.**—The period following the war was succeeded by commercial depression. The government met the crisis by renewed energy in harbour works, railway constructions, and the development of the natural resources of the country. A railway to the Zululand coal fields was completed in 1903, and in the same year a line was opened to Vryheid in the newly annexed territories. In Aug. 1903 Sir Alfred Hime, who had been premier after June 1899, resigned and was succeeded by George Sutton, the founder of the wattle industry in Natal and one of the pioneers in the coal-mining industry. In May 1905, the Sutton cabinet was replaced by a coalition ministry under C. J. Smythe, while in 1906 Sir F. R. Moor became premier. These changes of ministry reflected, chiefly, differences concerning the treatment of commercial questions and the policy to be adopted toward the natives. Toward those Boer colonists who had joined the enemy during the war leniency was shown, all rebels being pardoned. The attitude of the natives both in Natal proper and in Zululand caused much disquiet. The chief concern of the Natal government was to remodel its native policy where it proved inadequate. During 1903–04 a Native Affairs' commission, representative of all the South African states, had obtained much evidence on the status and conditions of the natives. Among its recommendations was the direct political representation of natives in the colonial legislatures on the New Zealand model, and the imposition of direct taxation upon natives. Carrying out this last recommendation Natal passed in 1905 an act imposing a poll tax of £1 on all males over 18 in the colony, except indentured Indians and natives paying hut tax (which was 14s. a year). Every European was bound to pay the tax. In 1906 a serious rebellion broke out in the colony, attributable ostensibly to the poll tax, and spread to Zululand. An incident which marked the beginning of this rebellion brought the Natal ministry into sharp conflict with the imperial government (the Campbell-Bannerman administration). Twelve natives were to be shot by order of a court martial for killing, at Byrnetown, two Europeans, who had been sent to enforce the collection of the poll tax. On the day before that fixed for the execution Lord Elgin, then secretary of state for the colonies, intervened and directed the governor to postpone the execution of the sentence. Thereupon the Natal ministry resigned, giving as its reason the importance of maintaining the authority of the colonial administration at a critical period and the constitutional question involved in the interference by the imperial authorities in the domestic affairs of a self-governing colony. After a day's delay, during which the governor of Natal, Sir Henry McCallum, reiterated his concurrence, already made known in London, in the justice of the sentence passed on the natives, Lord Elgin gave way (March 30). The Natal ministry thereupon remained in office. The guilty natives were shot on April 2. It was at this time that Bambaata, a chief in the Greytown district who had been deposed for misconduct, kidnapped the regent appointed in his stead. He was pursued and escaped to Zululand, where he received considerable help. He was killed in battle in June, and by the close of July 1906 the rebellion was at an end. As has been stated, it was ostensibly attributable to the poll tax, but the causes were more deep-seated. Though somewhat obscure they could be found in the growing sense of power and solidarity among all the Bantu tribes of South Africa. There were, moreover, special local causes, such as undoubted defects in the Natal administration. (*See* governor's dispatch, June 21, 1906, printed in the Blue Book, Cd. 3247). Many Natalians regarded Dinizulu, the son of Cetewayo, as the inciter of the rebellion and, after a series of murders of whites in Zululand in 1907 and evidences of continued unrest among the natives, the Natal government itself became convinced that Dinizulu was implicated in a rebellious movement. A force under Sir Duncan McKenzie (who had suppressed the 1906 revolt) entered Zululand. Thereupon Dinizulu surrendered (Dec. 1907) without opposition, and was removed to Maritzburg. He was in 1909 found guilty only on the minor charge of harbouring rebels.

The intercolonial commission had dealt with the native question as it affected South Africa as a whole; it was felt that a more local investigation was needed, and in Aug. 1906 a strong commission was appointed to inquire into the condition of the

Natal natives. The commission, whose report was published in Aug. 1907, declared that the chasm between the native and white races had been broadening for years and that the efforts of the administration to reconcile the Bantus to the changed conditions and to convert them into an element of strength had been ineffective. Among other proposals for a more liberal and sympathetic native policy the commission urged the creation of a native advisory board entrusted with very wide powers. "Personal rule," they declared, "supplies the keynote of successful native control" —a statement amply borne out by the influence over the natives exercised by Sir T. Shepstone. The unrest in Zululand delayed action being taken on the commission's report. But in 1909 an act was passed which placed native affairs in the hands of four district commissioners, gave to the minister for native affairs direct executive authority, and created an advisory council for native affairs on which nonofficial members had seats.

Concurrently with the efforts to reorganize its native policy the colony also endeavoured to deal with the Asiatic question. The rapid growth of the Indian population from about 1890 caused much disquiet among the majority of the white inhabitants, who viewed with especial anxiety the activities of the "free," *i.e.*, unindentured, Indians. Several acts had already been passed imposing restrictions upon Indians, and in 1908 a strong commission was appointed to inquire into the whole subject. This commission reported in 1909, its general conclusion being that in the interests of Natal the importation of indentured Indian labour should not be discontinued. For sugar, tea and wattle growing, farming, coal-mining and other industries, indentured Indian labour appeared to be essential. Nothing further was done in Natal up to the establishment of the Union of South Africa, when all questions specially or differentially affecting Asiatics were withdrawn from the competence of the provincial authorities.

**Union and After.**—Not long after the conclusion of the war of 1899–1902 the close commercial relations between the Transvaal and Natal led to suggestions for a union of the two colonies, but these suggestions were not seriously entertained. The federation or union of all the colonies was a different and more reasonable measure; and this matter was formally reopened by the Cape ministry in 1906. The movement for union rapidly gained strength, and a national convention to consider the matter met in Durban in Oct. 1908. In Natal, especially among the older colonists, who feared that in a united South Africa Natal interests would be overborne, the proposals for union were met with suspicion and opposition, and the Natal ministry felt bound to submit the question to the people. A referendum act was passed in April 1909, and in June 1910 the electors by 11,121 votes to 3,701 decided to join the Union. (*See* SOUTH AFRICA, UNION OF.) Meanwhile it was agreed by the Cape, Transvaal and Natal governments that, subject to Natal entering the Union, its share of the Rand import trade should be 25% before and 30% after the establishment of the Union. Previously Natal had only 22½% of the traffic, and this agreement led to a revival in trade. The closing months of Natal's existence as a separate colony thus found it peaceful and prosperous. On the establishment of the Union on May 31, 1910, Natal entered it as an original province, Sir F. R. Moor, the premier, becoming a member of the first Union cabinet. The change from the status of a self-governing colony to a province of the Union affected Natal politically more closely than any other province, since in it alone were the great majority of the white inhabitants of British descent. The firm attachment of Natalians to the British connection continued an unchanging factor in the South African situation. Provincial administration was, however, largely carried on upon non-party lines. An exception occurred in 1927 when not a single candidate opposed to the inclusion of the Union Jack in the national flag of the Union was returned to the provincial council. About 70% of the total expenditure of the council is on education. Sir George Plowman, who had filled the office of administrator with great ability after 1918, was succeeded as administrator in 1928 by H. Gordon Watson.

**The Indian Problem.**—Of the 219,691 Asiatics in the Union in 1936, no fewer than 183,661 lived in Natal. Besides labourers, there were many Indians engaged in professions and commerce. White South Africans in general opposed the further increase of Asiatics in the Union; while, in 1911, the Indian government, long dissatisfied with the attitude of Natal to Indians, prohibited the recruitment of indentured coolies. The Indians both in Natal and the Transvaal complained of many grievances, and their cause was championed by M. K. Gandhi, then resident in South Africa. Arising out of the agitation, riots and disturbances occurred in Natal in 1913. In 1914 the Union government passed legislation intended to prevent Indian immigration into South Africa and to prevent Asiatics already in the Union leaving the province in which they lived. The Smuts-Gandhi agreement of that year was designed to guard the vested interests of Indians already in the Union. The attitude of the white inhabitants of Natal was shown by the borough ordinance passed by the provincial council in Jan. 1924, debarring Indians in future from acquiring the municipal franchise. This ordinance was held up by the Union government for consideration, but in Dec. 1924 assent to its operation was given. The parliamentary franchise was, with few exceptions, already confined to whites. In 1925 there were 38,547 parliamentary electors, of whom only 24 were Indian. In 1927 an agreement on the Indian question was reached by the Union government and the government of India, which led to an amelioration of the condition of Indians in Natal. In accordance with this agreement, the government of India appointed an agent-general in the Union in order to secure effective co-operation between the two governments on this problem. The rank of this official was raised to that of high commissioner on Jan. 1, 1941. During World War II the Indian problem in Natal again became acute. The passage of the so-called "Pegging act" in 1943, intended to deal with the question of Indian penetration of formerly European areas, especially in Durban, was the occasion for the reopening of controversy on this issue.

BIBLIOGRAPHY.—H. Cloete, *Emigration of the Dutch Farmers from the Cape and their Settlement in Natal . . .* (Capetown, 1856), reprinted as *The History of the Great Boer Trek* (1899), an authoritative record; H. Brooks (ed. R. J. Mann), *Natal, a History and Description of the Colony* (1876); J. Bird, *The Annals of Natal, 1495 to 1845* (2 vols., Maritzburg, 1888), a work of permanent value; J. F. Ingram, *Natalia, a Condensed History of . . . Natal and Zululand* (1897); R. Russell, *The Garden Colony. The Story of Natal and its Neighbours* (1910 ed.); Eric A. Walker, *A History of South Africa* (London, 1928), with bibliography, including Blue Books. (F. R. C.; Ho. F.)

**NATAL,** a city and port of Brazil and capital of the state of Rio Grande do Norte, on the right bank of the Rio Potengí, or Rio Grande do Norte, about 2 mi. above its mouth. The population in 1940 was 51,896. Natal is the starting-point of the railway which extends on down the coast to Pernambuco and Maceió, and is a port of call for coastwise steamers, which usually anchor outside the bar. The harbour has been improved and the Brazilian government uses the port as a naval depot. A large airport for transatlantic planes lies a short distance from the city. The only industry of note is the manufacture of cotton, but the exports (chiefly sugar and cotton) are large. Natal was founded in 1597 as a military post to check an illicit trade in Brazil wood. It became the capital of a province in 1820.

**NATCHEZ,** a noted tribe of lower Mississippi river, near the present city of Natchez, Miss., who, after massacring the French in their territory in 1729, were defeated by them, the remnants taking refuge with the Chickasaw, and later with the Creek and Cherokee. Allied in general culture to the Muskogian tribes (*q.v.*), they had developed a sun worship with a perpetual fire in a temple, and a caste division into "suns," nobles, honoured men and commoners or "stinkards." This system was matrilineal and exogamic, "suns" marrying "stinkard" wives and having honoured children, whereas "sun" women married "stinkard" husbands and had "sun" children. The head "sun" had power of life and death over all others, and was followed in death by his spouses, attendants and voluntary victims. The origin of these anomalous customs is not clear. *See* J. R. Swanton, *Bur. Am. Ethn. Bull.* 43 (1911).

**NATCHEZ,** a city of Mississippi, U.S.A., on the Mississippi river, near the southern boundary of the state; county seat of

Adams county. It is on federal highways 61, 65 and 84, and is served by the Illinois Central, the Mississippi Central and the Missouri Pacific railways. A $4,000,000 Mississippi river bridge connects Natchez with Vidalia, La. Pop. (1920) 12,608 (54% Negroes); and 15,296 in 1940 by federal census. The city, centre of romantic life during steamboat days, is on bluffs over 200 ft. high above the river. There are three small parks overlooking the river; in the heart of the city is the Confederate Memorial park. Duncan park, city-owned park, contains 200 ac., with golf course, tennis courts. Jefferson Military college (chartered 1802), one of the oldest schools in the southwest, is six miles from the city.

Natchez has the distinction of being the annual mecca of thousands of pilgrims who come from every point of the compass to enjoy the deeply shaded avenues and the old ante bellum homes of this section. The Natchez Garden club and the Pilgrimage Garden club, organized to preserve the historic and architectural beauty of Natchez, hold annual pilgrimages each spring. Forty or more outstanding historic homes are thrown open to the public each year.

Natchez is a trading centre and an important shipping point for industrial and agricultural products. It has box factories, a modern garment plant, a modern tire and rubber company, a fruit-cake factory and coffee-roasting factories. The total industrial output in 1939 was valued at $6,861,161. Natural gas is piped from the Louisiana fields and a high-powered transmission line from Natchez to Amite, La., gives to Natchez two-way electric transmission service.

The Natchez Indians were living there when La Salle and De Tonty visited them in 1662, and when Le Moyne de Bienville in 1716 built a fort, which he named Rosalie, for the duchess of Pontchartrain. In 1764 Ft. Rosalie passed from the French to the English and was renamed Panmure; in 1779 it was turned over to the Spaniards; in 1798 it was occupied by U.S. troops. The city was chartered in 1803. It was the capital of Mississippi from 1798–1802 and from 1817–21.

**NATHANAEL,** THE APOSTLE. *See* APOSTLE.

**NATICK,** a town of Middlesex county, Massachusetts, U.S.A., 18 mi. W.S.W. of Boston, at the S.E. end of Cochituate lake. It is served by the Boston and Albany railroad. Pop. (1920) 10,907; (1940) 13,851. Its varied factory products were valued at $4,209,871 in 1937. Natick is the Indian name ("our land" or "hilly land") of the tract (originally part of Dedham) granted to John Eliot in 1650 for the "praying" Indians. Until 1719 the Indians held the land in common, and for some years the community was governed (in accordance with Exodus xviii.) by "rulers of tens," "rulers of fifties" and "rulers of hundreds." The town owns a copy of Eliot's Indian Bible. An Eliot monument was erected in 1847 near the site of the Indian church. Natick was incorporated as a town in 1781.

**NATIONAL ANTHEMS.** In *Europe* the chief national anthems are: *The United Kingdom,* "God Save the King" (*see* below); *France,* "The Marseillaise" (*q.v.*) by Rouget de Lisle; *Germany,* formerly "Heil dir im Siegerkranz," words by Balthazar Gerhard Schumacher, music of "God Save the King"; but after the Revolution, "Lied der Deutschen," (Deutschland, Deutschland, Deutschland über Alles, über Alles in der Welt) and after Hitler, the "Horst Wessel"; *Switzerland,* "Ruft du, mein Vaterland," music "God Save the King"; *Italy,* under fascism, "Giovinezza"; *Austria,* formerly "Gott erhalte unsern Kaiser," after the World War "Oesterreichische Bundeshymne," words by Karl Renner, music by Wilhelm Kienzl; *Hungary,* "Isten ald meg a Magyart"; *Belgium,* "La Brabançonne," by F. Campenhout; *Holland,* "Wien Nierlansch"; *Denmark,* "Kong Kristian stod ved hojen mast," words by Ewald, music by Hartman; "Der er et yndigt Land" has also been used at times on solemn occasions; *Sweden,* "Ur Svenska hjertans"; *Russia,* formerly "Bozhe Tsaryachrani," words by V. Joukovsky, music by A. F. Lvov; since the Revolution, the "Internationale," words by E. Pottier; *Rumania,* "Traeasca Regale," words by V. Alexandri, music by E. A. Hübsch; *Spain,* "Himno de Riego," music by Herta; *Norway,* "Ja Vi Elsker Dette Landet" (Yes, We Love This Country); *Czechoslovakia,* "Kde Domov Muj" (Where Is My Native Land?) which was the Czech anthem; the Slovak population sings "Nad Tatrou Se Blyska" (Lightning above the Mountains); *Bulgaria,* "Shoumi Maritza" (The Bubbling Maritza); *Greece,* "Ethnicos Ymnos" (The People's Hymn, which has been beautifully translated into English by Rudyard Kipling); *Serbia,* "Srpska Himna," (The Serbian Hymn); *Turkey,* "Istiklal Marsi" (The March of Independence). In *China,* "The Song of the Kuomintang"; *Japan,* "Kimigayo" (In the Reign of our Emperor), the tune of which Sullivan adapted in the prelude to *The Mikado; Canada,* "The Maple Leaf Forever." In the *United States,* "The Star-Spangled Banner" (1814; words by F. S. Key, music by J. S. Smith), "Hail Columbia" (1798; words by Hopkinson, music, Fyles) and "My Country, 'Tis of Thee" (1832; words by S. F. Smith, tune, "God Save the King") were sung as national songs. In 1931 Congress made "The Star-Spangled Banner" the national anthem.

Unlike the origin of many national anthems, that of "The Star-Spangled Banner" is well known and agreed upon by historians even to smaller details. Francis Scott Key (*q.v.*), an American lawyer, had been delegated to negotiate the release of a prominent physician, Dr. William Beanes, who had been captured by the British fleet in Chesapeake bay in 1814. He secured the physician's freedom but was detained aboard the British flagship during the projected bombardment of Baltimore. On the night of September 13–14 the British opened fire upon Ft. McHenry, one of the forts defending Baltimore at the mouth of the Patapsco. Under the cover of night, Key could not determine the issue of the battle but at dawn he was overjoyed to see the American flag still flying over the fortress. He then composed the poem, apparently having in mind a tune often employed before in American patriotic songs, that of "Anacreon in Heaven" composed by John Stafford Smith (1750–1836) as the club song of the Anacreontic Society, an association of musicians in London. After Key's return to shore "The Star-Spangled Banner" was set up in type and distributed throughout Baltimore, where it attained an almost instantaneous popularity. Less than a week afterward it was published with an account of its authorship in a Baltimore newspaper, and soon the song was known and sung throughout the nation. The main facts about its origin and adoption have been set forth in detail by O. G. T. Sonneck in his *Report on the Star-Spangled Banner,* issued by the U.S. Library of Congress in 1914. Among other published reports may be mentioned P. H. Magruder's description of the first and the final text in the *Proceedings of the U.S. Naval Institute,* June 1927. In 1933 the original manuscript of the verse was sold for $24,000.

One of the best known of national anthems is the English "God Save the King," which is said to have been first sung as his own composition by Henry Carey in 1740; a version was assigned by W. Chappell (*Popular Music*) to the *Harmonia Anglicana* of 1742 or 1743, but no copy exists and this is now doubted. Words and music were printed in the *Gentleman's Magazine* for October 1745. There has been much controversy as to the authorship, which is complicated by the fact that earlier forms of the air and the words are recorded. Such are an "Ayre" of 1619, attributed to John Bull, who has long been credited with the origin of the anthem; the Scottish carol, "Remember, O thou man," in Ravenscroft's *Melismata,* 1611; the ballad "Franklin is fled away" (printed 1669); and a piece in Purcell's *Choice Collection for the Harpsichord* (1696). The words or part of them are also found in various forms from the 16th century.

The question was discussed in Richard Clarke's *Account of the National Anthem* (1822), and was reinvestigated by W. H. Cummings in his *God save the King* (1902). Carey and Bull, in the general opinion of musical historians, divide the credit; but in his *Minstrelsy of England* (1901) Frank Kidson introduced a new claimant, James Oswald, a Scotsman who settled in London in 1742, and worked for John Simpson, the publisher of the early copies of "God Save the King," and who became chamber composer to George III. What appears to be certain is that 1745 is the earliest date assignable to the substantial national anthem as we know it, and that both words and music had been evolved out of earlier forms. Bull's is the earliest form of the air; Carey's claim to the remodelling of the anthem rests on an unauthoritative tradi-

tion; and, on general probabilities, Oswald is a strong candidate. The tune was adopted by Germany and by Denmark before the end of the 18th century.

**NATIONAL ARCHIVES, THE,** is a Federal agency of the United States whose purpose is "to preserve all archives or records belonging to the Government of the United States (legislative, executive, judicial and other), including motion-picture films and sound recordings illustrative of historical activities of the United States." It was created by act of Congress approved June 19, 1934 and is housed in the National Archives building at Washington. This building, structurally completed in 1937, is especially designed to receive and preserve records of the Government; the temperature, humidity and chemical content of the air in the stack areas is carefully controlled to prevent deterioration of the documents.

The archivist of the United States has authority to inspect the records of any Federal agency and to receive the full co-operation of all persons in charge of such records. Within certain prescribed limits he may authorize the transfer of the material to the National Archives. The National Archives Council, also created in 1934, advises the archivist and defines the classes of material that may be transferred into his custody. The council consists of the secretary of each executive department, the chairman of the Senate committee on the library, the chairman of the House committee on the library, the librarian of Congress, the secretary of the Smithsonian Institution, and the archivist.

By an act of Congress approved July 26, 1939, the archivist is required to edit the *Federal Register,* which contains any current presidential or executive order, and any order or similar instrument with legal effect issued by a Federal agency. The National Archives, with the collaboration of the Department of Justice, has also undertaken codification of U.S. administrative law.

**NATIONAL BANK OF EGYPT.** The National Bank of Egypt was founded by Sir Ernest Cassel in collaboration with a financial group in Egypt. It was established in 1898 by Khedivial Decree and was given the sole right of Note Issue. The head office is at Cairo and there are many branches in the rest of Egypt and the Sudan. There is also a London office at 6 and 7, King William Street, E.C. 4. Besides the board in Egypt, there is a London Committee. The first governor was Sir Elwin Palmer, who was succeeded by Sir F. Rowlatt.

The principal object of the bank, outside ordinary banking functions, was to act as bankers to the Egyptian Government and to provide a satisfactory paper currency. It had originally a department for making small loans to the *fellaheen* on security of mortgage, but this grew to such dimensions that it was handed over to a separate institution, the Agricultural Bank of Egypt.

Before the war, the note issue was based half on gold, half on securities approved by the Government. It attained a total of some £3,000,000 in 1913. On the outbreak of the World War (1914–18), the notes were made a forced legal tender, and in Oct. 1916, British Treasury bills deposited at the Bank of England were authorized as security in place of gold.

The total issue ran to over £70,000,000 in 1919, and was in 1939 more than £30,000,000.

The capital of the National Bank of Egypt was in 1939 £3,000,000 fully paid, with reserves of £2,775,000. (S. C. P.)

**NATIONAL BETTER BUSINESS BUREAU:** *see* BETTER BUSINESS BUREAUS.

**NATIONAL BISCUIT COMPANY,** a United States biscuit manufacturing company, was incorporated on Feb. 3, 1898, under the laws of New Jersey with a charter valid for 99 years. This company was the result of the merger of the New York Biscuit Company, American Biscuit and Manufacturing Company and the United States Baking Company, together with a number of smaller concerns. Originally capitalized at $55,000,000, the authorized capital stock in 1930 was $145,000,000, of which $25,000,000 was 7% preferred stock and $120,000,000 ($10.00 par value) common stock. There was outstanding as of Jan. 1, 1940, $24,804,500 preferred stock and $62,894,480 common stock.

Prior to 1898, biscuit and crackers had been sold in boxes, barrels, crates and other large containers with the resulting liability to staleness before the merchandise was disposed of to consumers. The new company inaugurated the package for biscuit with its "Uneeda Biscuit." The company produces more than 400 varieties of biscuit as well as cereals, bread, cake, pretzels, rusk, ice-cream cones and dog biscuit. The company operates cracker bakeries located in 36 cities of the United States, and has 252 selling branches, located in every section of the country. Bakeries in Toronto and Winnipeg are operated by a Canadian subsidiary, Christie, Brown & Co., Ltd. In 1930 National Biscuit Company acquired the business of Shredded Wheat Company, with plants in the United States, Canada and England. National Biscuit Company maintains and operates its own machine shops in which it develops and improves mechanical means to perform all the productive operations. Further economy is achieved through ownership of the National Milling Company at Toledo, O., where a large portion of the flour used by the company is manufactured, and by the manufacture of box-board and cartons by the company's paper board mill and carton factory at Marseilles, Ill. The company also operates a printing plant at Beacon, N. Y.

The company's general offices are in New York city.

**NATIONAL CITY,** a city of San Diego county, S.W. California, U.S.A., 5 mi. S.E. of the city of San Diego and about 10 mi. N. of the Mexican border. Pop. (1940) 10,344. National City is situated on U.S. highway 101 and is served by the Atchison, Topeka & Santa Fe and the San Diego and Arizona Eastern railroads. Several airports are nearby. The city's products are largely agricultural in nature.

**NATIONAL CITY BANK OF NEW YORK, THE,** was organized under a charter granted by the state of New York on June 16, 1812 as the City bank, with a paid-in capital of $800,000, its origin being closely associated with the dissolution of the First Bank of the United States, a national organization. Samuel Osgood, the first United States postmaster-general, was its first president.

In 1865, two years after the passage of the National Bank act, the City bank became a part of the new national system and at that time its name was changed to The National City Bank of New York, which name it has retained ever since.

Engaged primarily in the financing of commerce, the growth and development of the institution have kept pace with the subsequent tremendous expansion of United States industry and trade in all directions.

As late as 1892, 80 years after its organization, its capital stood at $1,000,000, the surplus and undivided profits at $2,500,000, and deposits at but $24,000,000. Commencing with the early years of the 20th century, the growth became more marked.

The capital was increased in 1900 from $1,000,000 to $10,000,000, and two years later from $10,000,000 to $25,000,000, at which figure it stood until 1920 when, with deposits of approximately $700,000,000, its capital was again increased to $40,000,000 and its capital structure, including both surplus and undivided profits, for the first time exceeded $100,000,000, with total resources in excess of $1,000,000,000. In June, 1929, the Farmers Loan and Trust company was affiliated with the National City Bank and, at that time, there was a re-arrangement of the National City organization under which the trust company became the City Bank Farmers Trust company.

On June 30, 1940 total resources of the National City Bank, amounting to $2,774,000,000, included $77,500,000 capital, $68,800,000 surplus and undivided profits and $2,591,000,000 deposits.

With the passage of the important Federal Reserve act which went into operation Nov. 16, 1914, the National City Bank of New York was the first of American institutions to establish foreign branches throughout the world, such branches in June 1940 numbering 68 in 24 different foreign countries. In 1921, because of changes in the law which then took place, branch expansion in the city of New York became possible and the National City Bank is operating 71 local branches.

**NATIONAL CONFEDERATION OF EMPLOYERS' ORGANIZATIONS.** This institution, which in 1939 changed its name to the British Employers' Confederation, is the employers' central organization in Great Britain for dealing with general labour questions on behalf of employers as a whole. Its constitution covers all questions arising out of industrial relations, but it does not deal with commercial questions.

Prior to the convening of the National Industrial Conference of Employers and Employed in 1919 by the prime minister, there was no central machinery for joint consultation on the employers' side between the employers' federations in the individual industries dealing with labour questions. The confederation's membership is confined to the central employers' federations dealing with labour questions in the various individual industries, and the federations within its membership cover industries employing over seven million workpeople.

In its national sphere, the confederation is officially recognized by the Government and by the various Government departments which deal with labour questions (*e.g.*, Ministry of Labour, Home Office, Ministry of Health, etc.). The subjects it deals with are varied, including factory law, unemployment and health insurance, workmen's compensation, hours and conditions of work and trade boards. The confederation also submits evidence for employers before royal commissions and Government committees. In its international sphere, the confederation is recognized by the Government as the industrial organization "most representative of employers" under Article 389 of the Treaty of Versailles. In that capacity it nominates the British employers' delegate to attend the annual International Labour Conferences held under the treaty, and its representative is a member of the governing body of the International Labour Office.

**NATIONAL CONVENTION, THE.** In the United States the National Convention is the political agency of the major parties which nominates the party candidates for president and vice president, adopts the platform, and performs other party functions. The first national nominating convention in the United States was that of the old Federalist Party which met in New York in Sept., 1812, and endorsed for the presidency De Witt Clinton, the candidate of the peace Republicans. This gathering, however, had no influence on the displacement of the congressional nominating caucus by the national convention. The Anti-Masonic Party met in national convention at Baltimore in Sept., 1831. This convention was composed of 112 delegates for 13 States and adopted "An Address to the People of the United States." The National Republican or Whig Party followed with a convention at Baltimore in December of the same year, with each State entitled to a delegation the size of the electoral vote of the State. A system of State and local correspondence committees was authorized. The Democratic Party held its first national convention in Baltimore in May, 1832, for the purpose of nominating Martin Van Buren for vice president, as the running mate to President Jackson. Since then the national convention has been the recognized method of selecting presidential and vice presidential candidates.

While the number of delegates in the early conventions fluctuated, ordinarily each State was limited to a vote equal to its electoral college strength. Eventually twice as many delegates were sent as there were electors, and finally each delegate was given an entire vote. The Democratic Party now allows twice as many delegates to each State as there are presidential electors with six each to Alaska, the Canal Zone, the District of Columbia, Hawaii, the Philippine islands and Porto Rico and two to the Virgin islands, making a total of 1,100 for the convention of 1928.

The Republicans formerly had a similar representation, but this was reduced in 1913 in order to lessen the influence of delegates from the normally Democratic States of the South, and again changed in 1921. The Republicans now allow four delegates from each State at large, with two additional where a representative in Congress is chosen from the State at large. In addition, the Republicans allow three more from each State at large where a majority of the electoral vote of the State went to the party at the preceding presidential election. Each congressional district is allowed one delegate, and an additional delegate from each district casting 10,000 votes for the Republican electoral ticket at the last presidential election or the same number of votes for the party candidate for representative in Congress at the last congressional election. Two delegates each are chosen by Alaska, the District of Columbia, Hawaii, the Philippine islands and Porto Rico. There were 1,089 delegates in the Republican convention of 1928. There are as many alternates as delegates who vote in the absence of the delegates.

In the December or January preceding the convention, the national committee of each party meets in Washington and issues the call for the next national convention At this time the allotment of delegates is made and the State committees are instructed as to how they are to be chosen. A convention city also is selected, giving consideration to auditorium facilities, hotel accommodations, financial donations and political benefits. The convention delegates are elected by State and district conventions and under the terms of presidential primary laws, according to State statutes and party rules and by State party committees. They are either instructed as to presidential preference or are sent uninstructed; some are instructed as to vice president. Prior to the convening of the convention, usually in June or July, the national committee meets to make final arrangements for the convention. A temporary roll of convention delegates is made and a temporary organization is suggested for the convention.

The chairman of the national committee calls the convention together and the first question is on temporary organization. After temporary organization has been effected, the temporary chairman makes a "key-note" speech sounding the campaign issues. Then the committees on rules and procedure, credentials, permanent organization, and platform and resolutions are appointed, each delegation having one member on each committee.

After the adoption of rules and the report on credentials, a permanent organization is effected. The permanent chairman also speaks in outline of the campaign issues. The convention then proceeds to nominate candidates and adopt a platform. Nominations for president are made by calling the roll of delegations. Seconding speeches often are made. A majority vote is necessary to nominate in the Republican convention while the Democrats require two-thirds. After the candidate for president is nominated, a choice for vice president is made along the same procedure. A platform is adopted either before, during or after the nominations. Committees on notification of the two candidates are named and the convention adjourns after authorizing the national committee to fill any vacancies on the ticket.

The national committee, composed of a man and woman from each State and territory, assumes office upon adjournment of the convention, the members being selected by the delegations or by State conventions or primaries if so authorized by State statutes or party rules or by State conventions

*See* C. E. Merriam, *The American Party System* (1922); R. C. Brooks, *Political Parties and Electoral Problems* (1927); E. M. Sait, *American Parties and Elections* (1927); H. R. Bruce, *American Parties and Politics* (1927); Stuart Lewis, *Party Principles and Practical Politics* (1928), and *Readings in Party Principles and Practical Politics* (1928). (S. Le.)

**NATIONAL COUNCIL OF EVANGELICAL FREE CHURCHES,** a voluntary association of British Nonconformist churches for co-operation in religious, social and civil work. It was the outcome of a unifying tendency displayed during the latter part of the 19th century. About 1890 the proposal that there should be a Nonconformist Church Congress analogous to the Anglican Church Congress was seriously considered, and the first was held in Manchester on the 7th of November 1892. In the following year it was resolved that the basis of representation should be neither personal (as in the Anglican Church Congress) nor denominational, but territorial; and the name of the organization was changed from Congress to National Council as soon as the assembly ceased to be a fortuitous concourse of atoms, and consisted of duly appointed representatives from the local councils of every part of England. The local councils consist of representatives of the Congregational and Baptist Churches, the Methodist Churches, the Presbyterian Church of England, the Free Episcopal Churches, the Society of Friends, and such other Evan-

gelical Churches as the National Council may at any time admit. The constitution states the following as the objects of the National Council: To facilitate fraternal intercourse and co-operation among the Evangelical Free Churches; to assist in the organization of local councils; to encourage devotional fellowship and mutual counsel concerning the spiritual life and religious activities of the Churches; to advocate the New Testament doctrine of the Church, and to defend the rights of the associated Churches; to promote the application of the law of Christ in every relation of human life. Although the objects of the Free Church councils are thus in their nature and spirit religious rather than political, there are occasions on which action is taken on great national affairs. The movement differs essentially from the Evangelical Alliance, inasmuch as its unit is not an individual, private Christian, but a definitely organized and visible Church. The essential doctrine of the movement is a particular doctrine of churchmanship which regards the Lord Jesus Christ as the sole and Divine Head of every branch of the Holy Catholic Church throughout the world.

The Report of the National Free Church Council is published at the headquarters of the organization, the Memorial Hall, Farringdon Street, London E. C. The Report for 1927–28 shows that England, Wales and the Channel Islands have been covered with a network of Councils, each of which elects its representatives to the annual gathering. The movement has spread to Australia, New Zealand, South Africa, Jamaica, the United States of America and India.

**NATIONAL DEBT.** A public debt is any obligation for the preservation or extinction of which a state is willing to devote its resources. "National debt" refers to the indebtedness of a central government, as distinct from that of a state, provincial, or subordinate political unit. Like any other debt it is a recognized obligation to pay a definite sum of money, either on demand or after specified notice, or on a definite date, or in instalments coming due on a series of dates. A national debt is both a contractual and moral obligation. Gaston Jèze, the eminent French jurist, limits public debts to those originating in "an act of borrowing"—that is, in a voluntary transaction between the state and the lender. But a forced loan, under which a state uses legal compulsion to secure capital, is no less a part of the national debt, if, or so long as, the obligation of repayment is recognized.

National debts are the debts of a political entity. They are not the aggregate debts of its citizens. Nor is private property, save through taxation, subject to seizure for payment of public debts. The state, moreover, fixes the rules under which it can be sued both for its torts and violation of contracts. Without its consent claims against it are not enforceable. Its debts are only those claims the state recognizes as such.

Due to the fact that resources of citizens are taken by taxation to pay interest or to retire the principal of national debts, these obligations are sometimes called "mortgages on the wealth and income of the people of a country," or "a lien on the income of taxpayers." Jèze called public loans "a financial device whereby receipts of imposts and taxes are anticipated." Josiah Stamp was of the opinion that "apart from their psychology, borrowing and taxation are interchangeable; there is no external difference between the intermediate effect of borrowing and taxation. They both mean that there are fewer tickets, and so fewer goods for the taxed person or for the lender to consume."

**What Is Included and Excluded.**—Public debts of various nations are not strictly comparable. They differ in inclusiveness due to variations in political structures (as in unitary or federated governments), in functions performed, and in accounting procedures employed. The gross public debt of the U.S., for example, is composed of the direct obligations of the federal government including obligations carried over from the Civil War, World War I, building the Panama Canal, and financing the relief-recovery program of the 1930s. The debt includes inter-fund borrowings, such as from the old age and survivors' insurance trust fund, the railroad retirement account and the postal savings system. It includes obligations on which interest has ceased, as where issues have been called for payment but not presented; it includes also noninterest-bearing debts such as savings stamps, demand notes and fractional currency issued at the time of the Civil War and not retired, legal tender notes and national bank notes. The U.S. gross debt does not include the contingent liabilities of the government, unless specifically stated as "the gross debt and guaranteed obligations of the U.S."

The contingent liabilities of the U.S. are authorized obligations issued by certain government corporations and agencies guaranteed as to payment of principal or interest by the U.S., or issued on the credit of the U.S. Among the issues *guaranteed* by the U.S. are obligations of the Commodity Credit corporation, Federal Housing administration, Reconstruction Finance corporation, and the Tennessee Valley authority. Deposits in the U.S. postal savings system are issued *"on the credit of the United States."* On Oct. 16, 1941, the treasury announced that thereafter it would provide funds needed by government corporations and agencies, and that the sale of obligations by these agencies would be discontinued. Maturities and redemptions of such outstanding issues were thereafter handled by the treasury. The distinction between direct and guaranteed debt in the U.S. will disappear in the course of time. The contingent liabilities of the U.S. for financing of corporations and agencies decreased from $6,360,000,000 on June 30, 1941, to $1,514,000,000 on Dec. 31, 1944. Loans for these public authorities are now included in the direct debt. A saving in interest costs is a result of the new arrangement.

Many other countries follow the practice of excluding contingent liabilities from the gross debt. The primary exclusion is for issues of central banks. (*E.g.*, federal reserve notes are listed as "other obligations" rather than as "guaranteed by" or "on the credit of the U.S.," in tabulations of contingent liabilities, but are not included in statistical totals for guaranteed debts. On Dec. 31, 1944, federal reserve notes outstanding amounted to $20,822,000,000.) In Italy, on the other hand, paper money and bank advances are considered as part of the national debt. Among the liabilities also generally excluded from public debt statements in the U.S. and U.K. are unpaid wages and salaries, unpaid rents, interest accrued but unpaid, open book accounts payable, liabilities under pension systems, judgments and adjudicated claims. Occasionally such liabilities are funded and hence are embraced within the national debt. For example, certain obligations to war veterans in the U.S. were met by the issuance of 3% Adjusted Service bonds in 1936. It may be argued, however, that this was in satisfaction of a moral claim rather than the funding of a current liability. Indemnities imposed by foreign states usually are excluded from debt statements.

Political loans have at times been concealed. Practices have also varied as to foreign debts. France, for example, carried the Morgan loan in its statement from 1871 until 1875 when it was repaid. Its foreign debts from World War I were included from 1916 to 1932 when payments were suspended under the Hoover moratorium (1931) and the Lausanne conference (July 1, 1932). Since Dec. 31, 1934, no foreign debts have appeared in the French statements of public debts. Italy traditionally separated foreign indebtedness from its domestic public debt statements. The U.S.S.R. excludes all foreign loans contracted under the tsarist regime.

Debt statements often reflect the various undertakings or industries owned and operated by governments. Railroad debts have been included among the debts of France, Germany, Switzerland, Canada and Japan. Capital expenditures for canals, telephone and telegraph systems, harbours, hydroelectric plants, housing, highways, armaments, etc., have been financed by public borrowing. In some cases the issues have been for designated purposes, in other cases they have been covered by general loans.

**Types of Public Credit.**—Public debts may be classified and identified by types. The use of the classification depends upon the purpose at hand. There are geographical as well as chronological variations in terms and usages. The following classification will cover most common usages of the present time. The groups shown are not mutually exclusive.

*Gross debt* refers to the total amount of debt outstanding. It ordinarily includes the sum of all obligations, funded and floating, except

contingent liabilities.

*Net or deadweight debt* is the gross debt less sinking fund or other assets dedicated to the retirement of such debt. "Deadweight" is in more general usage in England than in the United States.

*External or foreign debt* is a debt owed to a nonresident national, or to a foreign creditor or state. The payment of interest or principal on an external debt involves the transfer of goods or services to another country. At the time of the loan, however, the debtor received goods, services, or capital from abroad. Indemnities and reparations debts, by their nature, belong in this group. At the time of imposing the obligation, usually by force of arms or by treaty concluding a war, no *quid pro quo* was involved. Payments, however, represent transfers from the debtor to the creditor country.

*Internal debts* include loans within a state to the government thereof; or loans held within the debtor country and payable therein. Internal loans involve transfers within the debtor country. At the time of the loan, capital goods or services are placed at the disposal of the government. At the time of payment of interest or principal, taxpayers are deprived of resources for transfer to domestic holders of the debt (less costs of administration). In view of the transfer aspects of internal debts, the country *as a whole* is neither richer nor poorer as a result of the loan or its repayment, unless deleterious effects are produced by taxation for debt service or the loans cause a decrease in the efficiency of the use of capital.

*Funded debt* is a term of English origin derived from the fact that the interest due was originally paid from the proceeds of certain taxes or funds. Gradually the meaning was extended to cover debts due at some distant date, or to refer to formal obligations, like consols, redeemable at the pleasure of the government but not repayable at any definite time. The term "funding system" referred to the process of creating the "funded debt," although most writers devoted their attention to the evils of the system. Early English works on borrowing made general use of the term "funding." See for example David Ricardo's "Essay on the Funding System" in Supplement to *Encyclopædia Britannica,* 1824, or J. R. McCulloch, *Treatise on the Principles and Practical Influence of Taxation and the Funding System* (1845). Palgrave (*Dictionary of Pol. Econ.*) says that it was customary to associate the term "funding" with an agreement to repay a greater sum than was received, as happens when bonds are sold at a discount.

*Floating or unfunded debt.*—It is usual to define the "floating debt" as being unfunded. In essence it is a temporary or short-term indebtedness. It may be incurred as a result of an emergency, a temporary shortage of revenues, a lack of synchronization between the receipt of revenues and due dates of obligations, or even by reason of repeated failures to levy sufficient taxes to meet current expenditure requirements. In Britain and the U.S. floating debt generally refers to debts payable within one year. The League of Nations so classified debts payable within two years. In early usage the term referred to all except "funded debts," specifically including accounts, warrants, commissary certificates, obligations issued for commandeered military supplies, unliquidated claims for services or supplies, and even fiat money. It is now generally limited to liabilities in recognition of which the government has issued some type of paper (obligation). Therefore, it does not ordinarily include open accounts, unpaid wages, rent accruals or similar liabilities. The obligations given vary widely as to form. Often they are carried over from year to year and end by being funded into longer term debts. The conventional attitude is that floating debts should be kept at a minimum and, instead of being funded, should be paid as soon as practicable.

*Long-term debt* refers to obligations having a maturity date ten or more years after issue. It includes "perpetuities," or perpetual debts, which are loans having no fixed date for repayment but nevertheless are redeemable. British *consols* are of this type. When debts are classified into two groups, long- and short-term, the dividing line is usually placed at five years. This dual classification is not as satisfactory, particularly for purposes of analysis, as the three-fold grouping into long-term, intermediate, and short-term issues.

*Intermediate debt* refers to obligations having maturities of from five to ten years after issue. Many U.S. Treasury Notes fall in this category.

*Short-term debt* refers to obligations with maturities of less than five years. In the U.S., they have been used mainly in time of war or monetary crisis, and have been an outstanding feature of federal finance since World War I. In England, except for a few exchequer bonds introduced by Gladstone, they were also the creation of World War I and have been widely utilized ever since. The role of short-terms has thus changed from an emergency expedient to that of a permanent feature of regular borrowing programs. Treasury bills and certificates of indebtedness are typical short-terms issued by the U.S.; treasury bills and ways and means advances are English examples. Notes, certificates, etc., sold in anticipation of the receipt of funds from subsequent bond issues also belong in this group. In France, short-term debt appeared in statistics after 1816, but took on great importance only during and after World War I, as was also the case in Germany and Italy.

*Marketable debt* is composed of securities which may be sold by owners on the open market. Among the marketable issues of the U.S. are consols of 1930, Panama Canal loan bonds, Liberty bonds, treasury bonds, treasury notes, certificates of indebtedness and treasury bills. The term is synonymous with "negotiable." British, as well as most European, securities also are typically of the marketable variety. Such for example, were the Victory bonds of 1919, the Conversion Loan of 1924, and the National War bonds (1941– ) issued by the U.K.

*Nonmarketable debt* is composed of securities which cannot be freely sold by holders. When owners desire to convert them into cash, or other government securities, they must be presented to the treasury, or designated agents, for redemption at values usually declared at time of issue. Redemption at stated figures removes the risk of fluctuations in market prices. Lack of negotiability is ordinarily compensated by the rate of interest paid. These securities are designed primarily for holders (low-income groups) who can ill-afford to risk capital losses from price fluctuations. Nonmarketable issues of the U.S. include U.S. savings bonds, depositary bonds, and treasury tax savings notes. The U.K. national savings certificates issued during World War II are of this type.

*Special issues* are interest-bearing securities issued (specially) by the Treasury for the investment of trust and other funds deposited in the Treasury. They are obligations arising from inter-fund borrowing. They are not publicly issued, nor are they marketable. Interest paid is typically controlled by statute. Among U.S. special issues outstanding (1945) are: (1) treasury notes given to the federal old-age and survivors insurance trust fund, or to the civil service retirement fund; (2) certificates of indebtedness, such as have been issued to the unemployment trust fund.

The relative importance of marketable, nonmarketable and special issues in the U.S. government public debt, Dec. 31, 1944, may be seen from the following table:

| | In Millions | Per Cent |
|---|---|---|
| Total U.S. debt outstanding (direct and guaranteed obligations) | $232,144 | 100.0% |
| Marketable issues | 161,648 | 69.6 |
| Nonmarketable issues | 50,917 | 21.9 |
| Special issues | 16,326 | 7.0 |
| Matured debt and debt bearing no interest | 1,783 | 0.8 |
| Guaranteed obligations | 1,470 | 0.6 |

*Interest-bearing debt* includes all issues on which a government promises to pay interest, whether directly or by way of accumulations added to the issue price. Liberty bonds were of the coupon variety, interest being paid through banks upon presentation of coupons on their due date. Series E savings bonds issued by the U.S. during World War II were sold on a discount basis ($25 bonds issued at $18.75), interest being added to issue price at rate of 2.9% if held to maturity. (Maturity value at end of ten years, $25.)

*Noninterest bearing debt* denotes public securities issued without promise of payment of interest. Fiat or paper money is the typical illustration. (For other examples *see* above.) As governments exhaust taxing power and voluntary borrowing they have tended to turn to such issues. The relative importance of noninterest bearing issues tends to increase at such times. Some temporary issues, such as savings stamps, carry no interest because these debts are expected to be exchanged into more permanent form, because individual investments in them are nominal, and because of administrative difficulties in arranging to pay interest. Matured debt on which interest payments have ceased is not included in this category. On Dec. 31, 1944, the noninterest bearing debt of the U.S. was $1,553,000,000.

*Redeemable debt* includes issues as to which the government is under obligation to pay cash, usually at stated values, upon presentation prior to maturity.

*Nonredeemable debt* includes issues which the government has not promised to exchange for cash prior to maturity. Holders desiring to receive cash prior to maturity are usually free to sell in open market. Frequently issues are nonredeemable until after the lapse of a specified period. Redemption is sometimes determined by lot.

*Callable debt* consists of obligations which the issuing government is free to redeem at its convenience, or after the lapse of a specified time subsequent to issue, depending upon the agreement. The privilege of calling bonds for redemption prior to maturity enables the government to convert the debt so as to secure savings from lowered interest rates. Insertion of call privilege in contract is supposed to require payment of a slight extra premium over loans sold without such provisions, so as to cover uncertainty as to the life of the investment. This extra premium is not always exacted by lenders.

*Noncallable debt* consists of public obligations which do not contain the contractual right of redemption prior to maturity.

*Government obligations* are debts of issuing governments backed by the faith and credit of such governments. They are sometimes called "direct" debts.

*Government guaranteed debts* are obligations for the ultimate repayment of principal and interest of which a government has pledged its credit and resources.

*Voluntary loans* result from borrowing involving no element of coercion, direct or indirect, or conditional exercise of taxing power or implied use of administrative or regulatory authority. They refer to loans made in a free market by willing lenders. Only in exceptional cases are loans otherwise than voluntary. That a free market can be relied upon for public borrowing is an indication of the maturity of

governments as institutions, of the stability of credit and of the high state to which economic and financial institutions, including an organized money-market open to all, have evolved in the modern world.

*Compulsory or forced loans* are transfers of goods, services or capital to the use of a government brought about by the exercise of force, or the threatened use thereof upon failure to effect transfers of capital, but accompanied by a promise of repayment, or indemnification, with interest. The earliest loans seem to have been of this type, reflecting either the lack of a basis for voluntary credits, or the power of absolutist sovereigns to wrench capital from unwilling subjects or easy victims of political power. In England forced loans were originally raised from foreigners, especially Jews and Italian bankers. In the 15th century native lenders were common. Charles I employed a forced loan to finance an unpopular war with France and its failure led the Third Parliament in 1628 to draw up a Petition of Right outlawing forced loans, without the consent of parliament. Forced loans were employed in the city republics of Italy as early as 1171, but their precise origin is unknown. Their record of repayments was, on the whole, fairly good, and in due course, Italy pioneered the development of voluntary credit institutions and techniques, and transplanted them into northern Europe. France made some use of forced loans after the Revolution. Prussia utilized treasures during the 18th century to finance wars but these were exhausted by 1794. Among the expedients subsequently utilized were coinage debasement, lottery loans, and, in 1809, the delivery of all articles of gold and silver in return for certificates payable in coin. There was another forced loan in 1810. Out of exhausted credit and the ruthlessness of kings came the early antipathy to forced loans. From 1815 to 1914 there were few forced loans throughout the world.

During World War I and its aftermath, forced loans again appeared to reinforce weak taxation, or to drive through voluntary loans. In France, Britain and the U.S. it was argued that forced loans were appropriate if men were drafted for military service. Such loans were employed (1914–22) in Australia, Czechoslovakia, Germany, Greece, Holland, Italy, New Zealand, Norway and Poland without conspicuous success. In the U.S. during the war, many local committees adopted coercive methods to secure subscriptions to war bonds.

In the financing of World War II, forced loans, or forced saving plans, were employed in Great Britain, New Zealand, Japan, Germany and Italy. In Canada (1942–43), they were euphemistically termed "refundable taxes." The Victory tax in the U.S. and the Excess Profits tax in England with their postwar credits bore close resemblance to forced loans. Japan imposed forced loans in some of the occupied areas of southeast Asia, as well as at home, during World War II. The degree of compulsion exerted in some places in the U.S. to secure subscriptions to Series E war bonds should not be ignored. Many economists in Britain and the U.S. (especially J. M. Keynes) favoured compulsory loans during the war not only to aid in financing that undertaking, but as a means of mopping up purchasing power to help prevent inflation. This, in part, accounts for the forced saving incorporated in the British wartime personal income tax. This use of forced loans was in marked contrast to early usage. At first it was an instrument directed at the wealthy few, by a state with imperfect credit standing. During the 1940s it was aimed at the masses, the holders of the bulk of purchasing power. In its modern use it is really a form of universal saving, or a refundable tax and, when popularly sanctioned, may be used increasingly in the future by governments fully able to borrow by other means, which also will be utilized.

Among the practices which, from time to time, have been denominated forced loans are: Military requisitions, fiat money, currency debasement, withdrawal of conversion privilege from legal tender notes (as in the U.S. in 1863), the unilateral alternation of terms of loan contracts by the issuing government, and the appropriation of bank deposits, or portions thereof, by the government.

*Bond anticipation borrowing* is a form of short-term credit issued prior to the floating of a large bond issue from the proceeds of which the temporary anticipatory borrowings are to be retired. The use of interim short-terms makes possible the timing of long-term issues to coincide with better market opportunities.

*Tax anticipation borrowing* refers to short-term borrowing by the government in advance of the receipt of taxes soon to be in process of collection. The U.S. direct-tax loan of 1815 was of this type. This form of borrowing is more frequent in state and local governments than in national units. Such loans are usually secured only by the tax receipts anticipated and are in reality borrowings of "funds" rather than of governmental units. Such loans are to be distinguished from securities *sold to taxpayers* to permit them to prepay taxes or to save *via* government security purchases sums needed to meet tax liabilities. The tax anticipation warrants issued by the city of Chicago are examples of true tax anticipation borrowing, while the U.S. treasury tax notes issued subsequent to 1943 are illustrative of plans devised to help the individual accrue (save for) his tax liabilities. In both cases, however, the government secures use of capital prior to tax-payment dates.

**Differences Between Public and Private Credit.**—Many of the differences between public and private credit are due to differences between the state and the individual. The state has jurisdiction over all individuals in the social group; it is responsible for their welfare. It controls their actions, determines what they may do, establishes rules of conduct, provides opportunities for earning a living, regulates the ownership of property and provides the means through which wrongs may be redressed and breaches of contract indemnified. The state is the creator of credit and the agency which delegates this function to others, when it is lodged in private hands. Since the state makes the rules concerning credit creation it must be careful not to discriminate in its own favour, if a system of voluntary borrowing in a free market is to develop. Lack of such discrimination can be interpreted as one sign of the fiscal maturity of governments. Similarly the state must respect the financial institutions it creates. The state, too, has a permanence—a length of life—not possessed by the individual. The stability of government is reflected in its credit, and *vice versa*. This stability affects the risks investors must assume. The earning power of the individual is cut short by death; that of the state runs on. Its life may not be permanent, but ordinarily it is not fleeting. Its greater resources, lodged in the power to tax all individual wealth and income, as well as to utilize its own public domain, gives greater certainty of payment to obligations than the individual can provide. The state can compel the individual to pay his debts; only the combined wills (the mores) of the citizens, or external force, can compel the state to pay its debts. But the moral force for observance of public contracts is part of the heritage of modern states.

There was a time when it was said that the loans of the state were unproductive, going to pay for the wastes of past wars, or to finance useless undertakings, whereas private loans were investments, providing employment and raising the standards of living for citizens. Such notions hark back to the time when governments were regarded as unproductive and when tax payments were believed akin to losses. Modern students recognize that governments supply valuable utilities and that they make real contributions to economic and social welfare. Even the preservation of liberty, which has occasioned war debts, may be regarded as productive. What is regarded as unproductive, and there are ample illustrations in public and private spheres, is often determined by the political beliefs or ideologies of the critics, rather than by the economics of the case.

The purposes of public and private borrowing are numerous. Both the state and the individual may borrow to acquire goods. Both cause transfers from those who previously have saved wealth, or who create it for the purpose at hand. Both may borrow to add to the wealth under their control, although the state scarcely needs to borrow to acquire such control. The state, on the other hand, may borrow to avoid present taxation, to supply individuals with a safe place for investment of funds, or to provide a basis for a monetary or banking system. The individual can borrow only to the extent of his own resources; the state can borrow on the resources of all and can create credit of its own in addition, so long as it possesses the power to reinforce its promises with an ability to pay interest, or can maintain the confidence necessary to keep its credit instruments circulating at or near par. When a state exhausts its taxing power its credit sags. The extent to which a state can tax the resources of its citizens depends upon the public services provided and upon the emergencies at hand. The degree to which private wealth may be taken by the state is conditioned by the time, place and circumstances surrounding the event. Actually, though not legally, expropriation by the state, for debts or current services, is subject to limits. Even docile citizens may rebel or vote a debt-creating government out of power.

**Evolution of National Debts.**—Public debts are a product of political and commercial evolution. They do not arise until there is a political differentiation between the ruler and the state. The borrowings of the sovereign, secured by his jewels or domainal revenues, were personal rather than governmental obligations. The debts of one ruler were seldom assumed by his successors. If public debts were to have permanence or stability, governments had to develop a continuity apart from that of the

sovereigns. They had to secure regular and compulsory sources of income independent of privileges and feudal dues. Likewise, negotiation and voluntary subscription had to replace force, grants of privileges or confiscatory exactions as alternatives to voluntary loans. On the commercial side, credit institutions had to replace the wealthy subject who could be prodded into surrendering capital, or the ecclesiastical orders who could be persecuted and alienated from their domains. A monetary system of reasonable stability had to develop. These came with the rise of commerce and industry. The appearance of exchanges not only aided in financing new developments but made liquid the bulk of public and private debt instruments. Rising incomes and the diffusion of wealth and income in society made possible the ownership of public securities by the masses and their financial institutions. The public debt frequently became a coveted type of investment.

The stages in the development of public debts seem to run from public treasures for emergency use to forced loans, from loans to the sovereign to loans to the state, from loans anticipating taxes (or other revenues) to permanent obligations based upon the promise of the state to apply its resources to interest and the eventual repayment or refunding of the debt. In the evolution of the state from absolute to democratic rule, forced loans of the original type were virtually outlawed; and taxes as well as loans and expenditures required the sanction of legislative assemblies or of the electorate. As governmental functions increased, the needs for borrowing also rose. These steps were complete by the time modern governments appeared. To them public credit was a full-blown instrument of fiscal policy.

No histories of public debts, comparable with the notable histories of taxation, have yet been written. Hence the development of this institution can be sketched only in fragmentary fashion. The public credit institutions seem to stem from the Italian city banks: the Bank of Venice (1156), the Bank of St. George (1407) of Genoa and the Bardi of Florence. The Italians helped school the Dutch in financial methods. It was from Holland that public borrowing from private bankers and financial institutions spread to German cities and to England and France. Transplantation to the new world followed as a matter of course. Jèze says that public credit is essentially a product of modern times, developing after the end of the 18th century. H. C. Adams thought that conditions requisite for public borrowing were not realized until the latter part of that century. Bastable added the observation that the last 50 years of the 19th century were even more important for the development of public credit than the two preceding centuries. All writers agree that the evolution of public credit coincides with the development of the state as an institution and with the development of an industrial-commercial civilization with its attendant economic and financial institutions, especially banks and security exchanges with their ancillary agencies, to facilitate transfers and to provide an open market for the purchase and sale of debt instruments. A legal system for the enforcement of contracts, and social mores which require performance of contractual obligations assumed, particularly for the payment of interest and principal, are important. The development of a system of private credits, accounts and records, as well as surplus incomes available for investment have done much to carry public borrowing as an institution to modern levels.

TABLE I.—*Growth of National Debt in United Kingdom, United States, France, Germany, Japan and Canada*
(in millions of currency units shown)

| Year* | United Kingdom of Great Britain and Northern Ireland† (Pound Sterling) | United States‡ (Dollars) | France§ (Francs) | Germany‖ (Marks) | Japan¶ (Yen) | Canada♀ (Dollars) |
|---|---|---|---|---|---|---|
| 1697 | £ 14 | $ — | Fr. — | M. — | Y. — | $ — |
| 1757 | 77 | — | — | — | — | — |
| 1781 | 187 | — | — | — | — | — |
| 1791 | — | 75 | — | — | — | — |
| 1795 | (1793) 245 | 81 | — | — | — | — |
| 1800 | — | 83 | — | — | — | — |
| 1802 | 523 | 81 | — | — | — | — |
| 1805 | — | 82 | — | — | — | — |
| 1810 | — | 53 | — | — | — | — |
| 1815 | 834 | 100 (1816) 127 | 1,272 | — | — | — |
| 1820 | | 91 | 3,590 | — | — | — |
| 1825 | (1828) 800 | 84 | 4,123 | — | — | — |
| 1830 | — | 49 | 4,890 | — | — | — |
| 1835 | (1836) 832 | ♂ | 4,557 | — | — | — |
| 1840 | 827 | 4 | 4,682 | — | — | — |
| 1845 | 818 | 16 | 5,810 | — | — | — |
| 1850 | 804 | 63 | 5,426 | — | — | — |
| 1855 | 789 | 36 | 6,965 | — | — | — |
| 1860 | 799 | 65 | 10,262 | — | — | — |
| 1865 | 790 | 2,678 | 13,865 | — | — | — |
| 1867 | — | 2,650 | — | — | — | 75 |
| 1870 | 768 | 2,436 | 12,310 | 487 | 5 | 78 |
| 1875 | 742 | 2,156 | 21,185 | 120 | 56 | 116 |
| 1880 | 730 | 2,091 | 21,597 | 388 | 247 | 152 |
| 1885 | 703 | 1,579 | 24,943 | 587 | 240 | 196 |
| 1890 | 678 | 1,122 | 26,152 | 1,242 | 255 | 237 |
| 1895 | 627 | 1,097 | 27,258 | 2,205 | 299 | 253 |
| 1900 | 610 | 1,263 | 30,080 | 2,421 | 506 | 265 |
| 1905 | 756 | 1,132 | 30,610 | 3,327 | 1,292 | 266 |
| 1910 | 720 | 1,147 | 32,750 | 5,014 | 2,605 | 336 |
| 1915 | 1,104 | 1,191 | 39,023 | 16,955 | 2,506 | 449 |
| 1920 | 7,828 | 24,299 | 240,242 | 184,864 | 3,278 | 2,248 |
| 1925 | 7,597 | 20,516 | 418,075 | 2,413 | 4,901 | 2,417 |
| 1930 | 7,469 | 16,185 | 480,173 | 10,375 | 6,003 | 2,177 |
| 1935 | 7,687 | 28,701 | 324,013 | 14,253 | 9,613 | 2,846 |
| 1940 | 7,884 | 42,968 | (1941) 881,000 | 51,506 | 23,481 | 3,271 |
| 1943 | 15,828 | 136,696 | 1,255,000 | 197,227 | — | 6,182 |

*Fiscal years as of which data are reported vary as between countries and over the period covered for the same country, as a rule, in the countries shown above.

†The data from 1697–1828 inclusive are gross national debt figures from *The National Debt* by E. L. Hargreaves, London, 1930, p. 291. The data from 1836–1935 inclusive are "net national debt" figures compiled from British official "Accounts and Papers" by subtracting exchequer balances from total debt. The data from 1940 and 1943 are from annual reports of the Bank for International Settlements; they are actually "gross debt" insofar as exchequer balances are not deducted but they exclude accrued interest on National Savings certificates of £172,000,000 and the "old war debt" to the United States of £1,032,000,000.

‡Data from 1791 to 1850 taken from *Annual Report of the Secretary of the Treasury on the State of the Finances for the Fiscal Year Ended June 30, 1903*, p. 63; from 1855 to 1943 taken from *ibid.*, 1943, pp. 562–63.

§All data up to 1935 are computed from the *Annuaire Statistique de la France;* data for 1941 are League of Nations statistics; data for 1943 from *Bank for International Settlements, Thirteenth Annual Report, May 1944.*

‖From the *Statistische Jahrbuch für das Deutsche Reich* except for 1940 and 1943 which are from *Bank for International Settlements, Thirteenth Annual Report,* May 1944.

¶These data were computed from Japanese government sources, especially the *Financial and Economic Annual of Japan,* Department of Finance.

♀Data taken from *The Canada Yearbook.*

♂The total gross debt of U.S. on Jan. 1, 1835, was $33,733.05.

**Growth of National Debts.**—The growth of national debts in the U.K., U.S.A., France, Germany, Japan and Canada is presented in Table I. The series begins with 1697, the earliest date for which U.K. data are available, and picks up the series for the U.S. in 1791. French data begin with 1815 because regular financial statistics were introduced after the end of the Napoleonic regime. The Canadian series starts at the beginning of Confederation; German data start with the first year of the modern *Reichsschuld;* the Japanese series begins with the first public loan after the Meiji restoration, floated in London in 1870.

**Outstanding Debts of Principal Countries of the World.**—The gross national debts outstanding in the principal countries of the world are shown in Table II.

**Relation Between Public and Private Debts.**—The claims of creditors upon the income of debtors are in the nature of a lien to be discharged before debtors are free to spend or enjoy the resources remaining. In the case of private debts payments are voluntary but are made so that credit standing (the opportunity for future loans) may be maintained. Public creditors have their claims satisfied by revenues received from taxes; the state also fulfils its contractual obligations so that it may borrow again. Both types of debt service represent drains on current income for resources made available in the past. The productive use of the sums borrowed may, however, create the means of payment, yet with fluctuating incomes the burden of debt charges also fluctuates. What the individual borrows, and the charges on his income, he is generally in position to control. What the state borrows will, through taxes, affect the size of the personal income remaining. Individuals *per se* are seldom able to control the volume of public debts or the resulting debt charges. The claims of the state are superior to those of individual creditors, but the claims of both not only affect individual welfare but also the formation of capital and the volume of consumer spending. Taxes

TABLE II.—*Gross National Debt in Millions*§

| Country | Currency | Date | Amount of debt in Domestic Currency | Amount in U.S. dollars |
|---|---|---|---|---|
| Argentina | Pesos | Dec. 13, 1942 | 6,243.3 | $ 1,479.9 |
| Australia | £Aust. | June 30, 1943 | 1,107.0 | 3,559.0 |
| Belgium* | Francs | Sept. 30, 1943 | 155,500.0‡ | 5,249.7 |
| Bolivia† | Bolivianos | Dec. 31, 1940 | 2,928.5 | 74.9 |
| Brazil† | Milreis | Dec. 31, 1940 | 20,150.8 | 1,011.6 |
| British India | Rupees | Mar. 31, 1942 | 12,471.4 | 3,774.2 |
| Bulgaria* | Leva | Dec. 31, 1942 | 40,800.0 | 494.1 |
| Canada | $ Canadian | June 30, 1943 | 9,228.3 | 8,303.4 |
| Chile† | Pesos | Dec. 31, 1940 | 4,409.1 | 227.8 |
| China | $ Chinese | Feb. 28, 1942 | 33,000.0 | 1,753.3 |
| Colombia | Pesos | Dec. 31, 1941 | 214.7 | 122.4 |
| Costa Rica | Colones | Jan. 1, 1943 | 176.9 | 31.5 |
| Cuba | Pesos | Dec. 31, 1942 | 118.4 | 118.4 |
| Czechoslovakia | Koruny | Dec. 31, 1938 | 47,094.0 | 1,632.9 |
| Denmark | Kroner | Mar. 31, 1939 | 1,229.1 | 250.1 |
| Dominican Republic | Dollars | Sept. 1, 1942 | 14.1 | 14.1 |
| Ecuador | Sucrés | Dec. 31, 1942 | 448.3 | 30.1 |
| Egypt | £ Egyptian | May 1, 1942 | 92.7 | 374.0 |
| Eire | £ | Mar. 31, 1943 | 74.3 | 299.8 |
| Finland | Marks | May 31, 1943 | 41,300.0 | 830.2 |
| France | Francs | Sept. 30, 1943 | 1,255,000.0 | 26,137.9 |
| Germany | Marks | Mar. 31, 1943 | 179,227.0 | 78,827.7 |
| Greece | Drachmai | Dec. 31, 1938 | 52,141.9 | 467.1 |
| Guatemala | Quetzales | Dec. 31, 1942 | 10.0 | 10.0 |
| Haiti | Gourdes | Mar. 31, 1943 | 66.1 | 13.2 |
| Honduras | Lempiras | June 30, 1942 | 17.1 | 8.6 |
| Hungary | Pengö | Sept. 30, 1942 | 4,869.0 | 962.6 |
| Iceland | Krónur | Dec. 31, 1942 | 51.0 | 7.8 |
| Iran | Rials | Dec. 31, 1942 | 4,538.6 | 140.7 |
| Italy | Lire | June 30, 1943 | 405,823.0 | 20,576.4 |
| Japan | Yen | May 31, 1942 | 42,457.9 | 9,951.5 |
| Liberia | Dollars | Jan. 1, 1941 | 1.6 | 1.6 |
| Luxembourg | Francs | Dec. 31, 1938 | 762.5 | 32.2 |
| Mexico† | Pesos | Mar. 31, 1941 | 3,460.2 | 710.7 |
| Netherlands* | Guilders | June 30, 1943 | 12,042.0‡ | 6,397.7 |
| New Zealand | £ NZ | Mar. 31, 1943 | 463.8 | 1,503.6 |
| Nicaragua | Cordobas | June 30, 1942 | 25.7 | 4.5 |
| Norway | Kroner | June 30, 1939 | 1,464.2 | 340.1 |
| Panama | Balboas | Dec. 31, 1942 | 21.2 | 21.2 |
| Paraguay | Pesos (gold) | Dec. 31, 1941 | 39.2 | 37.8 |
| Peru | Soles | June 30, 1943 | 1,159.3 | 178.4 |
| Poland | Zloty | Oct. 1, 1938 | 4,973.0 | 937.9 |
| Portugal | Escudos | Jan. 1, 1943 | 6,062.8 | 2,426.5 |
| Rumania | Lei | April 1, 1939 | 104,127.4 | 762.7 |
| Salvador | Colones | April 30, 1943 | 52.2 | 20.9 |
| South Africa | ..... | Mar. 31, 1942 | 381.1 | 1,516.8 |
| Spain | Pesetas | Jan. 1, 1943 | 31,128.4 | 2,842.0 |
| Sweden | Kronor | Sept. 30, 1942 | 9,324.0 | 2,221.8 |
| Switzerland | Francs | Jan. 1, 1943 | 7,331.8 | 1,701.7 |
| Thailand | Bhats | Sept. 30, 1941 | 79.5 | 29.2 |
| Turkey | £ Turkish | May 31, 1943 | 1,300.0 | 1,006.8 |
| United Kingdom | £ Sterling | Mar. 31, 1943 | 15,828.0 | 63,866.0 |
| United States | $ | June 30, 1944 | 201,003.0 | 201,003.0 |
| U.S.S.R. | Roubles | Jan. 1, 1933 | 10,088.9 | 2,001.8 |
| Uruguay | Pesos | Dec. 31, 1942 | 493.2 | 260.0 |
| Venezuela | Bolivares | Dec. 31, 1942 | 15.5 | 4.9 |
| Yugoslavia | Dinars | July 22, 1942 | 30,533.0 | 683.9 |

Sources: *Statesman's Yearbook*, 1944, and *Federal Reserve Bulletins*.
*Bank for International Settlements, *Thirteenth Annual Report*, May 1944.
†*Anuario Estadistico Inter-Americano*, 1942.
‡The figures of the national debt for Belgium and Netherlands contain also amounts guaranteed to the respective national banks on account of the clearing with Germany.
§Rates of conversion into U.S. dollars are current open market rates where available; otherwise, official rates. For countries under enemy occupation, the last available pre-war rate was used; these rates are, of course, frequently misleading.

and public borrowing tend to reduce current income, or capital, available for investment or consumption. Public expenditures and payment of interest or principal reverse the process and tend to augment the flow of income or capital. Payments by individual debtors to their creditors are like payments of external debts—they tend to drain the individual's economy for the benefit of "foreign creditors." Payments to and by the state, on account of internal loans, which predominate in the affairs of major nations, involve transfers within the economy. Debts, public and private, must be evaluated therefore on the basis of the transfers (benefits) at the time of the loan as well as on the basis of the transfers (costs) at time of payments. The essence of loans is the transfer of purchasing power from the creditor to the debtor at the time of the loan and the return of purchasing power (but not necessarily of the same real value due to fluctuations in the value of money) upon repayment.

In the U.S. (and in many countries) private debt was the dominant factor in the economy, until World War II lifted the volume of public loans to unprecedented peaks. From 1916 to 1943 the relative importance of private debt instruments declined but it was not until 1943 that federal securities exceeded 50% of the total debt. This was due not alone to war borrowing but to the correlative policy of minimizing the production of civilian goods and the use of capital for financing such activities. The wartime capital requirements were supplied primarily by the government itself and augmented its borrowings. The relative importance of public and private debts in the U.S. from 1916 to 1943 is shown in Table III.

TABLE III.—*Outstanding Net Public and Private Debt in the United States: 1916–43**

| Year | Public and private total | PUBLIC | | | Total | PRIVATE† | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Long-term | | | | Short-term |
| | | Total | Federal government and federal agency | State and local government‡ | | Total | Corporate | Farm mortgage | Urban real estate mortgage§ | |
| | Amount (billions of dollars) | | | | | | | | | |
| 1916 | $74.7 | $ 5.8 | $ 1.2 | $ 4.6 | $68.9 | $43.4 | $29.1 | $ 5.8 | $ 8.5 | $25.5 |
| 1917 | 86.1 | 12.2 | 7.3 | 4.9 | 73.9 | 45.5 | 29.6 | 6.5 | 9.4 | 28.4 |
| 1918 | 104.3 | 26.1 | 20.9 | 5.2 | 78.2 | 47.0 | 30.2 | 7.1 | 9.7 | 31.2 |
| 1919 | 117.5 | 31.0 | 25.6 | 5.4 | 86.5 | 49.7 | 31.0 | 8.4 | 10.3 | 36.8 |
| 1920 | 124.3 | 29.9 | 23.8 | 6.1 | 94.4 | 54.8 | 32.6 | 10.2 | 12.0 | 39.6 |
| 1925 | 148.4 | 30.4 | 20.0 | 10.4 | 118.0 | 70.8 | 39.6 | 9.7 | 21.5 | 47.2 |
| 1930 | 174.0 | 30.1 | 15.4 | 14.7 | 143.9 | 93.1 | 51.0 | 9.4 | 32.6 | 50.8 |
| 1935 | 152.5 | 41.9 | 26.0 | 15.9 | 110.6 | 76.8 | 43.5 | 7.4 | 25.9 | 33.8 |
| 1940 | 166.5 | 52.9 | 36.7 | 16.2 | 113.5 | 77.3 | 44.0 | 6.5 | 26.8 | 36.2 |
| 1941 | 183.5 | 64.0 | 47.6 | 16.3 | 119.5 | 78.0 | 43.7 | 6.5 | 27.8 | 41.5 |
| 1942 | 223.3 | 109.2 | 93.4 | 15.8 | 114.1 | 77.7 | 43.3 | 6.1 | 28.3 | 36.4 |
| 1943 | 273.5 | 161.8 | 147.0 | 14.8 | 111.7 | 75.9 | 42.6 | 5.6 | 27.6 | 35.8 |
| | Percentages of total net debt | | | | | | | | | |
| 1916 | 100.0% | 7.8% | 1.6% | 6.2% | 92.2% | 58.1% | 39.0% | 7.8% | 11.3% | 34.1% |
| 1917 | 100.0 | 14.1 | 8.5 | 5.7 | 85.9 | 52.9 | 34.4 | 7.6 | 11.0 | 33.0 |
| 1918 | 100.0 | 25.0 | 20.1 | 5.0 | 75.0 | 45.1 | 29.0 | 8.1 | 9.3 | 29.9 |
| 1919 | 100.0 | 26.3 | 21.8 | 4.6 | 73.7 | 42.3 | 26.5 | 7.2 | 8.8 | 31.4 |
| 1920 | 100.0 | 24.1 | 19.2 | 4.9 | 75.9 | 44.1 | 26.2 | 8.2 | 9.6 | 31.9 |
| 1925 | 100.0 | 20.5 | 13.5 | 7.0 | 79.5 | 47.7 | 26.7 | 6.5 | 14.5 | 31.8 |
| 1930 | 100.0 | 17.3 | 8.8 | 8.5 | 82.7 | 53.5 | 29.3 | 5.4 | 18.8 | 29.2 |
| 1935 | 100.0 | 27.5 | 17.0 | 10.4 | 72.5 | 50.4 | 28.5 | 4.9 | 17.0 | 22.2 |
| 1940 | 100.0 | 31.8 | 22.1 | 9.7 | 68.2 | 46.5 | 26.4 | 3.9 | 16.1 | 21.7 |
| 1941 | 100.0 | 34.9 | 26.0 | 8.9 | 65.1 | 42.5 | 23.8 | 3.5 | 15.1 | 22.6 |
| 1942 | 100.0 | 49.1 | 42.0 | 7.1 | 50.9 | 34.6 | 19.1 | 2.7 | 12.7 | 16.4 |
| 1943 | 100.0 | 59.2 | 53.8 | 5.4 | 40.8 | 27.6 | 15.5 | 2.1 | 10.1 | 13.1 |

From Alvin Slater, "Wartime Debt Changes in the United States," *Survey of Current Business*, July 1944, p. 16.
*Components will not necessarily add to totals because of rounding.
†The short-term and mortgage debts of noncorporate borrowers represent total and not net debt.
‡Figures are for June 30 of each year.
§Data are for noncorporate borrowers only.

**Ratio Between Debt and National Income.**—The burden of debt is relative to national income from which interest and amortization are eventually paid. The volume of debt can be more appropriately related to national income than to national wealth or population. Per capita comparisons are of little significance because debts are not retired by poll taxes. Ratios of debts to wealth would be significant but estimates of national wealth are imperfect and cover only selected years. On the other hand,

TABLE IV.—*Relationship of United States Public Debt and Interest Thereon to National Income: 1919–44*

| Year | National income* (In millions) | Gross public debt† (In millions) | Ratio of public debt to national income* | Interest on public debt† | Ratio of interest on public debt to national income* | Computed interest charge† |
|---|---|---|---|---|---|---|
| 1914 | $33,900 | $ 1,188 | 3.50% | $ 22.8 | 0.07% | — |
| 1916 | 45,400 | 1,225 | 2.70 | 22.9 | 0.05 | 2.376% |
| 1918 | 60,400 | 12,244 | 20.27 | 189.7 | 0.31 | 3.910 |
| 1920 | 69,700 | 24,299 | 34.86 | 1,020.2 | 1.46 | 4.225 |
| 1922 | 60,400 | 22,963 | 38.02 | 991.0 | 1.64 | 4.240 |
| 1924 | 70,000 | 21,251 | 30.36 | 940.6 | 1.34 | 4.180 |
| 1926 | 76,800 | 19,643 | 25.58 | 831.9 | 1.08 | 4.093 |
| 1928 | 80,100 | 17,604 | 21.98 | 731.7 | 0.91 | 3.877 |
| 1930 | 68,858 | 16,185 | 23.50 | 659.3 | 0.96 | 3.807 |
| 1932 | 39,963 | 19,487 | 48.76 | 599.3 | 1.50 | 3.505 |
| 1934 | 49,455 | 27,053 | 54.70 | 746.6 | 1.53 | 3.181 |
| 1936 | 64,924 | 33,778 | 52.03 | 749.4 | 1.15 | 2.559 |
| 1938 | 64,200 | 37,165 | 57.89 | 926.3 | 1.44 | 2.589 |
| 1940 | 77,574 | 42,968 | 55.39 | 1,040.9 | 1.34 | 2.583 |
| 1942 | 121,568 | 72,422 | 59.57 | 1,260.1 | 1.04 | 2.285 |
| 1944 | 156,205(est.) | 201,003 | 128.68 | 2,609.0 | 1.67 | 1.929 |

*Estimates for 1914–18 are by Kuznets. Taken from *Income in the United States: Its Amount and Distribution 1909–19* (National Bureau of Economic Research, 1921), p. 13. Estimates 1920 to 1944 are from United States Department of Commerce.
†*Annual Report* and *Bulletins* of the Treasury Department.

estimates of national income in the U.S. (and certain other countries) are reliable and are available for many years, especially since World War I. The ratio of the national debt and interest charges to the U.S. national income are shown in Table IV. (*See* also *Borrowing in World War II,* below.)

**Relation of National to State and Local Debts.**—The form of political organization affects the size of national debts and their relationship to total public debts of a country. The greater the number of independent units with power to contract debts within a given country the more necessary it may be to add the debts of these units to the debt of the central government to secure a true picture of the debt situation within the country. In England, local debts need only to be added to the debt of the central government. In the United States the aggregate of public indebtedness includes obligations of the federal, state, county, township, city, village and *ad hoc* units. The situation in Canada resembles that of the U.S. From Table III, above, it can be seen that for the U.S. in 1916 the amount of state-local borrowing exceeded that of the federal government. This was true throughout many years in U.S. history, but since World War I, federal borrowing has been vastly more important than state-local borrowing. In 1944, state-local debts aggregated $17,426,000,000. Debts of cities accounted for 49%, state debts for 16% and special district debts for 15% of this total. The changes that have taken place in governmental borrowings in the U.S. since 1902 are shown in Table V.

TABLE V.—*Federal, State and Local Debt in the United States: By Selected Years 1902–44*

| Year | Total | Federal* | State and Local† | | |
|---|---|---|---|---|---|
| | | | Total | State | Local |
| | Gross Debt Outstanding (Amounts in millions) | | | | |
| 1944 | $218,429 | $201,003 | $17,426‡ | $2,768 | $14,703 |
| 1943 | 155,341 | 136,696 | 18,645‡ | 2,909 | 15,783 |
| 1942 | 92,137 | 72,495 | 19,642‡ | 3,211 | 16,479 |
| 1940 | 63,172 | 42,971 | 20,201‡ | 3,526 | 16,720 |
| 1932 | 39,049 | 19,487 | 19,562‡ | 2,896 | 16,680 |
| 1922 | 33,220 | 22,964 | 10,256 | 1,163 | 9,093 |
| 1912 | 5,692 | 1,194 | 4,498 | 423 | 4,075 |
| 1902 | 3,372 | 1,178 | 2,194 | 270 | 1,924 |
| | Percent Distribution, by Type of Government | | | | |
| 1944 | 100.0 | 92.0 | 8.0 | 1.3 | 6.7 |
| 1943 | 100.0 | 88.0 | 12.0 | 1.9 | 10.1 |
| 1942 | 100.0 | 78.6 | 21.4 | 3.5 | 17.9 |
| 1940 | 100.0 | 68.0 | 32.0 | 5.6 | 26.4 |
| 1932 | 100.0 | 49.9 | 50.1 | 7.4 | 42.7 |
| 1922 | 100.0 | 69.1 | 30.9 | 3.5 | 27.4 |
| 1912 | 100.0 | 21.0 | 79.0 | 7.4 | 71.6 |
| 1902 | 100.0 | 34.9 | 65.1 | 8.0 | 57.1 |

Source: *Governmental Debt in the United States* 1944, Bureau of Census.
*Debt of the United States government, exclusive of obligations of credit corporations and other separately financed federal agencies. Insofar as federal government utilities and enterprises are financed through general and special accounts, the federal debt comprises both general purposes and government enterprises.
†Comprises debts both for general purposes and for government enterprises.
‡Total is less than the sum of state and local public debt in five years because of the exclusion of state debts for reloan to local governments, which duplicate local obligations held by state governments. The amounts of excluded state loans were $45,000,000 in 1944 $47,000,000 in 1943, $48,000,000 in 1942, $45,000,000 in 1940 and $14,000,000 in 1932.,

**Justifiable Occasions for Borrowing.**—Classical writers on political economy justified resort to public borrowing on three occasions: (1) to meet fiscal emergencies; (2) to cover the initial cost of public works; and (3) to cover temporary deficits. The primary cause for public indebtedness throughout history has been war. The second major cause has been public works. The reflationary spending of major governments of the world during the depression of the 1930s was largely for public works. In Germany, however, the expenditures were mainly for rearmament and public works, such as roads, for strategic purposes. England, after expanding its public works program, turned in 1937 toward rearmament; the U.S. later followed, in June 1940. Local borrowings throughout the world have been mainly to acquire public works, such as streets, schools, public buildings, utility plants, etc. The fundamental purpose underlying most loans has, therefore, been the avoidance of frequent increases in current taxation. John Stuart Mill, in addition to approving the three occasions for loans enumerated above, did not regard as pernicious the borrowing of capital from abroad, or the borrowing of capital at home "which either would not have been saved at all unless this mode of investment had been open to it, or, after being saved, would have been wasted in unproductive enterprises, or sent to seek employment in foreign countries." (*Prin. of Pol. Econ.,* Bk. v, ch. vii, §1.)

Scholars must agree with Gustav Cohn that the history of public debts has been characterized "by the progressive development of occasions and inducements to the contraction of public debts." (*The Science of Finance,* p. 682.) Even the needs of lenders were considered. Low-income groups in France needed safe investments for savings; *rentes* were offered. Public credits, often issued to help the government finance emergencies, as in the U.S. Civil War, were made the basis of commercial banking. A government loan provided the capital of the Bank of England, chartered in 1694. Government securities have also provided endowments for charitable trusts and eleemosynary institutions. When national governments, after experimenting with banking and credit mechanisms to prevent recurrent financial crises, accepted direct responsibility for the economic welfare of citizens, public borrowing assumed a new role. Intentionally unbalanced budgets became common as public expenditures to provide relief, or to offset shrinkages in individual spending, or to provide employment *via* public works, were covered by recurrent borrowing. The problem at such times was largely one of maintaining aggregate purchasing power within the economy. Expenditures financed by borrowing created a smaller volume of counteracting (deflationary) forces than other types of financing. Through borrowing to provide a desired level of public expenditures, the government could directly, and *via* secondary or multiplier effects, affect the volume of consumer spending, the level of national income, and to some degree the volume of investment. Such fiscal policies follow the reasoning of J. M. Keynes in his *General Theory of Employment, Interest and Money.* Experiments in the U.S. from 1933–39 and expenditures for war 1940–45, also financed by borrowing, clearly demonstrated that the volume of production, spending, employment and flow of income can be affected by public spending supported by borrowing. The volume of effects from each dollar spent is still debated, but there is agreement among economists that the effects of initial expenditures decrease with the passage of time after expenditure.

These theories, particularly the multiplier analysis (secondary effects of expenditure), led to the formulation of a "pump-priming" theory under which it was held that public expenditures, particularly on public works, would generate economic recovery. A deflated economy would thus soon become "self-propelling" and prosperous, so that injections of purchasing power created by government borrowing would no longer be necessary. Such were not the results, however, of the relatively small U.S. spending program of the 1930 epoch. When government expenditures were reduced the volume of economic activity sagged in 1937–38. Other factors than the reduction of expenditures contributed to this slump but ability to create an economy capable of moving forward, with increased production and employment, when government-induced expenditures are curtailed remains to be demonstrated in fact, if not in theory.

The limitations of the "pump-priming" theory seemed to lead Alvin Hansen to the advocacy of another use for public debts. He saw in the mature economy of the 20th century declining outlets for new private investments. (See *Full Recovery or Stagnation?* and *Fiscal Policy and Business Cycles.*) This tendency, conducive to an increase in idle resources and unemployment, was to be offset by public investment covered by additions to the public debt. The factual reality of the "mature economy" hypothesis is doubted by many economists. It represents, however, one of the latest justifications for the expansion of public debts. It may take its place as an alternative to, or as a supplement to, theories of public works expenditures as anti-depression measures.

**War Borrowing.**—The old Roman principle was that every war should maintain itself. The Prussians subscribed to this—witness the war indemnities imposed—but embraced as well the ancient idea of a war chest acquired by taxation, expropriation, coinage debasement or other means. Later, as wars became more

costly, the treasure was supposed to be adequate for initial war expenses, to strengthen the public credit and to make possible the orderly increase of revenues. These advances were to be recouped, if possible, from the vanquished. The English and French, by way of contrast, relied heavily on loans, including fiat money, to finance wars. Neither treasures nor loans long sufficed to meet the mounting cost of wars; increased taxes soon had to be added, so that *loans and taxes* came to be the customary means of financing wars.

The ratio of loans to taxes became a crucial problem for finance ministers in war time. The economic effects produced by varying the contributions from these two sources had profound effects on the economic life of the country. The greater the portion of war costs paid from taxation the better it was for the future economy of the country. The disastrous effects of financing wars by loans were learned in the U.S. from the Revolutionary War and the War of 1812, to the cost of which taxes made only a negligible contribution. In the Civil War, 78% of the costs were met from loans. From 1861 to 1864 the credit of the Union fell steadily, fluctuating with the vicissitudes of the army. Prices during the war practically doubled as inflationary borrowing, including the printing of money, was utilized. World War I was more creditably financed in the U.S., loans covering about two-thirds of the costs. In Great Britain, 71% of total expenditures 1915–19, excluding loans to allies, were covered by loans, and 75% of war expenditures, also excluding loans to allies, were so covered. In France, more than 91% of expenditures (1914–19) were from loans; in Italy, 73% came from loans (1915–18); in Germany, 90% of expenditures (1914–18) were financed by loans.

The debts contracted by the belligerents during World War I are shown in Table VI.

TABLE VI.—*Public Debts of Countries Engaged in World War I, at Close of Fiscal Years 1919 or 1920*
(amounts in millions of "currency" dollars)

| Countries | Internal Debt | External Debt | Total National Debt |
|---|---|---|---|
| Allied Powers | | | |
| British Empire | | | |
| Great Britain | $ 32,089 | $ 6,222 | $ 38,311 |
| Australia | 1,312 | 543 | 1,855 |
| Canada | 2,481 | 561 | 3,042 |
| India | 1,329 | 937 | 2,266 |
| New Zealand | 497 | 482 | 979 |
| Union of South Africa | 246 | 600 | 846 |
| Other | — | 365 | 365 |
| Total Empire | 37,954 | 9,710 | 47,664 |
| Belgium | 3,456 | 325 | 3,781 |
| France | 34,769 | 6,481 | 41,250 |
| Greece | 326 | 298 | 624 |
| Italy | 13,938 | 3,911 | 17,849 |
| Japan | 979 | 653 | 1,632 |
| Portugal | 1,784 | 279 | 2,063 |
| Rumania | 1,638 | 514 | 2,152 |
| Russia | 18,627 | 5,937 | 24,564 |
| Serb, Croat, Slovene State | 484 | 64 | 548 |
| United States | 24,298 | — | 24,298 |
| Total Allied Powers | 138,253 | 28,172 | 166,425 |
| Central Powers | | | |
| Austria Hungary | 20,266 | 857 | 21,123 |
| Bulgaria | 772 | 202 | 974* |
| Germany | 46,886 | — | 46,886 |
| Turkey | 891 | 1,238 | 2,129 |
| Total Central Powers | 68,815 | 2,297 | 71,112 |
| Grand Total | $207,068 | $30,469 | $237,537 |

Harvey E. Fisk, *The Inter-Ally Debts*, p. 339.
*Germany claims to have loaned $476,000,000 to Bulgaria. Bulgaria also owes $434,000,000 war indemnity under the peace treaty.

This volume of borrowing called for the development of extraordinary methods for placing loans. It was desirable both for morale and financial reasons to have the debt widely held by citizens in each country. The banks, of course, could be relied upon to provide whatever residual financing was needed or to make loans to enable citizens to buy bonds. The latter policy was adopted and the use of "drives" to sell bonds inaugurated by the major belligerents. The results of the war loans are shown in Table VII.

**Inter-Allied Debts of World War I.**—In the financing of war and to assist in an enemy's defeat, nations have often made

TABLE VII.—*War Loans of Six Countries: 1914–19**
(in millions)

| Country | Date | Rate | Issue price | Amount subscribed |
|---|---|---|---|---|
| Great Britain | | | | £ |
| First war loan | March 1915 | 3½ | 95 | 332 |
| Second war loan | June 1915 | 4½ | 100 | 592 |
| Third war loan | April 1917 | 4–5 | 95–100 | 941 |
| Exchequer bonds | March 1915 | 3 | 95–100 | 48 |
| Exchequer bonds | Dec. 1915–April 1917 | 5 | 100 | 416 |
| Exchequer bonds | Oct. 1916 | 6 | 100 | 161 |
| National war bonds | Oct. 1917–May 1919 | 4–5 | 100–100½ | 1,743 |
| Victory and Funding loan | June–July 1919 | 4 | 80–85 | 633 |
| Total | | | | 4,866 |
| France | | | | fr. |
| First war loan | Nov. 1915 | 5 | 87¼ | 15,205† |
| Second war loan | Aug. 1916 | 5 | 88¾ | 11,514† |
| Third war loan | Dec. 1917 | 4 | 68.6 | 14,803† |
| Fourth war loan | Dec. 1918 | 4 | 70.8 | 27,853† |
| Total | | | | 69,375† |
| Italy | | | | li. |
| Mobilization loan | Jan. 1915 | 4½ | 97 | 1,000 |
| First war loan | July 1915 | 4½ | 93–95 | 1,146 |
| Second war loan | Jan. 1916 | 5 | 97½ | 3,014 |
| Third war loan | Jan. 1917 | 5 | 90 | 3,985 |
| Fourth war loan | Jan. 1918 | 5 | 86½ | 6,120 |
| Total | | | | 15,266 |
| Russia | | | | ru. |
| First war loan | Sept. 1914 | 5 | 94 | 500 |
| Second war loan | March 1915 | 5 | 94 | 500 |
| Third war loan | May 1915 | 5–5½ | 99 | 1,000 |
| Fourth war loan | Nov. 1915 | 5½ | 95 | 1,000 |
| Fifth war loan | Feb. 1916 | 5½ | 95 | 2,000 |
| Sixth war loan | Oct. 1916 | 5½ | 95 | 3,000 |
| Seventh war loan | March 1917 | 5 | 85 | 2,500 |
| Total | | | | 10,500 |
| Germany | | | | Mk. |
| First war loan | Sept. 1914 | 5 | 97½ | 4,480 |
| Second war loan | March 1915 | 5 | 98½ | 9,106 |
| Third war loan | Sept. 1915 | 5 | 99 | 12,162 |
| Fourth war loan | March 1916 | 4½–5 | 95–98½ | 10,767 |
| Fifth war loan | Sept. 1916 | 4½–5 | 95–98 | 10,699 |
| Sixth war loan | March 1917 | 4½–5 | 98 | 12,979 |
| Seventh war loan | Sept. 1917 | 4½–5 | 98 | 12,626 |
| Eighth war loan | March 1918 | 4½–5 | 98 | 14,789 |
| Ninth war loan | Sept. 1918 | 4½–5 | 98 | 10,434 |
| Total | | | | 98,042 |
| United States | | | | $ |
| First Liberty loan | June 1917 | 3½ | 100 | 1,989‡ |
| Second Liberty loan | Nov. 1917 | 4 | 100 | 3,808‡ |
| Third Liberty loan | May 1918 | 4¼ | 100 | 4,175‡ |
| Fourth Liberty loan | Sept. 1918 | 4¼ | 100 | 6,964‡ |
| Victory loan | April 1919 | 3¾–4¾ | 100 | 4,495‡ |
| Total | | | | 21,431‡ |

*E. R. A. Seligman, *Essays in Taxation*, 10th ed., p. 775; Shirras, *Public Finance*, vol. II, p. 904; Fisk, *English Public Finance*, pp. 23–129, 212–213; *Annual Report of Secretary of Treasury*, 1919, pp. 339–342; *ibid.*, 1920, pp. 426–427. †Nominal subscription.
‡Full-paid subscriptions.

"political" loans to allies and friendly countries. Some carried expectations of repayment; the majority probably have not. Some countries, like England, have preferred to give subsidies to allies rather than loans.

The first modern inter-allied loan was made by France to the U.S. during the Revolutionary War, amounting to $6,352,500. It was fully repaid by 1815. Great Britain made loans of £600,000 to Portugal in 1809, and £2,000,000 to Sardinia in 1855. Both were only partially repaid. Russia's request to England for a loan in Oct. 1914 ushered in the large-scale inter-allied loans of World War I. At the time of the armistice, Nov. 11, 1918, the inter-allied debts were as shown in Table VIII.

After the armistice, additional loans were made, especially by the U.S., for relief and reconstruction, including the shipment of food to starving countries, and for the purchase of army supplies left in France. By 1920, the aggregate of inter-allied indebtedness was $24,892,313,000, and in 1923 it was $28,261,000,000. Germany advanced to its allies during the war about 9,500,000,000 marks, or $2,261,000,000.

European allies were wont to regard the loans made by the U.S. as contributions to a common cause. Many U.S. citizens also shared this belief. Economists generally pointed out that the only way Europeans could pay the U.S. was through an increase in exports, the receipt of which might affect trade. They championed outright cancellation. The congress, however, was of a

TABLE VIII.—*Inter-Governmental Indebtedness on November 11, 1918 (or nearest date thereto)*
(amounts in thousands of dollars)

| Borrowing Governments | Great Britain to allied governments | Lending Governments | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Canada | France including supplies | Italy | Russia | United States | Argentina | Total |
| British Empire | | | | | | | | |
| Great Britain | $ — | $443,796 | $ 431,376† | $ 152,314‡ | $1,265,160 | $3,696,000 | $93,427 | $6,082,073 |
| Australia | 238,920 | — | — | — | — | — | — | 238,920 |
| Canada | 214,133* | — | — | — | — | — | — | 214,133 |
| New Zealand | 144,146 | — | — | — | — | — | — | 144,146 |
| Union of South Africa | 80,923 | — | — | — | — | — | — | 80,923 |
| British South Africa Co. | 8,933 | — | — | — | — | — | — | 8,933 |
| Newfoundland | 1,946 | — | — | — | — | — | — | 1,946 |
| Crown Colonies | 4,433 | — | — | — | — | — | — | 4,433 |
| Total British Empire | 693,434 | 443,796 | 431,376 | 152,314 | 1,265,160 | 3,696,000 | 93,427 | 6,775,507 |
| Belgium | 422,269 | — | 534,610 | — | — | 171,780 | — | 1,128,659 |
| Belgian Congo | 11,923 | — | — | — | — | — | — | 11,923 |
| Cuba | — | — | — | — | — | 10,000 | — | 10,000 |
| France | 2,114,228 | — | — | 96,625 | — | 1,970,000 | — | 4,180,853 |
| Greece | 90,338 | — | 154,979 | — | — | — | — | 245,317 |
| Italy | 2,007,322 | 176 | 171,577 | — | — | 1,031,000 | — | 3,210,075 |
| Montenegro | 932 | — | — | — | — | — | — | 932 |
| Portugal | 61,273 | — | — | — | — | — | — | 61,273 |
| Rumania | 78,051 | — | 220,406 | — | — | — | — | 298,457 |
| Russia | 3,737,005 | 36 | 955,157 | 6,972 | — | 187,730 | — | 4,886,900 |
| Serbia | 90,715 | — | 297,413 | — | — | 10,605 | — | 398,733 |
| United States | — | — | 382,719 | 8,369 | — | — | — | 391,088 |
| Grand Total | $9,307,490 | $444,008 | $3,148,237 | $264,280 | $1,265,160 | $7,077,115 | $93,427 | $21,599,717 |

H. E. Fisk, *The Inter-Ally Debts* (New York: Bankers Trust Company, 1924), p. 345.
*Canadian figure. Great Britain's figure is $352,337. †$393,162,000 (gold). ‡$80,674,000 (gold).

different mind—payment was desired and this led to the creation of the Funding Debt commission in 1922. This commission negotiated "settlements" under which the principal sum of the indebtedness was preserved but the rate of interest to be paid was scaled to meet the "capacity of the debtors to pay," ranging from purely nominal rates in the case of Italy to 3–3½% for Great Britain. The total payments scheduled, amounting to $22,000,000,000, were to extend over 62 years. Great Britain and France concluded similar agreements with their creditors; Britain endeavoured to collect no more than was required to meet its payments to the U.S., and in 1922 proposed a plan of forgiveness to its debtors if the U.S. would cancel Great Britain's debt. Its advances had exceeded those of the U.S. (*See* Table VIII.)

The repayment of inter-allied debts became inseparably linked with the collection of reparations from Germany. In 1921, these were officially assessed at 132,000,000,000 gold marks. Transfer difficulties arose almost at once; Germany soon defaulted. France, Belgium and Italy demanded specific performance of reparations obligations, but resisted payments in kind; practically all countries, through tariff increases, made it impossible for Germany to pay. The collapse of Germany led to the appointment of the Dawes commission in 1924. That committee set up a schedule of annuities for Germany to meet; though they were based upon a careful estimate of that country's ability to pay, they, too, soon proved excessive. The Young plan emerged in 1929. Under it, Germany's obligations were reduced to 121,000,000,000 marks to be discharged by annuities payable in 59 years, or by 1988. Further reduction of payments was provided if the U.S. should reduce the debts owing from its allies. The great depression made it impossible for European governments to meet payments to the U.S. The Young plan was suspended. In July 1931, President Hoover declared a moratorium on debt payments to the U.S. An international conference was summoned to meet at Lausanne where an agreement was reached on July 9, 1932, to permit Germany to meet its obligations by the deposit of 5% bonds for 3,000,000,000 marks ($714,000,000) with the Bank for International Settlements. These bonds were to be sold; any not sold after 15 years were to be cancelled. This agreement was not to be signed until creditors had made satisfactory settlements with the U.S. This was not attempted and the agreement has never been ratified. In the words of Hugh Dalton, the depression "washed away" the inter-allied debts of World War I.

**Borrowing in World War II.**—The levels of expenditure, taxes and borrowing required in World War II reached all-time peaks. The growth of interest-bearing debts in the U.S., the U.K. and Canada is shown in Table IX. (Reliable data for the axis countries are not available.) Note the declining rate of interest on borrowings after 1939.

In 1944, the debt of the U.S. was 29% greater than its national income, that of Canada was 25% larger, while the debt of the U.K. was equal to 246% of its national income. The interest charges amounted to 1.7% of national income in the U.S., 2.8% in Canada and 4.8% in the U.K. Both the U.K. and Canada relied more heavily on taxation to finance the war than did the U.S. Comparative data are shown for the three countries in Table X.

The U.S. relied more heavily on bank borrowing than either the U.K. or Canada, but the percentage of borrowings from banks was not as great in 1943 as in 1934 or subsequent years of depression. In 1934, out of $5,122,000,000 of loans, exclusive of trust-fund borrowing, $3,915,000,000 or 76.4% came from the banking system; in 1943, total borrowings were $53,965,000,000, of which $26,180,000,000 came from the banking system. England not only borrowed directly from banks but borrowed "spare" balances in commercial banks. Canada adopted this practice in 1942. England liquidated the foreign securities owned by citizens and borrowed heavily from abroad. The bank borrowings primarily took the form of short-term loans, which accounted for the low interest rates on the outstanding debt. Canada made greater use of intermediate and long-term bonds than either the U.S. or U.K., as is shown in Table XI. England continued its practice of issuing securities without definite maturity (perpetual debt), but also issued term maturities.

Every effort was made to secure a wide distribution of securities issued to finance the war. Public drives, such as were used in World War I, were revived. Prior to July 1, 1945, seven such drives had been held in the U.S. with the following results:

| War bond drives | Date | Total subscriptions in millions |
|---|---|---|
| First | Dec. 1942 | $12,947 |
| Second | April 1943 | 18,555 |
| Third | Sept. 1943 | 18,944 |
| Fourth | Jan. 1944 | 16,730 |
| Fifth | June 1944 | 20,639 |
| Sixth | Dec. 1944 | 21,621 |
| Seventh | May 1945 | 26,313 |

Data from *Bulletins of the Treasury Department.*

The above subscriptions are for all subscribers and all types of issues included in the drives. Banks were not eligible to make subscriptions except in the First and Second drives. For the first six drives, 25.4% of the subscriptions came from individuals, including partnerships and personal trusts, 65.3% came from corporations and other investors and 9.3% from banks.

The U.S. treasury also endeavoured to secure widespread distributions of securities by promoting the sale of War Savings bonds, a nonmarketable security with guaranteed redemption values 60 days after issue. These securities were always on sale (on "tap"), were included in drives, and were sold by pay-roll deduction plans to 27,600,000 participants in 1944, the purchases amounting to $5,546,000,000—or 9.6% of the participants' pay. These pay-roll deductions were voluntary, but considerable moral suasion was involved. The redemptions, however, were not large. From 1941 through 1944 the sales of Series E War bonds (which were for low-income groups and sold through pay-roll deduction plans) amounted to $29,857,800,000 of which only $4,605,000,000, or 15.4%, were redeemed.

TABLE IX.—*The Interest-Bearing Debt of the United States, United Kingdom and Canada, with the Annual Interest charge thereon, and the Computed Rate of Interest on the Outstanding Debt: 1939–44*

(amounts in millions of currency units indicated)

| End of fiscal year | Interest-bearing debt | Computed annual interest charge* | Computed rate of interest (Per cent) |
|---|---|---|---|
| United States: | | | |
| 1939 | $45,336 | $1,149 | 2.534% |
| 1940 | 47,874 | 1,203 | 2.514 |
| 1941 | 54,747 | 1,335 | 2.438 |
| 1942 | 76,517 | 1,729 | 2.260 |
| 1943 | 139,472 | 2,759 | 1.978 |
| 1944 | 201,059 | 3,868 | 1.924 |
| United Kingdom: | | | |
| 1939 | £ 7,247 | £ 224 | 3.092% |
| 1940 | 8,014 | 237 | 2.963 |
| 1941 | 10,449 | 273 | 2.612 |
| 1942 | 13,117 | 336 | 2.562 |
| 1943 | 15,737 | 391 | 2.486 |
| 1944 | 18,469 | 451 | 2.441 |
| Canada: | | | |
| 1939 | $ 4,255 | $ 158 | 3.714% |
| 1940 | 4,563 | 164 | 3.602 |
| 1941 | 5,230 | 173 | 3.310 |
| 1942 | 6,638 | 213 | 3.206 |
| 1943 | 8,585 | 243 | 2.832 |
| 1944 | 11,363 | 313 | 2.751 |

Harold L. Seligman, "Patterns of Wartime Borrowing in the United States, United Kingdom, and Canada," *Federal Reserve Bulletin*, Nov. 1944, p. 1064.

*The figures for the United Kingdom are approximate since data are not available for the exact interest rates on a few issues. The figures for Canada include the annual amortization of bond discounts and commissions, Canada being the only one of the three countries which during the war period issued securities below par and paid commissions to various sales outlets. These charges are, in fact, in the nature of interest payments.

TABLE X.—*Net Receipts from Borrowing and Taxation in the United States, United Kingdom and Canada: 1940–44**

(in millions of currency units indicated)

| Revenue source | Fiscal year† | | | | | |
|---|---|---|---|---|---|---|
| | 1940 | 1941 | 1942 | 1943 | 1944 | Total |
| United States: | | | | | | |
| Borrowing | $2,606 | $6,836 | $21,659 | $63,805 | $61,830 | $156,736 |
| Taxation | 5,114 | 7,093 | 12,513 | 21,365 | 40,857 | 86,942 |
| Per cent borrowed | 33.8% | 49.1% | 63.4% | 74.9% | 60.2% | 64.3% |
| United Kingdom: | | | | | | |
| Borrowing | £ 768 | £2,466 | £2,673 | £2,780 | £2,736 | £11,423 |
| Taxation | 1,017 | 1,359 | 1,962 | 2,483 | 2,948 | 9,769 |
| Per cent borrowed | 43.0% | 64.5% | 57.7% | 52.8% | 48.1% | 53.9% |
| Canada: | | | | | | |
| Borrowing | $308 | $678 | $1,414 | $1,963 | $2,779 | $7,142 |
| Taxation | 468 | 778 | 1,361 | 2,137 | 2,592 | 7,336 |
| Per cent borrowed | 39.7% | 46.6% | 51.0% | 47.9% | 51.8% | 49.3% |

Harold L. Seligman, "Patterns of Wartime Borrowing in the United States, United Kingdom, and Canada," *Federal Reserve Bulletin*, Nov. 1944, p. 1057.

*All money figures in this study are expressed in the currency of the country to which reference is made since, for comparative purposes, relationships rather than absolute amounts are important. Figures for taxation are net and exclude miscellaneous receipts.

†Fiscal years for the United Kingdom and Canada run from April 1 through March 31; for the United States from July 1 through June 30. Reference to a fiscal year is made according to the calendar year in which the fiscal year ends.

TABLE XI.—*Percentage Distribution of Maturities of Marketable Debt of the United States, United Kingdom and Canada: 1944*

| Due or Callable | Percentage of Total Marketable Debt | | |
|---|---|---|---|
| | United States on June 30, 1944 | United Kingdom on March 31, 1944* | Canada on March 31, 1944* |
| Within 1 year | 36.3% | 35.3% | 22.9% |
| 1 to 5 years | 17.7 | 8.2 | 22.0 |
| 5 to 10 years | 23.9 | 11.2 | 30.9 |
| 10 to 15 years | 6.9 | 10.2 | 23.4 |
| 15 to 20 years | 7.2 | 10.0 | .4 |
| 20 years and over | 8.0 | — | — |
| Perpetual debt | — | 22.4 | .5 |
| Other | † | 2.6 | — |
| Total | 100.0% | 100.0% | 100.0% |

Harold L. Seligman, "Patterns of Wartime Borrowing in the United States, United Kingdom, and Canada," *Federal Reserve Bulletin*, Nov. 1944, p. 1061.

*Due to their similarity to U.S. treasury bills, treasury deposit receipts are included for United Kingdom and treasury deposit certificates for Canada.

†Less than .05%.

**Lend-Lease in World War II.**—The experiences after World War I in connection with the nonpayment of inter-allied debts, and the realization in official quarters that they should not have been repaid, prompted the U.S. to devise a different arrangement for assisting its allies, popularly known as "lend-lease." The arrangements were developed "to promote the defense of the United States," which was the title of the act passed by congress and approved March 11, 1941 (55 U.S. Stat. Pub. Laws Ch. 11). Under the act, "defense articles" could be manufactured, sold, transferred, exchanged, leased, lent, or otherwise disposed of to any country for the defense of the U.S. "Defense articles" could also be repaired and reconditioned. No money could be given away or loaned. The initial act limited lend-lease aid from funds previously appropriated to $1,300,000,000; by June 30, 1944, total appropriations to the president for lend-lease amounted to $28,222,498,000 and additional transfers from army, navy and other appropriations aggregated $35,970,000,000.

TABLE XII.—*Total Lend-Lease Aid Provided by United States: March 1941 through June 30, 1944*

| Category | Amount | % of Total |
|---|---|---|
| Goods transferred: | | |
| Munitions | $15,162,329,000 | 53.6 |
| Industrial materials and products | 6,026,086,000 | 21.3 |
| Agricultural products | 3,630,585,000 | 12.9 |
| Total transfers | 24,819,000,000 | 87.8 |
| Services rendered: | | |
| Servicing and repair of ships, etc | 522,853,000 | 1.9 |
| Rental of ships, ferrying of aircraft, etc. | 2,210,752,000 | 7.8 |
| Production facilities in U.S. | 621,700,000 | 2.2 |
| Miscellaneous expenses | 96,046,000 | 0.3 |
| Total services | 3,451,351,000 | 12.2 |
| Total Lend-Lease aid | $28,270,351,000 | 100.0 |

*Sixteenth Report to Congress on Lend-Lease Operations, for the Period Ended June 30, 1944*, p. 11.

From its inception in March 1941, through Dec. 31, 1944, lend-lease aid totalled $35,382,646,000 as is shown in Table XII. In addition, goods to the value of $788,083,000 consigned to commanding generals in the field were turned over to U.S. allies for use, but are not included as part of lend-lease supplies. About 14% of the total U.S. munitions production went into lend-lease in comparison with 2% purchased directly by U.S. allies. About 98% of lend-lease aid went to the U.K., U.S.S.R., France and China. Lend-lease was administered by the Office of Lend-Lease administration created by Executive Order, Oct. 28, 1941.

The lend-lease act was implemented by a series of agreements concluded (up to June 30, 1944) with 32 countries, and supplemented by reciprocal-aid agreements signed with seven countries. The agreements covered, among other things, repayments and credit for reverse lend-lease aid.

The act of March 11, 1941, contained the following provision relative to repayment:

"The terms and conditions upon which any foreign government receives any aid . . . shall be those which the President deems satisfactory, and the benefit to the United States may be payment or repayment in kind or property, or any other direct or indirect benefit which the President deems satisfactory." Sec. 3 (b).

The master agreements concluded with various countries (in identical terms) provided (1) for the return to the U.S. at the conclusion of the war of articles not destroyed, lost or consumed deemed by the president to be useful to the U.S. in its defense or otherwise; (2) for credit against lend-lease aid of any reverse lend-lease assistance given by signers to the U.S.; and (3) that the terms and conditions under which lend-lease benefits should be fixed "shall be such as not to burden commerce between the two countries, but to promote mutually advantageous economic relations between them and the betterment of world-wide economic relations. To that end, they shall include provision for agreed action . . . , open to participation by all other countries of like mind, directed to the expansion, by appropriate international and domestic measures, of production, employment, and the consumption of goods . . . ; to the elimination of all forms of discriminatory treatment in international commerce, and to the reduction of tariffs and other trade barriers; and in general to the economic objectives set forth" in the Four Freedoms declaration of Aug. 14, 1941. Thus, the lend-lease plan sought to avoid pitfalls created by inter-governmental loans of World War I and trade policies adopted after the war which made the repayment of loans and reparations ultimately impossible.

**Reverse Lend-Lease.**—Mutual assistance, termed "reverse lend-lease," was extended to the U.S. by other allies, principally the U.K., Australia, India and New Zealand. It commenced when U.S. forces were shipped overseas and when maritime shipping was serviced by allies. Included in reverse lend-lease were supplies of strategic materials, such as crude rubber, tea, cocoa,

chrome, asbestos, jute, etc. Among the military supplies were ships, artificial harbours, bombs, etc. From the arrival of U.S. troops in Europe in 1942, until D-day, about one-third of all supplies and equipment of U.S. troops in the British Isles were provided under reverse lend-lease. The arrangements were important in promoting the effectiveness of the war. In its first year of operation, ending June 30, 1943, reverse lend-lease aggregated $1,175,000,000; by Oct. 1, 1944, it was $3,938,000,000, as is shown in Table XIII.

TABLE XIII.—*Reverse Lend-Lease Aid Given to United States: Cumulative to October 1, 1944*
(amounts in millions of dollars)

| Type of aid | United Kingdom | Australia | New Zealand | India | Total |
|---|---|---|---|---|---|
| Goods and services within country* | $1,278 | $335 | $ 90 | $185 | $1,888 |
| Shipping service and shipbuilding | 420 | 58 | 8 | 4 | 490 |
| Capital construction | 715 | 133 | 29 | 100 | 977 |
| Goods and services transferred to United States† | 413 | 119 | 23 | 28 | 583 |
| Total | $2,826 | $645 | $150 | $317 | $3,938 |

*Eighteenth Report to Congress on Lend-Lease Operations*, Feb. 20, 1945.
*Includes food, clothing, air force supplies and equipment, and other military supplies and equipment.
†Includes items identified as "transportation and other services."

**Burden of the Debt.**—Only superficial analysis leads to the conclusion that the burden of public debt is measured by interest requirements. Interest represents the cost to the government—hire for money borrowed. Interest is the minimum amount finance ministers must insert in governmental budgets to keep public loans afloat. The real burdens lie in the economic effects produced by taxes for debt service, by transfers of payments, and by the gains or losses arising from the comparative alternative uses of public and private capital. There are circumstances under which debts represent no economic burden whatever; there are other instances where society is poorer because capital, if left in private hands, would have been more effectively employed. Moreover, in discussing the burden of public debts, external and internal borrowing must be distinguished.

In the case of external loans the borrowing country receives a net addition to its capital at the time the loan is made. When interest or principal is repaid the debtor must export gold, goods or services to the creditor country. This deprives the debtor nation of these resources, provided they are not reinvested in the debtor country. These payments may not constitute a real burden, however, for the capital initially borrowed, if put to productive use, may have developed the resources of the debtor country or may have been employed in a specific venture the operation of which yielded the returns from which both principal and interest were paid. Domestic capital was thus free to add to the development of the debtor country. The external loan not only made the debtor country better off than it was before, but the capital borrowed produced interest and its own replacement. If the funds borrowed were not productively employed the debtor would suffer a real loss.

Instead of looking at goods and services produced or employed in payments abroad, gold was frequently the only object of attention. At the time of the loan, gold was received; at the time of payment, gold was exported. The fact that foreign loans were so often employed in wars and that shipments of gold to repay debts were a visible drain on debtor countries accounted for the early opposition of classical economists to public debts. Taxes employed in securing funds for the repayment of external loans were often burdensome *per se*. Their effects on incentives to produce or save were frequently negative, adding to the consequences of transfers abroad.

In the case of internal loans all payments are transfers within the country. The nation *as a whole* can be neither richer nor poorer. At the time of the loan, capital is either transferred from those who have previously saved it, or from those who have created it, to the use of the debtor. The question of burdens *at the time of the loan* is whether the transfer to the government will result in a more efficient or less efficient use of capital than if capital were left in private hands. If the use of the proceeds of loans to the government is to increase the productivity of capital, the economy of the country is better off than if capital were left in private hands. This is a question of fact rather than of theory, but unfortunately facts are seldom available for an answer.

*At the time of payments,* either of principal or interest, resources must be acquired by the government to discharge claims of creditors. Taxes collected to pay debts are transferred to holders of government securities. The country has neither gained nor lost *as a whole,* but the fortunes or distribution of income *among groups within the debtor country* have been affected, for seldom are bondholders paid by taxes primarily upon themselves. If bonds are paid by taxes imposed in such a way as to fall on funds which otherwise would have been spent, forced saving results, unless the bondholders, in turn, squander payments made to them. If forced saving results from tax payments and reinvestment of capital by bondholders, the net result of debt payments is an increase in the supply of capital. If taxes are paid from capital and funds are reinvested by bondholders, there is no loss of capital save to the extent that administrative costs represent diversions to consumption; but even administrators may save a portion of their incomes. If bondholders squander payments to them, capital decrements result. It is believed that owners of government bonds are more likely to reinvest than to consume the interest and capital payments received by them. This depends upon the time in the cycle, and the income groups or institutional holders, to which payments are made. If payments are made to individuals during depressions there is greater likelihood that the percentage reinvested will be smaller than during prosperity periods. There may, of course, be shifts in investments made, as from gilt-edged to speculative securities. This, too, is affected by prosperity and depression, as well as by investment fads. If, as a result of these shifts, individuals, who can ill-afford to assume losses, do purchase relatively risky investments, actual losses may be accompanied by disastrous consequences to them and even to society. The concentration of such losses among low-income (or middle-income) groups tends to increase the share of wealth held by the well-to-do.

Likewise, if the rich are the primary holders of bonds while taxes to service debts are paid mainly by the less well-to-do, the concentration of wealth in the hands of the rich is increased. If fortunes composed largely of government bonds are handed from one generation to another by inheritance such estates may be transferred with a larger percentage intact than fortunes composed of more risky investments. The privilege of tax exemption accorded to income from certain government securities by various units will affect these tendencies. They will also be affected by the levels of progressive income taxation, including provisions for the deduction of capital losses where incentives to save, to assume risks, and to hold investments may be involved. However, with advancing industrial civilization the concentration of government securities held by the rich has tended to decrease. The holdings of institutions, such as savings banks and insurance companies, in which are massed the small savings of the many, have steadily grown. This greatly complicates all generalizations as to debt burdens and effects of payments.

If internal loans are made by banks on the basis of credit created by them, a net addition to domestic investment or purchasing power results. This is inflationary unless the borrowing so scares the holders of capital or income that they reduce net investments and consumption. It also tends to free taxpayers from the payment of current taxes (to the extent of loans) if the activity financed by government would have been undertaken in any case. And, the larger the sums needed by government in a world full of wealth inequalities, the higher its tax-rate progressions would have to be. The distributional effects of taxes and debts increase with their size.

The manufacture of credit by banks for government (or private) use tends to create future difficulties both for banks and the economy as a whole. Inflationary financing tends to raise prices and interest rates; as interest rises the price of outstanding government bonds tends to fall, decreasing the value of bond portfolios and increasing the sale of bonds by private holders. This causes further declines until an equilibrium is reached. Such con-

ditions, in the past, have produced bank failures with widespread losses; market maintenance and other counter measures have been required, but the aftermath of credit creation has been depression, declining prices and an increase in the real burden of debt, for the charges have to be met from smaller national incomes and payments made in money of higher purchasing power.

**Present *vs.* Future Burdens.**—The question frequently is asked as to whether it is possible to pass internal debt burdens from present to future generations. The possibility is envisaged because borrowing precedes the imposition of taxes for the payment of interest and principal. However, *at the time of the loan,* lenders surrender present goods and services to the borrower. Private capital is surrendered for present economic goods. Lenders, moreover, forego consumption or alternative investment of their funds; those who sell goods part with them. The goods, in turn, may be currently consumed or converted into capital assets to render service until worn out. *At the time taxes are imposed to pay interest or principal,* goods are transferred by present taxpayers to holders of debt instruments. Taxpayers surrender goods or forego consumption; bondholders receive them. These are transfers *within the group in existence at the time transfers are made.* No transfers are made between the generations alive at the time of the loan to those at time of payment. The transfers are effected only within the groups on each separate occasion.

There are, however, circumstances when the burdens created by internal debts can be passed on to future generations: (1) when the proceeds of loans are put to unproductive use, as in a war of aggression ending in defeat, so that future generations are worse off than before; (2) when the present generation consumes its capital; (3) wastefully exploits its resources; (4) undermines the efficiency of its labour for a considerable period of time; (5) retards industrial progress; or (6) fails to maintain or replace depreciating productive plant and equipment. Thus future generations are made poorer by the profligacy of present generations. On the other hand, wise utilization of resources by the borrowing government should increase national productivity, making it easier for future payments to be made.

The ability to shift the burden of external loans to the future rests upon analysis similar to that above, and depends largely upon the uses to which borrowed funds were put. (*See* also *Burden of the Debt,* above.)

Every loan or tax means that the possessor of resources surrendered gives up the opportunity to consume or invest funds. The real cost of loans is found not in the interest paid but in the net comparative loss, if any, in the use of funds to lenders. Presumably money would not have been loaned if alternative and more productive employment of funds had been available. Nor should government devote its resources to debt repayment if more productive uses of funds are open. The net advantage from public or private use of capital depends on comparative rates of return. The gain from capital so employed must be set against the losses resulting from taxes collected. The use of capital borrowed holds the clue to real debt burdens.

**Problems of Issue.**—The problems confronting finance ministers at the time of borrowing are also of a technical order. They present a mixture of economic, political and administrative questions. Decisions made at the time of issue determine, for the most part, the problems of managing the public debt, until it is extinguished. Even the time of occurrence, and periodicity, of many problems is fixed when the terms of borrowing are decided. The problems of issue are, therefore, largely anticipatory management problems.

The main problem of issue is often said to be that of putting the debt in such form as to enable the state to borrow at the lowest effective rate. The way to achieve this is said to be by giving the investor the type of security he wants. This will facilitate sales but what the investor wants, or thinks he wants, may not be what he should have. Nor should the tastes of investors determine decisions as to the form of borrowing. Those decisions should be made in terms of policies calculated to maximize economic well-being—in terms, for example, of production, income flows, or incentives to work, save and invest. Such objectives are more important than borrowing at the lowest effective interest rate. There are times when the state should pay high rates rather than the lowest rate at which it can borrow, for example, in order to mop up income or to put securities into proper hands.

Among the primary decisions to be made at the time of the loan is, from whom should the government borrow? From individuals or banks? From hoards, idle balances or from the current-income stream? Is it better to concentrate on past savings or to utilize specially created credit? The economic effects flowing from loans from different sources, tapping unlike types of capital (or credit) are various. Some borrowing is inflationary, some is not. At certain times in the economic cycle, one type will be appropriate while another may not do at all. Those in charge of the state's fiscal policy will have to decide when it is appropriate to use a given type of borrowing, as well as the amount which, under the circumstances, is justified.

Akin to this is the question as to who should own or hold government securities. Should the government try to induce subscribers to hold bonds to maturity, or should it be indifferent to sales by owners? If government bonds become a conspicuous field for speculation, what may happen to the nation's apparent credit standing if securities yielding greater returns provide the inducement to owners of government securities to sell? And, who will the new holders be? Will the government, in order to minimize losses to owners, be forced to go into the market to buy up its own securities? Or, can it rely upon the approach of maturity, or call dates, gradually to bring its issues on the market up to par, as it prepares to pay off holders at maturity should they desire it? Answers to such questions are made when the treasury decides who is to be eligible to subscribe to specific issues, and on what terms. Similar decisions are made when limitations are placed on the amount of given securities any one person may own or purchase within a definite period. When loans are over-subscribed, purchases must be allocated among subscribers. The allocations need not be purely mathematical determinations; they may be selective so as to implement policy decisions.

The usual problems confronting the state at the time of borrowing relate to the form of the loan, the type of securities to be issued, the term of years or days for which money is to be borrowed, the rate of interest, marketability, negotiability and features to promote sales. Among the "lures" or "relishes" to be considered are tax exemption, circulation privileges, prize drawings or lotteries, use of securities at par or fixed values, in payment of taxes, etc. With the development of security markets and citizens' investment habits (along with funds for investment) such features have declined in importance.

The issuance of securities at par is preferable to their sale at discount. Sale at discount is not to be confused with sale *on a discount basis.* In the latter case, to the issue price is added interest accumulations so that the holder receives his return through additions to principal rather than *via* current interest payments. (*See* also *Interest-Bearing Debt,* above.) In the early days of public borrowing sale at discount was prevalent because the credit of states was weak and lenders could secure increased profits from loans (in the nature of underwriter's profits) without making conspicuous additions to the interest rate which opposition to usury also condemned. History is replete with examples, as in the U.S. during the Civil War, when treasuries refused to offer securities bearing as much as the market rate of interest, with the result that they could be sold only below par—or at a discount. Nevertheless such securities had to be redeemed at par. Consequently a higher effective rate of interest was paid over the life of the loan than was called for on the face of the debt instrument. More had to be paid at maturity than was in fact received at issue. Samuel Gale, writing in 1784 said, "If the rate of interest for money should be restrained by legal provisions, or apparently disguised . . . such disguise will be attended with the loss of a *principal* proportionate to the degree in which the rate of interest shall be so disguised." Similarly, when bonds are issued at interest rates above the market, a *premium* is received, based roughly on the present value of the excess interest, which is amortized over the life of the loan, the obligation being payable at par. It is hard

to justify the payment of excess interest in such cases over the life of the loan. If greater sums are needed by the state more securities should be issued at par.

With a constantly increasing public debt interest charges have also mounted, in spite of the recent tendency for rates of interest to fall (*see* Table IV, above). This has caused many government officials to be concerned over the budgeting of interest costs. As long as national incomes rise, interest requirements do not seem burdensome, but when depressions bring low-income payments the relative weight of interest rises. It becomes harder to wring from declining incomes the taxes required to pay interest on past debts. As interest burdens rise budget officers, too, seek to minimize the payments thus required. From fiscal officers naturally come demands that rates of interest be kept low. This desire, on the part of government, to minimize its own interest payments may be in conflict with the policies of monetary authorities, who at a given time may be increasing interest rates in order to curb inflationary credit expansion. Thus the policies of the government *as a debtor* may come into conflict with policies of government to control private credit, or the level of economic activity in the nation. The two policies will not always be in conflict. At times in the cycle, easy-money (low-interest) policies will be appropriate for both the treasury and monetary authorities and for the country as a whole. In other situations advancing interest rates may be desirable.

To an increasing extent in the future, proposals to reduce interest costs on the public debt will be made. For years groups have advocated the substitution of fiat money—often called "interest-free borrowing"—for interest-bearing securities. Likewise, increased borrowing from central banks as a regular policy rather than as a temporary emergency seems to be growing in favour. During World War II the large holdings of treasury bills by the federal reserve banks in the U.S. were tantamount to direct borrowing, as, of course, was the case of advances on ways and means in England. The treasury (U.S.) sold bills to commercial banks which, in turn, sold the bulk of them to the federal reserve banks. Direct borrowing would have had the same effect and perhaps also provided savings in interest costs. Opponents to direct borrowing denominate it as inflationary, but if credit was being created to finance the government at the time, the argument loses much force. Inflation, as a monetary phenomenon, arises from the source and volume of funds rather than from the type of instrument issued as an evidence of indebtedness, although some types of securities can be more easily substituted for money than others. Proposals have also been made to require banks to finance the government *at cost* for creating credit rather than at market rates of interest. Special securities designed only for bank ownership bearing a low rate may tend to lower interest. This has been the result of financing *via* short-term loans in both England and the U.S. since World War I. Speculation in government securities and profits from their appreciation in value tend to increase proposals to monetize public debts and otherwise to socialize public credit. The development of *rentier* classes or corporations tends to produce similar movements. Hence, modern governments desire a wide distribution of securities.

**Who Holds the Debt?**—During the 17th and 18th centuries when private bankers, such as the Barings, Hopes, Goldsmiths, and Rothschilds were financing governments, the concentration in debt ownership was evident. Speculation in public securities has been the source of many fortunes. The assumption of the Revolutionary War debt by the U.S. national government was opposed because it tended to enrich speculators. The financing of the Civil War "offered a rich harvest for the money lender" (H. C. Adams, *Public Debts,* p. 40). Not until comparatively recent times, and in only a few countries, are data available as to the distribution of debts. In 1880, in the U.S., when the registered debt was $1,173,749,250, foreign holdings were $27,894,350 (or 2.4%); national banks owned $319,937,800; the residuum of $825,917,100 was owned by 80,802 corporations and private individuals, no allowance being made for duplicate registrations by the same owners. The census bureau counted individual owners by size of holdings for $417,538,850 of bonds, of which 47.8% were held in amounts of more than $50,000, presumptively indicating ownership concentration in the upper-income level. Only 10.1% of the holdings were in amounts of $2,500 or less.

By 1935, although there remained a marked concentration of bond ownership among the rich, the distribution seems *a priori* to be more equitable than in 1880. Table XIV shows the distribution of tax-exempt interest on wholly- and partially-tax-exempt securities (federal, state and local issues), and the distribution of ownership among income classes for 1935. This is the closest approach that can be made in the U.S. to a personal distribution of bond ownership. Unfortunately, it does not cover the holdings of those with less than $5,000 personal income. In 1935–36, however, the study of *Consumer Expenditure in the United States,* by the National Resources committee, indicated that total savings by families and single persons in income groups below $5,000 amounted to $1,248,000,000, in comparison with $4,730,000,000 for income classes above the $5,000 level. The great increase in wages and salaries during World War II is believed to have greatly improved the lot, and, hence, the volume of saving, in income groups below $5,000. During World War II this group purchased substantial amounts of war bonds *via* pay-roll deductions. (See *Borrowing in World War II,* above.)

TABLE XIV.—*Ownership of and Interest from United States Tax-Exempt Obligations Reported by Individuals with Net Incomes of $5,000 and over, by Net Income Groups: 1935*
(amounts and net income classes in thousands of dollars)

| Net income classes | Net income (including wholly tax-exempt interest) | Tax-exempt interest | | Tax-exempt interest as a percentage of net income (including wholly tax-exempt interest) | Tax-exempt obligations owned | |
|---|---|---|---|---|---|---|
| | | Amount | Per cent of total reported | | Amount | Per cent of total reported |
| $ 5– 10 | $2,316,081 | $ 44,430 | 15.7% | 1.9% | $ 694,916 | 15.0% |
| 10– 25 | 1,878,468 | 70,534 | 24.9 | 3.8 | 1,127,219 | 24.4 |
| 25– 50 | 935,779 | 60,430 | 21.3 | 6.5 | 899,600 | 19.4 |
| 50–100 | 575,669 | 43,267 | 15.3 | 7.5 | 671,338 | 14.5 |
| 100–150 | 184,322 | 18,718 | 6.6 | 10.2 | 332,070 | 7.2 |
| Over 150 | 450,137 | 46,063 | 16.2 | 10.2 | 900,043 | 19.5 |
| Total | $6,340,456 | $283,442 | 100.0% | 4.5% | $4,625,186 | 100.0% |

Taken from *Securities Exempt from the Federal Income Tax as of June 30, 1937,* United States Treasury Department, Division of Research and Statistics, Aug. 1938, p. 102.

In recent years, there has been a growing tendency for larger fractions of the public debt to be held by institutional holders, particularly by banks, corporations and insurance companies. This complicates the problems of analysis, particularly as to who is being paid (either interest or principal) and by whom. The banks represent depositors and stockholders; insurance companies invest funds contributed by a legion of policy holders and the relatively small capital subscriptions of stockholders; savings banks invest the small surpluses of people of slender means; government trust funds invest contributions of other large groups but the composition of each group, by income classes, is unknown. That they are far-flung is common knowledge. Security ownership by institutional categories has been tabulated monthly in the U.S. since 1941. Data for June 30, 1941, and for Nov. 1944, as shown in Table XV, reflect the impact of financing World War II and indicate the degree to which individuals, as well as institutions, helped to underwrite the war.

Comparable information as to the ownership of national debts is not available for other countries. Harold Seligman has, however, worked out a distribution on the basis of the *increase* in debt since 1940 for the U.S., U.K. and Canada, as shown in Table XVI, which indicates the preponderant reliance on individual ("other") subscriptions in the U.K. and Canada and the slightly greater dependence on banks in the U.S. compared with Canada. Ownership distributions by income classes are unavailable in the U.K. and Canada.

*Problems of Debt Management.*—Debt management is concerned with problems arising from the time of issue through the payment of debt obligations, such as: (1) the redemption or funding of nonmarketable issues; (2) the funding or refunding of short-term issues; (3) the discharge or refunding of interfund borrowings; (4) maintaining the market, to promote stability of prices; (5) meeting maturity schedules; (6) covering interest costs or effecting reductions therein; and (7) repayment of the

TABLE XV.—*Ownership of Securities Issued or Guaranteed by the United States: June 30, 1941 and November 30, 1944*
(amounts in millions of dollars)

| Owners | June 30, 1941 | | November 30, 1944 | |
|---|---|---|---|---|
| | Amount | Per cent of total | Amount | Per cent of total |
| Commercial banks | $19,014 | 43.1% | $67,363 | 31.7% |
| Mutual savings banks* | 3,342 | 7.6 | 7,610 | 3.6 |
| Life insurance companies | 5,506 | 12.5 | 14,878 | 7.0 |
| Fire, casualty, marine insurance companies | 1,334 | 3.0 | 2,397 | 1.1 |
| U.S. government and federal reserve banks | 4,544 | 10.3 | 39,574 | 18.6 |
| All other investors | 10,332 | 23.4 | 80,422 | 37.9 |
| Total amount outstanding | $44,072 | 100.0% | $212,244 | 100.0% |

Data taken from *Bulletins of Treasury Department*, July 1941, p. 30; Feb. 1945, p. 49.
*Includes also a relatively small number of stock savings banks.

debt. These problems are also of a technical nature. Some arise inevitably as debt matures; others, particularly as complications arise, are created by uncertain economic events in an unpredictable future. Competent debt management must meet all conditions and use management policies, like taxation, borrowing and expenditure as an instrument of fiscal policy.

When the government agrees to redeem nonmarketable debt it must do so when called upon and at prices fixed in the loan contract, if its credit standing is to be maintained. Such securities, when eligible for redemption become, for practical purposes, *demand paper*. The government can secure funds for redemption *via* taxes or by new loans. In the latter case what is involved is a substitution of creditors. The volume of redemptions is affected both by the credit standing of the borrowing government and the cash requirements of the creditor. At maturity, nonmarketable debts present the same problems as other debts—payment or extension.

Ability to manage short-term debt is both a test of over-all debt policy and of efficiency of debt administration. Instead of being an instrument of emergency finance confined to periods of monetary crisis, when even circulation needs can be met, short-terms have become the conspicuous feature of U.S. and U.K. finance. Keeping them afloat involves the almost constant task of renewal; it keeps the government regularly in the money market, in close touch with commercial and central banks. If the credit of the government wanes, or if interest rates change, it becomes quickly visible in the short-term market. The traditional objection to the liberal use of short-terms has been this very dependence on the money-market for renewal. In times of crises it was feared that renewals would be difficult or even impossible to obtain or available only at prohibitive rates. Modern governments have met such criticism by increasing the size of working-cash balances, by anticipating borrowing requirements for longer periods even though slight increases in interest were involved, and by combining short-terms with borrowings on longer maturities. A further traditional objection has been that short-terms were inflationary. However, it is not the form of the security which creates inflation but the source and volume of borrowing. If borrowing is on the basis of manufactured credit, long-terms, short-terms and other issues will be inflationary; if borrowings are from current incomes the particular security offered cannot *at that time* make the transaction inflationary.

When these objections are not sufficient deterrents, the frequency of renewal is supposed to be conclusive. Such work is one reason, however, why administrators are hired. So long as financial institutions can absorb short-terms they will desire them in cyclically differing volumes; so long as governments can borrow upon them at lower effective rates than other securities they will be offered. Governments can be expected to utilize short-terms in the future in greater relative volume than in years prior to World War II.

On occasions of credit stringency, or at times when the market is propitious, governments may be expected to fund short-terms into longer maturities. Likewise, maturing long-terms may be exchanged for short-terms when such switches facilitate later refunding, or when market conditions justify increases in short-term borrowing. If debt is to be reduced, short-terms may be paid off first since recurrent maturities make this easy for the government to accomplish, as was the case in the U.S. between 1920 and 1930. But what securities, and whose, should be retired at any given time depend on the monetary and economic effects produced by repayment.

Interfund borrowings, to the degree utilized, free the government from recourse to the money market. The loans may, however, carry market rates of interest. If the rates are above market the borrowing fund subsidizes the creditor fund; if the rates are below market the debtor fund secures the advantage. One fund cannot loan to another unless it has a temporary surplus of cash. The interfund operations will fail, too, over the long run unless the debtor fund repays the creditor by the time cash is needed to meet current obligations. The management problem of the debtor, fundamentally, is that of meeting the cash requirements of creditor funds. To do this the debtor may need to resort to temporary borrowing in the market or secure revenue receipts by the time required. No fund should be plundered or robbed of cash for the sake of another.

Often a government is called upon to take steps to keep the market price of its securities from falling below par. The practice is more common in the U.S. than in England where temporary fluctuations in price are not regarded as a government responsibility. Not only has the U.S. government, through the open market committee of the federal reserve banks, tended to keep the price of its securities from falling below certain points but the committee has also sold securities to retard their advance in price and to check speculation. Three motives operate to foster price maintenance arrangements: (1) the desire to minimize losses to small investors; (2) the desire to minimize losses to financial institutions, particularly banks; and (3) the desire to implement monetary or fiscal policy. The sales of the open market committee reduce the reserves of member commercial banks; purchases provide reserves to the banking system. Sales help keep down the price of governments; purchases tend to bolster the market. Of course, it may be argued that purchasers of government securities have been paid interest which includes a premium for risks assumed. If purchasers buy short-terms the brief maturity protects them from capital losses due to fluctuations in price. Consequently, rates are low. Long-terms are exposed to all market forces during their life; therefore, interest rates are higher. Maintaining the market for long-terms tends to make them almost as riskless as short-terms, both being equally liquid in an active, available market. Such a price-pegging policy tends to increase the worth, in the market, of long-terms, rewarding present holders, but not the government, if the policy was settled upon after issue. Hence, apart from considerations urgent in monetary policy, the government may not have an economic interest in decreasing price fluctuations in its outstanding securities. If price changes depreciate the assets of the banking system, for example, its interest may become vital. The forces on each side of the market-maintenance controversy need to be weighed carefully. Answers cannot be categorical.

Meeting of maturity schedules is perhaps the most important task of debt management. At maturity, debts either have to be paid or extended. In case the obligation is renewed the operation

TABLE XVI.—*Increase in Interest-Bearing National Debt, Direct and Fully Guaranteed, in the United States, United Kingdom and Canada from 1940 through 1944, by type of holder*
(in millions)

| Type of holder | United States | | United Kingdom | | Canada | |
|---|---|---|---|---|---|---|
| | Total Amount of increase | Per cent | Total amount of increase | Per cent | Total amount of increase | Per cent |
| Commercial banks | $52,803 | 33.9% | £2,000 | 17.8% | $1,607 | 22.6% |
| Central banks* | 12,350 | 7.9 | 935 | 8.3 | 1,186 | 16.7 |
| Gov't agencies | 13,190 | 8.5 | 830 | 7.4 | — | — |
| Other investors† | 77,370 | 49.7 | 7,457 | 66.4 | 5,007 | 70.4 |
| Repatriation‡ | — | — | — | — | −692 | −9.7 |
| Total | $155,713 | 100.0% | £11,222 | 100.0% | $7,108 | 100.0% |

Adapted from Harold L. Seligman, "Patterns of Wartime Borrowing in the United States, United Kingdom and Canada," *Federal Reserve Bulletin*, Nov. 1944, p. 1066.
*Federal Reserve Banks in United States, Bank of England and Bank of Canada.
†Holdings of government agencies in Canada are not available and have been included in "other investors."
‡Securities repatriated from United Kingdom are shown as a negative figure to give a better picture of the share in the increase taken by "other investors" in Canada.

is one of *refunding*. Such extensions tend to maintain the credit standing of the state because they not only pay off those who want cash but adjust the new offerings to the requirements of the security market. Refunding operations are therefore timed, where possible, to market conditions propitious for renewal. The permanent loans (consols) of the British avoid these renewal problems. They carry no definite date of payment but the exchequer is free to pay them when convenient. From the standpoint of the treasury, "consols" are superior to term issues. Subscribers may not like them as well, for the government may redeem them at a time when investors find it difficult to reinvest funds, but such preferences are often imaginary.

Frequently long-term securities are issued with a "call" privilege. That gives the government the right to pay off issues prior to maturity. For example, the $2\frac{7}{8}\%$ bonds issued by the U.S. on March 15, 1935, are payable on March 15, 1960, but are subject to call for redemption on March 15, 1955. Any time between March 15, 1955, and March 15, 1960, these bonds can be paid upon notice to holders, or can be refunded or converted. The refunding operation has been described.

Conversion refers to an extension of debt under an agreement to exchange a security bearing a given rate of interest for one carrying a lower rate. Conversions are designed, therefore, to give the state the advantage of declines in market rates of interest. If holders do not care to accept new securities they are, usually, paid off in cash. In the early days some conversions were compulsory; in modern times exchanges have generally been voluntary. The earliest English conversion was engineered by Walpole but carried out by Stanhope in 1717, other notable conversions were those of Pelham (1750), Vansittart (1818 and 1822), Robinson (1824) Goulburn (1830 and 1844), Gladstone (1853) and Goschen (1888). After World War I numerous conversions were effected to take advantage of declines in interest rates, as, for example, the British conversion of 1932 and U.S. conversions of the First and Fourth Liberty Loans in 1934 and 1935.

The payment of interest without deviation from the terms of the loan contract assures the government a ready market for future issues appropriately priced and is the cardinal feature of excellent credit standing. The meeting of interest payments with fidelity is both a budgetary and a management task. Ordinarily interest payments will be appropriated from tax receipts. On occasion it may be necessary to cover them by temporary borrowing although a continuation of that practice for long periods inevitably leads to a deterioration of credit as well as a decline in the quality of the financial management of the state itself. Debt administrators naturally desire to keep interest costs at a minimum (see *Problems of Issue,* above), which cannot be done by refusing to pay the market rate for funds. The state, however, should take advantage of opportunities by refunding and conversion to keep its securities in line with market rates of interest; when necessary to adjust interest rates on public securities it should do so in a forthright manner. Unilateral adjustments—changes in debt contracts promulgated by the state without consent of creditors—are generally opposed. (See *Problems Created by Price Level Changes,* below.)

**Repayment of Principal.**—The repayment of national debts has long been the central problem of management and a chief concern of scholars. Classical economists looked at national debts as though they were personal obligations, to be repaid at the earliest opportunity. Unless debts were promptly repaid some future emergency might arise, when the borrowing power was exhausted. Furthermore, continuously mounting interest costs could only bring an increase of taxes; there might be also interferences with expenditure programs. Then, too, it was felt that mounting debts would progressively undermine the monetary system, especially if difficulties were encountered in meeting contractual payments. Finally, repayment was regarded as the means through which credit standing was maintained. More recently other aspects of management—fidelity of interest payments, refunding and conversion—are seen to be of equal importance.

Opposition to debt repayment has taken three forms: (1) objection to reduction of principal; (2) postponement of payment in order to discover, or utilize, means whereby burdens of retirement could be reduced; (3) opposition to the imposition of sufficient taxes to reduce debt. Procrastination in repayment, accompanied by the gradual depreciation of the purchasing power of money through rising prices has played into the hands of opponents of debt reduction. It has been argued that if the same efforts devoted to debt payment were turned to increasing production and the development of natural resources the burden of debt would be reduced and its eventual payment more easily effected. Such a program would also avoid dislocations of industry and the reduction of consumption and investment following heavy taxation for debt retirement. At times it has been pointed out, that there are better uses for public and private dollars than the reduction of national debts.

Payment has also been opposed on the ground that certain institutions and individuals need public securities. They have furnished part of the foundation for commercial banking; they have provided socially desirable institutions (charities, schools, hospitals, etc.) with certain income from endowments; they have given low-income groups a safe place to invest savings. Although these uses for government securities would be ended if the national debt were paid off in its *entirety*, much reduction is possible before the above uses are impinged.

In the case of an internal debt it has been argued that since "we owe it to ourselves," repayment is unimportant. What is taken away in taxes to repay the debt, is returned to holders of debt tickets, administrative expenses of taxes and loans being ignored. While the aggregate transfers do not change national income, the distribution of resources among income-groups within the country is affected, for the holders of debt and taxpayers who pay them are not identical. Certainly the realization that payments of internal debts are only transfers should dispose of the argument that debt repayment is desirable *per se*. Internal debts should be retired when beneficial economic effects for the whole group are to be realized. When other uses of funds are more important, a less important use, such as debt retirement, has little claim for attention. The larger the debt the more serious are the economic consequences of transfers. These effects provide the answer to the wisdom or folly of debt retirement.

In the case of external debts, payments to creditors involve the transfer of gold, goods or services abroad. The debtor country loses the use of whatever is shipped outside of its economy. A desire to cut off these losses as promptly as possible argues in favour of speedy retirement of foreign debts. Without bothering to distinguish between internal and external debt, many writers have applied their arguments to debts of all varieties.

F. W. Pethick-Lawrence (*The National Debt* [published by The Labour Publishing Co., Ltd.], p. 26) has pointed out nine ways in which a national debt can be reduced or extinguished:

> "(1) The debt may be redeemed. (2) The debtor and the creditor may become the same person. (3) The creditor may cease to exist. (4) The debtor may cease to exist. (5) The creditor may forgive the debt. (6) The debtor may refuse to acknowledge the debt, in whole or in part, and compel the creditor to accept the situation. (7) The debtor may become bankrupt. (8) The debtor and creditor may come to a mutual agreement to commute the debt into a different form. (9) The debt, while nominally remaining intact, may in effect be reduced, and even practically extinguished, by altering the standard of value in terms of which it is measured."

The methods by which a nation may pay its debt to an existing creditor may be divided into three general groups: (1) nonrecurrent opportunities for debt reduction, such as the sale of public property or a capital levy; (2) periodic or almost automatic retirements; and (3) retirements made to implement a cyclical fiscal policy. The last two groups are most important, both from the standpoint of use and theory.

The periodic or regular reduction plans include the dedication of yields from designated taxes or other revenues to debt payment, the creation of sinking funds and retirement *via* the issuance of annuities. The partial repayment of loans of World War I by their allies to the U.S. and U.K. may be included in this category.

The repayment of loans by the use of tax receipts pledged

therefor has long been prevalent in international finance. It was an almost certain method by which foreign bankers could extract payments from weak or newly established governments. The familiar dedication of the salt tax revenues of China to the payment of foreign loans is a case in point. Internal loans have been similarly retired. Special property tax levies have discharged most municipal debts in the U.S. Franchise taxes on federal reserve banks were devoted to the retirement of the U.S. national debt from 1918 to 1933. Gladstone and others have favoured the dedication of death tax receipts to debt reduction. The use of other specific taxes has been championed.

By far the most important method of debt reduction, historically and from the standpoint of the volume of scholarly output, has been from the creation and use of sinking funds. The essence of a sinking fund is the incorporation in the spending program (budget) of a regular appropriation for debt retirement to be covered by available revenues. In early years the miracles of compound interest caused sinking funds to be invested and held pending the maturity of the obligation, at which time the fund would be sufficient mathematically to retire the issue. Dr. Richard Price (1771), regarded as the classical progenitor of the sinking fund, believed that it should be set up from revenues; if these were insufficient, it would pay to borrow to make sinking fund payments, for that fund would accumulate at compound interest whereas the debt would draw only simple interest. Robert Hamilton (1813) completely punctured this illusion, establishing the valid point that the only true sinking fund, or effective method of debt reduction, is a surplus of revenues over expenditures.

The experience of English and American governments with sinking funds is long and notable—famous, for the most part, because debt reduction as planned was not achieved. Walpole established the first sinking fund in 1716 but it was violated by diversions to other objects of expenditure. Pitt based his experiment of 1786 on Price's theory, even to the extent of borrowing to maintain it. Some modifications were made in it in 1792, 1798 and 1802. In 1813, Vansittart revised it further to discharge the old debt of 1786 and to apply it to new loans. In 1817, the sinking fund of Ireland was consolidated with that of Great Britain. In 1821 Ricardo criticized the fund; Lord Grenville added an essay of criticism in 1827, with the result that reforms were again instituted in 1828. It appeared that more than twice as much debt had been accumulated as had been retired.

In the U.S., sinking funds have also been the chief means for reducing the national debt. The first sinking fund, sponsored by Alexander Hamilton, was created in 1790. The revenues set up for it were receipts from tonnage dues and the proceeds of a loan. In spite of the failures of this sinking fund, congress created another in 1817 to discharge the debts of the War of 1812. A specific appropriation was made to the fund and surplus revenues as well were provided. By 1835 the national debt was extinguished. A sinking fund for Civil War debts was established in 1862 but was inoperative until 1866. It was augmented by surpluses and led to the steady reduction of debt until 1893. A sinking fund was also created in 1919 for debts of World War I and became operative in (fiscal) 1921. From (fiscal) 1921 to 1943 debt retirements from this sinking fund amounted to $6,214,685,000 out of aggregate retirements of $11,594,000,000. More than 54% of the debt retirements thus came from the sinking fund.

An objection to the sinking fund technique is that it tends to provide a minimum of retirement. When debt is being increased, simultaneous retirement only augments total borrowing. When taxes should be increased to provide a maximum of debt retirement it is often pointed out that the sinking fund will retire the debt within a given period, or that provision has been made so to retire it, with the result that taxes are decreased and debt retirement is thereby minimized. Such was the result of the policies of the U.S. during the boom period 1921–29. The net result, over the course of the trade cycle, is that too little debt is paid off.

The history of attempts to retire debts has vindicated the scholar's assertion that a surplus of revenue is the *sine qua non* of debt reduction. This has caused many writers to advocate debt redemption by the application of surpluses; but unless a surplus is budgeted for debt retirement the reduction achieved is apt to be small. Casual surpluses cannot be depended upon for substantial retirements. The use of surpluses for debt reduction will, however, provide cyclical retirements, for surpluses are seldom achieved during depressions. Those who favour cyclical retirements usually advocate retirements during prosperity and booms, with debt expansion taking place during depressions. It is also possible to achieve a cyclical policy by imposing taxes for debt reduction during prosperity, but with the actual repayments being delayed until subsequent depressions appear. An intentionally realized surplus provides all of the advantages of a fixed provision for redemption with none of the embarrassments or moral hazards of rigid policies or accumulating funds. It gives the government flexibility but makes it squarely responsible for debt retirement.

**Problems Created by Price Level Changes.**—Changes in the general price level either decrease or make more severe the burden of taxes for the payment of public debts. Decreases in the value of money ease burdens upon debtors but return to creditors less than they transferred to debtors at the inception of the loan. Falling prices may carry with them the tax base so that nations, being unable to meet their contractual obligations, default upon loans. If this condition continues, unilateral adjustments of the loan contract may be the course of relief selected by the state. It may take the form of a compulsory reduction of interest, as in the Southern Confederacy in 1862, or in Australia (1931) and Argentina (1933); or a forced conversion, as in Belgium (1926), and New Zealand (1933); or an extension of the term of the loan, even to the extent of changing short- into long-term debt as was done in Italy in 1926; or of a devaluation of currency and the repeal of the "gold clause" relative to payments as in the U.S. in 1933; or the adjustment may take the form of an outright reduction of principal as in Turkey in 1881. Payment in other than stipulated media of exchange also took place in Russia in 1839 and in Germany and France after World War I. The extremities resulting from economic depression, and the alternatives available for avoiding them should be carefully weighed in appraising such actions. In terms of equity the question is whether justice to the debtor is to be preferred to benefits to the creditor. Many actions can be explained by attempts to balance these equities. The shifting of debt burdens is one of the penalties of a fluctuating price level.

**Repudiation.**—On rare occasions states have decided not to honour debt obligations. Repudiations are unlike defaults. When a nation defaults it is temporarily unable to pay its debts; when it repudiates it is unwilling to honour its obligations. Extreme depression may cause a nation in default to repudiate its debts. The usual cause of repudiation, however, is political rather than economic. The state contracting the loan may no longer exist and the new government may not care to assume the debts of the old, as in Spain (1823), Portugal (1832) and Mexico (1867). When revolts are quelled, the debts of rebellious groups are usually outlawed. After the Civil War, the U.S. constitution was amended (1868) to declare void the debts of the Confederacy. The total repudiation, scaling of principal and accrued interest on the scaled debt not paid amounted to $116,308,000 for eight of the southern states. The largest repudiation on record, however, is that of Russia, which in 1918, renounced the $19,000,000,000 debt of the tsarist regime; but the U.S.S.R. has since scrupulously observed all of its own obligations. Repudiations frequently are said to cause difficulties in the floating of future loans, or an increase in the rate of interest. On the other hand, instances are numerous where the state has quickly restored its credit standing, and its ability to borrow at market rates. That repudiations are rare is testimony to the extent to which the institution of public borrowing has progressed. It is part of the moral code of nations that its debt contracts, internal as well as external, be faithfully observed.

BIBLIOGRAPHY.—Henry Carter Adams, *Public Debts* (1893); C. F. Bastable, *Public Finance*, 3rd ed. (London, 1922); *Report of the Committee on National Debt and Taxation* (London, 1927), often referred to as Report of Colwyn Committee; Hugh Dalton, *The Capital Levy* (1923); F. Y. Edgeworth, *A Levy on Capital for the Discharge of Debt* (Oxford, 1919); Harvey E. Fisk, *English Public Fi-*

*nance* (1920); *idem, French Public Finance* (1922); *idem, Our Public Debt* (1919); *idem, The Inter-Ally Debts* (1924); Samuel Gale, *Essay II on the Nature and Principles of Public Credit* (London, 1784); Alexander Hamilton, "First Report on the Public Credit" (Jan. 14, 1790), "Second Report on the Public Credit" (Jan. 16, 1795), in *Papers on Public Credit, Commerce and Finance,* ed. by Samuel McKee, Jr. (1934); Robert Hamilton, *An Inquiry Concerning the Rise and Progress, the Redemption and Present State and the Management of the National Debt of Great Britain* (Edinburgh, 1813); Alvin H. Hansen, *Fiscal Policy and Business Cycles* (1941); *idem, Full Recovery or Stagnation* (1938); E. L. Hargreaves, *The National Debt* (London, 1930); Jacob H. Hollander, *War Borrowing* (1919); Jonathan Elliot, *The Funding System of the United States and of Great Britain with Some Tabular Facts of Other Nations Touching the Same Subject* (1845); John Maynard Keynes, *How to Pay for the War* (1940); S. E. Leland, "Management of the Public Debt After the War," *American Economic Review,* vol. xxxiv, no. 2, part 2, supplement, pp. 89–132 (June 1944); Lord Grenville, *Essay on the Supposed Advantages of a Sinking Fund* (London, 1828); J. R. McCulloch, *A Treatise on the Principles and Practical Influence of Taxation and the Funding System* (London, 1845); Harold G. Moulton and Leo Pasvolsky, *World War Debt Settlements* (1926); J. S. Nicholson, *War Finance* (London, 1917); Frederick William Pethick-Lawrence, *A Levy on Capital* (London, 1918); *idem, The National Debt* (London, 1924); Arthur C. Pigou, *A Capital Levy and a Levy on War Wealth* (1920); *idem, A Study in Public Finance* (London, 1928); Richard Price, *An Appeal to the Public on the Subject of National Debt* (London, 1771), 2nd ed. (1772); *idem, Observations on Reversionary Payments on Schemes for Providing Annuities for Widows, and for Persons in Old Age; on the Method of Calculating the Values of Assurances on Lives; and on the National Debt,* 4th ed. (London, 1783); David Ricardo, "Essay on the Funding System," supplement to *Encyclopædia Britannica* (1824); E. A. Ross, "Sinking Funds," Publications of American Economic Association (1892); Edwin R. A. Seligman, *Essays in Taxation;* G. Findlay Shirras, *Science of Public Finance,* vol. ii, 3rd ed. (London, 1924); Edward Ragnet Vansant, *The Floating Debt of the Federal Government, 1919–36* (1937); Jacob Viner, "Who Paid for the War," *Journal of Political Economy,* vol. xxviii, no. 1, pp. 46–76 (1920); William Withers, *The Retirement of National Debts* (1932). (S. E. L.)

**NATIONAL DEPOSIT FRIENDLY SOCIETY:** *see* FRIENDLY SOCIETIES.

**NATIONAL DIVIDEND.** National Income has been defined as "the aggregate money expression of those goods produced, and services performed, by the inhabitants of a country, which are, as a fact, generally exchanged for money." The terms National Income and National Dividend are convertible, only the latter is more significant "when we are looking at the national income in the character of the new sources of enjoyment that are available for distribution" (Marshall), *i.e.,* the flow or fund, before it is assigned to individuals. This may be looked at in two sharply contrasted ways: "the flow *produced* during a year, or, the flow *consumed.*" Dr. Marshall said "The labour and capital of the country, acting on its natural resources, produce annually a certain net aggregate of commodities, material and immaterial, including services of all kinds. This is the true net annual income or revenue of the country, or the national dividend." (Of course, services rendered by people to themselves, that they might have received from others and paid for, are not counted, otherwise the money valuation so essential for practical purposes would become difficult and vague.) Some writers (*e.g.,* Professor Fisher) have excluded savings as not being income, unequivocally claiming to "identify the National Dividend with those services and those only, that enter directly into consumption." But it is best to distinguish this and avoid confusion, as the "national income of consumable goods." Various corrections of gross money income of individuals taken in the aggregate are necessary to prevent double counting, *e.g.,* War loan interest paid out of income tax on incomes which have not been reduced (by the amount of the tax) in aggregation. If this were not done, the greater the War loan indebtedness the greater would be the amount of the national income, *without any change in the physical and usable incomes of goods and services.* (*See* also WEALTH, NATIONAL.)

BIBLIOGRAPHY.—Sir Josiah Stamp, *British Incomes and Property* (1916); *Wealth and Taxable Capacity* (2nd ed. 1923); *Current Problems in Finance and Government* (1924); Stamp and Bowley, *The National Income 1924* (1927); A. C. Pigou, *The Economics of Industry,* sect. 2 (2nd ed. 1924); Professor A. Marshall, *Principles of Economics* (8th ed. 1920); Sir Leo Chiozza Money, *Riches and Poverty* (new ed. 1913); *The Nation's Wealth* (1914). (J. S.)

**NATIONAL FINANCE:** *see* FINANCE.

**NATIONAL GEOGRAPHIC SOCIETY,** an American scientific society founded in Washington in 1888, "for the increase and diffusion of geographic knowledge." Its membership in 1929 was 1,200,000, of whom 77,000 resided in 88 other countries. In the field of research it has sent expeditions to many parts of the world, some wholly financed by it, others in collaboration with other institutions and organizations. The expeditions it has sent out to study the processes of volcanism and seismology, including studies at Mont Pelée, Messina, Mt. Katmai and the Pavlof area brought new light on these earth processes and resulted in the discovery of the Valley of Ten Thousand Smokes in Alaska, the greatest pre-geyser land known, which has been established as a national monument by proclamation of the U.S. president. In tracing the ancient civilizations of the New World the society, in conjunction with Yale university, unearthed the ancient Inca retreat, Machu Picchu, in Peru, and in a series of eight expeditions unearthed the even more ancient community of Pueblo Bonito, N.M., and laid the foundations for the co-ordination of the tree-ring calendar with our own and the establishment therefrom of an American chronology antedating the discovery of America by many centuries. In supporting active polar research the society aided Admiral Peary in all his Arctic work, sent the MacMillan-Byrd expedition to the Arctic (1925) and helped to finance the Byrd Antarctic expedition of 1928–29. In aiding solar research the society made the grants that provided the observatory and maintenance of the Brukkaros station of the Smithsonian Institution. In the field of spreading geographic knowledge the society publishes the *National Geographic Magazine,* which every member receives, issues a bulletin service for the daily press of the world, furnishes the schools of the United States with material for current-event geography and pictorial geography text in loose-leaf form. It also issues scientific monographs and publishes a widely distributed series of maps. (G. GR.)

**NATIONAL GUARD** is the name which has been given in the United States to military units which are composed of citizens who make only an avocation and a hobby of the profession of arms and which are controlled by the separate State governments. Because they are composed of men who carry on military work in peacetime in addition to their normal trades or occupations, they have been popularly and even officially termed "militia." Like militia, they are in origin and activity local units. However, the basic militia conception of universal obligation for service does not govern these National Guard units, for they are all composed of volunteers. The distinction in 18th century France between the *milice,* a mere means of conscripting man power by the drawing of lots (abolished at the time of the French Revolution), and the Garde Nationale (created at the time of the French Revolution), which consisted of actual units for local service, is an almost exact parallel. (*See* MILITIA.)

Just as some of the "train bands" of the cities of old England became voluntary associations, so in America there grew up in the larger centres of population volunteer military associations of citizens, of which the Military Company of Massachusetts (later the Ancient and Honorable Artillery Company), formed in Boston under a charter from the Governor in 1638, was probably the first. These civic organizations, adding social and recreational to their military activities, became very popular in many localities. Between the Mexican War and the Civil War, their growth and distribution were widespread, and many such units furnished the major man power of the northern response to Lincoln's first proclamation of April 15, 1861. (An exception is to be noted in Delaware, whose governor stated he had no organized militia units and recommended the formation of volunteer companies.) In other states they were highly organized and amalgamated into regiments, as were the Seventh New York, the Fifth Maryland, the First Vermont, the Fifth Massachusetts.

Although the colonial militia idea based on universal service, and the provisions of the Federal Militia Act of May 8, 1792, had not been carried into practical application under the government of the United States, in order to provide the "well-regulated militia" of which the Second Amendment spoke, these volunteer units were accepted in partial fulfillment of the militia requirement, and were indeed actually spoken of as the "uniformed" militia. Under the

Constitution the United States was to organize and arm the militia, and the States were to officer and control them. Although all of the obligatory, all-inclusive militia was not organized, these volunteer units were. They were therefore utilized by the States under the militia clauses of law in answering calls for service, whether local calls in local emergencies, or Federal calls on the States to furnish forces for service elsewhere. For the Mexican War, in the early stages of the Civil War and in the Spanish-American War, units like these volunteered en masse, even for overseas duty.

In spite, however, of local pride and some Federal aid, the National Guard of the 19th century was an unwieldy, un-uniform, unintegrated and sprawling force. After the mistakes of the mobilization for the campaign in Cuba had been made obvious, Secretary of War Elihu Root undertook a basic study and rearrangement of American military organization. A section of the Act of February 14, 1903, created a division of Militia Affairs in the War Department General Staff. An Act of Jan. 21, 1903 (the Dick Act), provided for close Federal supervision and aid to the National Guard units of the several States: issue of arms and ammunition and other supplies, inspections by regular officers, definite training programs and participation in joint manoeuvres with the regulars. Criticisms of this period, and an invidious connotation of the word "militia" resulting from the scathing historical facts made public by the printing of Upton's *Military Policy of the United States,* spurred the Guard to energetic effort and useful conformity with high standards. In 1913 a plan was broached—though not adopted—to put guard units in Federal pay. An Act of May 27, 1908 (35 Stat. 399), gave the President power to draft the National Guard into the service of the United States, either within or without the borders of the United States, without the formality or delay of securing volunteers either by organizations or by individuals. However, when Attorney General Wickersham in 1912 (29 Ops. Atty. Gen. 322) declared the exercise of such power in order to move National Guard units overseas would be unconstitutional, the project was dropped. At this time it was generally understood that the armed forces of the United States consisted of (1) the regular army, (2) the organized militia (*i.e.,* the National Guard), (3) the unorganized militia (unenrolled and uncalled, a mere tradition of obligation).

In 1916 National Guard units were called into the service of the United States under the militia clause (to protect against invasion, rebellion, etc.) and spent approximately six months on the Mexican border, to the number of about 100,000, patrolling the frontier, drilling and engaging in field training exercises. As a consequence, when war was declared with Germany in 1917, there was a thoroughly seasoned nucleus for some of the forces which would have to be raised to supplement the regular army. The National Guard on April 1, 1917, numbered 7,612 officers, 174,008 enlisted men. These were drafted into Federal service under the Selective Service Act of May 18, 1917, and by G.O. 95, July 18, 1917, and G.O. 101, Aug. 3, 1917, of the War Department, distributed and amalgamated into 16 distinctive National Guard combat divisions, each mobilized and trained in a separate camp. These did extended service overseas. In order to fit into the war effort of the nation, existing National Guard units enthusiastically accepted transformation from cavalry into artillery units, from infantry into machine gun units, and even into ammunition trains. On Aug. 7, 1918, in order to simplify administration and to create general unity of spirit, the War Department, by G.O. 73, abolished all distinction between Regular Army, National Guard and National Army, and prescribed for all one appellation: United States Army.

When the armistice came and the troops returned home, replacements and transfers had almost destroyed the local character of the various Guard units. Eagerness for demobilization completed the disintegration.

The defence force had to be rebuilt.

The National Defence Act of June 3, 1916 (39 Stat. 166), had established a separate Militia Bureau in the War Department, and had provided for increased Federal aid to, and increased Federal control of, this "organized" militia. However, the extended Federalized service on the Mexican border and the amalgamation into the overseas army of 1917–18 prevented general practical peacetime operation of this act. When the armistice was signed, a completely new military policy for the United States was projected. Some desired a very large regular army, with reserve contingents. Some desired to create a "continental" militia, Federal in character only. Some wished a large measure of compulsory military training. Largely due to the influence of General Pershing and General O'Ryan, famed National Guard commander, these projects were abandoned and an "Army of the United States" was created in which the National Guard was to be one of the three basic components. It was to remain a State force, under State command, except when in the actual service of the Federal government. This was accomplished by the Act of June 4, 1920 (41 Stat. 759). The Militia Bureau was continued (since 1933 called the National Guard Bureau). Federal aid, financial, material and personal, was expanded. The long traditions of local units and the splendid memories of World War (1917–18) achievements were preserved. Local pride was fostered, local cooperation secured. National Guard units were recruited by the States and, as standards as to strength and skill were attained, "recognized" for money grants by the United States. The Guard organized units for 18 combat divisions, and many Corps, Field Army and GHQ troops. Its legislative authorized strength for these two decades was 435,000, but funds had not been appropriated for more than a strength considerably smaller, rising slowly in 20 years from 56,090 in 1920 to 251,000 in 1940. Within each State the governor is peacetime commander-in-chief, with full power of control except when the unit is called into Federal service. He it is who calls the Guard out for local strike duty within the State. Arms and equipment, animals, motor vehicles and supplies are provided by the Federal government.

Pay is furnished by the Federal government for armoury drills and for field training, on the same scale, grade for grade, as to regular army personnel. National Guard personnel, at full pay, have also attended special courses at the regular army's special service schools, the command and general staff school and the Army War College.

To make these valuable National Guard troops more readily available for Federal purposes, the War Department during the first decade since the World War (1917–18) encouraged National Guard officers to seek and accept commissions in the Officers' Reserve Corps, which is a Federal force, until about 50% were so enrolled. By the Act of June 15, 1933 (48 Stat. 153, 155), however, this dual status was formalized and extended. The acts of 1916 and 1920 were further amended so as to create "The National Guard of the United States" as distinct from "The National Guard" of the several States. The two are one, with different characters. Officers and enlisted men take an oath as members of a Federal as well as of a State force. By provision of this law, when Congress declares a "national emergency" they may now be "ordered" into active service as Federal troops, without the necessity of going through the old process of being "called" through their governors under the strict circumstances which constitutional law permits (Martin *v.* Mott, 12 Wheat. 19); that is, in case of actual invasion, rebellion or to enforce the laws of the Union. This legislation integrates these volunteer units of the National Guard so closely into the Army of the United States, and the efficiency of the Guard has so improved during the two decades last past, with regular trainings thoroughly done, and special ones at Field Army manoeuvres annually with regulars since 1935, that the National Guard is now counted in war plans as a part (about 70%) of the "Initial Protective Force" of the United States and as a front line agency for national defence.

By special legislation it was called into Federal service in 1940 for a year's training, even though what existed was not an actual war.

In other respects, even though a volunteer force, the National Guard, in addition, continues (1940) to exist in its separate elements as a uniformed and organized militia force, capable of local use under State control to suppress disorder and maintain peace at home.

(E. Cy.)

**NATIONAL INSURANCE: HEALTH.** Any satisfactory scheme of national health insurance should have two main objects, (1) to secure for the insured any medical attendance that he may require at any time, and (2) to compensate him by money payments for the loss of wages when compelled to cease work through sickness. Until late in the 19th century there was little or no recognition in any country of any duty of the State to concern itself with the making of provision against sickness amongst its workers. In many countries some provision was made independently of the State by the workers themselves through mutual provident associations, but only part of the field was covered by this means, and the less thrifty section of the community, who were most in need of protection, were rarely included. The position in many working-class households was, therefore, that when sickness fell upon the breadwinner, involving ordinarily not only cessation of his wages, but also the extra cost of doctor's bills, as soon as any small savings had been exhausted there was no alternative but recourse to the poor law. In 1883 a compulsory scheme of insurance was introduced in Germany and this was extended in 1889 to cover permanent incapacity. The example of Germany was followed by Austria in 1888 and by Hungary in 1891. About the beginning of the 20th century public opinion in most European countries began to crystallize in favour of some organized provision to meet the contingency of sickness amongst the workers, and in one country after another schemes based on the German model of compulsory insurance were brought into operation.

### I. GREAT BRITAIN

The scheme of national health insurance in Great Britain was founded on the National Insurance Act, 1911, which was brought into operation on July 15, 1912. The scheme is on a compulsory and contributory basis, the cost being shared between the workers, the employers and the State. Since 1938, when employees under

16 were included, roughly all wage-earners with the exception of non-manual workers receiving more than £250 a year have been included under the insurance plan. There are, however, a few exceptions, of which the most important are persons employed under the Crown, a local authority or a statutory company who, by the terms of their employment, are entitled to provision during sickness at least equivalent to that provided under the act. In addition to these excepted persons who are completely outside the national scheme of health insurance, persons who would normally be compulsorily insured may claim exemption if they can prove that they have a pension or unearned income of at least £26 a year, or that they are mainly dependent for their livelihood on someone else or on some non-insurable occupation. The employers of these exempt persons are, however, required to pay the employer's share of the contribution. Persons who are compulsorily insured by virtue of their employment are known as employed contributors. The scheme also allows any person (other than a married woman) who has been insured for at least two years as an employed contributor and has paid at least 104 weekly contributions to continue in insurance as a voluntary contributor, if he so elects, on ceasing to be employed. A married woman may not herself be insured as a voluntary contributor but where an uninsured man marries an insured woman who has paid at least 104 contributions he is allowed to become a voluntary contributor. The total number of insured persons at the end of 1927 was about 16,000,000.

**Contributions.**—The weekly rate of contribution has, from the year 1926, been 9d. for men and 8½d. for women, of which 4½d. is payable by the employer. The employer is required to pay the whole contribution in the first instance, but may recover the portion for which he is not himself liable by deduction from the wages of the worker. In the case of a voluntary contributor the whole contribution is payable by the contributor himself. The contribution of the State towards the cost of the scheme takes the form of the payment of a definite proportion of the cost of all benefits and of their administration. Since 1926 the proportion payable by the State has been one-seventh in the case of men and one-fifth in the case of women insured persons.

The weekly contributions are at a flat rate irrespective of the age at which persons first become insured. The rates are fixed so as to cover the actuarial cost of the benefits in the case of persons entering insurance at the age of 16. For persons first becoming insured at higher ages the contributions at the flat rate would not in themselves be sufficient to cover the actuarial cost of the benefits and the shortage is made good by the creation of book credits called reserve values. These book credits are gradually converted into cash through the operation of a sinking fund derived from small deductions from all weekly contributions over a period of years. This system of reserve values, taken in conjunction with the payment by the State of a proportion of the cost of benefits and administration, is equivalent in its effect to the provision by the State of the reserves required to enable the benefits to be given to all insured persons at a flat rate of contribution irrespective of age at entry into insurance.

**Benefits.**—The benefits to which the insured persons become entitled in return for their contributions are—

(1) *Medical Benefit, i.e.,* free medical attendance and treatment and any necessary medicines. The medical attendance is limited to such as is within the competence of an average general practitioner. A person becomes entitled to medical benefit immediately on becoming insured and in general remains entitled throughout his insurance.

(2) *Sickness Benefit,* which consists of weekly cash payments to the insured person when rendered incapable of work by illness, the standard rates being 15s.0d. a week for men and 12s.0d. a week for women. Sickness benefit is payable from the fourth day of incapacity and may continue for a maximum period of 26 weeks. A person does not become entitled to sickness benefit until he has been insured for 26 weeks and has paid 26 weekly contributions. Benefit is then payable at the reduced rate of 9s.0d. a week for men and 7s.6d. a week for women. When 104 weeks of insurance have been completed and 104 contributions paid, benefit becomes payable at the full standard rates.

(3) *Disablement Benefit, i.e.,* weekly payments at a reduced rate when, and so long as, incapacity continues after the title to sickness benefit has been exhausted. The weekly benefit is 7s. 6d. for men, 6s.0d. for unmarried and 5s.0d. for married women. The qualifying conditions for the receipt of disablement benefit are 104 weeks of insurance and the payment of 104 weekly contributions.

(4) *Maternity Benefit, i.e.,* a money payment in the event of the confinement of an insured woman or the wife of an insured man. The standard rate of maternity benefit is £2, and in the case of a married woman who is herself insured, benefit is payable both in respect of her own and her husband's insurance. The qualification for maternity benefit is 42 weeks of insurance and the payment of 42 weekly contributions.

(5) *Additional Benefits,* which may take the form either of an increase in the standard rates of the cash benefits, or of payment towards the cost of various forms of treatment required by the insured persons, such as dental, ophthalmic or convalescent home treatment. These additional benefits differ from the ordinary benefits in that they are only payable by Approved Societies which are found on valuation to have a surplus available for the purpose.

Contributions are payable for every week during the whole or any part of which an insured person is employed. If there has been no employment during a week the insured person falls into arrears and unless these arrears are excused or redeemed by making the appropriate payment within the time allowed, penalties in the form of reduction or suspension of cash benefits will result. From the inception of the scheme arrears have been excused when due to incapacity for work through sickness of which notice has been given, and by the Act of 1928 arrears which can be shown to have been due to genuine unemployment also involve no penalty. In effect, therefore, the present position is that an insured person is credited with a contribution in respect of every week during which he is either employed, sick or genuinely out of work, but if, during any contribution year (July to June) there are any weeks in respect of which no contribution is credited, *e.g.,* weeks of voluntary abstention from work or weeks during which the insured person is engaged in some occupation which is not employment within the meaning of the Act, then unless the arrears for such weeks are redeemed within the period of grace the rates of sickness and disablement benefits are reduced throughout the ensuing calendar year in proportion to the number of arrears outstanding.

The title to sickness and disablement benefits and the liability for the payment of contributions cease on an insured person attaining the age of 65, at which age in the normal case the title to a contributory old age pension accrues.

Where an insured person is rendered incapable of work by an accident or industrial disease in respect of which he is entitled to compensation under the Workmen's Compensation Act or to damages, sickness and disablement benefits are not payable to him unless the weekly value of compensation or damages is less than that of the benefit which would ordinarily have been payable. In this case the difference only is payable by way of benefit.

An employed contributor does not cease to be insured and entitled to benefits immediately on ceasing employment but continues so entitled for a period between 1½ and 2 years at the full rates of benefit, and if he can show that throughout that period he was genuinely unemployed his insurance is continued for a further year, subject, however, to reduced rates of benefit. A person who has been insured for at least 10 years and who becomes unemployed after reaching the age of 60 is allowed to continue in insurance (so long as he remains genuinely unemployed) until he attains the age of 65, and thus his title to a contributory old age pension is safeguarded.

**Payment and Collection of Contributions.**—The contributions are paid by means of the purchase of special stamps at any post office. The health insurance contribution is paid jointly with the contribution payable under the State scheme of contributory widows', orphans' and old age pensions, by means of a single health insurance and pensions stamp to the amount of the joint contribution. One of these stamps has to be affixed to the

insured person's contribution card in respect of each week of employment, but special arrangements may be made in certain cases for stamping in bulk. It is the duty of every insured person to obtain a contribution card at the beginning of each contribution period and to present the card to his employer to be stamped at the proper times. The contribution period is a period of six months commencing on the first Monday in January and July of each year. If an insured person fails to produce a contribution card to his employer to be stamped at the proper time, the employer is required to stamp an emergency card, which can be obtained at any post office. The money for health insurance received at post offices from the sale of health insurance stamps is paid into a fund known as the National Health Insurance Fund, which (in England) is under the control of the Minister of Health and out of which all the moneys required for the payment of health insurance benefits and the cost of their administration is supplied.

**Medical Benefit.**—The arrangements for the administration of medical benefit are on a territorial basis and are made through special bodies, known as Insurance Committees, in every county and county borough. These committees are composed, as to a majority, of representatives of the insured persons in the area, the remaining members being representative of doctors or nominated by public authorities. It is the duty of the insurance committee to prepare a panel of all the doctors in the area of the committee who desire to treat insured persons, and any registered medical practitioner has the right to have his name placed upon the panel. The insured person has free choice of the insurance practitioner from whom he is to receive treatment. The insurance practitioner enters into an agreement with the insurance committee, by which he undertakes to provide to all insured persons on his list any medical treatment (within the competence of a general practitioner) which they may require at any time and to prescribe for them such medicines as may be necessary. In return for his services he is paid at the rate (since 1924) of 9s.0d. a year for every insured person on his list. In addition to this capitation payment doctors in rural areas receive a supplementary mileage allowance in respect of additional cost of travelling. The insured person can obtain the medicines prescribed for him by his doctor from any chemist taking part in the service. A further obligation of the insurance practitioner is to supply the insured persons on his list with such medical certificates of incapacity for work as they may require in order to make good their claims to sickness and disablement benefits. The total charge on insurance funds to meet the cost of medical benefit and its administration is limited by the Act to 13s.0d. per insured person per annum.

**Cash Benefits.**—The cash benefits, *i.e.,* sickness, disablement and maternity benefits, are administered by bodies known as Approved Societies. These bodies are independent self-governing groups of insured persons banded together for the purposes of the national health insurance scheme. They are not ordinarily on a territorial basis but the members generally have some community of interest which may be religious, occupational or social, or may arise out of private insurance with the same society. Any body of persons may make application to the Minister of Health for approval, the only statutory conditions attached being that the body should not be carried on for profit and that it should make rules to the satisfaction of the Minister for the administration of State insurance under which the affairs of the society must be subject to the absolute control of its members. On approval being granted the society becomes entitled to receive the contributions of all insured persons who become members and it undertakes to pay them the cash benefits to which they may become entitled. An insured person is free to select his own approved society and a society may accept or reject any applicant for membership in accordance with its rules. The number of approved societies in Great Britain is about 1,000, and the membership varies from less than 100 to more than 2,000,000. About thirty approved societies are divided into branches, each of which is a separate and autonomous financial unit. The total number of such branches is about 7,000. Approved societies are of many types, of which the principal are Friendly Societies (either with or without branches), Trade Unions, societies associated with industrial assurance companies, and employers, or works, societies. Every approved society has complete control of its own funds and the members stand to gain or lose as the result of their society's experience and standard of administration. The insured members of a society are required to surrender to the society their stamped contribution cards at the end of each contribution period and the society is credited in the National Health Insurance Fund with the total value of health insurance contributions represented by the stamps on the cards surrendered by all the members of the society. Out of its credit in this fund, with the relative State grant, the society obtains the necessary money for paying all benefits to which the members become entitled, as well as the cost of the society's administration. So far as the amount standing to the credit of a society in the National Health Insurance Fund is more than sufficient to meet the current expenses of the society, the balance becomes available for permanent investment and one-half is paid over to the society itself for investment by the trustees, the other half being transferred to the credit of the society in the investment account and invested by the national debt commissioners.

A small deduction is made from every weekly contribution paid in respect of each member of a society and is allocated to a contingencies fund which is available to meet any deficiency which may be disclosed on the valuation of the society. After each valuation the sum standing to the credit of the contingencies fund is transferred to the benefit fund of the society, and in so far as it is not required to make good any deficiency it becomes available for the provision of benefits. A further protective fund, similarly derived, but augmented by a contribution from the Exchequer, is the Central Fund, which is a single fund common to all societies and is available to meet the balance of any valuation deficiency which cannot be met out of a society's own contingencies fund. The granting of assistance from the central fund is conditional on the deficiency not being due to unsatisfactory administration on the part of the society.

In order to claim sickness or disablement benefit an insured person who has become incapable of work through sickness should at once obtain from his insurance doctor a certificate of incapacity and should forward it to his approved society. Further medical certificates should similarly be obtained and forwarded at intervals (normally weekly) as required. If the society is satisfied that the member is incapable of work and that the necessary qualifying conditions for benefit are satisfied, payment of benefit is made to the member weekly. Similarly a claim for maternity benefit is made by the insured person sending to the society the necessary certificate of confinement. Any dispute between an insured person and his society with reference to a claim for benefit has to be referred to arbitration in accordance with the rules of the society, and a final right of appeal lies to the Minister of Health, whose decision is binding on both parties.

A society which is in doubt as to the incapacity for work of a member claiming benefit, can obtain a second medical opinion on the point by referring the member for examination to one of a body of medical referees known as Regional Medical Officers, appointed by the Minister of Health.

Every approved society is required to keep accounts of its receipts and expenditure under the act and to submit these accounts to audit by auditors appointed by the Treasury. The amount which a society may expend on administration is limited to 4s.6d. per member per annum. Every approved society and branch is subject to a valuation of its assets and liabilities at intervals, usually of five years, by valuers appointed by the Treasury. If on valuation a surplus is disclosed, such part of the surplus as the valuer certifies to be disposable for the purpose is used by the society in providing additional benefits for its members in accordance with a scheme drawn up by the society and sanctioned by the Minister of Health. A scheme of additional benefits ordinarily covers a period of five years. If on valuation a society or branch is found to be in deficiency, recourse must be had first to the society's own contingencies fund, and if that is not sufficient

to make good the deficiency application may be made for a grant from the central fund.

The results of the valuations which have been made show that the finance of national health insurance is on a thoroughly sound basis. At the first valuation, which was made as at Dec. 31, 1918, the great majority of all societies and branches were found to have surpluses, the aggregate amount of which was about £17,000,000. On the second valuation, which was made as at Dec. 31, 1923 (or a year earlier in the case of certain societies) the membership of societies showing surpluses was about 15,000,000, while that of societies with deficiencies was less than 250,000. The aggregate amount of the surpluses exceeded £42,000,000, of which about £15,000,000 was kept in reserve, the balance being devoted to the provision of additional benefits. Many of the societies were thus enabled to make substantial additions to the standard rates of sickness, disablement and maternity benefits, and also to pay the whole or part of the cost of various forms of treatment required by their members and not provided as part of medical benefit. The most popular of these treatment benefits is dental benefit, which is provided for about 75 per cent of the whole insured population, and to which a sum of nearly £3,000,000 a year is devoted. The benefit ordinarily takes the form of the payment by the society of not less than 75 per cent of the cost of any dental treatment obtained by the member and not less than 50 per cent of the cost of any dentures supplied. A scale of charges has been agreed between the approved societies and the dental profession, and insured persons are given free choice amongst the dentists willing to provide treatment on the agreed scale.

Other widely adopted additional benefits are ophthalmic benefit (including the provision of spectacles), treatment in convalescent homes, and the provision of medical and surgical appliances.

**Deposit Contributors.**—Insured persons who do not join an approved society within a certain time after their entry into insurance fall automatically into a special class known as deposit contributors. Such persons are only entitled to benefits up to the limit of the amount standing to their own individual credit as the result of the contributions paid in respect of them, but the usual proportion of the cost of their benefits is paid by the State. The number of deposit contributors at the end of 1926 was 282,400. It is always open to a deposit contributor at any time to join any approved society which is prepared to admit him to membership. By the Act of 1928 a special insurance section was set up through which any deposit contributor who can prove that he is unable, by reason of the state of his health, to obtain admission to an approved society, is able to obtain the full normal benefits of the scheme on an insurance basis.

**Central Administration.**—The general supervision of the scheme of national health insurance on behalf of the central government is vested in the Minister of Health in England and Wales, and in the Scottish Board of Health in Scotland, and the cost of the central administration is borne by the Exchequer. It rests with the Minister to determine doubtful questions of insurability, to enforce the payment of the statutory contributions, and to satisfy himself that the scheme is properly administered by approved societies and insurance committees. The Minister is empowered to withdraw approval from a society which is found, after enquiry, to be administering the scheme in a manner prejudicial to the interests of its members.

**Statistics.**—The total number of insured persons at the end of 1936 was approximately 16 million, of whom more than 92 per cent were members of approved societies. The total income of the scheme for the year was about £35 million, of which £24¼ million was derived from the contributions of insured persons and their employers; £6 million was paid by the Exchequer, and nearly £6 million was derived from interest on accumulated funds. The expenditure on benefits was about £32 million and the total cost of administration by approved societies, insurance committees and the central departments was approximately £5 million. The cost of administration was, therefore, about 14 per cent of the total revenue of the scheme. The total accumulated funds at the end of 1936 amounted to £131 million.

**Royal Commission on National Health Insurance.**—A Royal Commission was appointed in 1924 to enquire into the scheme of national health insurance and to recommend any alterations or extensions which might be thought desirable. After hearing evidence from representatives of all bodies or persons participating in, or affected by, the scheme, the commission issued their report in 1926 and arrived at the conclusion that "national health insurance has established its position as a permanent feature of the social system in this country and should be continued on its present compulsory and contributory basis." The commission, however, made many recommendations for the improvement of the scheme in detail. Amongst the most important were that medical benefit should be extended to include a consultant and specialist service; that the insurance medical service should be properly co-ordinated with other health services, and that in order to promote this end the insurance committees should be abolished and their powers transferred to the county and county borough councils. A further important recommendation was that there should be a partial pooling of the surpluses of approved societies in order to provide the necessary funds for the proposed extension of medical benefit, and also to mitigate to some extent the inequalities between different approved societies arising out of favourable or unfavourable experience as revealed on valuation. A minority of the commission reported in favour of the abolition of the approved society system and the transfer of the administration of the cash benefits, as well as medical benefit, to the local health authorities.

**Success of the Scheme.**—There can be no doubt that the British scheme of national health insurance has thoroughly justified itself by its results. At the inception of the scheme considerable hostility and opposition were encountered. It did not meet with a favourable reception from the medical profession and was unpopular with large sections of employers and with some classes of insured workers. This opposition has now almost entirely disappeared. There can be no question that the benefits provided under the scheme are highly appreciated amongst the insured community and the contributions are paid with almost entire absence of friction. The financial success of the scheme has been demonstrated by the results of successive valuations, and the great majority of insured persons are receiving benefits substantially greater than the minimum provided under the act. The amount of distress amongst the working-classes occasioned by reason of sickness of the wage-earners has been materially reduced, with the result that expenditure on poor law relief is substantially less than it would have been in the absence of a scheme of national health insurance. As regards the effect of the scheme on the general health of the nation, it is difficult to produce any convincing statistics but the fact that all insured workers are entitled to free medical attendance immediately they have any need of it must obviously be conducive to prompt treatment of incipient illness, with a consequent lessening of more serious results. The general death rate has fallen materially since the scheme was introduced and it is reasonable to attribute this in some measure to the medical and other benefits provided under the scheme.

**Northern Ireland.**—The original National Insurance Act of 1911 applied to the whole of Ireland as well as to Great Britain, and as a consequence a scheme of national health insurance almost identical with that of Great Britain is still in operation in Northern Ireland. The most important variation is that medical benefit is not included in the Northern Irish scheme, but a benefit known as sanatorium benefit is provided. This benefit consists of the right of treatment in sanatoria or otherwise of insured persons suffering from tuberculosis. It is administered through the local insurance committees under arrangements made with the councils of the counties and county boroughs. The same benefit was originally provided in Great Britain but was discontinued in 1921 when the duty of making comprehensive arrangements for the treatment of tuberculosis amongst the whole population, insured and uninsured alike, was laid upon the county and county borough councils. Owing to the absence of medical benefit in Northern Ireland the rates of contributions are less than those in Great Britain by 2d. a week.

### II. BRITISH DOMINIONS

Aside from the Irish Free State no complete scheme of national health insurance exists in the self-governing dominions of the British Empire. Measures to establish such schemes have been introduced in several Canadian provincial parliaments, and the parliament of British Columbia passed such a law in 1937, but the Ministry suspended its operation because of the objections of the medical profession. Governmental commissions and committees of the medical profession in 1939 were studying various proposals looking to the enactment of legislation. Experiments in providing medical care for the indigent by provincial and local governments in co-operation with the medical profession form the basis of the proposed laws. In 1939 parliaments of Australia and New Zealand passed acts to establish health insurance, but objections of the medical profession to certain features led to a suspension of the acts. (E. HA.; X.)

### III. UNITED STATES

An active agitation for health insurance in the United States from 1912–19 led several State legislatures to appoint commissions to investigate the subject and to the introduction of numerous proposals but no legislation. Interest was revived by the report of the Committee on the Cost of Medical Care in 1932 which recommended health insurance. In 1934 a Committee on Economic Security was appointed to draw up a program of social legislation which originally proposed to include health insurance. Objections by the medical profession led to the omission of health insurance from the Social Security Bill, which became a law Aug. 14, 1935. This law contained extensive medical provisions for maternal and child health, for crippled children and for the extension of public health as well as for unemployment and old age insurance. The Interdepartmental Committee, appointed by the President continued the agitation and submitted a report, many of the factual statements of which were challenged, recommending a broad "health program" of extension of hospital facilities and public health services. The whole program depended upon heavy Federal subsidies to the States and included a section which was interpreted as offering Federal financial assistance to States establishing health insurance schemes. Although extensive hearings were held before a congressional committee, this law was still pending in Congress in 1939. In the meantime State and county medical societies set up a large number of voluntary prepayment or insurance plans to assist the low income class in paying for medical care. (A. M. SI.)

### IV. EUROPEAN COUNTRIES

Organized provision of some kind for the insurance of workers against sickness has been made in all European countries. Among the countries having compulsory schemes are Bulgaria, Denmark, France, Germany, Hungary, Norway, Rumania, Russia and Yugoslavia and certain cantons of Switzerland. All these schemes are on a contributory basis, the cost being shared between the employers and workers, except in Rumania, where the whole contribution is payable by the worker, and in Russia, where the whole cost falls on the employer. Some part of the cost of the scheme is borne directly by the State or other public funds in Bulgaria, Norway and Switzerland and more or less indirectly in other countries. Voluntary schemes, which receive assistance from public funds, and which cover a large proportion of all the wage-earners, are in operation in Belgium, Sweden and Switzerland. In Holland a compulsory scheme of insurance against permanent invalidity was brought into force in 1919 but up to 1939 sickness insurance was still on a voluntary basis and received no direct assistance from the State. In Italy a scheme of compulsory maternity insurance for employed women was instituted in 1910, and compulsory insurance against invalidity in 1919. Seamen, civil aviators and some sections of agricultural workers are covered by schemes of partially compulsory sickness insurance, and a special plan for insurance against tuberculosis is in existence. All such plans are a part of the Fascist organization of industry.

There are three main differences between the schemes in force in European countries and the British scheme. In the first place, while in Great Britain the contributions and benefits are on a flat rate, in other countries they are graded in accordance with the wages of the insured workers. Again, in Great Britain the weekly payments to the insured while incapacitated for work through illness are continued in the form of disablement benefit without any time limit after the maximum period of sickness benefit has been exhausted, but in the continental schemes the payments cease after a period, usually of 26 weeks but shorter in some countries and longer in others, and the insured person, if still remaining incapable of work, is not entitled to any further payment under the sickness insurance scheme. He may, however, then become entitled to relief under the scheme of invalidity pensions, which is separately administered, either as an independent scheme or in conjunction with the State scheme of old age pensions. Finally, in contrast to the British system of approved societies as agencies for the administration of the cash benefits, the insurance institutions in continental countries are in general organized on either a territorial or an occupational basis, or both.

**International Conference on Sickness Insurance.**—An International Labour Conference on Sickness Insurance was held at Geneva in 1927 under the auspices of the League of Nations. Delegates from 43 countries were present and the arrangements for sickness insurance in each of these countries were passed under review. As a result the conference adopted a convention with regard to sickness insurance which was remitted for ratification to all the States members of the League. The scheme outlined in this convention was similar in all essentials to that in force in Great Britain. All countries which ratify the convention pledge themselves to set up a compulsory scheme of sickness insurance applicable both to manual and non-manual workers, deriving its income from contributions by workers and their employers, and providing medical attendance for the insured workers, together with cash payments in compensation for loss of wages through sickness. The International Labour Office reports that up to 1938 eleven nations had ratified the convention providing for a system of compulsory sickness insurance.

BIBLIOGRAPHY.—The whole of the statutory provisions with regard to national health insurance in Great Britain is to be found in the *Statutes, Regulations and Orders relating to National Health Insurance,* published by H.M. Stationery Office. The best critical review of the scheme is contained in the *Report of the Royal Commission on National Health Insurance,* Cmd. 2596 of 1926. Much interesting information with regard to the financial and actuarial aspects of the scheme is to be found in the *Report by the Government Actuary on the Second Valuation of Approved Societies,* Cmd. 2785 of 1927, and in *National Health Insurance, a Statistical Review,* Watson, J.R.S.S., Vol. 90, Part 3. For comparative statements of the schemes in different European countries, reference should be made to various publications of the International Labour Office, Geneva, and in particular to *General Problems of Social Insurance,* Studies and Reports, Series M. No. 1, 1925 and *Compulsory Sickness Insurance,* Studies and Reports, Series M. No. 6, 1927. Miller, *Social Insurance in the United States* (1918) and Morgan, *Public Relief of Sickness* (1923). (E. HA.; X.)

**NATIONAL INSURANCE: WIDOWS' AND ORPHANS' PENSIONS.** The first quarter of the 20th century was remarkable for the rapid development of schemes of social insurance. The article that follows deals with developments in Europe. These do not exist in the United States except in the form of Mothers' pensions, an account of which will be found in the article PENSIONS: *The United States.* While at first the schemes were directed to the protection of the workman himself, the necessity of making provision for the family when death removes the breadwinner has increasingly claimed attention. In Great Britain the problem of the widow and fatherless children received special consideration in the Report of the Royal Commission on the Poor Laws, published in 1909. The subject was debated in the House of Commons for the first time in 1919, and afterwards in 1923, 1924 and 1925. There was general agreement as to the desirability of establishing a scheme of pensions for widows, but the debates showed divergence of opinion as to the method of financing the scheme. Within a month after the last debate Mr. Winston Churchill in introducing the Budget announced that the Government had decided to bring in a Bill establishing widows' and orphans' pensions and old age pensions at the age of 65. The Widows', Orphans' and Old Age

Contributory Pensions Bill, the second reading of which was moved by the Minister of Health, Mr. Neville Chamberlain, on May 18, 1925, proclaimed that the Government had adopted the contributory principle. It became law, and the provisions relating to widows and orphans came into operation on Jan. 4, 1926.

**Scope of the Scheme.**—The scheme is contributory and compulsory and is interlocked with the national health insurance scheme (*see* NATIONAL INSURANCE: HEALTH), all persons insured under the latter, whether as employed or as voluntary contributors, being within the scope of the widows' and orphans' scheme. Employed contributors are persons compulsorily insured and consist in the main of persons employed under a contract of service, with a remuneration limit of £250 per annum in the case of persons employed in a non-manual capacity. Two comparatively small classes who are not insured under the health insurance scheme are compulsorily insured for widows' and orphans' pensions. These classes consist of men who hold certificates exempting them from liability to be insured under the National Health Insurance Act and of persons employed in certain types of "excepted employment." Voluntary insurance under the National Health Insurance Act is limited to persons who, having previously been compulsorily insured for a minimum period, elect within a specified time to continue as voluntary contributors. On the same principle the right to continue as voluntary contributors is given on certain conditions to persons who were previously insured compulsorily for widows' and orphans' pensions only, *i.e.*, as exempt men or as persons in excepted employment.

The Pensions Act made a further addition to the classes of persons eligible for voluntary insurance. As a married woman is debarred from being a voluntary contributor under the Health Insurance Act, the Pensions Act provides that an uninsured man may become a voluntary contributor within a prescribed time after his marriage to an insured woman if certain conditions attaching to her previous insurance are satisfied, so that her insurance before marriage gives *inter alia* the opportunity of acquiring a title to a widow's pension.

**Contributions.**—The normal contribution, 9d. a week for a man and 4½d. for a woman, includes the contribution for old age pensions between 65 and 70. Exempt men, however, and the majority of persons in excepted employment are not insured for old age pensions and their contributions, for widows' and orphans' pensions only, are 7d. for men and 3½d. for women. It is to be observed that the woman's contribution, which in general is half the man's contribution, is not based solely on the value of the benefits which flow from her own insurance.

From the starting point that the contribution of the insured woman would be equal to half the contribution of the insured man, it was found that the appropriate contribution to provide all the benefits of the Act (including old age pensions between the ages of 65 and 70) in the case of a boy of 16, the age at which contributions begin, was 10d. a week. Certain savings, however, resulting to the Exchequer from adjustments in Unemployment Insurance consequent on the Pensions Act were taken into consideration and as a result the rate of contribution was fixed at 9d. per week, a uniform rate for all men without having regard to their age at the date that they became insured. As the contributions are based on the rates appropriate to those entering the scheme at the age of 16, they are insufficient to provide the benefits for entrants over that age. The residual liability is carried by the Exchequer. In the first two years the contributions were more than sufficient to meet the payments but thereafter there is a growing demand on the Exchequer. This liability, which includes the Exchequer's contribution to old age pensions between 65 and 70, was estimated to amount to a net total of £46,000,000 over the first ten years, and the Act provides for its liquidation by a uniform payment of £4,000,000 a year.

The contribution for men is divided between the employer and employee in equal shares except in the case of the exempt man, where the employer pays his normal contribution of 4½d. and the employee 2½d. In the case of women 2½d. (excepted women 2d) is paid by the employer and 2d (excepted women 1½d) by the employee. Although an exempt woman is not insured under the pensions scheme her employer is required to pay his normal contribution of 2½d a week.

Contributions begin at the age of 16 and, as regards the employee's portion, cease at 65 but the employer's liability to contribute terminates only on the termination of employment. The employer's contribution for an employee over 65 is 9d (for a woman 7d) but as his contribution for health insurance (4½d for man or woman) ceases on the employee attaining 65, his total liability under the two schemes is unaltered. The employer pays the weekly contributions for health and pensions by affixing a single stamp to the contribution card of the employee and he is entitled to recover the employee's share by deduction from wages. For persons in excepted employment, who are outside the health insurance scheme, contributions are paid periodically in cash. The contributions for voluntary contributors are the same as for employed contributors, viz. 9d and 4½d for men and women respectively, the whole amount being paid by the contributor.

The number of insured persons paying contributions during the first year of the scheme was approximately 16,300,000.

**Benefits and Qualifications.**—The benefits for widows and orphans—an orphan is defined as a child both of whose parents are dead—are:—

(1) Widow's pension—a payment of 10/– a week to the widow of an insured man until she reaches the age of 70 or marries, with an additional allowance for children under the age of 14 or under the age of 16 if still at school, at the rate of 5/– a week for the eldest and 3/– a week for each other child.

A widow who is in receipt of a widow's pension on reaching the age of 70 is entitled to an old age pension at the same rate. A widow on remarriage continues to receive the allowance for children under the specified age. The allowance for children is, on the death of the widow, transformed into orphans' pensions.

(2) Orphans' pensions—a payment of 7s. 6d. a week for each child, under the specified age, of an insured man, being a married man or a widower, or of an insured widow.

An orphan's pension is payable to the guardian or other person having the charge of the child.

The qualifying conditions are: (i.) the insured person must have been insured for not less than 104 weeks and not less than 104 contributions must have been paid: (ii.) over the three contribution years (running from July in one year to June in the next) preceding his death an average of 26 contributions a year must have been paid, but for this purpose weeks of incapacity for work due to sickness and weeks of genuine unemployment count as weeks for which contributions were paid: (iii.) he must have been resident in Great Britain for two years immediately prior to his death and his last employment (excluding temporary employment) must have been in Great Britain. The last condition does not apply to soldiers, sailors and airmen.

A pension or an additional allowance is not payable to or for any person (a) while an inmate of a poor law institution, unless admission was for the purpose of obtaining medical or surgical treatment, when there is no disqualification, up to a maximum of three months from date of admission, so long as treatment continues: (b) while detained in a lunatic asylum: (c) while being maintained in any place as a pauper-lunatic or criminal lunatic: (d) while undergoing a period of imprisonment given without the option of a fine. A widow is not entitled to her pension, but the additional allowance remains payable to her, while she is cohabiting with a man as his wife.

With certain exceptions, a person who is receiving a World War pension for the death of any person, other than a son, is not entitled to a pension under the Act, but if the pension which otherwise would have been payable under the Act is the greater, the excess is paid as an addition to the War Pension. A similar provision applies to a person who is receiving a pension for the death of any person whose death was attributable to service at any time with the naval, military or air force.

When compensation is received for a child under the Workmen's Compensation Act, the additional allowance or orphan's pension under the Act is payable only to the extent that it exceeds the weekly value of the compensation. The widow's pension of

10/– a week is unaffected by the receipt of compensation.

**Non-contributory Classes.**—Exceptional provision was made for the widows and children of men who, having died before Jan. 4, 1926, the date of the commencement of the Act, could not have participated in the contributory scheme. The rates of widows' and orphans' pensions are the same as under the contributory scheme, but a widow in this class is only entitled to a pension if there was a child under the age of 14 at the commencement of the Act, and she ceases to be entitled six months after her youngest child reaches the age of 14.

The capital value at the commencement of the Act of the total amount which the Exchequer would have to provide for these non-contributory classes was estimated at £42,000,000.

In the restricted provision made for the widow this non-contributory section of the scheme is closely in line with most of the non-contributory schemes of mothers' pensions which operate in several parts of the British Dominions and in many States of the U.S.A. The widow as widow was not the object of the benefit. The provision was designed entirely in the interests of the children.

**Administration.**—In England and Wales the scheme is administered by the Minister of Health and in Scotland by the Scottish Board of Health. Claims for pension are made on forms which are obtainable at all Post Offices. Successful applicants receive a notice from the Department for presentation at the Post Office which they nominated on their claim forms and are given in exchange a book containing a series of weekly orders. Bound up in every order book is a form which the pensioner completes shortly before the currency of the book expires, thereby requisitioning a new book.

**British Dominions and Northern Ireland.**—None of the Dominions has a contributory scheme of widows' and orphans' pensions, but non-contributory schemes, which provide assistance to needy and worthy mothers for the care of their children in their own homes, have been established in Canada (Alberta, British Columbia, Manitoba, Ontario and Saskatchewan), Australia (New South Wales) and New Zealand.

The Widows', Orphans' and Old Age Contributory Pensions Act (Northern Ireland) was passed on Nov. 6, 1925. In all essential particulars its provisions are identical with those of the British Act. Reciprocal arrangements between Great Britain and Northern Ireland were at once made, with the result that contributions paid in Great Britain rank as valid contributions in connection with a claim for pension made in Northern Ireland and vice versa.

**European Countries.**—In several countries provision for the widow and children of a deceased insured person is made under contributory schemes providing invalidity and old age pensions. Pensions for the widow and children are usually based on the invalidity or old age pension to which the deceased was entitled, and the proportion varies considerably in different countries, from 20 to 50% for the widow and from 10 to 50% for the children. Pensions to widows and children are paid in Germany (salaried employees' scheme), Austria (salaried employees' scheme), Belgium and the Netherlands. Children's pensions are payable under the manual workers' scheme in Germany and under schemes in Czechoslovakia and Jugoslavia, but in these cases the provision made for the widow is limited: in Germany her pension is deferred until she is 65 unless she is unable to work, in Czechoslovakia she is entitled only if unable to work, and in Jugoslavia her pension ceases three years after her husband's death.

A non-contributory scheme exists in Denmark under which indigent widows have the right to a public contribution towards the support and education of children under 14.

BIBLIOGRAPHY.—*Report by the Government Actuary on the Financial Provisions of the Widows', Orphans' and Old Age Contributory Pensions Bill* (Cmd. 2406, H.M. Stationery Office), contains a detailed explanation of the financial basis, estimates of the future number of beneficiaries and future cost of the scheme in selected years up to 1965–66. *General Problems of Social Insurance* (Internat. Labour Office, League of Nations), contains a review of the position of social insurance in general. *Social Insurance* (the Report of League of Nations Union Conference, Nov. 1925), contains *inter alia* a report of a discussion on the scheme of the 1925 Act, in which the relative merits of contributory and non-contributory schemes are argued.

For old age pensions and unemployment insurance *see* OLD AGE PENSIONS and UNEMPLOYMENT INSURANCE. *See* also PENSIONS: THE UNITED STATES. (J.M.H.)

**NATIONALISM,** a state of mind, in which the supreme loyalty of the individual is felt to be due to the nation-state. Though attachment to the native soil, to parental traditions and to established territorial authorities have been known throughout history as prevailing sentiments of varying strength, nationalism began only at the end of the 18th century to become a generally recognized sentiment moulding public and private life and one of the great, if not the greatest, single determining factors of history. Thus nationalism is a modern movement, but in the short span of its existence as a dominant element of societal life and organization, it has shown such a dynamic vitality and such an all-pervading character, that the mistake has been frequently made of regarding nationalism as a permanent or at least very ancient factor of history. In reality, nationalism arose as a dominant force in the 18th century in western Europe and in North America; the American and the French revolutions may be regarded as its first powerful manifestations; from the western world it spread at the beginning of the 19th century to central Europe, thence, towards the middle of the century, to eastern and southeastern Europe, until, at the beginning of the 20th century, it put its stamp on the ancient lands of Asia and Africa, after having penetrated the new countries of Latin America. Thus nationalism has become at present a force dominating everywhere on earth, so much so that the 19th century has been called "the age of nationalism" in Europe, while the 20th century has witnessed the rise and struggle of national movements throughout Asia.

Nationalism implies the identification of the state or nation with the people, or at least the desirability of determining the extent of the state according to ethnographic principles. In the age of nationalism, but only in the age of nationalism, the principle was generally recognized that each nationality should form a state, its state, and that the state should include the whole nationality. Formerly states, or territories under one administration, were not delineated by nationality; men's loyalty was not due to the nation-state, but to different other forms of political aspiration: the city-state, the feudal fief and its lord, the dynastic state, the religious group or the sect. The nation-state not only did not form a reality during the greater part of history, for a very long time it did not appear even as an ideal. In the first 15 centuries of the Christian era the ideal was the universal world-state, not the loyalty to any separate political entity. The Roman empire had set the great example which survived not only in the Holy Roman empire of the middle ages, but also in the *res publica christiana* and in its later secularized form of a united world civilization and world policy as it appeared in the writings of the 17th century.

As political allegiance, before the age of nationalism, was not determined by nationality, so was civilization not regarded as nationally determined. During the middle ages civilization was regarded as determined religiously; for all the different nationalities of Christendom as well as for those of Islam there was but one civilization—Christian or Mohammedan, and but one language of culture—Latin (or Greek) or Arabic (or Persian). Later, in the periods of renaissance and classicism, it was the ancient Greek and Roman civilizations which became a universal norm, valid for all people and all times. Still later the French civilization was regarded throughout Europe as a valid civilization for all educated people of all nationalities. It was only at the end of the 18th century that for the first time civilization was regarded as determined by nationality and that the principle was put forward that man can be educated only in his own mother tongue, not in languages of other civilizations and other times, be it classical languages or the literary creations of other peoples who had reached a high degree of civilization. From the end of the 18th century on, the nationalization of education and national life went hand in hand with the nationalization of states and political loyalties. In many cases poets and scholars emphasized cultural nationalism first, reformed the national language, elevated it to the rank of a literary language, delved deep into the

national past, so as to prepare the foundations for the political claims for national statehood soon to be raised by a people in which the spirit of nationalism had been kindled by writers and educators.

Though national feeling was evident in certain groups at certain periods, especially periods of stress and conflict before the 18th century, nationalism became only in the 18th century a dominant force. Its rise was prepared by a number of complex events: the creation of large and centralized states by the absolute monarchs, which destroyed the feudal allegiances and thus made the integration of all loyalties in one centre possible; the secularization of life and education which fostered the development of the vernacular languages and weakened the ties of religious or sectarian loyalties; the growing economic interdependence which demanded larger territorial units, which would at the same time give the necessary scope to the dynamic spirit of the rising middle classes and their capitalistic enterprise. All these developments created the large and unified territorial state with its political and economic centralization. This existing form of the nation-state was filled in the 18th century with a new spirit of nationalism. It received from it an emotional fervour, similar to that which in preceding periods characterized religious movements. Under the influence of the new theories of the sovereignty of the people and of the rights of man, the king as centre of the nation was replaced by the people. No longer was he the nation or the state; the state, formerly a royal state, had become the people's state, a national state, a fatherland. The word "patrie" gained a new emotional depth and a new activist fervour. The land was no longer the king's, no longer his, but the nation's, ours, the land of our fathers and of our children, a fatherland. The nation, no longer the king or a ruling oligarchy, felt itself responsible for the country's destiny; nation and state became identified, as civilization became identified with national civilization.

This new thinking of nationalism was opposed to all the conceptions which had dominated thought for the last 2,000 years. During that period man had commonly stressed the general and the universal and seen in unity the desirable goal. Nationalism stressed the peculiar and parochial, the differences and the national individualities. These tendencies have become more pronounced as nationalism developed. In the 17th and 18th centuries the common standards of western civilization, the regard for the universally human, the faith in reason, one and the same everywhere, and in common sense, the survival of the Christian and Stoic traditions: all that was too strong to allow nationalism to develop its full tendencies, and to disrupt the society of man. Thus nationalism in its beginning was thought compatible with cosmopolitan convictions and with the general love of mankind. This was especially true of nationalism in western Europe and North America.

The first full manifestation of modern nationalism occurred in 17th-century England, in the Puritan revolution. That century saw England the leading nation in the scientific spirit, in commercial enterprise, in political thought and activity. Swelled by an immense confidence in the new age and in the immense possibilities opening up, the English people felt upon their shoulders the mission of history, a new sense that they, the common people of England, were builders of destiny at a great turning point from which a new true reformation and a new liberty would start. In the English revolution a new optimistic humanism and Calvinist ethics merged; the influence of the Old Testament formed the new nationalism by identifying the English people with ancient Israel. The new message, carried by the new people not only for England, but for whole mankind, was expressed in the writings of Milton in whose famous vision the idea of liberty was seen spreading from Britain, "celebrated for endless ages as a soil most genial to the growth of liberty" to all the corners of the earth. "Surrounded by congregated multitudes, I now imagine that I behold the nations of the earth recovering that liberty which they so long had lost; and that the people of this island are disseminating the blessings of civilization and freedom among cities, kingdoms and nations."

English nationalism was thus much nearer to its religious matrix than later nationalism which rose in the 18th and 19th centuries after the process of secularization had made much greater progress; the nationalism of the 18th century shared, however, with English nationalism the enthusiasm for liberty, the humanitarian character, the emphasis upon the individual and his rights and upon the human community beyond all national divisions. The rise of English nationalism coincided with the rise of the English trading middle classes; it found its final expression in Locke's political philosophy. It was in that form that English nationalism influenced American and French nationalism in the following century.

The rising nationalism of the 18th century settlers in British North America was influenced partly by the English traditions of the Puritan revolution and of Locke, and partly by the new rational interpretation given to English liberty by the French philosophers of the century. American nationalism became the typical product of the 18th century: the American settlers became a nation in a fight for liberty and individual rights on the basis of the thought of the century as expressed above all by Thomas Jefferson and Thomas Paine. It was a liberal and humanitarian nationalism, regarding America as the vanguard of mankind on its march to greater liberty, equality and happiness for all. The ideas of the 18th century had found their first political realization in the Declaration of Independence and in the birth of the American nation. Their deep influence was felt in the French revolution which enthroned French nationalism as the decisive factor in place of French royalty.

Rousseau had prepared the soil for the growth of nationalism, not only by his stress of popular sovereignty and of the general co-operation of all in forming the national will, but also by his regard for the common people as the true depository of civilization. Under his influence Johann Gottfried Herder gained a new understanding of art and civilization by emphasizing folk lore, folk songs and primitive popular traditions as revealing the true creative forces of a nation. He went beyond Rousseau in his appeal to the past, often to the primitive past. He glorified the instinctive and irrational, and turned the attention from the universally human and general to the peculiarities of each national tradition, regarding them as valuable sources of creative inspiration. Under Herder's influence German romantic nationalism later stressed these factors of irrationalism and of national peculiarities; while the nationalism of the French revolution was the triumphant expression of a rational faith in common humanity and liberal progress. The famous slogan of "liberty, equality, fraternity" and the Declaration of the Rights of Man and of the Citizen were not only thought valid for the French people, but for all peoples. Individual liberty, human equality, fraternity of all peoples: these were the common corner-stones of all liberal and democratic nationalism. In their name the French nation constituted itself, overthrew the monarchy and began soon to spread the new gospel across Europe. Under their inspiration a new ritual was developed which partly took the place of the old religious ritual: festivals and flags, music and poetry, national holidays and patriotic sermons: in the most varied forms nationalism permeated all manifestations of life. Like the rise of American nationalism, the rise of the French produced a deep change in the art of warfare: the nation in arms. These citizen armies, untrained but filled with a new fervour, proved in America and in France superior to the highly trained professional armies of the 18th century who fought however without the incentive of nationalism. The revolutionary French nationalism stressed the element of will, of free individual decision, in the formation of nations. Nations were constituted by an act, in self-determination of their members. The plebiscite became the instrument whereby the will of the nation was expressed. Nationalism meant, in America as well as in revolutionary France, the adherence to an idea, a universal progressive idea, looking towards a common future of freedom and equality, not towards the past which had been characterized by authoritarianism and inequality.

Napoleon's armies spread this nationalism throughout Europe and even into the near east; under the inspiration of the American and French revolutions it aroused the Latin Americans. But Napoleon's yoke turned the newly awakened nationalism of the European peoples against France. In Germany where the struggle was led by writers and intellectuals it turned not only into a rejection of Napoleon's rule but of all the principles upon which the American and the French revolutions were based, and against the liberal and humani-

tarian form of nationalism. German nationalism began to stress instinct against reason; the power of historical tradition against rational attempts at progress and at a more just order; the eternal differences between nations based upon the past, against their common aspirations turned towards the future. The French revolution, liberalism and equality were regarded as a brief aberration, against which the eternal foundations of societal order would prevail. This prophecy was proven groundless by the development of the 19th century: liberal nationalism reasserted itself, it permeated more and more peoples, the rising middle class and the new proletariat. The revolutionary wave of 1848, the year of "the spring of the peoples," seemed to realize the hopes of nationalists like Mazzini who had devoted his life to the unification of the Italian nation by democratic means and to the brotherhood of all free nations. Though his hopes were disappointed, the 12 years from 1859 to 1871 brought the unification of Italy and Rumania, both with the help of Napoleon III, and of Germany; at the same time the '60s saw everywhere a great progress in liberalism, even in Russia and Spain. This victorious trend of liberal nationalism was however reversed in Germany by Bismarck's success. He unified Germany on a conservative and authoritarian basis and defeated German liberalism. The annexation of Alsace-Lorraine against the will of the inhabitants rejected the principle of nationalism based upon the free will of man. It maintained that the people of Alsace-Lorraine were German by objective factors, by race, independent of their will or of their allegiance to any nationality of their free choice.

In the second half of the 19th century nationalism disintegrated the supranational states of the Habsburgs and of the Ottoman sultans which were based upon prenational loyalties. In Russia the penetration of nationalism provoked a two-fold attitude: some nationalists advocated an acculturation of Russia to the general progress of western mankind. They proposed a westernized Russia, following the common destiny of progressive society. Others stressed the peculiar character of Russia, its independent and different destiny, based upon its past of autocracy and orthodoxy. These Slavophiles, similar to and influenced by German romantic thinkers, regarded Russia as a future saviour of the west which was undermined by liberalism and the heritage of the American and French revolutions.

In the 20th century nationalism spread over Asia. Under English influence Indian nationalists organized in 1885 the Indian National congress to promote a liberal and progressive nationalism. Japan, similar in that to Bismarck's Prussia, made use of modern technique to strengthen a conservative trend of nationalism based upon the past. Her victory over Russia in 1905 convinced other oriental nations that modern nationhood with its forms of technique and administration could save them from conquest. The revolutions in China, Turkey and Persia manifested this new will; but they remained confined to a small upper class. Only World War I stirred the oriental masses into activism. Under leaders like Mustapha Kemal, Saad Zaghlul, Ibn Saud, Gandhi and Sun Yat Sen, the oriental peoples inaugurated their age of nationalism.

The end of World War I witnessed the triumph of liberal nationalism. The victory of the Allies seemed to establish firmly the principles underlying the English, American and French revolutions. In 1919 many nations rose to freedom, liberal constitutions were introduced, self-determination of peoples expressed itself in plebiscites, the rights of national minorities were protected. The Habsburg and Ottoman empires disintegrated, the Romonov empire was reorganized as a federation of equal nationalities. But conditions in the 20th century with its fast growing economic interdependence of all parts of the world and its sudden revolutionary changes in communication indicated instead of a fragmentization of the world into national states, some of them even stressing their independent destiny, an international co-operation on a world-wide basis corresponding to the reality of the common destiny of mankind. The League of Nations, conceived in the spirit of the American tradition, was the first feeble attempt to bring this about. It succumbed under the hammer blows of Japanese, German and Italian fascism, which represented a form of nationalism in which the nation is absolutized, in which the values of individual liberty and common humanity are abandoned and despised, and which glory in an extreme national egoism and in the subjection of weaker nationalities by war. In a certain sense, fascism represented an exaggeration of nationalism, but at the same time the uncompromising rejection of the liberal and progressive bases on which nationalism arose in the 18th century. Thus fascism represented a return to the prenational stage of inequality and authoritarianism, to a primitive stage, which English, American and French nationalists hoped to have overcome forever. On the other hand, fascism with its dangerous aspirations of world conquest might well bring about the need in the 20th century for a world-wide organization and, with such an organization, perhaps the end of the age of nationalism.

BIBLIOGRAPHY.—A. E. Zimmern, *Nationality and Government* (1918); W. B. Pillsbury, The *Psychology of Nationality and Internationalism* (1919); W. Mitscherlich, *Der Nationalismus Westeuropas* (1920); C. J. H. Hayes, *Essays on Nationalism* (1926); *idem, France, A Nation of Patriots* (1930); *idem, The Historical Evolution of Modern Nationalism* (1931); K. S. Pinson, *A Bibliographical Introduction to Nationalism* (1935); Royal Institute of International Affairs, *Nationalism: A Report by a Study Group* (1940); H. Kohn, *World Order in Historical Perspective* (1942); *idem,* "The Genesis and Character of English Nationalism," *Journal of the History of Ideas,* I, 69–94.

(H. Ko.)

**NATIONALITY AND NATURALIZATION.** Nationality may be defined as the quality of being a national of a given State. It may be pointed out by way of abundant caution that in the British empire the term nationality is used only in the political sense, since the empire having no common law, the personal law of a British subject is determined not by his nationality, but by his domicil. In those States where the national law prevails throughout their respective territories, the necessity for this distinction does not arise. Political and civil status are synonymous. The law of British nationality then now rests upon the common law and upon three statutes, viz., the British Nationality and Status of Aliens Act 1914 which came into operation on Jan. 1, 1915, which professed to be a consolidating and amending statute, and which repealed a number of former enactments; the Amending Act 1918; and the Amending Act 1922. These statutes are now officially printed as one statute and cited as the British Nationality and Status of Aliens Acts 1914–22.

At common law, with certain exceptions to be mentioned later, all persons born within the British dominions are natural-born British subjects. For instance the child of French parents born during their temporary residence in England is a British subject and liable to be convicted of high treason if he took part in hostile operations against Great Britain.

By s. 1 (1) of the statute the following persons are deemed to be natural-born British subjects, viz.:—(a) "Any person born within His Majesty's dominions and allegiance." It was necessary to add the condition of birth *within the allegiance* of the king in order to prevent the acquisition of British nationality by a child born to an enemy father within the British dominions at the time in the occupation of the enemy or by a child born to a foreign sovereign or foreign ambassador or diplomatic agent. (b) "Any person born out of His Majesty's dominions whose father was at the time of that person's birth a British subject, and who fulfills any of the following conditions, that is to say, if either (i.) his father was born within His Majesty's allegiance; or (ii.) his father was a person to whom a certificate of naturalization had been granted; or (iii.) his father had become a British subject by reason of any annexation of territory; or (iv.) his father was at the time of that person's birth in the service of the Crown; or (v.) his birth was registered at a British consulate within one year or in special circumstances, with the consent of the secretary of State, two years after its occurrence, or in the case of a person born on or after the first day of Jan. 1915, who would have been a British subject, if born before that date, within 12 months after the first day of Aug. 1922." (c) "Any person born on board a British ship whether in foreign territorial waters or not: provided that the child of a British subject, whether that child was born before or after the passing of the act, shall be deemed to have been born within His Majesty's allegiance if born in a place where by treaty, capitulation, grant, usage, sufferance or other lawful means, His Majesty exercises jurisdiction over British subjects. Provided also that any person whose British nationality is conditional upon registration at a British consulate shall cease to be a British subject unless within one year after he attains the age of 21 or within such extended period as may be authorized in special cases by regulations made under this act (i.) he asserts British nationality by a declaration of retention of British nationality in such manner as may be prescribed by regulations made under the act; and (ii.) if he is a subject or citizen of a foreign country under the law of which he can, at the time of asserting his British nationality, divest himself of the nationality of that foreign country by making a declaration of alienage or otherwise, he divests himself of such nationality accordingly."

By the act of 1772 a child born out of the British dominions whose father *or whose grandfather* was born within those dominions was deemed to be a natural-born British subject, provided that his father at the time of his death had not ceased to be a British subject. By the act of 1914, however, this privilege was

taken away from grandchildren born after Jan. 1, 1915, outside the British dominions. Such children were not British subjects unless their father had been born within the British dominions, with the exception of those children born in a place where by treaty, capitulation, etc., His Majesty exercised jurisdiction over British subjects. But owing to the agitation by British subjects resident in foreign countries and particularly by those residing in the Argentine—the British colony in Buenos Aires numbered some 30,000—the act of 1922 was carried, which provides that a British subject who has a child born abroad after Jan. 1, 1915, may secure British nationality for such child by registering its birth at a British consulate in the manner above stated. Consequently British subjects, whether natural-born or not, living abroad can extend British nationality to their descendants in perpetuity.

In *Carlebach's Case,* 1915, 3 K.B. 716, it was held that under the act of 1870 a naturalized British subject could not transmit his nationality to his children born abroad, who consequently became aliens. Now by the act of 1914 such children born abroad after Jan. 1, 1915, are deemed to be natural-born subjects. And by iii. and iv. of para. (b) of subsect. (1) the provisions of the common law are enlarged and the children of a father wherever born who, at the time of their birth, had become a British subject by reason of any annexation of territory, or who was in the service of the Crown, are deemed to be natural-born British subjects. It is the better opinion that the inhabitants of a conquered territory do not cease to be the subjects of their former sovereign by annexation accomplished during the war. A complete title can only be acquired either through the cessation of hostilities or by a treaty of peace. Nevertheless this distinction was not observed or even mentioned by the Judicial Committee of the Privy Council in *Gout* v. *Cimitian,* 1922, A.C. 105.

(d) "Any person born on board a British ship whether on the high seas or in foreign territorial waters is a British subject." The term "British ship" includes vessels of the royal navy and of the navies of the dominions, and vessels as defined by s. 1 of the Merchant Shipping Act 1894, viz., vessels owned wholly by natural-born British subjects, by naturalized British subjects, by British denizens, and by corporations established under and subject to the laws of some parts of His Majesty's dominions and having their principal place of business in those dominions.

It should be noted that the act is not retrospective, except as otherwise expressly provided. Consequently the old law applies to those born prior to Jan. 1, 1915.

**Naturalization** is the act of investing an alien with the status of a national in a given State. Aliens may still acquire British nationality by a private act of parliament or may become denizens by grant of letters of denization by the Crown. The former process is extremely rare. When the late Lord Reay succeeded to a Scottish peerage in 1877 he was naturalized by act of parliament. The latter although preserved by s. 25 of the act of 1914 is likely to fall into disuse owing to the disqualifications which still attach to denizens. By s. 2 of the act an alien may obtain a certificate of naturalization from the secretary of State provided he has resided in His Majesty's dominions for not less than five years or been in the service of the Crown for not less than five years within the last eight years, is of good character and has an adequate knowledge of the English language and intends to reside in His Majesty's dominions or to continue in the service of the Crown. He must have resided in Great Britain for at least one year immediately preceding his application. The grant of such certificate lies in the absolute discretion of the secretary of State and the certificate does not take effect until the applicant has taken the oath of allegiance. A person to whom a certificate is granted is entitled to all political and other rights, powers and privileges and is subject to all obligations, duties and liabilities as a natural-born British subject and to all intents and purposes enjoys the status of a natural-born British subject (s. 3 [1]). By the Act of Settlement 1700, naturalized persons and denizens could not be privy councillors, or members of either House of Parliament, or enjoy any office or place of trust, civil or military, or take any grant of lands from the Crown. *Quoad* naturalized aliens these disqualifications were abolished (s. 3 [2]; see *Rex* v. *Speyer,* 1916, 2 K.B. 858). The secretary of State may also grant a special certificate of naturalization to any person with respect to whose nationality a doubt exists (s. 4); and may include in a certificate the name of any infant born before the date of such certificate and such child may within one year of obtaining his majority make a declaration of alienage and thereupon cease to be a British subject (s. 5). A certificate of naturalization may be revoked by the secretary of State if it has been obtained by false representation or fraud or by concealment of material circumstances, or if the person to whom the certificate is granted has shown himself to be disaffected or disloyal, or by reason of other specified grounds (s. 7). The wife and children may be included in this revocation, but if not they remain British subjects. The wife may, however, make a declaration of alienage for herself and her infants (s. 7, A).

By complying with the provisions contained in the act, the Government of any British possession may invest aliens residing in its territory with the status of a natural-born British subject. All the six self-governing "Dominions," which were exempted from the operations of the act, have now adopted it. So far only Australia, Canada and Newfoundland have availed themselves of this power. Where a possession has not done so, a person naturalized by the Government of such possession is not a British subject in Great Britain (s. 8; see *Rex* v. *Francis, ex p. Markwald,* 1918, 1 K.B. 617; *Markwald* v. *Att. Gen.* 1920, 1 Ch. 348). Naturalization by a certificate granted in Great Britain has no effect within the Dominions unless through the legislatures they have adopted Part II of the act.

In one important respect the position of married women has been worsened by the act. Under the act of 1870, the natural-born British wife of an alien became the subject of the State of which her husband was a subject. But if he were not a subject of any State, she remained by the common law a British subject. By s. 10 of the act of 1914, however, the wife of an alien is deemed to be an alien. Consequently if the husband is Stateless, the wife also is Stateless. It is, however, provided that if the husband ceases to be a British subject, the wife may by declaration retain her British nationality, and if her husband is a subject of a State at war with Great Britain, she may by declaration resume her British nationality. Upon the death of the husband or dissolution of the marriage, the wife does not regain her British nationality, but a decree of nullity will revive her British nationality, since if there were no marriage it had never been lost (s. 11). Where a person ceases to be a British subject his infants also cease to be British subjects, unless they fail to be naturalized in another country. But where a British widow marries an alien her infants by her husband do not cease to be British subjects. An infant who has so ceased to be a British subject may within one year of attaining his majority by a declaration resume his British nationality (s. 12).

British nationality is lost by foreign naturalization. Until the Naturalization Act 1870, the maxim *nemo potest exuere patriam* prevailed. By s. 6 of that statute a British subject by voluntary naturalization in a foreign State ceased to be a British subject. But it was subsequently held in *R.* v. *Lynch,* 1908, 1 K.B. 444 that this section did not enable a British subject to become naturalized in an enemy State during time of war. The section was substantially re-enacted by s. 13 of act of 1914. But it would appear from the decision in *Pedlar* v. *Johnson,* 1920, 2 I.R. 450 that a British subject may become naturalized in a neutral State during time of war and engage in acts of hostility against his State of origin without sacrificing his rights as a friendly alien.

(H. H. L. B.)

**United States.**—Nationality rests upon the fundamental law of the United States, its Constitution, or enactments of Congress and treaties made pursuant thereto, whether the individual be of native or of foreign birth. In art. 1., s. 8, clause 4 of the Constitution, among the powers given to Congress is that to "establish an uniform rule of naturalization." The First Congress exercised this power in the enactment of the statute of March 26, 1790 (1 Stat. 103), by which a rule was established for the acquisition of citizenship in the United States by those of foreign birth.

This Act was based upon the principle of the right of expatriation as inherent in the individual, which principle was declared in affirmative form in the Act of July 27, 1868 (15 Stat. 223), referred to hereinafter.

The statute of 1790 also asserted the doctrine of *jus sanguinis* (status by blood) in declaring as citizens the children of citizens of the United States though born beyond the sea or out of the limits of the United States. By this Act the Congress refused to recognize citizenship as descending through such foreign-born citizens as did not reside in the United States prior to the birth of children. *See* also Acts of April 14, 1802 (2 Stat. 155) and Feb. 10, 1855 (10 Stat. 604), the latter now appearing as s. 1993 of the Revised Statutes of the United States. These Acts of Congress declaring certain classes of persons to be citizens have been recognized by the Supreme Court of the United States as the exercise of a constitutional authority (*U.S.* v. *Wong Kim Ark,* 1898, 169 U.S. 649, 703, and *Weedin* v. *Chin Bow,* 1927, 274 U.S. 657).

The following words of s. 1 of Amendment XIV. of the Constitution of the United States, proclaimed July 28, 1868, give recognition to the doctrine of *jus soli* (status by country of birth): "All persons born or naturalized in the United States, and subject to the jurisdiction thereof, are citizens of the United States and of the State wherein they reside." Birth, therefore, confers citizenship notwithstanding there may be racial ineligibility of the parents for naturalization (*U.S.* v. *Wong Kim Ark,* 169 U.S. 649).

Congress has both conferred citizenship and fixed the national status of the inhabitants of certain territory through its treaty-making powers, and by statute pursuant thereto from time to time effected their collective naturalization either prior to or upon the admission of such acquired territory to statehood. Such action was taken in territory acquired under treaties concluded with Great Britain—Territory of Michigan (1794, 8 Stat. 116); France—Louisiana (1803, 8 Stat. 200); Spain—Florida (1819, 8 Stat. 252); Mexico—Guadalupe-Hidalgo (1848, 9 Stat. 922) and Gadsden (1853, 10 Stat. 1031); Russia—Alaska (1867, 15 Stat. 542); Denmark—Virgin islands (1916, 39 Stat. 1706).

In the absence of definite treaty stipulations, citizenship has been conferred upon inhabitants of acquired territory by legislative enactments prior to statehood. In this category may be included the Hawaiians (Act of April 30, 1900, 31 Stat. 141) and Porto Ricans (Act of March 2, 1917, 39 Stat. 953). United States citizenship was conferred collectively through the political incorporation of the original States into the United States also in the case of the State of Texas upon its annexation and direct admission into the Union as a State.

Congress formerly dealt with the Indian natives of the United States by treaty but afterwards by statute subsequent to the law of March 3, 1871 (16 Stat. 566). Certain of these acquired citizenship from time to time but all North American Indians born within the territorial limits of the United States were given citizenship by the Act of June 2, 1924 (43 Stat. 253).

The natives of the Philippine islands acquired the status of United States nationals under the treaty of peace with Spain, concluded Dec. 10, 1898 (30 Stat. 1759). The Philippine legislature, by enactment of March 26, 1920, provided for the naturalization of persons as Philippine citizens.

Citizenship is open to aliens who are free white persons and to aliens of African nativity or descent (s. 2169 R.S.U.S.). Aliens of the Japanese and Hindu races have been decided to be inadmissible by the Supreme Court (*Takao Ozawa* v. *U.S.,* 1922, 260 U.S. 178, and *U.S.* v. *Bhagat Singh Thind,* 1923, 260 U.S. 204). Chinese are excluded by the Act of May 6, 1882 (22 Stat. 61).

**Naturalization Procedure.**—On June 29, 1906, Congress repealed with but slight exception the then existing naturalization laws and enacted one major law or rule (34 Stat. 596). This law and the unrepealed laws are under the special supervision of a Federal commissioner of naturalization at Washington in the Bureau of Naturalization of the Department of Labor. This bureau has branch offices throughout the United States, strategically located in 27 cities.

On Sept. 22, 1922, by Act of Congress (42 Stat. 1021), women were required to become citizens independently of their husbands, with the repeal of s. 1994 of the Revised Statutes of the United States, by which a foreign-born woman acquired citizenship on marriage to an American citizen. By this Act of 1922 an American woman citizen who marries an alien racially ineligible to citizenship loses and cannot regain her citizenship during the continuance of the marital status.

Naturalization is a judicial proceeding, determinable by the district courts of the United States, and by the State courts of original jurisdiction in law or equity or law and equity in which the amount in controversy is unlimited. These State courts have been clothed by Congress with concurrent Federal authority for this purpose. In such a proceeding an alien, who has been admitted to the United States in conformity with the immigration laws for permanent residence, may declare his intention as soon as he desires before the clerk of the court within the jurisdiction of which he resides. Upon completion of five years of continuous residence within the United States he may petition the court of the jurisdiction where he then resides for admission to citizenship, if at that time his declaration of intention is two years old, or at such time as it shall become two years old. Two citizens of the United States as witnesses must be present so as appropriately to prove his allegations of residence and establish his good moral character and attachment to the principles of the Constitution. A woman who is the wife of an American citizen, or who lost her citizenship through marriage to an alien eligible for citizenship, is not required to make the preliminary declaration of intention and is required to have only one year of residence in the United States immediately preceding the time she petitions for naturalization. A period of 90 days must intervene after filing a petition before the court may hear it. Exceptions are allowed to certain aliens such as sailors and soldiers. The officers of the Naturalization Bureau examine the applicant and witnesses and appear in court on behalf of the Government at the hearing. Before many Federal courts they have a quasi-judicial authority in determining admissibility. A certificate of citizenship, furnished by the Bureau of Naturalization, is issued to the newly naturalized citizen by the clerk of the court. The costs are $1.00 for a declaration of intention, and $4.00 for the petition to the court and certificate of citizenship, if granted.

An alien born child derives citizenship through the acquisition of that status by the parent if the child take up permanent residence in the United States prior to its attainment of the age of 21 years (s. 2172 R.S.U.S.; s. 5, Act of March 2, 1907, 34 Stat. 1229; *Kaplan* v. *Tod,* 267 U.S. 229).

**Protection Abroad.**—All children born and residing outside of the United States who acquire citizenship through their fathers, are, in order to receive the protection of the United States Government, required upon reaching the age of 18 years to record their intention to become residents of the United States and to remain citizens thereof. They are further required to take the oath of allegiance to the United States on attaining the age of 21 years.

Citizenship acquired by naturalization is a conditional status. It shall be presumed to cease upon residence for two years in the State of former allegiance or for five years in any other foreign State. This presumption may be overcome upon the presentation of satisfactory evidence to a diplomatic or consular officer of the United States under rules of the Department of State. An oath of allegiance to or naturalization in any foreign State accomplishes expatriation of an American citizen, whether native or naturalized.

**Recent Legislation.**—Certificates of citizenship are obtainable by those who are citizens through the naturalization of the parent, and by women who acquired citizenship through the citizenship of their husbands during the time citizenship was acquired by marriage, if the citizen is in the United States.

Costs for a certificate showing the date, place and manner of lawful arrival of the alien in the United States are $5.00; for the declaration of intention, $5.00; for the petition to the court and the certificate of citizenship if granted, $10.00; for a certificate of citizenship issued by the commissioner of naturalization to a foreign-born person who has acquired citizenship through the parent or the husband, and for a special certificate of citizenship to be issued for the purpose of securing recognition as an Ameri-

can citizen by the former sovereignty, to be delivered through the Secretary of State to such sovereignty, $10.00; for a new declaration of intention or a new certificate of naturalization in lieu of one lost or destroyed, $10.00. (R. F. C.)

**France.**—French nationality attaches to (1) children born anywhere of a French father; (2) children born in France (a) of unknown parents or of parents of unknown nationality; (b) of foreign parents, one of whom was born in France; (c) of foreign parents not born in France (see *Code Civil* Liv., i. tit. i.). By the law of Aug. 10, 1927, every male born in France of a foreign father, and domiciled, becomes French on making the required declaration under the age of 18. At 21 he would become French, but has a year to disclaim. An alien of 18 may become naturalized after uninterrupted residence of three years. An alien woman marrying a Frenchman is thereby naturalized only if by her national law she loses her former nationality, or on her express demand. The whole subject is now governed by the law mentioned.

**Germany.**—By Art. 110 of the Constitution of 1919, nationality in the Federation and in the States is acquired and lost in accordance with the provisions of a federal law. Every subject of a State is a subject of the Federation. By s. 2 of the Law of Nationality and Naturalization 1870, citizenship of a State is acquired by (1) descent, (2) legitimation, (3) marriage, (4) admission, and (5) naturalization. Admission is confined to Germans and naturalization to aliens. Both are conferred by a certificate. S. 2 was re-enacted in the Law of Nationality of the empire of July 22, 1913, by which imperial nationality must be conferred upon similar terms. By s. 25 a German by obtaining the written consent of the competent authorities of his home State could retain his German nationality even though naturalized in a foreign country. Germany, however, was constrained by Art. 278 of the Versailles Treaty of June 28, 1919 to undertake to recognize any new nationality which had or might be acquired by her nationals under the laws of the Allied and Associated Powers.

**Other Countries.**—For the nationality and naturalization laws of the following countries, viz., Afghanistan, Austria, Belgium, China, Danzig, Denmark, Ecuador, Egypt, Esthonia, Greece, Honduras, Italy, Japan, Latvia, Lebanon and Syria, Lithuania, Monaco, Norway, Peru, Poland, Rumania, Russia (Soviet Union), Spain, Sweden, Switzerland, Syria, Tunis, Turkey, United States and Venezuela, reference should be made to *Parliamentary Papers, Misc.* No. 7 (1922), *Misc.* No. 2 (1927), and *Misc.* No. 8 (1927). *See* also Clunet, *Journal du Droit International; Annuaire de législation étrangère,* of the Société de legislation comparée, Paris; *American Journal of International Law; Journal of Comparative Legislation and International Law.* For the Argentine Republic *see* Zeballos, *La Nationalité,* 1914–19; for Bulgaria see *British & Foreign State Papers* 1911, and *Annuaire* 1911 p. 765; for Costa Rica *see* Constitution, 1917, Arts. 40–44, 60, 99, and 105; *La Gaceta,* June 13, 1917; for the Dominican Republic *see* Constitution, 1924, Pan-American Union *Law & Treaty Series,* No. 1 (1925), 6, 8, 10, 19, 21, Arts. 8, 18, 21, 55, 63; Naturalization Law of Oct. 31, 1924, Clunet, 53 *Journal* 1926, p. 243; for Finland *see* Constitution 1919, Art. 4; *see* also McBain & Lindsay Rogers, *The New Constitutions of Europe* (1922); for Mexico *see* Constitution, 1917, Arts. 27 (1), 30, 37, 73 (16); 111 *British & Foreign State Papers,* 787, 792, 794, 804; for the Netherlands *see* Law of Feb. 10, 1910, law of July 15, 1910, law of Dec. 31, 1920 and Constitution of 1922; 103 *British and Foreign State Papers,* 600; *Annuaire* 1910, 321; *ibid.* 1920, 116; 116 *British and Foreign State Papers,* 863; for Nicaragua *see* Constitution of 1911, Arts. 7–11, 111 (17); 107 *British and Foreign State Papers* 1039, 1051–52; New Constitution of 1913; for Portugal *see* decree of Dec. 2, 1910; 103 *British and Foreign State Papers,* 619; decree of March 28, 1911; *Annuaire* 1911, 366; Constitution of 1911, Art. 74; 105 *British and Foreign State Papers,* 779; for San Marino *see* decree of Jan. 21, 1910; *Annuaire* 1910, 286; for Serbia *see* Constitution, Arts. 6, 29, 144 (9); 110 *British and Foreign State Papers,* 934, 936, 939–940; for Siam *see* Law of May 18, 1911; 105 *British and Foreign State Papers,* 793; decree of Aug. 7, 1911; *Annuaire* 1911, 718; law of April 10, 1913; 108 *British and Foreign State Papers,* 793; decree of Aug. 7, 1911; *Annuaire* 1911, 718; law of April 10, 1913; 108 *British and Foreign State Papers,* 585; Command Paper (1928), 3,221.

*See* Foote, *Private International Law* (5th ed., 1925); J. Westlake, *A Treatise on Private International Law* (7th ed., 1925); A. V. Dicey, *Conflict of Laws* (Edit. by A. B. Keith, 4th ed., 1927). (H. H. L. B.)

**NATIONALIZATION:** *see* COLLECTIVISM, SOCIALISM.

**NATIONAL OLD TRAILS ROAD,** an American highway, the only one originally built by the U.S. Government. It was conceived by George Washington in Colonial days, financed by Congress on admitting Ohio into the Union in 1802, and extended by Congress in 1825 to Santa Fe, then in Mexico. In 1837 it passed under State control. It is variously known as the "National Pike," "Cumberland road" and "Santa Fe trail." It extends from Washington, D.C., to Los Angeles, Calif., a distance of 3,096 m. It is the most northerly all-year road from the Atlantic to the Pacific. It traverses many scenic wonders, including the Grand Canyon of the Colorado and Petrified Forest and offers an unsurpassed view of Pikes Peak and the Spanish Peaks of the Rocky mountains. It is largely due to the initiative of Judge G. M. Lowe. It passes through Columbus, O., Indianapolis, Ind., St. Louis and Kansas City, Mo., Great Bend, Kan., La Junta, Col., Santa Fe and Socorro, N.M., St. Johns, Ariz., and San Bernardino, Calif.

**NATIONAL PARKS AND MONUMENTS, THE:** *see* NATIONAL PARK SYSTEM, THE.

**NATIONAL PARKS HIGHWAY** (Northwest Trail), a highway from Chicago to Seattle, Wash. It is paved through Illinois, Wisconsin and most of Minnesota; the balance is mostly gravel with short graded stretches. It is 2,532 mi. long and passes just north of the Yellowstone National Park and south of Glacier National Park. It serves, among others, the cities of Fargo, N.D., Billings and Helena, Mont., and Spokane and Seattle, Wash.

**NATIONAL PARK SYSTEM, THE,** of the United States. The preservation of great works of nature and of sites of significant historic events is predicated upon the belief that a reasonable proportion of the country's native landscape and of its sites connected with events that have helped to shape the national destiny, should be held inviolate for the benefit and use of all the people as part of their national heritage. Areas set aside for this purpose make up the National Park system, which is administered by the national park service, a bureau of the United States department of the interior.

**The Start of the National Park System.**—The first national park, the Yellowstone, was established by congress in 1872, "as a pleasuring ground for the benefit and enjoyment of the people." It had been long a land of mystery, known only to a few hunters, trappers, explorers and Indians, when rumours of its geysers and other phenomena resulted in exploration of the region in 1869 and 1870. The explorers of the 1870 expedition, who first considered claiming the lands for private exploitation, were moved by the plea of one of their number to give up all idea of private gain and work to the end that it be made a national park. Thus was conceived the national park system and with it a new form of land use that later spread to all continents.

Four more national parks were created during the last decade of the 19th century and others followed in the early 1900s. These were mostly of the scenic wilderness type.

Meanwhile, however, scenes of great episodes in the history of the United States, especially lands where had occurred significant battles or events in the country's expansion and development, were being included in military and historical parks which were placed under the jurisdiction of the secretary of war and were not considered part of the national park system. In the early days, national parks primarily connoted the wilderness; and these battlefield sites were more in the nature of shrines to a heroic past.

**Antiquities Act.**—An important development in the growth of the national park system occurred in 1906, when congress enacted the "Antiquities Act"—legislation that empowered the president to establish as national monuments areas containing historic, pre-

| National Parks, Monuments, etc. | Location | Area in Acres | Outstanding Characteristics |
|---|---|---|---|
| *National Parks* | | | |
| Acadia 1919 | Maine | 28,291.07 | Scenic, rugged coastal area on Mount Desert Island, most prominent elevation on eastern seaboard; also includes picturesque Schoodic point on mainland. |
| Big Bend 1944 | Texas | 691,338.95 | Spectacular mountain and desert scenery; variety of unusual geological structures; enclosed in the great bend of the Rio Grande. |
| Bryce Canyon 1928 | Utah | 36,010.38 | Rocks among the most colourful of any of the earth's crust, exposed in a box canyon and shaped by erosion into pinnacles and grotesque forms. |
| Carlsbad Caverns 1930 | New Mexico | 45,526.59 | Largest subterranean labyrinth yet discovered; a series of connected caverns with a myriad of magnificent and curious formations. |
| Crater Lake 1902 | Oregon | 160,290.33 | Lake of deepest blue in heart of once active volcano; encircled by multicoloured lava walls 500 to 2,000 ft. high. |
| Glacier 1910 | Montana | 997,486.80 | Superb Rocky mountain scenery, with numerous glaciers and lakes nestling among the highest peaks; forms part of the Waterton-Glacier International Peace park, established on May 2, 1932. |
| Grand Canyon 1919 | Arizona | 645,084.31 | Tremendous mile-deep gorge, 4 to 18 mi. wide, 217 mi. long of which 105 mi. are within the park; contains fantastically eroded and coloured rock masses. |
| Grand Teton 1929 | Wyoming | 94,892.92 | Series of imposing high peaks which constitute the scenic climax of the majestic Teton range; once a noted landmark of Indians and "Mountain Men." |
| Great Smoky Mountains 1930 | North Carolina; Tennessee | 460,882.46 | Loftiest range east of the Black hills and one of the oldest land areas on earth. Outstandingly diversified and luxuriant plant life, often of extraordinary size. |
| Hawaii 1916 | Territory of Hawaii | 173,404.60 | A spectacular volcanic area; includes two volcanoes in frequent eruption, also one of world's largest dormant volcanoes; luxuriant tropical vegetation; fern forests. |
| Hot Springs 1921 | Arkansas | 1,019.13 | Contains 47 mineral hot springs said to have therapeutic value; known to the Indians and early Spaniards. |
| Isle Royale 1940 | Michigan | 133,838.51 | Forested island, the largest in Lake Superior, distinguished for its wilderness character; great moose herd; pre-Columbian copper mines. |
| Kings Canyon 1940 | California | 452,984.02 | Sublime mountain wilderness dominated by the two enormous canyons of the Kings river and by the summit peaks of the High Sierra. The former General Grant National park, with its giant sequoias, is a detached section of the park. |
| Lassen Volcanic 1916 | California | 101,880.41 | Lassen peak, only recently active volcano in United States proper, erupted between 1914 and 1921; spectacular volcanic exhibits. |
| Mammoth Cave 1936 | Kentucky | 50,547.51 | Historic series of underground passages, 150 mi. of which have been explored; beautiful limestone formations; river 360 ft. beneath surface; famous for more than a century. |
| Mesa Verde 1906 | Colorado | 51,017.87 | Has most notable and best preserved prehistoric cliff dwellings and other structures in the United States. |
| Mount McKinley 1917 | Alaska | 1,939,199.04 | Mount McKinley, highest mountain in North America; large glaciers of the Alaska range; caribou and mountain sheep. |
| Mount Rainier 1899 | Washington | 241,219.92 | Greatest single-peak glacial system in the United States, radiating from the summit and slopes of an ancient volcano; dense forests. |
| Olympic 1938 | Washington | 848,212.30 | Mountain wilderness containing finest remnant of Pacific northwest rain forests; active glaciers; rare Roosevelt elk. |
| Platt 1906 | Oklahoma | 911.97 | Numerous cold mineral springs with distinctive properties, including several bromide springs. |
| Rocky Mountain 1915 | Colorado | 252,625.87 | One of the most magnificent and diversified sections of the Rocky mountains, with 65 named peaks in excess of 10,000 ft. |
| Sequoia 1890 | California | 385,100.13 | Great groves of giant sequoia trees, world's largest and probably oldest living things; magnificent High Sierra scenery, including Mount Whitney, highest mountain in United States proper. |
| Shenandoah 1935 | Virginia | 193,472.98 | Tree-covered mountains in the heart of the Blue ridge; scenic Skyline drive; panoramic views of historic Virginia. |
| Wind Cave 1903 | South Dakota | 11,718.17 | Limestone caverns in scenic Black hills, decorated by beautiful "boxwork" formations tipped with white crystals; buffalo herd. |
| Yellowstone 1872 | Wyoming; Montana; Idaho | 2,213,206.55 | World's greatest geyser area, with 3,000 geysers and hot springs; spectacular falls and canyon of the Yellowstone river; one of the world's greatest wildlife sanctuaries. |
| Yosemite 1890 | California | 756,294.65 | Mountainous region of unusual beauty; Yosemite and other inspiring gorges with sheer granite cliffs; spectacular waterfalls; three groves of giant sequoias. |
| Zion 1919 | Utah | 94,241.06 | Multicoloured gorge in heart of southern Utah's dramatic desert and canyon country; erosional formations of great height and spectacular carving. |
| *National Historical Parks* | | | |
| Abraham Lincoln 1939 | Kentucky | 110.50 | Log cabin believed to be that in which Abraham Lincoln was born, enclosed in protective memorial building on the site of Lincoln's birthplace. |
| Chalmette 1939 | Louisiana | 29.52 | Part of the ground on which was fought the battle of New Orleans, a brilliant U. S. victory of the War of 1812 and one which brought much fame to Andrew Jackson. Includes military cemetery. |
| Colonial 1936 | Virginia | 7,057.16 | Most of Jamestown Island, site of first permanent English settlement in U. S.; Yorktown, scene of U. S. victory over Cornwallis, 1781, culminating battle of Revolution; parkway connecting these and other colonial sites with colonial Williamsburg. |
| Morristown 1933 | New Jersey | 958.37 | Sites of important military encampments during the Revolution; Washington's headquarters, 1779–80; 18th century houses; museum and collection of Washingtoniana. |
| *National Monuments* | | | |
| Ackia Battleground 1938 | Mississippi | 49.15 | Site of a Chickasaw Indian village and a memorial commemorating the battle of Ackia, in which the Chickasaws, aided by British troops, repulsed attack of the French and their Choctaw allies, May 26, 1736. |
| Andrew Johnson 1942 | Tennessee | 17.08 | President Andrew Johnson's home, tailor shop and grave. |
| Appomattox Court House 1940 | Virginia | 968.25 | Scene of the surrender on April 9, 1865, of the Confederate army under Gen. Robert E. Lee to the Federal army under Gen. Ulysses S. Grant. |

| National Parks, Monuments, etc. | Location | Area in Acres | Outstanding Characteristics |
|---|---|---|---|
| *National Monuments—Continued* | | | |
| Arches 1929 | Utah | 34,089.94 | Extraordinary examples of erosion in the form of giant arches, windows, pinnacles and pedestals. |
| Aztec Ruins 1923 | New Mexico | 25.88 | The ruins of a great prehistoric American Indian town built of masonry and timber in the 12th century; largely excavated and stabilized. |
| Badlands 1939 | South Dakota | 122,812.46 | Magnificently eroded layers of Badlands deposits containing great numbers of prehistoric animal fossils. |
| Bandelier 1916 | New Mexico | 27,048.89 | Ruins of prehistoric Indian homes of the later Pueblo period, built in the canyon-slashed slopes of the Pajarito plateau. |
| Big Hole Battlefield 1910 | Montana | 200.00 | Site of important battle along the line of the famous retreat of Chief Joseph and his Nez Perce Indians in 1877. |
| Black Canyon of the Gunnison 1933 | Colorado | 12,040.55 | Remarkable deep narrow canyon with sheer rocks of great geologic interest so altered through compression and lava intrusion that their origin is in doubt. |
| Cabrillo 1913 | California | .50 | Memorial to Juan Rodriguez Cabrillo, who discovered San Diego bay in 1542. |
| Canyon de Chelly 1931 | Arizona | 83,840.00 | Prehistoric Indian ruins built at the base of sheer red cliffs or in caves in canyon walls; contains modern Navajo Indian homes and farms. |
| Capitol Reef 1937 | Utah | 33,068.74 | Twenty-mile-long buttressed sandstone cliff of Gothic appearance, with dome-shaped white formations superimposed on lower colourful strata. |
| Capulin Mountain 1916 | New Mexico | 680.42 | Huge cinder cone, an interesting example of a recently extinct volcano. |
| Casa Grande 1918 | Arizona | 472.50 | A ruined adobe tower built by Indians who farmed the Gila valley 600 years ago; the only prehistoric building of its particular type still standing. |
| Castillo de San Marcos 1924 | Florida | 18.51 | Oldest masonry fort in the United States; construction started in 1672 by the Spanish to protect St. Augustine, first permanent white settlement in the U. S. |
| Castle Pinckney 1924 | South Carolina | 3.50 | Part of the early defenses of Charleston harbour. |
| Cedar Breaks 1933 | Utah | 6,052.20 | Great amphitheatre eroded into the vividly coloured Pink Cliffs formation which here has a depth of 2,000 ft. |
| Chaco Canyon 1907 | New Mexico | 18,039.39 | Thirteen major Indian ruins without equal in the U. S., representing highest point of Pueblo prehistoric civilization; hundreds of smaller ruins. |
| Channel Islands 1938 | California | 1,119.98 | Large rookery of sea lions; unique plants and mammals; and fossils ranging from marine invertebrates to Pleistocene elephants. This monument includes Santa Barbara and Anacapa Islands. |
| Chiricahua 1924 | Arizona | 10,529.80 | Wilderness of unusual rock shapes; rock strata telling story of nearly a billion (1,000,000,000) years of the earth's forces. |
| Colorado 1911 | Colorado | 18,120.55 | Sheer-walled canyons, towering monoliths and weird formations hewed by erosion in sandstone. |
| Craters of the Moon 1924 | Idaho | 47,540.70 | Fissure eruptions, volcanic cones, craters, lava flows, caves and other volcanic phenomena. |
| Custer Battlefield 1946 | Montana | 757.84 | The monument is on the site of the famous battle of the Little Bighorn river, June 25, 1876, in which Lt. Col. George A. Custer and his command of 226 were destroyed to a man by the Sioux Indians. |
| Death Valley 1933 | California; Nevada | 1,850,565.20 | Vast desert solitude, weird natural phenomena, extensive salt beds and borax formations; includes lowest point in United States, 280 ft. below the sea; famous in history of the west; a great obstacle to the forty-niners in California gold rush. |
| Devil Postpile 1911 | California | 798.46 | Symmetrical blue-gray columns rising as high as 60 ft., fitting closely together, a remnant of a basaltic lava flow. |
| Devils Tower 1906 | Wyoming | 1,193.91 | An 865 ft. tower of columnar volcanic rock, the remains of an igneous intrusion. Was first national monument. |
| Dinosaur 1915 | Utah; Colorado | 190,801.65 | Nation's richest fossil quarries containing skeletal remains of giant reptiles and other creatures of remote geologic time, preserved in excellent condition. |
| El Morro 1906 | New Mexico | 240.00 | "Inscription Rock," soft sandstone monolith on which are carved hundreds of inscriptions, including those of early Spanish explorers and early U. S. emigrants and settlers; also prehistoric petroglyphs. |
| Father Millet Cross 1925 | New York | .01 | Memorial cross in memory of Father Pierre Millet, 17th century missionary to Indians who erected a cross on that site in 1688. |
| Fort Frederica 1945 | Georgia | 74.53 | Built in 1736 by Gen. James Edward Oglethorpe, colonizer of Georgia, as an English outpost against Spain. |
| Fort Jefferson 1935 | Florida | 86.82 | Largest all-masonry fortification in western world, built in 1846 for control of Florida straits. Federal military prison during and after the Civil War. Outstanding bird refuge. Extraordinary marine life. |
| Fort Laramie 1938 | Wyoming | 214.41 | Buildings of old fort that served as principal U. S. military post guarding caravans on route of forty-niners and the Oregon trail. |
| Fort Matanzas 1924 | Florida | 18.34 | Spanish fort built in 1737 to protect back door to St. Augustine. Near this site Menendez massacred two parties of French Huguenots in 1565, thus determining that Florida should remain Spanish rather than French territory. |
| Fort McHenry 1939 | Maryland | 47.64 | The successful defense of this fort on Sept. 13–14, 1814, inspired the writing of the U. S. national anthem. |
| Fort Pulaski 1924 | Georgia | 5,427.39 | Massive early 19th century fortification whose successful bombardment by federal rifled cannon in 1862 first demonstrated total ineffectiveness of old style masonry fortresses. |
| Fossil Cycad 1922 | South Dakota | 320.00 | Deposits of fossil remains of fernlike plants of Mesozoic period or Age of Dinosaurs. |
| George Washington Birthplace 1930 | Virginia | 393.68 | Memorial mansion and gardens on the site of Washington's birthplace. |
| Gila Cliff Dwellings 1907 | New Mexico | 160.00 | Well-preserved cliff dwellings in four natural cavities in the face of an overhanging cliff; 150 ft. high. |

| National Parks, Monuments, etc. | Location | Area in Acres | Outstanding Characteristics |
|---|---|---|---|
| *National Monuments—Continued* | | | |
| Glacier Bay 1925 | Alaska | 2,297,456.27 | Contains great tidewater glaciers and interesting exhibit of early stages of postglacial forests. |
| Grand Canyon 1932 | Arizona | 196,051.00 | Part of the Grand canyon of the Colorado containing Toroweap point with its unusual view of the inner gorge and recent lava dam. |
| Gran Quivira 1909 | New Mexico | 450.94 | Site of 17th century Spanish mission; ruins of two mission buildings and of 18 Indian pueblo house mounds. |
| Great Sand Dunes 1932 | Colorado | 36,609.19 | Shifting sand dunes entrapped by a great hook in the Sangre de Cristo Mountains; they are among the largest and highest dunes in the United States. |
| Holy Cross 1929 | Colorado | 1,392.00 | Two crevices on side of Mount of Holy Cross, which, when filled with snow, form a cross. |
| Homestead 1939 | Nebraska | 162.73 | Site of the first claim under the Homestead Act of 1862, marking the beginning of "homesteading," the U. S. democratic land settlement policy. |
| Hovenweep 1923 | Utah; Colorado | 299.34 | Four groups of remarkable prehistoric towers, pueblos and cliff dwellings. |
| Jackson Hole 1943 | Wyoming | 173,064.62 | Portion of Teton "block-fault"; potholes and other glacial phenomena; favoured haunt of fur trappers and traders; foreground of Teton range. |
| Jewel Cave 1908 | South Dakota | 1,274.56 | Cave in limestone formation consisting of series of chambers connected by narrow passages; numerous side galleries; fine calcite crystal encrustations. |
| Joshua Tree 1936 | California | 655,961.33 | Representative stand of the rare and rapidly diminishing Joshua tree; many other varieties of desert flora. |
| Katmai 1918 | Alaska | 2,697,590.00 | Dying volcanic region; includes the Valley of Ten Thousand Smokes, scene of a violent eruption in 1912. |
| Lava Beds 1925 | California | 45,867.56 | Principal theatre of the Modoc Indian War of 1873; unusual exhibits of volcanic activity. |
| Lehman Caves 1922 | Nevada | 639.31 | Caves of light gray and white limestone honeycombed by tunnels and galleries of stalactite formations. |
| Meriwether Lewis 1925 | Tennessee | 300.00 | Site on Natchez trace where Meriwether Lewis, leader of the Lewis and Clark expedition, is buried. |
| Montezuma Castle 1906 | Arizona | 521.41 | One of the best preserved and most interesting cliff dwellings in the United States; built in cavern-pitted limestone cliff; original 5-story, 20-room castle is 90% intact. |
| Mound City Group 1923 | Ohio | 57.00 | Famous group of prehistoric Indian mounds. |
| Muir Woods 1908 | California | 424.56 | Preserves virgin stand of coast Redwoods, the tallest of living things. |
| Natural Bridges 1908 | Utah | 2,740.00 | Three natural bridges carved out of sandstone; the highest is 222 ft. above the stream bed, with span of 261 ft. |
| Navaho (Navajo) 1909 | Arizona | 360.00 | Contains three of largest and most intricate of known cliff dwellings—Betatakin, Keet Seel and Inscription House. |
| Ocmulgee 1936 | Georgia | 683.48 | Contains numerous outstanding and unique remains of mounds, and prehistoric towns, representative of the cultural evolution of the southern mound-builder civilization. |
| Old Kasaan 1916 | Alaska | 38.00 | Site of abandoned Haida Indian village. |
| Oregon Caves 1909 | Oregon | 480.00 | Caves in limestone formation of great variety and beauty. |
| Organ Pipe Cactus 1937 | Arizona | 328,161.73 | Examples of Organ Pipe Cactus and other desert plants found nowhere else in United States; traces of the Camino del Diablo, historic Spanish route. |
| Perry's Victory and International Peace Memorial 1936 | Ohio | 14.25 | At Put-In bay Commodore Perry won greatest naval battle of War of 1812; commemorates century of peace between the United States and Canada. |
| Petrified Forest 1906 | Arizona | 85,306.00 | Most spectacular display of petrified wood known in the world; Indian ruins and petroglyphs; portion of colourful Painted desert. |
| Pinnacles 1908 | California | 12,817.77 | Spire-like rock formations 500 to 1,200 ft. high, together with numerous caves and a variety of volcanic features. |
| Pipe Spring 1923 | Arizona | 40.00 | Contains historic Mormon fort, also structures built by Mormons during 1869–70 and later used by private ranchers and as cattle-buying and shipping point; commemorates significant phase of westward movement by U. S. pioneers. |
| Pipestone 1937 | Minnesota | 115.08 | Notable for its quarry from which Indians obtained materials for making peace pipes used in ceremonies. |
| Rainbow Bridge 1910 | Utah | 160.00 | Greatest of world's known natural bridges; a symmetrical arch of salmon pink sandstone, curving in form of a rainbow; rises 309 ft., from bottom of gorge. |
| Saguaro 1933 | Arizona | 53,669.24 | Cactus forest containing giant saguaro unique to deserts of southern Arizona and northwestern Mexico. |
| Santa Rosa Island 1939 | Florida | 9,500.00 | A barrier reef type island 44 mi. long and from one-eighth to one-half mile wide, of unusual scientific and historic value. |
| Scotts Bluff 1919 | Nebraska | 2,292.15 | Well-known landmark on Oregon trail associated with mass migration between 1843 and 1869 across treeless plains. |
| Shoshone Cavern 1909 | Wyoming | 212.37 | A cave of considerable extent decorated with encrustations of crystals. |
| Sitka 1910 | Alaska | 57.00 | Russian capital of Alaska and centre of fur trading activities. |
| Statue of Liberty 1924 | New York | 10.38 | Colossal copper statue on Bedloe's Island; a gift of the people of France; commemorates alliance of France and U. S. during American Revolution; universal symbol of freedom and democracy. |

| National Parks, Monuments, etc. | Location | Area in Acres | Outstanding Characteristics |
|---|---|---|---|
| *National Monuments—Continued* | | | |
| Sunset Crater 1930 | Arizona | 3,040.00 | Truncated volcanic cone, the upper portion so highly coloured as to give rim appearance of sunset glow; lava flows and ice caves. |
| Timpanogos Cave 1922 | Utah | 250.00 | Limestone cavern located on side of Mount Timpanogos, with passageways leading back into the mountain. |
| Tonto 1907 | Arizona | 1,120.00 | Two large and well-preserved Pueblo cliff dwellings occupied during the early part of the 14th century by Indians who farmed in the Salt River valley. |
| Tumacacori 1908 | Arizona | 10.00 | A historic Spanish Catholic mission building on site first visited by Father Kino, a Jesuit, in 1691. |
| Tuzigoot 1939 | Arizona | 42.67 | Excavated ruins of a prehistoric pueblo which flourished between A.D. 1000 and 1400; outstanding example of large late prehistoric pueblos of the Verde valley. |
| Verendrye 1917 | North Dakota | 253.04 | Commemorates the Verendrye explorations in North Dakota and along the upper Missouri river. |
| Walnut Canyon 1915 | Arizona | 1,641.62 | Cliff dwellings in shallow caves under ledges of limestone, built by Pueblo Indians about 1,000 years ago. |
| Wheeler 1908 | Colorado | 300.00 | Remarkable example of extinct volcanic action and eccentric erosion, combining fantastic pinnacles and deep gorges. |
| White Sands 1933 | New Mexico | 138,567.36 | Glistening white gypsum sands, drifting into dunes 10 to 60 ft. high. |
| Whitman 1940 | Washington | 45.84 | Site where Dr. Marcus Whitman and wife ministered to spiritual and physical needs of Indians until massacred by them in 1847; landmark on Oregon trail. |
| Wupatki 1924 | Arizona | 34,693.03 | Contains red sandstone prehistoric pueblos built by group of farming Indians whose descendants are believed to be the picturesque Hopis. |
| Yucca House 1919 | Colorado | 9.60 | Remnants of once thriving prehistoric Indian village. |
| Zion 1937 | Utah | 33,920.75 | Contains colourful Kolob canyon and famous Hurricane Fault, notable examples of geologic phenomena. |
| *National Military Parks* | | | |
| Chickamauga and Chattanooga 1890 | Georgia; Tennessee | 8,146.33 | Embraces battlefields of Chickamauga, Orchard Knob, Lookout mountain and Missionary ridge, important in operations around Chattanooga during 1863. |
| Fort Donelson 1928 | Tennessee | 102.54 | Fortification controlling the upper Cumberland river captured by Grant in 1862. |
| Fredericksburg and Spotsylvania County Battlefields Memorial 1927 | Virginia | 2,420.15 | Embraces portions of Fredericksburg, Chancellorsville, the Wilderness and Spotsylvania court house battlefields where major battles were fought between 1862 and 1864. |
| Gettysburg 1895 | Pennsylvania | 2,448.17 | Battlefield that marks the turning point of the Confederacy; portion of battleground dedicated as burial ground by President Lincoln in his famous Gettysburg address. |
| Guilford Courthouse 1917 | North Carolina | 148.83 | Commemorates battle fought March 15, 1781, between British and U. S. forces, which marked the beginning of the end of the Revolutionary struggle. |
| Kings Mountain 1931 | South Carolina | 4,012.00 | Site of an important victory for U. S. frontiersmen at a critical point in the Revolutionary War, Oct. 7, 1780. |
| Moores Creek 1926 | North Carolina | 30.00 | Scene of a memorable battle in 1776 between North Carolina Whigs and Tories. |
| Petersburg 1926 | Virginia | 1,310.41 | Scene of the "Battle of the Crater" and of the longest siege in the history of the United States, 1864–1865; about 100 mi. of well-preserved earthworks. |
| Shiloh 1894 | Tennessee | 3,717.59 | Natural park embracing the battlefield of Shiloh near Pittsburg Landing (1862) which prepared the way for Grant's successful siege of Vicksburg; also well-preserved Indian mounds. |
| Stones River 1927 | Tennessee | 323.86 | Scene of a stubbornly fought midwinter battle in 1862, which began the great Federal offensive to trisect the Confederacy. Includes part of the battlefield and a portion of Fortress Rosecrans. |
| Vicksburg 1899 | Mississippi | 1,323.56 | Remarkably preserved fortifications of 47-day siege of Vicksburg (1863), which gave the north control of the Mississippi river and cut the Confederacy in two. |
| *National Battlefield Parks* | | | |
| Richmond 1944 | Virginia | 684.44 | Scene of several battles in defense of Richmond during the Civil War; includes portions of battlefields of first and second Cold Harbor and Malvern hill, and massive fortifications along the James river and at Fort Harrison. |
| *National Battlefield Sites* | | | |
| Antietam 1890 | Maryland | 183.32 | Scene of the battle which brought to an end Lee's first invasion of the north in 1862; includes avenues and monument plots, and overlooks commanding a view of the Burnside bridge and the sunken road or "bloody lane." |
| Brices Cross Roads 1929 | Mississippi | 1.00 | Scene of the battle of June 10, 1864, in which Confederate cavalry under Gen. Nathan B. Forrest was employed with extraordinary skill. |
| Cowpens 1929 | South Carolina | 1.00 | Site of Daniel Morgan's victory over the British under Banastre Tarleton on Jan. 17, 1781. |
| Fort Necessity 1931 | Pennsylvania | 2.00 | Scene of a battle between colonial troops led by George Washington and French troops assisted by Indians, July 3, 1754; opening battle of the French and Indian War. |
| Kennesaw Mountain 1917 | Georgia | 60.00 | Embraces Cheatham's hill, on which the most desperate action during the battle of Kennesaw mountain (June 27, 1864) took place; and includes the main Union and Confederate earthworks and troop positions. |
| Tupelo 1929 | Mississippi | 1.00 | Commemorates the battle of Tupelo, July 13 and 14, 1864. |
| White Plains 1926 | New York | .00 | Memorials showing the positions held by Washington's army at the battle of White Plains in 1776. |
| *National Historic Sites* | | | |
| Atlanta Campaign 1944 | Georgia | 20.96 | Marks significant points on the route of Sherman's march from Chattanooga to Atlanta, prelude to the "March to the Sea" which finally trisected the Confederacy. |

| National Parks, Monuments, etc. | Location | Area in Acres | Outstanding Characteristics |
|---|---|---|---|
| *National Historic Sites—Continued* | | | |
| Federal Hall Memorial 1939 | New York | .49 | On this spot, the site of the present federal subtreasury building, stood the famous Federal hall, the first seat of the new federal government, and the scene of many momentous events in the early days of the republic. |
| Fort Raleigh 1941 | North Carolina | 16.45 | Place of first attempted English settlement within the confines of the United States, 1585–87. Site of the "Lost Colony" settlement of Sir Walter Raleigh and birthplace of Virginia Dare, first child of English parentage to be born in the new world. |
| Home of Franklin D. Roosevelt 1944 | New York | 33.23 | Fine home in the "Hudson River bracketed" style; birthplace, home and "Summer White House" of President Franklin D. Roosevelt where many distinguished visitors, including kings and queens and Prime Minister Churchill, were entertained. |
| Hopewell Village 1938 | Pennsylvania | 6,197.00 | One of the finest examples of U. S. 18th and early 19th century iron-making villages; includes the ruins of the old furnace and numerous dependent structures. |
| Jefferson National Expansion Memorial 1935 | Missouri | 82.58 | To commemorate the territorial expansion of the United States and conspicuous persons and events connected therewith. |
| Manassas National Battlefield Park 1940 | Virginia | 1,604.57 | Scene of the battles of First and Second Manassas on July 21, 1861, and Aug. 29–30, 1862. The former battle, often called "Bull Run," was the first test of northern and southern military prowess. Here, Jackson acquired the nickname "Stonewall." |
| Old Philadelphia Custom House 1939 | Pennsylvania | 0.79 | This building, completed in 1824, is one of the finest U. S. examples of Greek revival architecture; famous as the second bank of the United States, which figured so prominently in the historic controversy between President Andrew Jackson and the Whigs over national banking policies. |
| Salem Maritime 1938 | Massachusetts | 8.61 | Includes Derby Wharf, the Richard Derby house, Hawkes house and the Old Customs house in which Nathaniel Hawthorne worked—all of national significance because of their importance in the early maritime history of New England and architectural history. |
| Vanderbilt Mansion 1940 | New York | 211.65 | Mansion and grounds of the late Frederick W. Vanderbilt overlooking the Hudson river; fine example of the palatial U. S. residence of the period 1880–1900. |
| *National Memorials* | | | |
| House Where Lincoln Died 1896 | District of Columbia | 0.05 | Lincoln died here on April 15, 1865. House has been refurnished to give atmosphere of a typical home of the 1860s. |
| Kill Devil Hill Monument 1927 | North Carolina | 314.40 | Site of the first sustained flight by a heavier-than-air machine, made by Wilbur and Orville Wright. |
| Lee Mansion 1925 | Virginia | .50 | Splendid antebellum home of Robert E. Lee, commander in chief of the Confederate army. |
| Lincoln Memorial 1922 | District of Columbia | .61 | Classical structure of great beauty with a seated figure, 20 ft. high, of the Great Emancipator. |
| Lincoln Museum 1932 | District of Columbia | 0.18 | Located in this building was Ford's theatre in which Lincoln was shot by John Wilkes Booth on the night of April 14, 1865. Contains famous collection of Lincolniana. |
| Mount Rushmore 1929 | South Dakota | 1,686.40 | Colossal figures carved on the face of Mount Rushmore, delineating the features of four great presidents: George Washington, Thomas Jefferson, Abraham Lincoln and Theodore Roosevelt. |
| New Echota Marker 1930 | Georgia | .92 | Site of the last capital of the Cherokee Indians in Georgia. |
| Thomas Jefferson 1943 | District of Columbia | 1.2 | Circular colonnaded structure or rotunda in classic style introduced in the U. S. by Jefferson; on interior walls are four panels with inscriptions based upon writings of Jefferson. |
| Washington Monument 1885 | District of Columbia | .37 | Built in commemoration of George Washington, this monument (in the form of an obelisk, 555 ft. high) is one of the dominating features of the U. S. capital. |
| *National Cemeteries* | | | |
| Antietam 1862 | Maryland | 11.36 | The cemetery is divided into segments, each representing a state. Interments: 4,833 (unidentified, 1,836). |
| Battleground 1864 | District of Columbia | 1.03 | On Georgia ave., between Van Buren and Whittier sts. Interments: 44. |
| Fort Donelson 1867 | Tennessee | 15.34 | Interments: 684. |
| Fredericksburg 1865 | Virginia | 12.00 | Interments: 15,260. |
| Gettysburg 1863 | Pennsylvania | 15.55 | Interments: 3,785. |
| Poplar Grove 1866 | Virginia | 8.72 | Cemetery is on camping ground of the 50th regiment of New York engineers. Interments: 6,265 (unidentified, 2,163). |
| Shiloh 1866 | Tennessee | 10.25 | Burial place of men who fell at battle of Shiloh and the surrounding area. Interments: 3,653 (unidentified, 2,417). |
| Stones River 1865 | Tennessee | 20.09 | Interments: 6,179 (unidentified, 2,560). |
| Vicksburg 1865 | Mississippi | 119.76 | Two miles north of city on highway 61. Includes many who died in a radius of 150 miles from Vicksburg during the Civil War. Interments: 17,450 (unidentified, 12,911). |
| Yorktown 1866 | Virginia | 2.91 | Interments: 2,204 (unidentified, 1,446). |
| *National Parkways* | | | |
| Blue Ridge Parkway 1933 | Virginia; North Carolina | 38,911.50 | Scenic parkway averaging 3,000 ft. above sea level; follows Blue Ridge mountains and embraces several scenic and recreational areas en route; estimated length when completed: 477 mi. |
| George Washington Memorial Parkway 1930 | Virginia; Maryland | 2,458.68 | Embraces many interesting landmarks associated with the life of George Washington; planned as continuous boulevard along the Maryland and Virginia shores of Potomac river; includes Mount Vernon Memorial highway between the U. S. capital and Mount Vernon. Estimated length when completed: 57 mi. |
| Natchez Trace Parkway 1934 | Mississippi; Tennessee; Alabama | 13,648.87 | Follows general location of the old Indian trail between Nashville and Natchez, known as the "Natchez Trace," an important route in early travel; estimated length when completed: 447 mi. |
| *National Capital Parks* | | | |
| National Capital Parks 1790 | District of Columbia; Va.; Md. | 27,790.36 | The park system of the U. S. capital comprising more than 704 units in the District of Columbia and vicinity. |

OTHER AREAS ADMINISTERED BY THE NATIONAL PARK SERVICE
(Not Part of National Park System—Pending Total Land Acquisition)

| Name | Location | Area in Acres | Outstanding Characteristics |
|---|---|---|---|
| *National Historical Park Project* | | | |
| Saratoga 1938 | New York | 2,479.60 (1,864.60 now in federal ownership) | Scene of the U. S. victory over the British General Burgoyne, 1777, leading to the capture of his entire army; turning point of the Revolution, recognized as one of the decisive battles of world history. |
| *National Battlefield Park Project* | | | |
| Kennesaw Mountain 1935 | Georgia | 3,834.21 (3,034.21 now in federal ownership) | Historic field on which occurred one of the two heavy assaults made by Sherman on Confederate positions during the Atlanta campaign (June 27, 1864). The proposed park will include the Kennesaw Mountain National Battlefield site of 60 ac. |

historic or scientific objects. Passage of this act not only indicated a broadening of public and official interest in preserving for posterity areas of unusual interest scientifically or those tied into the historic background of the country, but it made possible the quick preservation of many areas that otherwise might have been exploited or destroyed in the westward surge of settlement. Several parks, among them the world-famous Grand canyon, which because of bogus mining claims was denied national park status for 34 years from the time Senator (later president) Benjamin Harrison of Indiana first introduced a bill to establish the Grand Canyon National park, were given protection from pre-emption under the Antiquities act. These were administered by the interior department, the department of agriculture and the war department.

**National Park Service Established.**—The protection afforded the scenic, scientific and historic areas under park and monument reservation was not sufficient to guard their rare exhibits. Eventually the growth and expansion of the national park system pointed up the need for establishment of a federal agency to co-ordinate protective and use activities. As a result the national park service was created by act of congress, approved Aug. 25, 1916.

In that act the bureau thus established was directed to "promote and regulate the use of the Federal areas known as national parks, monuments, and reservations herein specified by such means and measures as conform to the fundamental purpose of said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." All the policies and procedures of the national park service have evolved to meet this dual problem of protection and of human use.

**All Federal Park Administration Consolidated.**—In 1933 all federal park activities were consolidated. Transferred to the department of the interior at that time were the military and other historical parks, memorials and allied areas formerly managed by the war department, numerous national monuments of historic nature administered by the war department and other monuments until then under the control of the department of agriculture and the national capital parks of the District of Columbia consisting of more than 700 units. A new type of recreational area that developed after that time is the national parkway. On June 1, 1946, the national park system consisted of 169 areas.

**National Park System Categories.**—The categories shown in the accompanying table are not mutually exclusive, as the various classifications, set by act of the congress, somewhat overlap. Certain types, however, are clearly defined.

National parks are spacious land areas essentially of primitive or wilderness character that contain scenery and natural wonders so outstanding in quality that their preservation intact for the benefit, enjoyment and inspiration of the people is a national concern.

National monuments are those lands given that status under the Antiquities act or by act of congress for the protection and perpetuation of the historic, prehistoric or scientific objects or features that they contain.

The national historical parks, national military parks and national historic sites are quite similar in purpose and are not easily distinguishable from the national monuments that protect historic objects except in legal origins. National memorials and inactive national cemeteries also derive their significance from human associations. Change in designation of areas established by act of congress can be made only with congressional sanction.

The national parkway is a development of the automobile age—an elongated type of park created for the motorist and designed to provide him with a route of travel which, free from commercial traffic and uncluttered by roadside developments, will furnish the maximum of enjoyment and satisfaction in motion.

**Policies Guiding New Park Establishment.**—The long-range policy governing the addition of new areas to the national park system has been one of restricting selection to areas superlative in their own fields of scenery, natural science or history. Emphasis has been placed upon quality rather than quantity, and upon the national rather than the local significance of the areas acquired. Although proposals for the establishment of new national parks and allied areas are legion (in one eight-year period they totalled nearly 800), but few areas are added to the national park system each year, and these only after careful investigation of their intrinsic scenic, scientific or historic values has shown them to be of national calibre.

**Administration and Protection.**—Protection of these diverse areas and the management thereof for public use and enjoyment involve problems in many fields of endeavour. Administration originates in the office of the director of the national park service and flows through four regional offices, with headquarters in Richmond, Va., Omaha, Neb., Santa Fe, N. M., and San Francisco, Calif., to the individual areas. The local officer in charge is the superintendent or custodian (the latter title applying in some of the smaller areas). Protection is afforded by the park rangers.

Not until many years after the establishment of the first national park were federal funds appropriated for their protection by such civilian staffs. Meanwhile, with the integrity of Yellowstone National park threatened through raids on its wildlife herds and attempts to use the park for private and commercial gain, congress authorized the secretary of the interior to call upon the secretary of war to patrol the park. A cavalry detachment took over in 1886 and military protection continued until 1918. When Yosemite, Sequoia and General Grant National parks were established in 1890, their protection, following the Yellowstone pattern, also was entrusted to the cavalry. In these parks civilian administrations replaced the military in 1914. Practically all road construction in the national parks prior to the establishment of the national park service, with the exception of some private toll roads, was handled by the corps of engineers of the United States army.

**Conservation in the National Park System.**—Protection policies of the national park service are based upon congressional mandate as expressed in the organic act creating the national park service. "Protection" implies a certain degree of management, especially of wildlife. All areas of the system are game sanctuaries. The basic wildlife policy is to permit each native species, once established on a normal, healthy basis, to carry on its struggle for existence without artificial aid, in the belief that this is for the ultimate good of the species and conforms to primary national park purposes, provided a proper balance among all spe-

cies is maintained. Should emergency management of a particular species become necessary, protective measures may be adopted. Careful management of Yellowstone's buffalo herd, including the introduction of new animals from an outstanding private herd, insured survival of this once-vanishing species.

The forests of the national parks are priceless remnants of the formerly widespread virgin forests of the United States. Held as representative exhibits of the great forests of the past, their protection is a service responsibility of the first magnitude. These forests not only serve to enhance the scenic grandeur of the parks, but they also are important in the protection of water-sheds and in the regulation of stream flow. In addition, they provide habitats for many species of wildlife. Their protection involves preventing and combating forest fires and controlling insect infestations and tree diseases. The park meadowlands also must be protected against overgrazing in order to avoid erosion, to preserve the natural cover and to provide forage for the parks' grazing animals that depend upon them for forage.

**Nonconforming Uses.**—Constantly recurring demands are made by special interests for the use of park features for private gain, to the detriment of the great mass of citizens who own and are entitled to enjoy the national park areas. Attacks are primarily directed at the use of high mountain lakes and rivers for power and irrigation development; at certain park forests, cutting of which would afford a temporary prop to overexpanded and sometimes declining local industries while seriously impairing the beauty of the parks; at minerals; and at mountain meadow lands for domestic cattle grazing. All of these resources are available elsewhere, although possibly at greater cost to the proponents of the projects.

The waters of Yellowstone National park have frequently been the targets of irrigation and power project proponents. Repeated attempts to dam Yellowstone lake have been defeated, as have proposals directed at the use of other scenic park lakes. A 1938 project to dam Yellowstone lake for commercial irrigation, which involved construction of a dam and tunnel within the park, brought a protest from the secretary of the Swedish Government Committee on Planning and Recreation.

The outstanding example of exploitation and despoliation of a national park feature for private gain was the damming of Hetch Hetchy valley in Yosemite National park to provide a water supply for the city of San Francisco. This occurred before the establishment of the national park service and during a period in U.S. history when exploitation rather than conservation was the watchword.

Since all national park areas are deficient in rangeland, the grazing of livestock constitutes a threat to park wildlife. Experiments in cattle grazing during World Wars I and II proved conclusively that to extend such grazing privileges would ruin park meadows with resultant disastrous effect upon the deer, elk, antelope, buffalo and other wildlife species which are such an important feature in the national park scene. These experiments also demonstrated that livestock grazing in the parks could not appreciably influence the meat situation in the U.S.

**Planning.**—To insure all possible protection to the natural or historic features, the location and plan of all administrative buildings, employees' residences, facilities for the public, roads and trails and other construction are carefully planned. Construction of roads is held to the minimum compatible with service to the visitor. Only such roads are built as are necessary to enable the public to see the major scenic, scientific or historic features for which the parks were established. In the Yellowstone, for instance, which has the largest road mileage of any area in the system, less than 10% of the area is opened by roads. Use of park trails, either on foot or on horseback, is encouraged as the ideal way to see and enjoy the wilderness national parks and monuments.

**Master Plans.**—The basis of construction in each area of the National Park system is its "master plan." This is a general development plan, the result of a careful study of the area for human enjoyment. It performs the same function as a city plan and is based upon a thorough knowledge of the land involved, of how the people are to use it and of the quantitative use factor. With this basis, a design for future guidance is worked out in co-operation with all officials concerned. Once the master plan for an area is approved, each construction project, of whatever nature, is checked against it to insure conformity to the general development scheme. The master plans are fluid, subject to constant change as new factors develop. In the larger parks the master plan for each is a number of plans. One general map shows the entire region, with the roads, trails and telephone lines that connect the several developed areas; it is supported by plans of each developed area and by a written development outline. Availability of the master plans made possible the service's quick swinging into action under the Civilian Conservation corps and other emergency relief programs of the 1930s.

**The Automobile in National Parks.**—The aggregate travel to the national parks never reached 250,000 visitors annually until automobiles were admitted to those areas. Even before there was any transportation service, seekers after the sublime in scenery came into the early wilderness parks on foot and on horseback. At that time rough roads permitted buckboards. Next were the picturesque stagecoaches, many drawn by six horses, that continued in use until automobiles were permitted on park roads.

The first automobiles were admitted to Yosemite valley in Yosemite National park in 1913, and then were chained in the parking place as a precautionary method. By 1916 all the parks were opened to motorists. The following year motorbusses supplanted the horse-drawn stagecoaches in Yellowstone National park. Better roads became necessary, both within the national parks and leading to the parks. More visitors came, and more facilities to house and otherwise provide for their comfort were needed.

**Visitors' Facilities.**—Foreseeing the demand for accommodations for visitors to national parks, congress provided, in the acts creating the various parks, for the granting of franchises to private capital for the furnishing of public facilities. This franchise policy was reaffirmed in the act establishing the national park service. Operations, prices, plans and types of expansion are subject to approval by the national park service.

Of recent years, however, a small beginning has been made toward government ownership of the physical plants, wherever possible, with operation on a concession basis. As of June 1, 1946, concession facilities in 39 minor areas under national park service administration were owned in whole or in part by the federal government.

The most significant development in this field came in 1941, with the formation of a nonprofit-distributing private corporation known as National Park Concessions, Inc., to operate hotel and other facilities on lands at Mammoth Cave National park that had been donated to the government. This corporation was invited to extend operations to other areas in the national park system where the government had acquired or constructed the physical properties.

Further expansion along this line is dependent upon congressional appropriations for purchase of existing facilities and for construction of other facilities as needed.

**Interpretive Services Initiated.**—The basis for interpretive programs throughout the national park system is found in the desire of the visitor to develop his understanding and appreciation of characteristic park features; to be stimulated in his thinking; and to be guided in the full use of the park areas. In the scenic and scientific areas he wants to know the genesis of the Grand canyon; the cause of eruptive geysers; and the underlying causative factors of the other geological and the biological features. In the historic areas, his desire is to know who did what, when and where. In the early days of park use, information, frequently based upon folklore and local opinion, was furnished by the picturesque old-time guides. With the influx of visitors that came with the arrival of the motor age, the need was demonstrated for an interpretive service based upon the latest scientific and historical data. Such a service was inaugurated in Yosemite National park, in the form of a free nature guide service, in 1920. The California State Fish and Game commission, the University of Cali-

fornia and certain private interests co-operated in making this experiment possible. The guide service rapidly spread to other parks, both on a federal basis and with private financial assistance. Meanwhile the American Association of Museums secured funds from the Laura Spelman Rockefeller memorial to further the study for and construction and installation of museums in Yosemite and Yellowstone National parks. In 1946 the interpretive work has a much wider connotation than the public service represented by nature study trips and history tours. It means also research and much of the investigation upon which preservation, management and use of natural and historical values of park areas are based. It means information service, lectures, radio programs, motion pictures, photographs, lantern slides, signs, illustrated literature, markers, museum exhibits and a variety of visual aids employed in conveying the story of the United States to the multitude of park visitors. It is an organized program of popular study and conservation education. The informative talks by the park naturalists and historians reach millions of visitors annually. Some 130 trailside museums in the parks contribute notably to public understanding of the areas.

**Historic Sites Act.**—Although national monuments, military parks and other areas had long been established, it was not until 1935 that congress, through passage of the Historic Sites act, provided the implement for undertaking a comprehensive program for investigation, selection and protection of nationally significant historic and prehistoric sites. In the selection and evaluation of proposed sites the advisory board on national parks, historic sites, buildings and monuments passes on and recommends to the secretary those to be considered for national recognition. In June 1946 the national park system included more than 100 prehistoric and historic areas.

In addition to the historic sites established as units of the national park system, the Historic Sites act provides authority for the secretary of the interior to designate outstanding areas in state or local government or private ownership as historic sites and to enter into co-operative agreements with nonfederal agencies for the conservation of national historic sites regardless of title to the property.

As of June 1, 1946, the following seven national historic sites not federally-owned had been designated: Gloria Dei (Old Swedes') Church and Independence hall, Pennsylvania; Jamestown, Virginia; McLoughlin house, Oregon; St. Paul's Church, New York; San Jose mission, Texas; and Touro Synagogue, Rhode Island.

The national park service in its historical program endeavours to interpret to the public the broad national aspects of the history of the United States. Beginning with the undocumented history of the American Indian showing the colourful evolution of pre-Columbian peoples, the story carries through the period of documented history. Of the historical areas of the national park system, 18 relate to pre-Columbian history; 16 to social history; 6 to religious history; 12 to economic history; 3 to maritime history; 8 to the history of the westward movement; 6 to political history; 12 to biography; and 39 to military and naval history.

The national park service seeks to present a well-balanced program of prehistoric and historic sites illustrative of the growth and development of the United States in terms of physical remains. It emphasizes preservation rather than restoration or reconstruction, adhering to the principle that it is better to preserve than to repair, better to repair than to restore and better to restore than to reconstruct.

Through the Historic American Buildings survey, photographs and measured drawings have been made of many historic structures.

**Recreational Demonstration Areas.**—As part of the federal government's plan to acquire and reallocate mistreated and worn-out agricultural lands to better use, the national park service in 1934 undertook acquisition of 46 such areas in 24 states and their development as recreational demonstration areas, designed primarily to provide organized camp and other recreational facilities. Since these areas had never been considered part of the national park system, their development was a contribution of the service in the field of local recreation. By June 1, 1946, all but nine of the areas had been disposed of, mainly by transfer to the states in which they were located, but partly through adding them to existing national park areas or by transferring them to other federal agencies.

**Development of Recreational Areas in Connection with Water-Control Projects.**—Under co-operative agreement with the bureau of reclamation and the corps of engineers, the national park service administers the Boulder Dam National Recreational area in Arizona and Nevada, Shasta and Millerton Lakes Recreational areas in California and Lake Texoma Recreational area in Texas and Oklahoma. An agreement was pending in 1946 covering similar administration and development of the Grand Coulee Dam Recreational area.

**Co-operation with other Agencies.**—Under authority of the act of 1936 (49 Stat. 1894), the national park service co-operates with other federal and state agencies in planning for their park, parkway and recreational area programs. Under co-operative agreements with the bureau of reclamation and the corps of engineers, the service also investigates and appraises the recreational resources of reservoir projects throughout the country and prepares recommendations for their protection and use. The Civilian Conservation corps program provided opportunity for the greatest period of co-operation with state park agencies. Availability of CCC manpower and materials tremendously stimulated state park acquisition, planning and development.

The state park movement, however, had grown along with that in the national field, and even antedated national parks. In 1864 President Abraham Lincoln approved an act of congress setting aside Yosemite valley and the Mariposa Grove of Big Trees to be administered as a public trust by the state of California. Following establishment of Yosemite National park, these areas were receded to the federal government for inclusion therein. In 1885 New York's first state parks were established, and other state parks followed in the 1890s. Through the interest of national park service officials and other prominent conservationists, a meeting was called in Iowa in 1921 which resulted in establishment of the National Conference on State Parks to stimulate and give direction to the provision of outdoor recreational opportunities.

**The Inholding Problem.**—Probably the most serious single problem facing the national park service in 1946 was the existence, within authorized park boundaries, of about 600,000 ac. of land and water privately owned and used or belonging to state or other local governments. In private ownership at the time of park or monument establishment, such lands were not affected by the park status given the surrounding lands. On many of these inholdings there were developments that clashed violently with the standards of development established by the service, or types of use destructive of scenery or other resources. They interfered with comprehensive planning, and frequently precluded or made difficult the provision of facilities needed for public use.

The service was endeavouring to establish an orderly program of land acquisition, based on reasonable recurring appropriations and directed toward ultimate elimination of nonfederal land ownership from within authorized park boundaries. Such elimination would be through purchase at fair prices based on impartial appraisals or by exchange with lands of equal value in government ownership elsewhere. (I. F. S.)

**NATIONAL PROVINCIAL BANK LIMITED.** This great British banking institution, one of the "Big Five" (*see* BANKS, HISTORY OF), has over 1,300 branches in London and the provinces. The amalgamation movement wrought great changes in the English banking system, and the National Provincial bank has been closely identified with it, particularly during the period from 1918 to 1924. The most important amalgamation effected by the bank took place in 1918, when it took over the Union of London and Smiths bank, Limited. In the same year, the business of the Bradford District bank Limited was acquired. The Sheffield Banking company Limited was absorbed in 1919, the Northamptonshire Union bank Limited in 1920 and the Guernsey Banking company Limited in 1924. A number of private banks also were absorbed; in 1920 and 1924 respectively Coutts and Co. and Grindlay and Co. Ltd. became affiliated, though both organizations continue business in their own names.

The parent bank was founded in 1833. At the time of its establishment, the creation of joint stock banks had but recently been legalized, and any such banks conducting business within 65 miles of London were denied the right of issuing notes, at that time a lucrative privilege. It was decided to confine the banking activities of the new company to the provinces, thereby securing the right of note issue, and to maintain control from an administrative office in London. The first office was opened at Gloucester on January 1, 1834, and by 1838 there were 60 offices open. After some years the directors decided that the advantages of conducting business in London would outweigh those of retaining their note issue. Accordingly, business commenced in 1866 in Bishopsgate, London. At that time the bank was given a seat in the London Bankers' clearing house, a privilege hitherto withheld owing to the antagonism of the private banks to their joint stock rivals. In 1880 the institution was registered as a limited liability company. The growth of the National Provincial bank is shown in the following figures:—

| | Paid up capital and reserves | Deposits | No. of offices |
|---|---|---|---|
| | £ | £ | |
| 1870 . . . . | 1,513,373 | 15,734,999 | 133 |
| 1914 . . . . | 5,000,000 | 74,916,017 | 444 |
| 1938 . . . . | 17,979,416 | 310,383,397 | 1,324 |

On December 31, 1938, the accounts of the National Provincial bank disclosed a balance of current, deposit and other accounts amounting to over £310,000,000 and the manner in which these funds were utilized will be seen from the following summary of the balance sheet as at that date.

| *Liabilities* | £ | *Assets* | £ |
|---|---|---|---|
| Capital, paid up | 9,479,416 | Cash in Hand and at Bank of England | 34,320,774 |
| Reserve Fund | 8,500,003 | Cheques in course of Collection, etc. | 10,650,987 |
| Deposits | 310,383,397 | Money at Call and Short Notice | 17,991,280 |
| Acceptances, Engagements, etc., as *per contra* | 7,951,839 | Bills Discounted | 32,189,714 |
| Profit and Loss A/C | 573,588 | Investments | 86,802,779 |
| | | Advances | 139,586,104 |
| | | Bank Premises | 7,394,763 |
| | | Acceptances, Engagements, etc., as *per contra* | 7,951,839 |
| | £336,888,240 | | £336,888,240 |

While the bulk of its resources is employed in various interest-earning capacities, the bank keeps available in the form of cash in hand and balance at the Bank of England the substantial sum of £34,000,000. The item, money at call and short notice, of over £17,000,000, represents advances to the bill brokers and discount houses, chiefly against deposit of treasury bills or first class bank bills. These advances, as their name indicates, are very liquid and are repayable at short notice. Bills discounted include a large proportion of treasury bills and the item investments includes over £77,000,000 of British Government securities.

A large part of the bank's funds is employed in advances to customers. Trading and industrial concerns borrow considerable sums in the normal course of business and bank advances therefore occupy an important place in the economic structure.

**NATIONAL RECOVERY ACT:** *see* UNITED STATES.

**NATIONAL RESERVE.** A body of British ex-soldiers originally raised (as the "Veteran Reserve") in 1910 for service in time of grave national emergency, and registered with the County Associations. Field-Marshal Lord Roberts became colonel in 1911. It served at home in various capacities, providing guards over vulnerable points, messengers, etc., during the war of 1914–18, and at its close was disbanded.

**NATIONAL ROOSEVELT MIDLAND TRAIL,** an American highway connecting Newport News, Va., and Los Angeles, Calif., traversing about 3,550 miles. It passes over the Appalachian mountains on the eastern end, through the farming districts of the midwest, across the plains, through one of the most mountainous regions of the Rockies, and over Westgard Pass into California at the foot of the Sierra Nevadas. In this section, for 100 mi. on either side of Mt. Whitney, the highest American peak, there is a view of saw-tooth, snow-capped ranges. From Newport News to Kansas City, Mo., the roadway is paved, hard and improved; beyond it is partly paved, hard, gravelled or graded. Other localities served by the route are Richmond, Va., Charleston, W.Va., Lexington, Ky., Vincennes, Ind., St. Louis, Mo., Topeka, Kan., Denver, Hot Sulphur Springs and Grand Junction, Colo., Salt Lake City, Utah, McGill, Nev., and Big Pine and Olancha, Calif.

**NATIONAL SAVINGS.** Saving means the setting aside for future use of part of current income—the excess over the amount currently consumed or paid in taxes. Saving may thus be performed by anybody having an income—by an individual or family, or by a business firm. On account of disagreement as to the sense in which a government body has an income, there is some difference of opinion among economists as to whether or not it is appropriate to say that governments (as distinct from the citizens and businesses under their jurisdiction) carry on saving. But whether or not the *government* is said to save, the *nation* may be said to save the sum of the amounts saved by the individuals and business firms (plus government bodies if they are considered to have savings) which it includes. Since there are always some individuals and businesses whose current expenses and taxes outrun their incomes—and whose savings are therefore negative—national savings must be thought of as a *net* total with negative savings subtracted out.

**Forms Taken by Savings.**—Saving is often spoken of loosely as if it were synonymous with the piling up of "savings deposits," or of idle cash. This interpretation is misleading. While it is true by definition that savings are not spent on the consumption of the saver, it does not follow that they are not spent at all; indeed what is saved commonly is spent. It may be spent directly by the saver, or indirectly by business firms he helps to finance, on the purchase of new items being added to the community's stock of wealth, such as new houses or machinery. It may be spent indirectly on the consumption of some other person who borrows or sells property to finance his negative savings. Or it may help to finance a government deficit, thus supporting whatever spending the government is carrying on—whether for battleships or for highways, or for food to feed the hungry, or for routine government expenses. Part of current savings—sometimes a small part, sometimes a large part—appears in the form of increase in savings deposits and other cash assets held by the individuals or business firms doing the saving. The remainder is represented in their accounts by additions to their holdings of physical property, acquisition of government or private securities, reduction of their debts owed to others, etc.

**Savings and Investment.**—Under the generally accepted use of terms, it will always be found at the end of any accounting period that if the revenues and expenditures of government are equal ("the budget balanced") and if all government expenditures are on current account, national savings for the period amount to just as much as "investment" in new buildings, equipment, etc. This is a matter of definition. Saving means the excess of national income over consumption and taxes. "Investment" is taken to mean the excess of net national product (which is the same thing as national income) over the parts of the product made up of consumption goods and services and items bought by government expenditures. Since government expenditure is assumed equal to taxes, both saving and investment can be found by subtracting the sum of consumption and taxes from national income; so that they are necessarily equal.

Since economic progress depends largely on the increase of wealth through investment, it follows also that economic progress is linked with the achievement of national savings. Some increase in production might be possible without any net national savings, through increasing the labour force, finding new ways to use existing equipment and labour, and replacing old equipment and buildings as they wear out (*see* DEPRECIATION) with more modern types. But to make full use both of the growing labour force and of new methods of production requires a net increase of plant, equipment, etc.; besides this there is always a backlog of opportunities to increase production, with pre-existing methods and labour force, for which more equipment would have been required. The need of investment and savings to increase production is of course most acute in countries where modern technology has not yet been put into operation, and in devastated areas where houses, workshops, transportation equipment, etc., have been destroyed.

This is the meaning of the much-misunderstood doctrine of "abstinence": if there is to be an increase of productive wealth, somewhere in the economic system somebody must "abstain" from consuming his entire income. It does not necessarily follow that those who "abstain" from consuming are suffering. On the contrary, in so far as saving is left to individuals, it is performed chiefly by persons with high incomes who both save heavily and consume considerably more than the average. But for the community as a whole it is impossible both to consume the whole of current income and to build up productive wealth.

It should be observed that these propositions do not prove that economic progress either will or will not be served by an increased inclination to thrift on the part of individuals and business firms. Progress depends on the *achievement* of substantial investment and therefore of substantial savings. But as John Maynard Keynes has pointed out, decisions to save and decisions to invest are taken by different persons operating under different incentives. A decision by one individual to save more, unaccompanied by a decision by him or anybody else to invest more, cannot be guaranteed to increase the volume of saving and investment actually realized; in fact, many economists argue that

the effect would be to decrease that volume. This point will be examined further below.

**Effect of Government on Savings-Investment Relation.**—If the government's revenues and expenditures are unequal, the relation of savings to investment just described is modified. In a period of depression, for example, the tax base shrinks and reduces revenue, while the addition of relief, etc., to government responsibility increases expenditure. Government is therefore obliged to finance its expenditures in part either by borrowing, or by paying out cash on hand, or by issuing money. Some savers in consequence either use their savings to buy government securities, or hold more cash, or have larger balances with banks and other credit institutions while the latter have more cash and government securities. The same is true when a government deficit is incurred for war purposes.

In these circumstances, it is no longer true that the net total of savings made by individuals and businesses is equal to the net total invested by individuals and businesses in new productive wealth. *Private* savings exceed *private* investment by the amount of the deficit. Whether *national* savings are said to exceed *national* investment is a matter of language. Some part of government expenditure (used to pay for productive wealth such as hydroelectric dams, roads, needed buildings, recreation facilities) can reasonably be described as investment. Any excess of the deficit over such government investment can be described as negative saving by government, reducing the net total of national savings. This way of using language has the advantage of stressing the fact that when "government savings" are positive (that is, when government has an excess of revenue over current expenses, the excess serving to reduce government's net debt and to finance government investment) there can be an increase of the nation's productive wealth in the absence of private saving. But it has the drawback of inviting dispute as to the scope and measurement of government activity to be classified as "investment" (particularly in time of war) and leaving statistical measurements of national savings with a much wider range of possible error than measurements of private savings.

**Ways of Estimating Savings.**—For an individual, there are two ways to measure his savings for a given accounting period. One is to estimate his income and subtract his current expenditure, the difference being his savings. The alternative is to examine his balance sheet (his property and his debts) at the beginning and end of the period and measure the increase in net worth which reflects his saving. While the figures taken out of the individual's accounts under these two procedures are different, the two are logically equivalent. In either case it is necessary to make sure that we do not include in income (or in the increase of net worth) any items which reflect merely changes in price levels at which pieces of property are valued, or items reflecting events not regarded as linked with income—broadly speaking, to exclude capital gains and losses (whether realized or "paper") from income. For example, losses due to property destruction by enemy action in wartime, or gains due to a rise of prices on the stock market, would be excluded in income determination. If income is measured by the rules generally adopted by national income statisticians, the result is to exclude not merely the effects of price changes but some actual physical changes—chiefly losses —in wealth. The net total of savings estimated in this way tends to exceed the value of additions to the nation's stock of wealth to the extent that war damage, uninsured fire losses and similar events fail to appear in the income account. On the other hand, it tends to fall short to the extent that new wealth is found (for example through mineral discoveries) or that wealth becomes more useful through new techniques (for example through the development of dry farming techniques which made previously worthless land take on value).

For national totals, estimates based on changes in national wealth would be too unreliable for use, owing to the inaccuracy of the reports on which wealth statistics are based, the extraordinary difficulty of allowances for price changes, and other drawbacks. But the general principles just described suggest three other ways of estimating national savings:

(1) By estimating "investment," with adjustments for government.
(2) By estimating income of individuals, personal taxes paid, and consumption expenditures to give savings of individuals by subtraction, with separate estimates for savings of business corporations and of government bodies.
(3) By estimating changes in the various asset and liability accounts of individuals which reflect current savings, with separate estimates for the savings of business corporations and of government bodies.

All these methods are in practical use.

**Estimation of Investment.**—Investment estimates by decades from 1879 onward have been made for the United States at the National Bureau of Economic Research. These estimates testify to the power of a comparatively modest rate of saving to multiply productive wealth. The proportion of national income going into investment (called by the National Bureau of Economic Research "net capital formation") was between 10% and 12% most of the time from 1879 to 1929, and much lower 1929–39. But of the total "reproducible wealth outside households" existing in 1939, seven-eighths reflected accumulation after 1879, and two-thirds accumulation after 1899. Despite a population growth of more than 150%, 1879–1939, the amount of reproducible wealth outside households per capita nearly trebled. (These figures rest on estimates "in 1929 dollars," with price changes eliminated.)

Estimates of investment for the interwar period are available both from the National Bureau of Economic Research (through 1938) and the U.S. department of commerce (beginning with 1929). These are given in current dollars (*i.e.*, without price level correction) in Table I.

TABLE I.—*National Savings Measured by Investment, U.S.A., 1919–1941*
(billions of current dollars)

| Years | Construction of buildings, etc. | | Producers' durable equipment | Net changes in | | Gross total | | Depreciation and related charges | Net total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Private | Public | | Business inventories | Money metals and foreign claims | Private only | Incl. public construction | | Private only | Incl. public construction |
| | (1) | (2) | (3) | (4) | (5) | (6)*a* | (7)*b* | (8) | (9)*c* | (10)*d* |
| 1919–28 ave.*f* | $8.5 | | $4.9 | $1.8 | $1.0 | — | $16.2 | $8.4 | — | $7.8 |
| 1929–38 ave.*f* | 5.7 | | 4.2 | 0.1 | 0.2 | — | 10.2 | 8.3 | — | 1.9 |
| 1929–38 ave.*g* | $3.4 | $2.0 | $4.5 | $−0.2 | $0.5 | $8.3 | $10.3 | $8.1*e* | $2.2 | — |
| 1929 | $8.3 | 2.4 | 7.3 | 1.6 | 0.4 | 17.6 | 20.0 | 8.6*e* | 9.0 | — |
| 1930 | 5.6 | 2.8 | 6.0 | −0.3 | 0.8 | 12.1 | 14.9 | 8.8*e* | 3.3 | — |
| 1931 | 3.8 | 2.6 | 4.2 | −2.0 | 0.4 | 6.4 | 9.0 | 8.6*e* | −2.2 | — |
| 1932 | 1.8 | 1.8 | 2.4 | −2.3 | 0.3 | 2.2 | 4.0 | 8.1*e* | −5.9 | — |
| 1933 | 1.3 | 1.2 | 2.1 | −0.7 | 0.6 | 3.3 | 4.5 | 7.8*e* | −4.5 | — |
| 1934 | 1.6 | 1.5 | 3.1 | −0.1 | 0.7 | 5.3 | 6.8 | 7.7*e* | −2.4 | — |
| 1935 | 2.1 | 1.4 | 4.0 | 0.2 | 0.4 | 6.7 | 8.1 | 7.6*e* | −0.9 | — |
| 1936 | 2.9 | 2.2 | 5.2 | 2.2 | −0.3 | 10.0 | 12.2 | 8.3*e* | 1.7 | — |
| 1937 | 3.7 | 2.0 | 6.3 | 1.1 | 0.5 | 11.6 | 13.6 | 7.9*e* | 3.7 | — |
| 1938 | 3.3 | 2.1 | 4.5 | −1.3 | 1.2 | 7.7 | 9.8 | 7.2*e* | 0.5 | — |
| 1939 | 3.6 | 2.5 | 5.5 | 0.9 | 0.9 | 10.9 | 13.4 | 7.7*e* | 3.2 | — |
| 1940 | 4.3 | 2.8 | 6.9 | 1.8 | 1.8 | 14.8 | 17.6 | 8.0*e* | 6.8 | — |
| 1941 | 5.4 | 5.9 | 8.9 | 3.5 | 1.2 | 19.0 | 24.9 | 9.1*e* | 9.9 | — |

*a* Col. (6)=total of Cols. (1)+(3)+(4)+(5).
*b* Col. (7)=total of Cols. (2)+(6).
*c* Col. (9)=Col. (6) less Col. (8).
*d* Col. (10)=Col. (7) less Col. (8).
*e* Includes no allowance for depreciation of government property.
*f* From National Bureau of Economic Research.
*g* From U.S. Department of Commerce.

The net totals at the right-hand side of the table give a rough picture of the current value of net additions to the nation's productive wealth. The contrast between the 1919–28 and 1929–38 decades is somewhat exaggerated on account of the inaccurate measurement of the using-up of equipment, etc., by available statistics (*see* DEPRECIATION). Depreciation and similar charges in 1919–28 were too low to measure actual using-up, because much of the equipment in use had been bought before 1919 at prices below current replacement cost; these charges were too high during the depression years beginning in 1930, because the equipment in use had largely been bought in 1919–29 at prices above current replacement cost, and because actual wear and

tear was reduced by the low level of activity. Public construction apparently outweighed corresponding depreciation throughout. It is undoubtedly a fact, however, that from 1931 through 1935 additions to productive wealth were very small by previous standards; and there may have been a net shrinkage in 1932 and 1933 at the low ebb of the great depression.

**Estimation of Personal Incomes, Taxes, Spending and Savings.**—For the later years of the interwar period (1929–41), estimates of savings of individuals have been made by the U.S. department of commerce by subtracting estimated personal taxes and consumer expenditures from income payments to individuals. These estimates may be related to those given in Table I by adding the savings of corporations (adjusted to eliminate the effects of inventory revaluations on profits) and subtracting the amount of savings apparently absorbed by government. This is done in Table II.

TABLE II.—*Savings of Individuals and National Savings Measured by Incomes and Expenditures, U.S.A., 1929–1941*
(billions of current dollars)

| Year | Income payments to individuals (1) | Subtractions: Personal taxes (2) | Subtractions: Consumer expenditure (3) | Net savings of individuals (4)[a] | Corporate savings, adjusted for inventory values (5) | Apparent absorption of savings by gov't (6) | Net national savings (private only) (7)[b] |
|---|---|---|---|---|---|---|---|
| 1929 | $82.6 | 3.0 | 70.8 | 8.8 | 1.7 | 1.5 | 9.0 |
| 1930 | 73.3 | 2.6 | 64.9 | 5.8 | — .2 | 2.3 | 3.3 |
| 1931 | 62.0 | 2.4 | 54.2 | 5.4 | —3.0 | 4.6 | —2.2 |
| 1932 | 47.5 | 1.9 | 43.0 | 2.6 | —5.2 | 3.3 | —5.9 |
| 1933 | 46.3 | 1.8 | 42.4 | 2.1 | —4.7 | 1.9 | —4.5 |
| 1934 | 52.9 | 1.9 | 47.7 | 3.3 | —3.0 | 2.7 | —2.4 |
| 1935 | 58.6 | 2.3 | 52.2 | 4.1 | —1.9 | 3.1 | — .9 |
| 1936 | 68.1 | 2.9 | 59.1 | 6.1 | —1.2 | 3.2 | 1.7 |
| 1937 | 72.3 | 3.1 | 62.5 | 6.7 | —1.5 | 1.5 | 3.7 |
| 1938 | 66.2 | 3.3 | 58.5 | 4.4 | — .6 | 3.3 | .5 |
| 1939 | 70.8 | 3.1 | 61.7 | 6.0 | .0 | 2.9 | 3.1[c] |
| 1940 | 76.2 | 3.3 | 65.7 | 7.3 | 1.4 | 1.7 | 7.2[c] |
| 1941 | 92.7 | 4.0 | 74.6 | 14.2 | 0.8 | 3.4 | 11.6[c] |

*a* Col. (4) = Col. (1) less Cols. (2) and (3).
*b* Col. (7) = Cols. (4) and (5) less Col. (6).
*c* Differences from Table I reflect "adjustment for discrepancies" made by U. S. Department of Commerce for 1939–41.

These figures illustrate the fact that savings of individuals may diverge considerably from private investment; the largest difference in the table ($8,500,000,000 in 1932) is comparable in size to the total net investment of a prosperity year. Furthermore, even the year-to-year changes are not all in the same direction. This divergence results from fluctuations in corporate saving, and even more from shifts in government revenue and expenditure.

Residual calculations of saving have also been made by investigating the number of families and single individuals with incomes in different income-size classes, and the aggregate income, expenditure and taxes in each income-size class. These investigations make it clear that the average proportion of income saved is much larger for those with large incomes than for those with small incomes. In fact, many of those with low incomes spend more than their incomes, and average savings in the lowest income brackets are therefore negative. Unfortunately, all the magnitudes found in field studies of income and expenditure tend to fall somewhat short of corresponding national totals estimated in other ways—presumably chiefly because of lapse of memory on the part of those supplying the information—so that the allocation of savings by income brackets remains uncertain. The most that can be said positively is that the bulk of current savings must come from the wealthiest 5% or 10% of the population, and that saving is more equally distributed among rural than among urban people.

The inference often drawn from this evidence that saving would be sharply altered by measures to "redistribute" income is open to some doubt. The proportion of a hundred dollar difference in income which takes the form of a difference in saving is apparently more uniform among income size-classes than is the proportion of income saved.

**Assets and Liabilities.**—For the latter part of the interwar period (1933–1940), estimates of savings based on changes in the assets and liabilities of individuals have been made by the U.S. Securities and Exchange commission. Results for the eight-year period are summarized in Table III.

TABLE III.—*National Savings Measured by Changes in Assets and Liabilities, U.S.A., 1933–1940*
(billions of current dollars)

| Savings component | Net amount (A) | Allowance for depreciation, etc. (B) | Net amount (C)[a] |
|---|---|---|---|
| *Individual Savings*: | | | |
| 1. Growth in holding of currency and bank deposits | $13.9 | — | $13.9 |
| 2. Growth in balances with savings and loan associations. | —1.0 | — | — 1.0 |
| 3. Growth in insurance and pension reserves: | | | |
| a. Social security | 4.0 | — | 4.0 |
| b. Other (private) | 13.2 | — | 13.2 |
| 4. Net growth in holdings of securities | —1.9 | — | — 1.9 |
| 5. Growth in equity in non-farm dwellings | 6.5 | $11.4 | — 4.9 |
| 6. Growth of equity in automobiles | 15.0 | 14.7 | 0.3 |
| 7. Growth of equity in other durable consumers' goods | 34.1 | 30.9 | 3.2 |
| 8. Liquidation of debt not elsewhere classified | —1.9 | — | — 1.9 |
| 9. Business savings of farmers | 5.0 | 6.7 | — 1.7 |
| 10. Total individual savings | 86.9 | 63.7 | 23.2 |
| 11. Corporate saving | 19.2 | 30.0 | —10.8 |
| 12. Private saving (10 plus 11) | 106.1 | 93.7 | 12.4 |
| 13. Government saving (public construction less growth in debt): | | | |
| a. State and local | 9.0 | 2.9 | 6.1 |
| b. Federal | —10.3 | 1.5 | —11.8 |
| | —1.3 | 4.4 | — 5.7 |
| 14. National savings (12 plus 13) | 104.8 | 98.1 | 6.7 |

*a* Col. (C) = Col. (A) less Col. (B).

It will be observed that the estimates diverge sharply from those obtained by different methods, and on a somewhat different definition of savings, in Table II. The eight-year total from Table II, for individual net savings, in particular, is $40,000,000,000 as compared with $23,200,000,000 from Table III. Most of the difference must reflect the accumulation of numerical errors in one or both estimates rather than differences in the concept of savings used.

**War Savings.**—Savings under war conditions follow different patterns than in peace. Individuals and businesses set aside a larger proportion of their incomes, so that net private savings grow enormously. On the other hand, private investment is restricted because war needs divert labour and materials from making buildings and equipment for private use. Public construction and acquisition of equipment by government expands; but most of the resulting facilities are either used up in the war or are inconvertible to civilian uses thereafter. The consequence is a great growth in the paper wealth of individuals and business firms (corresponding to the growth of the government's debt) with little or no growth in actual productive wealth.

Not much precise information is available about savings during World War I. Interwar studies reveal that individuals and business firms saved in 1919 a much larger proportion of income than in any year in the 1920s, and that savings in 1920, though declining, were still high. For World War II, comparatively reliable

studies made at the time show that the proportion of income saved rose well above peacetime levels during 1941 and continued to rise through 1942 and 1943. At the peak of war activity, individuals were saving nearly one-third of their disposable incomes (*i.e.,* income payments less personal taxes), and corporations well over one-half of theirs. The total wartime accumulation by individuals amounted to far more than the income of any single year of the interwar period, and the great bulk took the form of additional currency, bank deposits, government securities, and claims upon life insurance companies.

It is probable that the savings of the richer groups of the population made up a much smaller proportion of the war savings than of peacetime savings; but the difference must not be exaggerated. About half of the wartime accumulation of individuals and corporations was accounted for by the growth in their holdings of government bonds—more than two-thirds in denominations of $500 and upwards—which were not to any great extent small savings. The proportion of the growth in bank deposits, currency and insurance claims representing large savers was probably still higher.

**Motives for Saving.**—Saving is a very complex phenomenon. Different savers save for different reasons, and a given saver for a mixture of reasons. At any given moment, furthermore, many individuals find themselves spending less or more than their incomes simply because their incomes are more or less than was expected when commitments to spend were made; this is true especially for farmers and self-employed business and professional men, whose incomes are subject to unexpected fluctuations. In so far as saving goes back to *decisions to save,* the main motives seem to be the following:

(1) Provision for a future period when income is expected to be less or the need for expenditure greater than at present—for example, provision for retirement, for education, or for vacations.
(2) Provision against unpredictable decline in income or growth in need—for example, against sickness in the family, or loss of earning power by the breadwinner.
(3) Acquisition of higher income, either by improving the equipment, etc., of a business, or by being housed better or at less expense, or by obtaining interest, dividends, rent or other "property income."
(4) Gain in social status through acquiring property.
(5) Direct subjective satisfaction from accumulation ("miser's instinct").

Pulling against these motives, of course, is the desirability of current consumption, and the desirability of having more leisure at the expense of potential income.

This hypothesis about the motives for saving explains the record fairly well. High-income individuals have greater incentives to save than low-income individuals, for example, because the former (a) are a group many of whose members are enjoying temporary increase of income and must expect a drop later on, (b) have better opportunities to place savings where they will yield income, (c) are more able to gain power and social approbation by saving, and (d) are less hard-pressed to maintain what they regard as necessary standards of consumption and of leisure. Rural people are more inclined to save than urban people of like income because (a) their incomes are more uncertain, (b) their opportunities to gain income from saving are better and the fruits of their savings (in buildings, livestock, equipment, etc.) are more visible and thus more conducive to improved social standing and direct enjoyment; furthermore, (c) their standards of consumption and of leisure are less exacting. War savings are higher than peacetime savings because (a) incomes are regarded as abnormally high and are above immediately previous levels, (b) ordinary outlets for "negative savings" (retirement of elderly people, education, prolonged vacations and medical treatments) are reduced, (c) incomes are less secure, (d) social pressures to save are intensified, (e) normal standards of consumption and leisure are suspended. The fact that the rising trend of real per capita income did not bring a rising trend in the proportion saved in the prewar and interwar period is explained by (a) progressive urbanization, (b) rising standards of consumption and leisure, (c) the trend away from private houses and away from direct ownership by individuals of tangible business property (which reduces both opportunities to gain income and opportunities to gain social status and direct satisfaction by increase of property), (d) the downward drift in interest rates, and (e) increased importance of some sources of "negative savings" (in particular the increased stress upon higher education and the increased proportion in the population of elderly people who tend to live on past savings). (*See* also CAPITAL AND INTEREST; CONSUMPTION; INCOME: ECONOMIC DEFINITION; INVESTMENT; NATIONAL DEBT; NATIONAL DIVIDEND; SOCIAL SECURITY.)

(A. G. HT.)

**NATIONAL SOCIALISM,** the name of a movement started as the Nationalsozialistische Deutsche Arbeiterpartei (NSDAP) by Adolf Hitler in Germany in 1919. Its name already reveals its emphasis upon nationalism, socialism, Germanism and the working class. Like Mussolini's fascism, it combined an appeal to extreme and exclusive nationalism and chauvinist expansionism with a revolutionary call to the masses. Many traits were from the beginning common to fascism and national socialism, which may be regarded as the German form of fascism. Both proclaim themselves the implacable enemies of liberalism and democracy, of individual rights and all movements of international co-operation and peace; both stress the subordination of the individual to the state, the inequality of men and races, the right of the strong to rule the weak, and the necessity of the principle of blind and unswerving obedience to leaders appointed from above. Both praise the military virtues, despise and reject pacifism, humanitarianism and charity, glorify hatred and conquest, and aim at the transformation of the whole nation into an armed camp and an instrument of perpetual readiness for warfare.

But national socialism has its peculiarly German roots. They can be traced to the Prussian tradition as it developed under the inspiration of great soldier kings like Frederick William I and Frederick II and men of blood and iron like Bismarck. This tradition has always regarded the militant spirit and the discipline of the Prussian army as the model for all individual and civic life. To it was added the tradition of political romanticism with its sharp hostility to rationalism, to the principles underlying the French Revolution, to the "superficiality" of the west, and with its emphasis on instinct, on the past, even on the remote past, and its proclamation of the rights of the exceptional over all universal law and rules. Thus the exceptional becomes a law unto himself. These two traditions were later enforced by the 19th-century adoration of "science" and of the "laws of nature" which with their "iron logic" worked out beyond all concepts of good and evil, and by a biological theory of life which led to the acceptance of that racialism first proclaimed by the Frenchman, Arthur, Count de Gobineau, in his *Essai sur l'inégalité des races humaines* (1853–55), and then propounded by Richard Wagner (1813–83), who combined it with a heroic ideal of the Nordic superman, and by his son-in-law Houston Stewart Chamberlain, whose *Foundations of the Nineteenth Century* (1899) profoundly influenced early Hitlerism. To romanticism, national socialism owes the vague and fluid conceptions of folk as the basis of cultural and political organization, and of *Weltanschauung* or "total world outlook" as opposed in the name of *Kultur* to the more rational civilization of the west.

In addition to these currents in the German tradition, it ought to be pointed out that Hitler's formation was influenced during his youth by specific Austrian movements. National socialism owes much to Dr. Karl Lueger (1844–1910), who organized the Catholic lower middle classes of Vienna in an anti-capitalistic and anti-Semitic movement called the Christian Socialist party, but who remained loyal to Habsburg conservatism, and to Georg von Schönerer (1842–1921), who combined racial anti-Semitism with a violent anti-Catholicism and pan-Germanic expansionism and a bitter hostility to the Habsburgs. Schönerer's disciple Karl Hermann Wolf founded among the Sudeten Germans in Bohemia a German Workers' party which was later to assume the name of Deutsche National-Sozialistische Arbeiterpartei, a few years be-

fore Hitler founded his almost identically named NSDAP in Munich. Much in Hitler's ferocious nationalism and his contempt of the Slavs can be explained by the experience of his youth amid the bitter nationality struggles of the multi-racial Habsburg empire.

When Hitler started his agitation in Munich immediately after the war of 1914–18 he found the intellectual soil well prepared by the writings of the German romanticists, and of the German publicists of the War of Liberation like Ernst Moritz Arndt (1769–1860) and Friedrich Ludwig Jahn (1778–1852). The last years before the war of 1914–18 were characterized by a renewed interest in romanticism and in the War of Liberation of 1813. In those years a German youth movement with its longing for a true community, a *Gemeinschaft,* the rebirth of the nation, and with its vague mystical enthusiasm for leadership and comradeship, expressed the opposition to rationalism and "bourgeois" liberalism. It had come largely under the influence of Friedrich Nietzsche (1844–1900) and the German poet Stefan George (1868–1933). Oswald Spengler (1880–1935), the author of *Decline of the West, Prussianism and Socialism* and *Years of Decision,* and Moeller van den Bruck (1876–1925), the author of *Der preussische Stil* and *Das Dritte Reich,* can be regarded as the immediate forerunners of national socialism in the intellectual field. But the intellectual preparation would in no way have been sufficient for the growth of national socialism in Germany if the defeat in the war of 1914–18 with its ensuing disillusionment and pauperization, especially in the lower middle classes, had not paved the way for Hitler's propaganda. The peace treaty of Versailles gave to Hitler a starting point, but the violent opposition which he evoked was not directed in reality against the peace treaty but against the fact that Germany had been defeated and that her plans had been frustrated. From the beginning Hitler's propaganda appealed to the military circles, who regarded the peace only as a temporary setback in Germany's expansionist program. Hitler added to the pan-Germanic aspirations for world hegemony the almost mystical fanaticism of a faith in the mission of the German race and the fervour of a social revolutionary gospel. In the years of political and economic depression which followed Germany's defeat, Hitler's appeal to the German masses as the bearers of the most exalted racial ideals in the world was eagerly accepted to counteract their inferiority complex.

Though Hitler accepted many elements of the technique of the bolshevik revolution, he found a powerful ally in the widespread fear of bolshevism which he exploited, first in Germany and then on a worldwide scale, posing as the bulwark against bolshevism. Thus he secured the financial and moral support of many conservative circles who misunderstood the revolutionary and nihilistic character of his movement, and of many influential members of the high finance group and of big business. On the other hand, he gained the adherence of the masses by vague promises of an anti-capitalistic order. The banner of the NSDAP was the red flag of the revolution, but altered to the German imperial colours by the addition of a white circle and a black swastika in the centre. Thus Hitler combined the appeal of social revolution and that of a militant and mystical nationalism; the extraordinary flexibility of his dynamic doctrine enabled him to stress different elements at different times and to adapt his attitude momentarily to changing circumstances, even with complete disregard for previous statements. His most important individual contribution to the theory and practice of national socialism was his deep understanding of mass psychology and mass propaganda in the contemporary world, and his genius for using the most refined and elaborate technique. His chapter on propaganda in *Mein Kampf* can be regarded as of the most fundamental importance. He stressed the fact that all propaganda must keep its intellectual level to the capacity of the least intelligent of those at whom it is directed, and that its content of truth does not count compared with the only valid criterion, that of success. "The slighter its scientific ballast, and the more exclusively it considers the emotions of the masses, the more complete the success."

Propaganda should say very little, but repeat this very little forever.

Hitler has understood that, especially with as wide and far-reaching a goal as world domination, it is of the utmost importance to be able to present under one common denominator all potential adversaries who may themselves change according to the circumstances. "The art of truly great popular leaders in all ages has consisted chiefly in not distracting the attention of the people, but concentrating always on a single adversary. The more unified the object of the people's will to fight, the greater will be the magnetic attraction of the movement and the more tremendous its impact. It is part of a great leader's genius to make even widely separated adversaries appear as if they belonged to but one category, because among weakly and indecided characters the recognition of various enemies all too easily marks the beginning of doubt of one's own rightness." It was a stroke of genius on the part of Hitler to find this common denominator in the Jews and in Judaism. This enabled him to discover the "Jew" behind all his changing adversaries, sometimes behind communism or Moscow, at other times behind Great Britain and the United States—in short, behind everybody and everything which at a given moment seemed to oppose his wishes or to arouse his wrath.

Anti-Judaism served him also for two other purposes. National socialism is fundamentally opposed to all concepts of international co-operation and universal catholicity; it destroys the framework of a common humanity with common and absolute standards of law, truth and good, applicable to all men. National socialism, therein following Nietzsche, regarded Christianity and prophetic Judaism, with their emphasis on the equality of all men under one common God and upon absolute standards of justice, as alien and inimical to the new hero ideal of the superrace which was interpreted—not by Nietzsche, but by the national socialists—as the true Germanic ideal. Judaism and the ethics of the Bible therefore stood in opposition to national socialism.

National socialism proclaimed the Germanic race as the new *corpus mysticum* on which the salvation of the world depends, as the embodiment of all nobility and creative genius, as the reich which must become the world-controlling reich. This reich necessarily had to have a *Gegenreich,* a counter-race which on a similarly worldwide basis would represent the antithesis of salvation and creative genius. So the Jewish race became the counter-race. National socialism saw its duty not only in the destruction of this counter-race, but in the preparation of the German race for its real task of establishing the new world order. The third reich, ruled by what Hitler called "the highest human species given by the grace of the Almighty to this earth," "will have, by suitable education of the youth, in the future a generation mature for the ultimate and greatest decision on this globe. The nation which will first take this road will be victorious," and become "one day the master of the globe."

Working from these principles, Adolf Hitler was able to carry his party from its small beginnings in a beer cellar in Munich to a dominant position in world politics within 20 years. Among his more important collaborators were Alfred Rosenberg, the author of *Der Mythus des 20. Jahrhunderts,* the most widely read book of the national socialist movement besides Hitler's own *Mein Kampf,* and of *Blut und Ehre;* Rudolf Hess, who helped Hitler write *Mein Kampf* during their internment in the fortress in Landsberg am Lech in 1924; Gregor Strasser, probably the most important of Hitler's collaborators, who separated from him in protest against the leader's opportunist policies and was killed in the blood purge of June 1934; his brother Otto Strasser, who in 1930 founded the Black Front as a more radical wing opposed to Hitler; Gottfried Feder, who drew up the first program of national socialism and was for several years its economic "expert" but has long since receded into oblivion; Capt. Ernst Röhm, the founder and organizer of the S.A. or *Sturm Abteilungen,* the National Socialist militia, who was purged in June 1934; Julius Streicher, who became famous through his anti-Semitic weekly, *Der Stürmer;* Heinrich Himmler, the organizer and commander of the S.S. or *Schutz Staffel,* Hitler's personal elite guard, and of the gestapo (*Geheime Staats Polizei*), the secret police; Joseph Goebbels, the master of national socialist propaganda;

Hermann Goering, the organizer of the German air force and controller of the German industrial mobilization; R. Walther Darré, the author of *Neuadel aus Blut und Boden* and organizer of the national socialist peasant policy; and finally Dr. Robert Ley, the leader of the German Workers' front.

It took 14 years for the NSDAP to conquer power in Germany. It had been born at a time when it was only one of many semi-revolutionary, reactionary and terrorist organizations springing up as *Freikorps* throughout Germany, composed of former officers and soldiers, students and other elements dissatisfied with the republican democratic and peaceful order which seemed to dawn for Germany in 1919. That it survived and absorbed all others was due to Hitler's leadership and to the fact that Capt. Röhm interested the Reichswehr in supporting Hitler. On Feb. 24, 1920, the NSDAP drafted in Munich, the centre of its activities, a program of 25 points, which in 1926 was declared unalterable, but which in reality has long been surpassed by developments. On Nov. 9, 1923, Hitler, supported by Field Marshal Ludendorff, attempted his first *Putsch* in Munich, but it miscarried. Reaction was so firmly entrenched then in Bavaria, however, that Hitler was let off with only a formal punishment. The ensuing years of political and economic consolidation in Germany did not allow Hitler to make any considerable progress, but the economic crisis at the beginning of the '30s and the lack of energetic measures on the part of the government against the indefatigable propaganda to undermine democracy brought the first great success of the NSDAP in the reichstag elections of Sept. 14, 1930. The reichstag elections of Nov. 6, 1932, marked a definite setback for Hitler and a weakening of his influence, but though his party in no way represented then a majority of the German people, an intrigue, started by Franz von Papen, prevailed upon the aged president of the German republic, Marshal Hindenburg, to name Hitler chancellor on Jan. 30, 1933. He was then only the head of a coalition cabinet of national socialists and members of the conservative and nationalistic right. A fire in the reichstag building on Feb. 27, 1933, gave Hitler the chance to rouse the spectre of a bolshevik revolutionary danger, to dissolve the communist party and to frighten large parts of the electorate. In spite of that, and in spite of widespread terrorism, the elections of March 5, 1933, the last elections held in Germany, gave the national socialists only 44% of the votes. But the new reichstag meeting on March 21, 1933, in the garrison church in Potsdam, the historic receptacle of Prussian military spirit, "enabled" the government to assume dictatorial powers. From that moment on, the relentless process of *Gleichschaltung* began, and within a very few months the German reich had become a totalitarian state which was entirely identical with the NSDAP in every concern of public or private life, and that means with the will of its leader. The death of Hindenburg on Aug. 2, 1934, removed the last conservative obstacle. Hitler became *Reichsfuehrer* and chancellor, the presidency was abolished, and all troops and officials were immediately forced to take the oath of fidelity to Hitler personally. The third reich was now to create the "new order" which, according to Hitler, was to last for 1,000 years.

But it was to be not a new order of authoritarianism and of inequality for Germany alone. Its dynamism was bound to expand and to spread. By its own nature it could not recognize any limits of its own volition, only limits set by opposed superior force. The first years were spent in absolute concentration upon forging that instrument which would enable national socialism to establish its military and industrial superiority and thus to fulfil its ambitions. With mounting success, the aims grew in quick progression. The first aim was to unite all Germans within the reich on the basis of "self-determination," which was proclaimed as the right of the German, but denied to other peoples. The next step foresaw the creation of a *Grosswirtschaftsraum,* or a *Lebensraum,* in which the German master race or *Herrenvolk* would rule over a hierarchy of subordinate peoples. The success of that plan widened it into the vision of a hemispheric order which would embrace all of Europe, western Asia and Africa, and finally of a world order which would establish the principles of national socialism, with its emphasis upon the Germans as the leading race, all over the globe. The extreme neo-mercantilism which received the new name of *Wehrwirtschaft* was accompanied by an extreme cultural autarchy, a resolute hostility against all "western" thought, a repudiation of all efforts at synthesis between western tradition and Germanism which had been the goal of most of the best Germans in the preceding centuries. The rejection of the west and its standards of justice, law and reciprocity led also to the proclamation of the official maxim that "Right is whatever profits the German nation; wrong is whatever harms it," which was regarded by Reichsminister Dr. Hans Frank, the head of the Academy of German Law, in an address on Dec. 4, 1939, as the "beginning of national socialist justice." The absolute world rule to which national socialism aspires will not only represent, according to national socialist expectations, a military, economic and political domination, but equally an intellectual and moral leadership. Their new world age or *Weltzeitalter* will be German and national socialist at the same time.

National socialist parties exist outside of the reich everywhere where there is a population of German descent which national socialist agitation has succeeded in organizing for its own aims. According to national socialist doctrine, loyalty to one's "race" or "blood" takes precedence over one's loyalty as a citizen. "Blood," and not a spiritual decision of allegiance, the new doctrine teaches, is the decisive factor. Wherever national socialist propaganda penetrates among people of German descent outside Germany, it tries to fill them with the same spirit dominant today in Germany, and to create the same institutions and organizations. Thus the implacable fight against democracy, against the principles of the equality of all citizens and of equal justice for all, is being carried directly into democratic countries. This disintegration of unity and morale in democratic countries serves at the same time as a preparation for future possible political or military actions against these states. National socialism, which started as a purely German movement, produced by conditions and traditions peculiar to Germany, has assumed after 20 years of incessant and successful struggle a worldwide importance, and bids to influence and determine the course of history on a worldwide scale.

BIBLIOGRAPHY.—Alfred Rosenberg, *Der Mythus des 20. Jahrhunderts* (1930); Gregor Strasser, *Kampf um Deutschland* (1932); Walther R. Darré, *Neuadel aus Blut und Boden* (1933); Oswald Spengler, *Politische Schriften* (1933) and *Years of Decision* (1934); Werner Sombart, *Deutscher Sozialismus* (1934); Erich Unger, *Das Schrifttum des Nationalsozialismus 1919–1934* (1934); J. E. Spenlé, *La pensée allemande* (1934); K. Heiden, *A History of National Socialism* (1934); J. Goebbels, *Der Angriff* (1935); R. Olden, *Hitler* (1936); F. L. Schuman, *The Nazi Dictatorship,* 2nd ed. (1936); Henri Lichtenberger, *The Third Reich* (1937); Edmond Vermeil, *Doctrinaires de la revolution allemande* (1938); Aurel Kolnai, *The War Against the West* (1938); Edgar A. Mowrer, *Germany Puts the Clock Back,* new ed. (1938); Hermann Rauschning, *Revolution of Nihilism* (1939) and *The Voice of Destruction* (1940); Karl Barth, *The Church and the Political Question of Our Day* (1939); Robert d'Harcourt, *The German Catholics* (1939); Adolf Hitler, *Mein Kampf,* 2 vols. (1925, 1927), English translation, unabridged (1940); K. Loewenstein, *Hitler's Germany,* new ed. (1940); F. W. Foerster, *Europe and the German Question* (1940); Gustav Stolper, *German Economy, 1870–1940* (1940); Edmond Taylor, *Strategy of Terror* (1940); Hans Kohn, *Not by Arms Alone* (1940) and *Revolutions and Dictatorships,* 2nd ed. (1941); Crane Brinton, *Nietzsche* (1941); G. F. Kneller, *The Educational Philosophy of National Socialism* (1941). (H. Ko.)

**NATIONAL WORKSHOPS** (in French, *Ateliers Nationaux*), the term applied to the workshops established to provide work for the unemployed by the French provisional government after the revolution of 1848. (The term is also incorrectly applied to the proposed *ateliers sociaux* of Louis Blanc [*q.v.*], state-supported co-operative productive societies.) The revolution was both preceded and followed by a severe financial and industrial crisis which rendered the problem of unemployment in Paris very acute. The provisional government under the influence of one of its members, Louis Blanc, and on the demand of a deputation of Parisian workers, passed a decree (Feb. 25, 1848) which contained bold promises assuring relief from the extreme conditions then prevailing. Moreover, this relief was to be immediate, effectual and universal. The following is an extract from the decree:—

"The provisional government of the French Republic undertakes to guarantee the existence of the workmen by work. It undertakes to guarantee work for every citizen."

For the carrying out of this decree, Louis Blanc wanted the formation of a ministry of labour, but this was shelved by his colleagues who, as a compromise, appointed the "Luxembourg" labour commission, under the presidency of Louis Blanc, with power of inquiry and consultation only. The carrying out of the decree of Feb. 25 was entrusted to the minister of public works, M. Marie, and various public works were immediately started. These included clearing the trench of Clamart and conveying the earth to Paris for the construction of a railway station on the chemin de fer de l'Ouest; construction of the Paris terminus of the Paris-Chartres railway; improvement of the navigation of the Oise; extension of the Sceaux railway to Orsay.

Those applying for work far exceeded in number the jobs available. There was no effective administrative service and no real desire on the part of the government to make the experiment a success.

The disorder and waste were amazing.

Owing to the increase in the number of those claiming work or relief, disorganization set in, and both the bureaus and the *mairies* became the centres of disturbances, those in charge of the offices being unable to control the crowds. As a consequence M. Marie commissioned Émile Thomas, a chemist, connected with the École Centrale, to reorganize the works. When Thomas took the work in hand on March 5, the number of unemployed had increased to 14,000 in addition to some 4,000 or 5,000 employed on public

works, and it was steadily on the increase. On March 16 the daily pay of the workmen who were not working was reduced to one franc; work was guaranteed for at least every other day, in which case the pay was to be two francs for the day.

The National Assembly had in the meanwhile been elected, and met on May 4. The Executive Commission was elected a few days later; Louis Blanc was excluded, but all the other members of the provisional government were on it. Blanc renewed his motion for a ministry of labour; this was rejected. The dispersal of the *emeute* of May 15 freed the Assembly from fear of the revolutionary clubs, and on May 15 Thomas received instructions to dismiss all unmarried men under 25 years of age who would not enlist in the army, all men who could not prove six months' residence in Paris, and all who refused offers of private employment. Piece-work was to be established instead of time-work, and men were to be prepared to be drafted into the provinces. The protests of Thomas held this plan up, but he was removed from office on May 26 and on June 20 the proposals were approved, and the sequel was the insurrection of June 23 and following days (*see* FRANCE: *History*).

BIBLIOGRAPHY.—E. Thomas, *Histoire des ateliers nationaux* (1848); L. Blanc, *Histoire de la révolution française de 1848* (1870–80); A. de Lamartine, *Histoire de la révolution de 1848* (1849); English Board of Trade, *Report on Agencies and Methods for dealing with the Unemployed* (*c.* 7182, 1893); R. W. Postgate, *Revolution from 1789 to 1900*, ch. iv. (1920).

**NATIONS, LAW OF:** *see* INTERNATIONAL LAW.

**NATROLITE,** a mineral species belonging to the zeolite group. It is a hydrated sodium and aluminium silicate with the formula $Na_2Al_2Si_3O_{10}\cdot 2H_2O$, and containing sodium ($Na_2O$, 16·3%). "Needlestone" or "needle-zeolite" are other names, alluding to the common acicular habit of the crystals, which are often very slender and are aggregated in divergent tufts. Larger crystals have the form of a square prism terminated by a low pyramid: the prism angle being nearly a right angle (88° 45½′), the crystals are tetragonal in appearance, though actually orthorhombic. There are perfect cleavages parallel to the faces of the prism. The mineral also often occurs in compact fibrous aggregates, the fibres having a divergent or radial arrangement. Natrolite is usually white or colourless, but sometimes reddish or yellowish. The lustre is vitreous, or in finely fibrous specimens sometimes silky. The spec. grav. is 2·2, and the hardness 5½. The mineral is readily fusible. It is decomposed by hydrochloric acid with separation of gelatinous silica.

**NATTIER, JEAN MARC** (1685–1766), French painter, was born in Paris in 1685, the son of Marc Nattier, a portrait painter, and of Marie Courtois, a miniaturist. He received his first instruction from his father, and took the first prize at the Paris Academy at the age of fifteen. He refused to study at the French Academy in Rome, and in 1715 went to Amsterdam, where Peter the Great was then staying. There he painted portraits of the tsar and the empress Catherine, but declined an offer to go to Russia. Between 1715 and 1720 he painted the "Battle of Pultawa," for Peter the Great, and the "Petrification of Phineus and of his Companions," which led to his election to the Academy. The financial collapse of 1720 caused by the schemes of Law all but ruined Nattier, who was obliged to turn to portraiture. He became the painter of the artificial ladies of Louis XV.'s court. The most notable examples of his straightforward portraiture are the "Marie Leszczinska" at the Dijon Museum, and a group of the artist surrounded by his family, dated 1730. He died in Paris in 1766.

Among his pictures are the "Magdalen" at the Louvre; "La Camargo" and "A Lady of the Court of Louis XV." at Nantes; the "Head of a Young Girl" at Orléans and "Mme. de Pompadour" at Marseilles. The Versailles Museum owns an important group of two ladies, and the Dresden Gallery a portrait of the "Maréchal de Saxe." In the Wallace collection are "The Comtesse de Dillières," "The Bath (Mdlle. de Clermont)," "Portrait of a Lady in Blue," "Marie Leszczinska" and "A Prince of the House of France." Nattier's works have been engraved by Leroy, Tardieu, Lépicié, Audran, and other noted craftsmen.

*See* "J. M. Nattier," by Paul Mantz, in the *Gazette des beaux-arts* (1904); *Life of Nattier*, by his daughter, Madame Tocqué; *Nattier*, by Pierre de Nolhac (1904, revised 1910); and *French Painters of the XVIIIth Century*, by Lady Dilke (London, 1899).

**NATURAL BRIDGE,** a small village of Rockbridge county, Va., in the western part of the State, 179 m. by rail W. of Richmond, and about 16 m. S.E. of Lexington, the county seat. It is served by the Chesapeake and Ohio and the Norfolk and Western railways. In the vicinity of the village, which is about 1,500 ft. above sea-level, is the great natural curiosity from which it derives its name—a bridge of natural rock 90 ft. long and from 50 to 150 ft. wide, which spans Cedar Creek at a height of 215 ft. above that stream. It consists of horizontal limestone strata, and is the remains of the roof of a cave or underground tunnel through which the creek once flowed. It is crossed by a public road. In the village are magnesia and lithia springs and a saltpetre cave.

**NATURAL GAS** is the name given to the inflammable gas which occurs in porous, sub-surface, imperviously capped earth formations. Petroleum is found in many instances with the gas. Brine waters are generally present. The occurrence of natural gas is wide-spread both geographically and geologically. Geographically, natural gas is produced in North America, South America, Europe, Asia, and Africa. The major producing fields of North America are: Texas, California, Louisiana, Oklahoma, West Virginia, and Pennsylvania; in Canada, the provinces of Alberta and Ontario; in Mexico, the States of Vera Cruz, Tamaulipas, and Tabasco; in South America, Venezuela, Colombia, Peru, Argentina, Ecuador, and Trinidad; in Europe, the Soviet Union, Rumania, and Poland; in Asia, Iraq, Iran, Netherlands East Indies, Bahrein Island, British India, and Japan; and in Africa, Egypt. Geologically, these deposits of natural gas are variously found in the Carboniferous, Devonian, Silurian, Ordovician, Cambrian, Tertiary, Cretaceous, and Jurassic systems.

**Chemical Composition.**—Natural gas is for the most part composed of the hydrocarbons of the paraffin series. However, its composition varies considerably in the different fields. Carbon dioxide, nitrogen, hydrogen sulphide, and helium are sometimes present. Natural gas of the East American or Appalachian field is almost entirely made up of methane, ethane, propane, the butanes, and the vapours of pentane, hexane, heptane, and octane. The gas from some parts of Texas, Oklahoma, and Kansas is high in nitrogen content and some of these high nitrogen gases contain helium. The content of nitrogen is so high in some of the gas from the wells of West Texas, that the gas is non-combustible. Practically all the so-called "sour" gas contains hydrogen sulphide and organic sulphur compounds. Some natural gas of California, Colorado, Utah, New Mexico, and Washington contains high percentages of carbon dioxide. Natural gas suitable for producing solid carbon dioxide is obtained in several States and natural "dry ice" plants have been built in all these States except New Mexico, to utilize this gas. The rated capacity of these plants totals 80 to 100 tons daily.

Natural gas wells are, and have been for the most part, remote from the gas-consuming markets. Fusion-welded and "Dresser-coupling" steel lines are used in the transportation of gas. Many of these lines are more than 100 miles in length—one line is 1,000 miles long. The pressure of transportation varies from 200 to more than 400lbs.—one line transports gas at 1,300lbs. pressure. When and where natural well pressures are inadequate to effect delivery, compressing stations are installed. One large gas-transporting company has 72,700 installed horse-power compressing capacity. Many of the transporting lines are 20 to 22 inches in diameter—one is a 36-inch line. During the winter months when consumption is large, temperatures are low, and transporting pressures are high, it has been necessary to install dehydrating plants on the large lines to eliminate stoppage of lines due to the formation of crystalline hydrates. The hydrate of methane contains 6 molecules of water, while those of ethane, propane, and iso-butane contain 7 molecules of water. These hydrates are stable at all temperatures below 66° F. The other hydrocarbons of natural gas do not form hydrates. The wholesale metering of gas in the large transporting lines is effected with orifice meters. The average deviation of natural gas from Boyle's law at 60° F. is approximately 8% at 300lbs. pressure and 20% at 1,300 pounds.

Natural gas as distributed is for the most part refined. It has been processed for the elimination of suspended and finely di-

vided solids and water. On practically all the large transporting systems, gasoline and liquefied petroleum gas recovery plants are installed. In some few instances natural gas is processed to remove its content of hydrogen sulphide and organic sulphur compounds. The so-called "dry" natural gas of commerce is mainly made up of the hydrocarbon methane associated with varying quantities of ethane, propane, and the butanes. The total heating value per cubic foot, measured at 60° F. and 30 inches mercury pressure, varies from 1,000 to 1,200 British thermal units. The specific gravity (air=1) varies from ·56 to ·67. The explosive limits are 4·8 to 15.

The liquefied hydrocarbons—whose critical temperatures are above the prevailing atmospheric temperatures—are ethane, propane, normal butane, and iso-butane. These are recovered in a high state of purity in plants generally associated with natural gasoline recovery plants.

**Gasoline Recovery.**—Natural gasoline is recovered by three processes: compression and cooling, oil absorption, and charcoal adsorption, and is marketed in a variety of grades, generally based upon two factors; the Reid Vapour Pressure Test at 100° F., expressed in pounds per square inch pressure, and the percentage which is distillable and recoverable at 140° F. Both methods are official and standardized by the U.S. Bureau of Mines. The chemical composition of natural gasoline will vary with its grade of commercial quality. Generally speaking it is composed of normal butane, the pentanes, the hexanes, the heptanes, and the octanes. Those gasolines which have Reid vapour pressures in excess of 22 pounds at 100° F. also contain variable quantities of iso-butane and may carry some propane. Practically all the marketed natural gasoline is processed to remove hydrogen sulphide and organic sulphur by some one of the following treatments: dilute caustic soda, dilute sodium hypochlorite, cupric sulphate or monoethanolamine.

The deepest natural gas producing well in the U.S. was drilled to a depth of 15,004ft. at Wasco, Calif., in 1938. There are now over 54,000 gas wells operating in the U.S. The Candelaria Well No. 1 in Harris county, near Houston, Texas, has a "shut-in" pressure of 4,800 pounds gauge pressure. The depth of this well is 8,101 feet.

**Major Uses of Natural Gas.**—The following are statistical data for the United States in 1937:

(1) As Fuel—(domestic, commercial, and industrial), 2,370,000,000,000 cu.ft.

(2) As source of Carbon Black Manufacture—510,606,000lbs. produced.

(3) As source of Natural Gasoline Recovery—2,039,100,000gals.

(4) As source of Liquefied Petroleum Gas Recovery—141,505,000gals.

(5) As source of Helium Recovery—4,809,230 cu.ft.

(6) As source of Carbon Dioxide (Dry Ice)—20,000,000lbs.

**Minor Uses of Natural Gas.**—The following are data for the United States in 1937:

(1) Pentane in the production of 50 synthetic chemicals of greater or less commercial importance.

(2) Mixtures of ethane, propane, and the butanes in the mass production of one hundred synthetic chemicals—alcohols, alcohol ethers, ketones, esters, acids, acid anhydrides, aldehydes, oxides, amines, ethers, and chlorinated derivatives.

(3) Mixtures of ethane, propane, and the butanes in the mass production of "poly" gasoline—a motor fuel of high octane rating.

(4) Butane in the production of butadiene, synthetic rubber, and as a solvent for the extraction of oils, fats, resins, nicotine, and perfumes.

(5) Propane as fuel in isolated districts and as selective solvent in mass production of motor oils of low cold test, high viscosity index, better colour and bloom, and high resistance to oxidation and the formation of carbon and sludge.

(6) Ethane in the production of ethylene—useful in citrus fruit ripening, as an anaesthetic, as a refrigerant, and in the manufacture of mustard gas and ethylene bromide. Large quantities of the latter chemical are used in connection with tetraethyl lead to yield high octane (anti-knock) motor fuels. (J. B. G.)

**NATURALIZATION:** *see* NATIONALITY AND NATURALIZATION.

**NATURALISM,** in philosophy, is the view which maintains that all explanation should keep within the realm of what is natural, and avoid all recourse to the supernatural. Thinkers may be agreed about this even if they differ on many other points. Thus, for example, materialism, pantheism, positivism are all naturalistic; but it is absurd to equate them for that reason.

**NATURAL LAW,** in science, means the formulation of some uniform characters or connection of things or events; but it is frequently used for the uniformity itself as it exists in natural phenomena. Any such uniformity may be called a natural law (*e.g.*, all the laws formulated in Physics and Chemistry). On the other hand the term "Law of Nature" is sometimes restricted to irreducible or ultimate laws (like the Law of Gravitation), as distinguished from derivative laws (like Kepler's three laws of planetary motion). *See* LAW (in science, etc.); SCIENTIFIC METHOD; J. S. Mill, *System of Logic* (1875, etc.).

**NATURAL RESOURCES, CONSERVATION OF.** This term came into common use in the United States early in the present century and had public attention focused upon it by a conference of governors of the States, called by President Roosevelt on May 13–15, 1908, which resulted in the National Conservation Commission. The latter issued an exhaustive report in 1909, and the same year Canada established the Commission of Conservation for Canada. Many States have since formed conservation commissions, as have many nations of the world. The National Trust and other bodies perform equivalent functions in Great Britain.

Productive use of agricultural land, continuous production of forests, skilful development of waters coupled with the protection of their forests, economy in the use of mineral reserves, the building up of fisheries, the increase of the protection of wild life and the proper handling and safeguarding of recreation resources are instances of conservation. Use of natural resources without waste, economic development to secure from them the maximum service, continuous production of renewable resources and permanence of industries and of community life, lie as the basis of the conservation principle. In the article entitled PHYSICAL RESOURCES OF THE WORLD, a description is given of the known reserves of the world. *See* also BIOLOGICAL SURVEY; GAME RESERVES; NATIONAL PARKS AND MONUMENTS; NATURE RESERVES.

**NATURE.** In the history of philosophy the term "nature" has been used in various inconsistent senses, corresponding more or less to the different attitudes which thinkers adopted towards the material part of the world in relation to the rest. The early Greek thinkers known as the hylozoists were not conscious of any fundamental difference between mere matter, on the one hand, and life and consciousness on the other. For them, accordingly, "nature" (*φύσις*) included everything that is, or that ever came into being (Latin *natura* from *nasci*, to be born). Later on the Sophists contrasted the "natural" with the "conventional," or that which anything is originally and what it is as the result of human intervention. In this way they and others described as conventional not only law and custom, but even colours and other secondary qualities in contrast with matter and motion. Thus the "natural" came to be contrasted with the "human" and, of course, the superhuman. Then owing partly to the influence of Plato, and partly to the influence of Christianity, it became customary to set body and mind (to say nothing of Platonic "Ideas," the "Good," and God, etc.) sharply against one another, and to identify "nature," or "the world and the flesh," with the material part of the universe only. This is one of the reasons for the rather common tendency to identify "naturalism" with materialism. With the Renaissance there came a more friendly attitude towards the material world, and the older Greek conception of "nature" was revived. And so in due course we find in Bruno and Spinoza, among others, the term "nature" used in the all-comprehensive sense of the entire universe—a sense which, of course, excluded the possibility of anything "supernatural." Hence the other meaning of the term "naturalism," merely as the antithesis to "supernatural-

ism" in science and philosophy. For the conception of nature in recent science *see* A. N. Whitehead, *The Concept of Nature* (1920).

**NATURE RESERVES:** *see* WILDLIFE RESERVES.

**NAUEN,** a town in the Prussian province of Brandenburg, Germany, 22 mi. N.W. of Berlin on the Berlin-Hamburg railway. Pop. (1939) 12,167, 70% Protestant. It was formerly an old German toll-house, and has a harbour connecting with the Havelland main canal. It has a powerful radio broadcasting station.

**NAUGATUCK,** a borough of New Haven county, Connecticut, U.S.A., land area 16.6 sq.mi. on the Naugatuck river, 15 mi. N.W. of New Haven. It is served by the New York, New Haven and Hartford railroad, and there is an aviation field 6 mi. from the business district. Pop. (1920) 15,051 (32% foreign-born white); 1940, federal census, 15,388. The principal public buildings, including a fine high school, are grouped around the central green. A mile to the north is the 18th century Porter tavern, and 2 mi. south the Collins tavern (1810), a noted stopping-place on the stage-coach route between New Haven and Litchfield. The manufacture of rubber goods (including 100,000 pairs of shoes and boots daily) is the leading industry, and one of the largest rubber-regenerating plants in the world is situated there. Other important products are safety-pins (1,000,000 daily), candies, malleable iron castings, copper floats and aircraft instruments. The aggregate factory output was valued at $16,087,524 in 1927. Naugatuck was the home of Charles Goodyear (*q.v.*) who in 1839 invented the process of vulcanizing rubber. The name is an Algonkin word meaning "one tree."

**NAUHEIM** or **BAD-NAUHEIM,** a watering-place of Germany, in the *Land* of Hesse, situated on the north-east slope of the Taunus mountains, 24 mi. by rail N. of Frankfort-on-Main on the main line of railway to Cassel. Pop. (1939) 12,981. Nauheim, which was bestowed by Napoleon upon Marshal Davout, became a town in 1854. From 1815 to 1866 it belonged to the electorate of Hesse-Cassel, but in 1866 it was ceded to the grand-duchy of Hesse-Darmstadt. Its thermal waters (84° to 95° F.), although known for centuries, were, prior to 1835, only employed for the extraction of salt. The waters, which are saline, strongly impregnated with carbonic acid, and to a less extent with iron, are principally used for bathing, and are specific in cases of gout and rheumatism, but especially for heart affections. Three smaller springs, situated outside the Kurpark, supply water for drinking. In 1899–1900 a new spring (saline) was tapped at a depth of 682 ft. Another attraction of the place is the Johannisberg, a hill 773 ft. high, overlooking the town.

**NAUKRATIS,** an ancient Greek settlement in Egypt. The site was discovered by Professor W. M. Flinders Petrie in 1884, on the eastern bank of a canal, about 10 mi. W. of the present Rosetta branch of the Nile. In ancient times it was approached by the Canopic mouth, which was farther to the west. The identification of the site is placed beyond doubt by the discovery of inscriptions, with the name of the town, and of great masses of early Greek pottery. The site was excavated in 1884–86 by the Egypt Exploration fund, and a supplementary excavation was made by the British school at Athens in 1899. A list of the temples of Naukratis is given by Herodotus (ii, 178); they were the Hellenion, common to all the colonizing cities, and those dedicated by the Aeginetans to Zeus, by the Samians to Hera, and by the Milesians to Apollo. A temple of Aphrodite is also mentioned by Athenaeus. Traces of all these temples, except that of Zeus, or at least dedications coming from them, have been found in the excavations, and another has been added to them, the temple of the Dioscuri. In addition to these temples, there was also found a great fortified enclosure, about 860 ft. by 750, in the southeastern part of the town; within it was a square tower or fort. A portico of entrance and an avenue of rows of sphinxes was added in Ptolemaic times, as is shown by the foundation deposits found at the corners of the portico; these consisted of models of the tools and materials used in the buildings, models of instruments for sacrifice or ceremonies, and cartouches of King Ptolemy Philadelphus. Dr. Hogarth subsequently found traces of another great walled enclosure to the northeast of the town, together with pottery dedicated τοῖς τῶν Ἑλλήνων θεοῖς, and he claims with reason that this enclosure is more likely than the other to be the Hellenion.

Apart from the historic interest of the site, as the only Greek colony in Egypt in early times, the chief importance of the excavations lies in the rich finds of early pottery and in the inscriptions upon them, which throw light on the early history of the alphabet. There are clear traces of a settlement going back to the 7th century, including a scarab factory, and yielding fragments of early Greek pottery. It seems a fair inference that the makers of these were Greeks, and that they probably represent the early Milesian colony, settled here in the time of Psammetichus I.

**NAULETTE,** a large cavern on the left bank of the Lesse, which joins the Meuse above Dinant, Belgium. Here in 1866 Edouard Dupont discovered an imperfect human lower jaw, now in the Brussels Natural History museum. It is of a very ape-like type in its extreme projection and that of the teeth sockets (teeth themselves lost), with canines very strong and large molars increasing in size backward. It was found associated with the remains of mammoth, rhinoceros and reindeer. The Naulette man is now assigned to the Mousterian Epoch.

*See* G. de Mortillet, *Le Préhistorique* (1900); J. Dechelette, *Archéologie,* vol. i, p. 281 (1912).

**NAUMACHIA,** the Greek word denoting a naval battle (*ναῦς,* ship, and *μάχη,* battle), used by the Romans as a term for a mimic sea-fight. These entertainments took place in the amphitheatre, which was flooded with water, or in specially constructed basins (also called *naumachiae*). The first on record, representing an engagement between a Tyrian and an Egyptian fleet, was given by Julius Caesar (46 B.C.) on a lake which he constructed in the Campus Martius. In 2 B.C. Augustus, at the dedication of the temple of Mars Ultor, exhibited a naumachia between Athenians and Persians, in a basin probably in the *horti Caesaris,* where subsequently Titus gave a representation of a sea-fight between Corinth and Corcyra. In that given by Claudius (A.D. 52) on the *lacus Fucinus,* 19,000 men dressed as Rhodians and Sicilians manoeuvred and fought. The crews consisted of gladiators, condemned criminals, and in later times, volunteers.

*See* GAMES: *Classical;* ROME: *Ancient City;* PANATHENAEA.

**NAUMBURG,** a town in the *Land* of Saxony, Germany, the seat of the provincial law courts and court of appeal for the province and the neighbouring districts. It is situated on the Saale, near its junction with the Unstrut, 29 mi. S.W. from Halle, on the railway to Weimar and Erfurt. Pop. (1939) 36,310. In the 10th century Naumburg was a stronghold of the margraves of Meissen, who in 1029 transferred to it the bishopric of Zeitz. In 1564 the last bishop died, and the bishopric fell to the elector of Saxony. In 1631 the town was taken by Tilly, and in 1632 by Gustavus Adolphus. It became Prussian in 1814. The cathedral, a building in the Romanesque Transition style (1207–42), has a Gothic choir at each end, and contains some mediaeval sculptures. It is remarkable for its large crypt and its towers.

**NAUNDORFF** (or NAÜNDORFF), **KARL WILHELM** (d. 1845), French pretender, claimed to be the dauphin, Louis Charles, son of Louis XVI and Marie Antoinette, who was announced as having died in the Temple in 1795.

Naundorff, who had arrived from nowhere in Berlin in 1810, with papers giving the name Karl Wilhelm Naundorff, in order to escape the persecutions of which he declared himself the object, settled at Spandau in 1812 as a clockmaker, and married in 1818 Johanna Einert. In 1822 he removed to Brandenburg, and in 1828 to Crossen, near Frankfurt. He was imprisoned from 1825 to 1828 for coining, though apparently on insufficient evidence, and in 1833 came to push his claims in Paris, where he was recognized as the dauphin by many persons formerly connected with the court of Louis XVI. Expelled from France in 1836, the day after bringing a suit against the duchess of Angoulême for the restitution of the dauphin's private property, he lived in exile until his death at Delft on Aug. 10, 1845, and his tomb was inscribed "Louis XVII, roi de France et de Navarre (Charles Louis, duc de Normandie)."

BIBLIOGRAPHY.—For the case of Naündorff *see* his own narrative,

*Abrégé de l'histoire des infortunes du Dauphin* (1836; Eng. trans., 1838); also Modeste Gruau de l'Barre, *Intrigues dévoilées ou Louis XVII . . .* (3 vols., Rotterdam, 1846–48); O. Friedrichs, *Correspondance intime et inédite de Louis XVII.* (Naundorff) 1834–38 (2 vols., 1904); *Plaidoirie de Jules Favre devant la cour d'appel de Paris pour les héritiers de feu Charles-Guillaume Naundorff* (1874); H. Provins, *Le Dernier roi légitime de France* (2 vols., the first of which consists of destructive criticism of Beauchesne and his followers, 1889); A. Lanne, "Louis XVII, et le secret de la Révolution," *Bulletin Mensuel* (1893, *et seq.*) of the Société des études sur la question Louis XVII, also *La Légitimité* (Bordeaux, Toulouse, 1883–98). *See* further, the article "Naundorff" in M. Tourneux, *Bibl. de la ville de Paris pendant la Révolution,* vol. iv (1906).

**NAUNTON, SIR ROBERT** (1563–1635), English politician, was educated at Trinity college, Cambridge, of which he became a fellow in 1585. He entered parliament in 1606 for Helston, and sat in five successive parliaments. Through Buckingham's influence he became secretary of State in 1618; his strong Protestant opinions and enforcement of the laws against the Catholics brought complaints from the Spanish ambassador Gondomar and censure from the king. Naunton then resigned. He died at Letheringham, Suffolk, on March 27, 1635. He wrote *Fragmenta Regalia* (1641, 2nd ed. 1653; Arber reprint, 1870), a valuable account of Elizabeth's reign.

See *Memoirs of Sir Robert Naunton* (1814).

**NAUPLIA,** a town in the Peloponnesus, at the head of the Argolic Gulf, the seaport of the plain in which Argos and Mycenae are situated, with several tombs of the Mycenaean age. A hero Nauplius took part in the Argonautic expedition; another was king of Euboea. In classical times it was of no importance, and Pausanias, about A.D. 150, found it deserted. The mythic importance of the town revived in the middle ages, when it became chief city of the Morea. It was captured in 1211 by Godfrey Villehardouin with the help of Venetian ships; a French dynasty ruled in it for some time, and established feudalism. In 1388 the Venetians bought Argos and Nauplia. In the wars between Venice and the Turks it often changed masters: given to the Turks in 1540, it was recaptured by Venice in 1686, and the Palamidhi hill overhanging the town was fortified. In 1715 it was taken by the Turks; in 1770 the Russians occupied it for a short time. The Greeks captured it during the War of Independence on Dec. 12, 1822, and it was the seat of the Greek administration till 1833, when Athens became the capital of the country. It is the chief town of the department of Argolis. Population is 7,600.

**NAURU:** *see* PACIFIC ISLANDS.

**NAUSEA,** sea-sickness, or generally any disposition to vomit; also used figuratively to denote feelings of strong aversion or dislike.

**NAUSICAA,** in Greek legend, daughter of Alcinous, king of the Phaeacians in the island of Scheria (*Odyssey,* vi, 15–315, viii, 457). When Odysseus (*q.v.*) swam ashore to Scheria, he was found by Nausicaa, who supplied him with clothes and took him to her father's palace, where he was hospitably entertained.

**NAUTCH,** an Indian ballet-dance (Hindostani *nach*). The nautch is performed by nautch-girls, who scarcely move their feet, and the dance consists of swaying and posturing with the arms.

**NAUTILUS,** the name given by the ancient Greeks to a cephalopod mollusc, *Argonauta argo* (the paper nautilus). Linné, however, applied it as a scientific designation to another cephalopod, the pearly nautilus of eastern seas, and named the "nautilus" of the Greeks, *Argonauta.* The structure and zoological position of the pearly nautilus are discussed in the article CEPHALOPODA. It is represented at the present time by four species, which are restricted to the area between the Fiji and the Philippine islands. It usually lives near the sea bottom at considerable depths, though at night it comes into shallow water where it is caught for food by the natives.

The paper nautilus (*Argonauta*) is found in practically all subtropical and tropical seas. Although it has been taken from depths over 500 fathoms it is characteristically found at the surface. It is placed along with a few other genera in a separate family of the Octopoda or eight-armed cephalopods. The genus is characterized by several very peculiar features. In the first place the male *Argonauta* is very much smaller than the female, the latter in certain cases being as much as 15 times the size of the male. Like the rest of the Octopoda the male *Argonauta* lacks an external shell, but the two dorsal arms of the female secrete a calcareous shell which is unique in the mollusc phylum. Its origin from the arms is unlike that of the shell of other molluscs which is developed from the mantle. Moreover this shell is used as a receptacle for the eggs and in it they are incubated until the young are hatched out.

BIBLIOGRAPHY.—A. Naef, *Fauna e Flora del Golfo di Napoli Monogr. 35.* (1923); G. Steinmann, *Zeitschr. Ind. Abst. Vererb.* (1925); G. C. Robson, *Ann. Mag. Nat. Hist.* (1928). (G. C. R.)

**NAUVOO,** a city of Hancock county, Illinois, U.S.A., on the Mississippi river 30 mi. S. of Burlington and about 50 mi. above Quincy. Pop. (1940) 1,088. On the opposite bank of the river is Montrose, Iowa, pop. (1940) 592, served by the Chicago, Burlington and Quincy railway. "Commerce city" was laid out here in 1834 by Connecticut speculators; but the first settlement of importance was made by the Mormons (*q.v.*) in 1839–40; they named it Nauvoo, in obedience to a "revelation" made to Joseph Smith, and secured a city charter in 1840. The Mormons said the name was of Hebrew origin and meant "beautiful place"; Hebrew "naveh" means "pleasant." In 1844 its population was about 15,000, and a large Mormon temple had been built, but internal dissensions arose, "gentile" hostility was aroused, the charter of Nauvoo was revoked in 1845, two of the leaders, Joseph Smith and his brother Hyrum, were killed at Carthage, the county-seat, by a mob, and in 1846 the sect was driven from the state. Traces of Mormonism remain in the many old Mormon homes, including Prophet Joseph Smith's and Brigham Young's. Three years after the expulsion of the Mormons, Nauvoo was occupied by the remnant (some 250) of a colony of French communists, the Icarians, who had come out under the leadership of Étienne Cabet (*q.v.*). For a few years the colony prospered, and by 1855 its membership had doubled. Each family occupied its own home, but property was held in common, all ate at the common table, and the children were taught in the community school. A proposal to revise the constitution resulted in rending the colony into two irreconcilable factions, and in Oct. 1856 Cabet with the minority (172) withdrew to St. Louis, Mo. Soon after the schism of 1856 those who had rebelled against Cabet began to prepare a permanent home in Adams county, Iowa. There too in 1879 the community split into two factions, the Young Party and the Old Party. Most of the members of the Young Party removed to Sonoma county, Calif., and here early in 1884, formed the Icaria-Speranza Community. All branches of the society ceased to exist after 1895.

*See* Albert Shaw, *Icaria: A Chapter in the History of Communism* (1884); Jules Prudhommeaux, *Icaria et son fondateur Étienne Cabet* (1907).

**NAVAHO,** an Athabascan people in northern Arizona and New Mexico, situated between the various Pueblo Indians. They are first mentioned about 1630; they may have been met by the Spaniards before this without being distinguished from the Apache. They are probably an Apache division in origin, specialized through contact with the Pueblos. Their territory comprises the heart of the prehistoric Pueblo area about Chaco canyon and other affluents of the San Juan river; but they have never adopted the masonry houses, sedentary life, or, except to limited extent, agriculture of the Pueblos. For several centuries they raided these people and the Spanish-Mexican colonists, drove off their stock, and gradually acquired herds of horses, cattle, goats and especially sheep, from which their living is still largely derived. They are noted for their blankets and silver work. Their great ceremonies last nine days. The Navaho are matrilineal, their 50–60 clans bearing the names of localities but being exogamous. Their houses are of stick and earth covered on a foundation of logs; they make very little pottery and basketry. The original population was probably only a few thousand; it is thought to have reached 9,000 in 1869, and since 1900 has been variously reported from 20–28,000.

**NAVAL AND MILITARY SCIENTIFIC SOCIETIES.** The *Royal United Service Institution,* first known as the *Naval and*

*Military Library and Museum* (1831), took the name of the *United Service Institution* in 1839, and was incorporated in 1860; its professional museum is housed in the banqueting hall at Whitehall; it publishes a *Journal* (1857, etc.). The *Institution of Naval Architects* (1860) publishes *Transactions* (4to, 1860, etc.). The *Royal Artillery Institution* (1838), which issues the *Royal Artillery Journal*, is at Woolwich, and the *Institution of Royal Engineers* (1875), which issues the *R. E. Journal*, at Chatham. The *Navy Records Soc.* (1893) publishes works connected with the history of the British Navy. CANADA: Toronto, *Military Inst.* INDIA: Simla, *United Service Institution.*

UNITED STATES: New York, *Military Service Inst.* (1878), *Journal* (1879, etc.); *Soc. of Naval Architects and Marine Eng., Proc.* Annapolis, *U.S. Naval Inst.* (1873), *Proc.* Wash., D.C., *Am. Soc. of Naval Eng.* (1889), *Journal; Soc. of Military Eng.* (1919), *Military Engineer; Army Ordnance Assn.* (1920), *Army Ordnance; Am. Military Inst.* (1933), *Journal; Soc. of Military Surgeons* (1891), *Military Surgeon; U.S. Infantry Assn.* (1904), *Infantry Journal; Naval Historical Foundation* (1926). FRANCE: Paris, *Réunion des Officiers*, now *Cercle Militaire, Bull.* (1871, etc.). GERMANY and AUSTRIA-HUNGARY: Munich, *Militär. Ges.* (1868), *Jahrbuch.* (1871, etc.). Vienna, *K. k. Milit.-Geogr. Inst., Arbeiten* (1871, etc.). HOLLAND: Utrecht, *Vereen. tot Verspreiding van Kennis aangaande s'Lands Verdediging, Jaarsverslag* (1872, etc.) and *Werken.* NORWAY: Christiana, *Militaere Samfund, Nordsk Milit. Tidsskrift* (1848, etc.). DENMARK: Copenhagen, *Krigsvidenskabelige Selskab, Milit. Tidsskrift* (1872, etc.).

**NAVAL ARTICLES.** The subject of navies generally is dealt with in the article NAVY AND NAVIES. The navies of the various nations are dealt with under the name of each nation, but separate articles have been allotted to the various types of warships, *e.g.*, AIRCRAFT CARRIER, BATTLESHIP, CRUISER, DESTROYER, FLEET AUXILIARY VESSELS, SUBMARINE.

Historical aspects are dealt with under NAVY, GREAT BRITAIN, UNITED STATES, WORLD WAR: *Naval*, while important operations or engagements, such as ARMADA, BELGIAN COAST OPERATIONS (including Zeebrugge), COPENHAGEN, CORONEL, DARDANELLES CAMPAIGN, DOGGER BANK, DUTCH WARS, FALKLAND ISLANDS, FIRST OF JUNE, FRENCH REVOLUTIONARY WARS, JUTLAND, NAPOLEONIC CAMPAIGNS, NAVARINO, NILE, QUIBERON, SAINTS, SEVEN YEARS' WAR, ST. VINCENT, TOULON, TRAFALGAR, are found under their appropriate headings. Biographies of distinguished naval commanders will be found under their names. For a more general study of naval warfare, see articles on BLOCKADE, COAST DEFENCE, CONVOY, FUELLING STATIONS, DOCKYARDS AND NAVAL BASES, NAVAL STRATEGY AND TACTICS, SEA POWER.

Technical articles in addition to those dealing with each of the various types of ships include ANCHOR, ARMOUR PLATES, BUOY, CAMOUFLAGE, CABLE, CAPSTAN, CHRONOMETER, FIRESHIP, FLEET, FRIGATE, GALLEY, GUNNERY; LOG, MARITIME; MINES, MINE-LAYING AND MINESWEEPING; ORDNANCE, PARAVANE, PILOTAGE, PILOTAGE LAWS, RANGE-FINDERS, RULE OF THE ROAD AT SEA, SEAMANSHIP, SHIP, SHIPBUILDING, SHIPS' FIGUREHEADS, TORPEDOES, WASHINGTON TREATY.

Administration and personnel will be found dealt with under ADMIRAL, ADMIRALTY, CAPTAIN, COURT-MARTIAL, MARINES, MEDICAL SERVICE, MIDSHIPMAN, PRESS GANG, STAFF, UNIFORMS.

**NAVAL STORES,** a trade name for the products derived from the oleoresin (gum or pitch) of the pine tree. As originally used the term included all raw materials used in building and maintaining sailing vessels, as, for instance, tar, pitch, rosin, flax, cordage, masts and timber. The possibility of obtaining a source of supply for these materials independent of Russia and the Dutch traders had considerable influence upon the British in establishing the colonies in Virginia. Flax, cordage and lumber are no longer classed as naval stores. The term embraces turpentine, rosin, pine oil, pine tar, pine tar oil, pitch and rosin oil. Charcoal from the destructive distillation of "lightwood" and pine needle oil are sometimes included but are not generally considered to be true naval stores products.

The former is made from the wood and not from the oleoresin of the tree and the latter is an essential oil usually classed under drugs and chemicals.

Approximately 50% of the world's production of naval stores comes from the United States, 15% from France, 10% each from Russia and Portugal, with smaller amounts from Spain, Greece, Mexico and a few other countries. The United States naval stores crop is all produced in the southern pine belt which includes North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana and a small part of Texas. American naval stores for years were produced from the long leaf pine (*Pinus palustris* or *Pinus australis*). Now that the virgin forests have been cut, these products are obtained from second growth which is chiefly slash or Cuban pine (*Pinus caribaea*). The French source of naval stores is the maritime pine (*Pinus pinaster*) in the Landes.

There are four distinct methods of manufacture, and the products therefrom vary widely in their characteristics. The largest amount of naval stores is produced by the gum method. The trees are "chipped" and the oleoresin which exudes from the wood in order to heal the wound is caught in cups, collected each week and transported to a still. The historic method of processing the gum, and the method still largely used, is to put it in a copper still heated by direct fire. The volatile material is distilled off with steam (generated from the water in the gum) and condensed as gum turpentine. The residue is gum rosin and is run out of the bottom of the still, strained through cotton batting into troughs and dipped into barrels. An increasing percentage of the oleoresin crop has been transported to centrally located factories and distilled in modern equipment under technical control The rosin is graded according to colour and freedom from dirt—the pale grades being *X, WW, WG, N, M;* the medium grades being *K, I, H, G* and *F;* the dark grades being *D* and *B.*

*DD* turpentine, *DD* pine oil, pine tar, pine tar oil and charcoal are produced by the destructive distillation of the dead wood and stumps left on the ground after the lumbering industry has taken off the timber. Long leaf pine wood contains only 5% resinous material, but the dead wood and stumps may contain as high as 40% and wood can be obtained in commercial quantities with more than 20% resinous material. Destructive distillation was originally carried out in the woods by covering a pile of dead wood with sod, clay, etc., and burning the pile with an insufficient amount of air to form complete combustion. The process is now carried out in well designed retorts where all volatile materials can be recovered.

The third method of manufacture is the so-called steam-distillation, solvent-extraction process, wherein the dead wood and stumps from cut-over land are ground up, loaded into steel retorts, steamed with live steam, extracted with solvents, and the pine products recovered. Some of the steam distillation plants represent large investments and have spent much money and effort on research programs. They have improved and diversified their products and made them the foundation of a pine tree chemical industry. The production of steam distilled wood turpentine, and wood rosin is equal to 60% of America's output of gum turpentine and gum rosin. The fourth method manufactures sulphate wood turpentine, sulphate pine oil and liquid rosin as by-products from the manufacture of paper pulp from pine wood by the sulphate process. Turpentine is used chiefly in the paint and varnish industry, in chemicals and pharmaceuticals, and in shoe polish; rosin, in paper, soap, paint and varnish, foundry and linoleum; pine oil, in mining, textile manufacture, disinfectants and rubber.

*See* Gamble's *Naval Stores Year Book* (Savannah, Ga.); *Annual Naval Stores Report* (U.S. Dept. of Agriculture). (V. R. C.)

**NAVAL STRATEGY AND TACTICS** both have to do with the conduct of war at sea and, in the broad sense, are premised on the same principles as are military (land) strategy and tactics. Strategy has to do with all those dispositions and operations which precede and lead up to actual contact of opposing naval forces; tactics with the continuation of such dispositions and operations after contact, which normally culminates in battle, whether of fleets or of detachments. The differentiation is not exact as to contact, for strategy merges into and blends with tactics as the near approach of opposing forces causes battle to become imminent. Certain well-defined principles governing strategy, developed from the study of history, are applicable today, but while this is also true of tactics, the latter is more continuously modified in application by the development of new weapons and of new degrees of mobility, factors which have changed repeatedly and will continue to change with the advance of science and the development of material.

### NAVAL STRATEGY

A basic conception of war is the seeming paradox that it is a continuance of international relations by means of hostilities; it emphasizes the controlling part of the government and of diplomacy in determination of what national policies are considered

vital even though they are in conflict with similar policies of another nation; not the least among vital national policies is that of the scope and efficacy of national defense that is to be attained and maintained in readiness to back up other vital national policies. It follows that not only do national policies influence the strategy of a war but also that the relation between national policies and national strategy is definite and unmistakable.

Naval strategy may be said to comprise three phases—preparation, adaptation, execution. *Preparation,* the first phase, is that wherein ships and bases are provided, personnel recruited and trained, stores and munitions acquired and stored to meet the expected general needs of national defense. *Adaptation,* the second phase, is that in which decision is made, premised on current and presumably critical international circumstances, as to the nature and extent of the war to be conducted and is necessarily premised on the state of one's own preparation on the one hand and on the realities and potentialities of the enemy's preparations on the other. *Execution,* the final phase, is that wherein the war is actually conducted and that in which naval strategy, as ordinarily meant, is exercised. Preparation takes account of the geographical situation of one's own and of potential enemy countries; of physical, financial and man-power resources; of ship-building, munitions-making and fuel-supply capacities; and in particular, of vital interests and corresponding national policies which may prove to be in conflict with those of certain countries and so render them potential enemies and, finally, relative naval strengths. All of these considerations are the premises from which national naval needs are derived, not only as to number and character of naval vessels, but number, location and adequacy of naval bases. Adaptation takes account of the same factors as does preparation but from considerations applied to a particular enemy country whose national policies are so actively in conflict with one's own that war is imminent. The relative naval strengths, the location and adequacy of naval bases, possible allies or associates on both sides, the expected attitude of neutrals, are some of the chief premises on which is predicated the character of the war about to be conducted, whether total war or one of lesser degree such as blockade in one or more of its many forms, and so whether, in effect, the war is to be active (aggressive) or passive (defensive).

The phases herein called preparation and adaptation are in the domain of national policy and national strategy and so are the functions of the government in power and by no means those of the naval authorities alone, though it is obvious that the latter must be consulted—and heeded—on the strategical and like technical considerations involved; however, when a course of action is decided upon, execution is the province of the naval authorities alone; it is for them to conduct the war and it is the business of all others in authority to keep hands off unless or until a change in the international situation or other major development makes necessary a new adaptation which may call for the conduct of war on a different basis. When the government, for due cause, such as a new ally (own or enemy), the changed attitude of a neutral nation or domestic opposition, sees fit to direct that a campaign be halted or even abandoned and a new one begun, that hostilities shall cease or slow up or increase in intensity or decrees any other measures that appear to be to the advantage of the nation (state), its authority is unmistakable but its directions to the armed forces will be as general in scope as its understanding and judgment are sound, as when a lawyer's client allows his lawyer to conduct his case in court.

History records all too many instances where political objectives have conflicted in time or in space with the correct military (naval) objective in war, or in the sequence of war events, to such an extent as to imperil the outcome. Such unfortunate circumstances are usually due to lack of community of ideas and of comprehension between the political leaders and the heads of the fighting forces, not infrequently because of excluding the latter from council on the one hand or, on the other, reluctance to speak out without invitation even when present in council. In the United States, the constitution provides for essential coordination and correlation between the government and the armed forces by making the president, executive head of the government, also commander-in-chief of the army and navy. There is the further need that the heads of the armed forces be kept as adequately informed of the political situation as they themselves are required to keep the government informed as to the military situation; not only in time of war but even more in time of peace when national policies are in process of development or adoption, certainly when conflict is in prospect, and positively when war is imminent. Such are the essential means to ensure that correlation which is indispensable to the unity of understanding and of action which leads to success in war.

Certain immutable principles are established as to the conduct of war by the experience recorded in history, ancient and modern; they are (1) Naval efforts, like military operations, must always be subordinate to government policy and general direction, but although political factors have their due effect on naval objectives, they are never to be allowed by the government to dictate courses of action which are at variance with sound naval strategy; (2) the primary function of a navy in war is, in general, to deny the use of the sea to the enemy while preserving its use to one's own interests; (3) concentration of effort must be the aim of the naval forces because with it comes economy of force and resultant conservation of energy. Certain of the factors of naval strategy become relatively fixed as soon as the enemy country is known. These factors are chiefly geographical and determine the availability of naval bases (permanent or temporary) which, in turn, indicate the factors of distances and directions, the foci of vital trade routes and other like matters which sum up into relative positions which require to be taken into account. The other important factor that is sensibly fixed is relative naval strengths which, as to combatant ships in particular, is not subject to change except by the building of additional ships or obviously, by losses in the war which is being undertaken. Relative strengths of opposing fleets comprise not only the hitting power and defensive characteristics of available numbers and types of combatant ships but their seaworthiness, ruggedness, sustained sea speed and last but not least, endurance, or the fuel and other capacity to remain at sea.

Naval strategy in itself may be described as the art of disposing and moving a fleet (or parts thereof) in the area of operations with a view to placing it (them) in such position relative to the enemy as to promote the accomplishment of the objective in hand, increase the chances for victory in battle and enhance the consequences of success in battle. The method of determining the strategy (or, similarly, the tactics) suited to given circumstances follows a well-established procedure designed to include all pertinent factors; the first step is to make sure that the objective is correctly and clearly in mind; the second is to review and summarize relative fighting strengths, relative location of naval bases whether established (permanent) or potential (temporary), relative locations and dispositions of fleets and other naval forces; the next is to estimate and consider what the enemy is most likely to do and, particularly, what he can do that will be most unfavourable for one's own cause and then, fourth, what can be done to advance one's own cause even in the face of enemy opposition; the final step is determination of a definite line of action (including the component parts thereof) which is to be followed until such time as new circumstances require a departure therefrom or compel the adoption of another and different line of action.

An important and often determining element in naval strategy is *logistics,* which is an all-inclusive term involving locations and distances (time and space) translated into terms of fuel endurance, and of supplies, munitions, food and other essential stores on hand or to be made available. In a very general way, it may be said that the combatant ships of a fleet can operate to a distance of about 2,000 mi. from a base, or for a period of about 15 days, after which it will become necessary to have access to a base where fuel, in particular, and other essentials may be replenished. Logistics necessarily takes account of the number, distribution and capacities of naval bases, whether permanent or temporary, where the materials of logistics are avail-

able to the fleet and, as well, where essential stocks of fuels, munitions and other supplies must be kept up. The maintenance of adequate stocks of logistic materials involves transportation which, when required to be conducted by sea, adds to the considerations with which naval strategy is concerned and emphasizes the importance of what are known as *lines of communication.* In overseas operations in particular, the maintenance of lines of communication is indispensable in the logistics which enable the fleet to be effective in the overseas area and, in fact, reduces its efficacy because of the need to safeguard essential lines of communication and to keep the bases in use secure. The effect of these factors is indicated in the 5:3 ratio of the Washington treaty (1922) in that the United States fleet's 5, when operating overseas in the western Pacific, would be sensibly on a parity with the Japanese fleet's 3, the latter being in or near its home waters.

There are two general forms of naval strategy in the conduct of war at sea—total war, which needs no elaboration to indicate its all-out character and its ultimate objective as destruction of the enemy fleet, as compared with the lesser degrees which may be generalized as *blockade,* an all-around term for interruption of or interference with enemy sea trade or naval communications and includes not only actual blockade of enemy ports but seizure of ships on the high seas bound to or from enemy ports whether found at focal points or en route, called by the French the *guerre de course* and rendered into English as *cruiser warfare.* As the greater always includes the less, so does total war include blockade and cruiser warfare, which latter are, in such case, not ends in themselves but the means whereby to compel the enemy fleet to battle. An example of the lesser degree of war is that waged by the Germans in 1914–18 by means of submarine operations directed against British and French merchant shipping; in fact, it came near to success in 1917 and that it did not is good evidence of the fact that a serious menace impels the creation and development of counter-measures.

The development of aircraft in striking power and in range has brought them into the field of naval strategy so that aircraft play an indispensable part whether in the "service of information and security" or in battle itself. For best results in naval strategy—and in naval tactics—it is deemed essential that aircraft shall constitute an integral part of fleets and so be indoctrinated and trained in the seagoing elements which are vital factors in naval operations.

The advent of radio has been decisive in increasing the flexibility of strategy both as to transmission of important information of the enemy and adaptation of orders or dispositions to meet the new circumstances so made known, as compared with information and orders conveyed by ships and, later, by cable when circumstances enabled it to be employed.

It has long been maintained that the chief objective of the fleet should be to engage and destroy that of the enemy, but such a dictum is at once too simple in statement and too difficult of attainment to be considered the *sine qua non* of naval warfare. While there can be no doubt that the destruction of the enemy fleet is the most drastically effective means of depriving him of the use of the sea, it is improbable that an adversary would cooperate to enable his inferior fleet to be met and so probably destroyed. Further, an inferior fleet can safeguard itself against being compelled to an unequal contest by outer defenses such as mines and submarines and aircraft, so that it continues in existence as a "fleet in being," a potential menace and therefore a constant source of attention and concern. To claim, therefore, that the primary objective of a fleet is to defeat the enemy fleet is both a truism and a *non sequitur* which confuse the means with the end in view. If one's own fleet is so superior or can be so disposed that one has control of the sea areas vital to one's own cause and, above all, if at the same time the enemy is deprived of the use of sea areas vital to him, the purpose of sea power is being accomplished and he must endure the situation or risk his fleet to oppose such control. An example of this kind is found in British naval strategy in 1914–18 when, at the outset of hostilities, the British fleet went to its war bases in the north of Scotland. Throughout the war, the predominance of the British fleet, based far to the northward, contained and restricted the German fleet so effectively that the latter became largely a fleet in being which was unable to prevent the gradual elimination of German cruisers and shipping from the seas or to check the passage of armies and war materials to do battle against the German army and its allies in whatever part of the world was desired. The correlation and interdependence of naval and military strategy was such that the security and maintenance of the British and allied armies in every theatre of war was never seriously threatened, though dependent directly on the British main fleet in the north of Scotland. The inferior German fleet was only once brought to battle—at Jutland in 1916—and then not so much by intent of the German high command as by the alertness, initiative and readiness of the British fleet.

To sum up, the primary object of all naval strategy—whether preparatory, adaptative or executive—is to attain and maintain control of vital sea areas and, of course, to deny such vital areas to the enemy. Control of vital sea areas is attained by the main body of the fleet whether by defeating the enemy fleet in battle or by keeping the main body in such position relative to the vital sea areas that the enemy fleet is compelled to accept battle in order to contest the control of such vital areas. It is apparent that naval strategy is thus largely premised on the possession or occupation of naval bases which enable the necessary and appropriate positions to be maintained.

## NAVAL TACTICS

When naval strategy has done its part to bring opposing naval forces into contact, that is, so that they are in the presence of each other and battle is consequently imminent, strategy merges with and blends into tactics.

Naval tactics is the art of handling naval combatant forces when in contact with each other, that is, in battle, whether of fleets or of detachments, in such a way that success in battle is to be expected. It is premised on the same principles as land (army) tactics and so is predicated on the application of the available forms of offense (attack) which are the gun, the bomb, the torpedo and the mine. It involves consideration and provision of passive defensive means against the several forms of attack, chiefly armour (vertical and horizontal) and subdivision (compartmentation), and includes considerations, both as to attack and defense, of number and types, and of speed, manoeuvrability and disposition (arrangement).

The object in naval tactics being the same in principle as in land (army) tactics, the endeavour is to effect the maximum practicable concentration of attack on a part of the enemy, preferably that part whose weakening (if not destruction) will bring about the defeat of the enemy. The evolution of tactics has consisted of application of established principles to the conditions which have arisen from time to time by reason of the evolution of weapons and the advent of new degrees of mobility in manoeuvre. These two factors, *weapons* and *mobility*, are subject to continuing modification as science advances and scientific applications enable development and evolution of material.

The original forms of attack in the days of the galley were ramming and boarding, that is, hand-to-hand fighting; ramming included the disablement of oars, the motive power, which was often done in the process of boarding or to facilitate it; use was also made of fire and of "Greek fire." The introduction of the gun enabled action to take place before the actual contact of ships permitted ramming and boarding. The improvement of the gun enabled attack to be accomplished at greater distance, but that is not to say that boarding and ramming are extinct in naval tactics; ramming still occurs as against submarines and boarding still is occasionally made use of, as in destroyer actions in the English Channel in 1914–18 and in the rescue of prisoners from the "Altmark" in Norway in 1939.

The advent of the gun and the improvements in the use of sails for motive power evolved ships which persisted through the centuries until steam propulsion and the availability of steel, both the result of industrial advancement, made practicable the early

editions of men-of-war as they are known today. The advent of steam power first in the reciprocating engine and later in the turbine and the more recent development of the Diesel engine enabled ships to move independently of wind, rendered sails obsolete, and brought about precision in manoeuvre and speed in execution which had tremendous effect in the evolution of naval tactics as well as of naval strategy. The development of the gun with its constantly increasing range, of steam propulsion to afford higher and higher speeds, the change from wood to steel ships which enabled larger ships to be built, had their counterparts in the consequent great need to embody compensating *passive defense* features in ships, chiefly armour and subdivision (compartmentation), while the advent of aircraft has required the introduction of the anti-aircraft gun and of protection against the bomb. Industrial development further brought about the invention and the evolution of the automobile torpedo and of ships armed with it, which was for a time hailed as the death-blow of navies. Then came the perfection of the submarine which was again to spell the end of surface ships. Finally, there has come the aircraft and its bombs and once again the surface ship is to be made obsolete. The menace of the torpedo and of the submarine has been duly countered by suitable construction features and by appropriate dispositions and other counter-measures; it is to be expected that in due course the menace of the aircraft and its bombs will likewise come to be effectively counteracted.

The gun is the universal weapon; it varies in size (bore, calibre) from about $\frac{1}{4}$ in. in machine guns to 16 and 18 in. in the largest ship guns; range and smashing power increase with size so that the larger guns have ranges of some 20 to 25 mi. for projectiles which weigh a ton or more. The bomb, chief weapon of aircraft, varies in size from the anti-aircraft bomb of 2 or 3 lb. to those of 1,000 and 2,000 lb. and even larger; it is a characteristic of bombs that, in general, they attain a terminal velocity of about 1,100 ft. per second and that only when dropped from heights greater than 15,000 ft. The depth charge used against submarines is, in effect, an underwater bomb; it is set for a predetermined depth at which it is exploded by the action of the corresponding hydrostatic pressure. The torpedo, chief weapon of submarines and destroyers, is automotive in character; its destructive power consists of explosive of several hundred pounds weight exploded by contact with the objective or upon passing close thereto. The mine is a weapon of locality, laid by submarines or mine vessels or aircraft, equipped with firing devices which explode the charge when the objective comes in contact or comes close thereto. The striking power (whether bombs or torpedoes), speed and range of aircraft make them important and even indispensable "weapons"; considered as weapons they markedly outrange the gun but not its rate-of-fire, that is, the weight of metal or explosive per hour delivered in attack is decidedly less; this relative inferiority is counter-balanced by the flexibility of application of point of attack which, again, is chiefly due to its range and freedom of movement in what may be called its "trajectory."

The development of the means of forecasting weather, expedited by the needs of aircraft, has restored that interest in weather which diminished when sail was no longer the chief means of propulsion of ships. The uses of aerology are by no means restricted to the capabilities and limitations of operations in accordance with predicted weather but have their due effect on considerations of the disposition of ships in both strategy and tactics. The preferred weather-gauge of the days of sailing ships is still of moment in modern naval tactics in the advantages and disadvantages involved in spray and funnel smoke interference. To these are added the matters of sun glare, silhouette and, in the words of the rules of the road—fog, mist, rain and falling snow. That these seemingly minor factors may on occasion become of paramount concern is evidenced by the effect of visibility conditions—haze, smoke, mist—and the light conditions—silhouette, sun glare—which were important factors in the battle of Jutland in 1916 and, as well, at Coronel in 1914.

In the days of the galley and of the sailing ship there came to be three general types, chiefly distinguished by their relative sizes of which the largest was the battleship of its day. At present (1940) naval combatant ships comprise five well-defined categories—battleships, carriers, cruisers, destroyers and submarines—to which must be added three types of aircraft—patrol planes (flying boats), carrier planes and the catapult-launched planes of battleships and cruisers. All combatant ships (men-of-war) embody four main characteristics—capacity to hit, capacity to resist damage, speed, endurance or capacity to remain at sea in terms of time. The battleship is more correctly termed the capital ship—the best of its kind in guns (capacity in offensive power) and in defensive protection, to which ends speed may be a lesser factor. One of the inherent requirements of aircraft carriers is speed, next endurance, while size plays its part in capacity to operate numbers of planes; the result may be that guns and protection are necessarily reduced. In the cruiser, speed and endurance are of such importance that guns are reduced in calibre (bore) and protection in accordance therewith. In the destroyer, speed is paramount for the successful employment of the torpedo so that guns are inferior, endurance reduced and protection practically nil. In the submarine, protection consists of submergence, the weapon is the torpedo, submerged speed and endurance are low, surface speed moderate but endurance (due to Diesel engines) is comparatively great.

The use of *offense* (*weapons*) has been developed from the earliest times of naval warfare by the use of what may be called aids in offense (attack). Of these the chief has been concentration of superior force against an inferior force by disposition and by manoeuvre but, particularly where lesser ships attack greater ships, there is the timing of attack to take place when the enemy's attention is occupied in greater or less degree by attack from other ships, also submerged approach by submarines, night attacks by destroyers, the use of smoke screens by destroyers and aircraft, and attack from the direction of the sun or from behind clouds by aircraft.

The history of the evolution of naval tactics during the past hundred years has not only been the development of *offense* (*weapons*)—the gun, torpedo, mine and bomb; the development of means of *defense* (*protection*) against the weapons has also taken place in two ways, one passive, the other active. The passive forms of defense are chiefly those provided by armour—vertical against projectiles, horizontal against projectiles and bombs—by subdivision (compartmentation) against torpedoes and mines and, as well, the use of mobility (speed and manoeuvrability) in evasion of attack by gun, torpedo and bomb; submarines make use of submergence, smoke screens serve to mask ships under heavy attack, clouds are a refuge for aircraft, and darkness has its uses and, as well, its dangers. As to active forms of defense, it continues as true today as when Farragut said, "the best defense is well-directed fire from your own ships," a principle which is expanded in application not only for ship against ship, but ship against torpedo-armed vessels (destroyer and submarine) and ship against aircraft. Active defense has, in due course, evolved the destroyer from original offensive-defensive measures against torpedo-boats and its uses include the offensive-defensive against submarines with guns and with depth-charges and even by ramming.

Naval tactics also involve, particularly in fleet actions, the appropriate disposition and manoeuvre of battleships, cruisers, destroyers, submarines, aircraft—each to the other and as to the whole—to effect success, not only by promoting concentration on a vital part of the enemy but in countering his endeavours to the same end and to guard against flank attack and other like enemy efforts. Such dispositions are in general geometric in principle but are flexible and ever-changing as manoeuvre is brought into play to meet requirements as the situation develops. There are two aspects connected with disposition and manoeuvre which have given rise to a good deal of discussion and even serious controversy: the amount of freedom of action (initiative) to be allowed subordinates; an extreme case of this kind was where Admiral Byng of the British navy was shot (1757) for not complying with rigid rules for conducting battle prescribed in the regulations; a striking contrast occurred 40 years later when Nelson's initiative at the battle of St. Vincent (1797) was heartily approved by Sir John Jervis. The solution generally accepted is that based on the common sense facts that orders premised on expected conditions frequently do not apply in the actual circumstances, that the superior officer cannot be aware of the development of situations remote from his observation, and that valuable time may be lost in obtaining authority to act in accordance with the actual circumstances that the subordinate is confronted with; all these considerations combine to make it not only proper for the

subordinate to take action that will promote success of the prescribed general plan, but incumbent on him to take action where strict adherence to orders would obviously cause unfavourable and unhelpful results, that is, he is required to act as he believes his superior would have him act if the superior were on the spot and so immediately aware of the needs of the case.

From the multiplicity of factors noted it will be seen that naval tactics is very much more an art than it is a science, but unless there is comprehension of the science involved success in the art is not to be expected. The key idea, however, is to overpower a part of the enemy as the effective means of initiating his eventual defeat. This key idea was embodied in the Nelson touch carried into effect at the battle of Trafalgar in 1805 and was a deliberate plan to accept the calculated risk involved in breaking the opposing French-Spanish line head-on in order to overwhelm a part of it before the other part could come to its support. In these days of long-range heavy guns, the Nelson touch can no longer be attempted as in the days of sailing ships, but the principle he employed is eternal even though the application of it must be accomplished by other means. It is characteristically indicated by the constant endeavour to reach a similar key position called *capping* or crossing the "T," wherein the governing idea is so to dispose and so to manoeuvre as to be able to bring the full power of broadsides to bear against the lesser bow or stern fire; this is not different in principle from that of raking fire in the days of sailing ship duels but is, of course, carried out at long range and with many ships on both sides. To sum up, naval tactics may be described as the art of handling a fleet and its component parts in the presence of the enemy in such a way that one's own weapons are brought to bear, and are kept, in superior concentration on that flank or other vital part of the enemy which, being kept thus constantly at a disadvantage, is steadily weakened and eventually overwhelmed, with consequent victory in the battle.

BIBLIOGRAPHY.—A. T. Mahan, *The Influence of Sea Power upon History* (1890), *The Influence of Sea Power on the French Revolution and Empire* (2 vols., 1892), *State Papers relating to the Defeat of the Spanish Armada* (ed. J. K. Laughton, 2 vols., 1894); J. S. Corbett, *Drake and the Tudor Navy* (1898), *England in the Mediterranean* (1904), *England in the Seven Years' War* (1907), *The Campaign of Trafalgar* (1910), *Some Principles of Maritime Strategy* (1911); H. Richmond, *The Navy in the War of 1739–48* (3 vols., 1920); W. S. Churchill, *The World Crisis* (4 vols., 1923–27); R. Custance, *A Study of War* (1924, 2nd ed. 1927); G. Ellison, *The Perils of Amateur Strategy* (1926); W. N. James, *The British Navy in Adversity* (1926); *Official History of the Russo-Japanese War* (ed. E. O. Swinton, 3 vols., 1910–20); J. Corbett, *Official History of the War. Naval Operations, 1914–16* (1920, etc.); A. Hurd, *Italian Sea Power and the Great War* (1918), *Official History of the Merchant Navy* (3 vols., 1920–24); C. E. Fayle, *Official History of Sea-Borne Trade* (1920); Earl Jellicoe, *The Grand Fleet, 1914–16* (1919), *The Crisis of the Naval War, 1916–17* (1920); R. H. S. Bacon, *The Dover Patrol* (2 vols., 1919); A. P. F. von Tirpitz, *My Memoirs* (1919); R. Scheer, *Germany's High Sea Fleet in the World War* (1920); W. S. Sims, *The Victory at Sea* (1920); Wester Wemyss, *The Navy in the Dardanelles Campaign* (1924).

*Tactics.* A. Baudry, *The Naval Battle* (1914); J. Corbett, *Fighting Instructions: Signals and Instructions, 1776–94* (1908); R. Custance, *The Ship of the Line in Battle* (1912), *Battle of Jutland, Official Dispatches* (Admiralty, 1916); H. Bingham, *The Falklands, Jutland and the Bight* (1919), *Narrative of the Battle of Jutland* (Admiralty, 1924); R. Bacon, *The Jutland Scandal* (1924); H. W. Wilson, *Battleships in Action* (1926); G. von Hase, *Kiel and Jutland* (trans. A. Chambers and F. H. Holt, 2nd ed. 1927); J. E. T. Harper, *The Truth About Jutland* (1927). (E. J. KG.)

**NAVAN** (An Uaimh), a market town of co. Meath, Eire, situated at the confluence of the Blackwater with the Boyne. Pop. (1936) 4,123. Here the Clonsilla and Kingscourt branch of the Great Southern railway crosses the Drogheda and Oldcastle branch of the Great Northern. By the former it is 30 mi. N.W. of Dublin. Navan has considerable trade in corn and flour, some manufacture of woollens and of agricultural implements, and a tannery. It was a barony of the palatinate of Meath, was walled and fortified, and was incorporated by charter of Edward IV. It suffered in the civil wars of 1641. It is a favourite centre for rod-fishing.

**NAVARINO, BATTLE OF,** fought on Oct. 20, 1827. By the treaty signed in London on July 6, 1827 (*see* GREECE, *History*), England, France and Russia agreed to demand an armistice, as preliminary to a settlement. Sir Edward Codrington, then British commander-in-chief in the Mediterranean, received the treaty on the night of Aug. 10 at Smyrna, together with instructions to demand an armistice, and to intercept all supplies coming to the Turkish forces in the Morea. He at once proceeded to Nauplia to communicate with the Greeks, accompanied by his French colleague, Rear-admiral de Rigny. The Greek Government agreed to accept the armistice. Admiral de Rigny left for a cruise in the Levant, and Sir Edward Codrington, hearing that an Egyptian armament was on its way from Alexandria, found it, together with a Turkish squadron, at anchor at Navarino on Sept. 12. The Turkish Government refused to accept the armistice, but on the 25th an interview took place between Codrington, de Rigny, who had just arrived, and Ibrahim Pasha on behalf of the sultan, at which Ibrahim gave a verbal engagement not to act against the Greeks pending further orders. The allies, who were in want of stores, now separated again, Codrington going to Zante and de Rigny to Cervi, frigates being left to watch Navarino. The British admiral had barely anchored at Zante before he was informed that the sultan's forces were putting to sea. From Oct. 3 to 5 Codrington, who had with him only his flagship the "Asia" (84) and some smaller vessels, was engaged in turning back the Egyptian and Turkish vessels, a task in which he was aided by a violent gale. He resumed his watch off Navarino, and on the 13th was joined by de Rigny and the Russian squadron under Rear-admiral Heiden. By agreement among the Powers the command was entrusted to Codrington. The allied force consisted of three British, four French and four Russian sail of the line, and a total of 15 frigates, brigs and schooners. The Egyptians and Turks had three ships of the line and 15 large frigates, together with a swarm of small craft making a total of over 80. Ibrahim Pasha, though unable to operate at sea, considered himself at liberty to carry on the war by land, and his men were employed in burning the Greek villages. On Oct. 17 a joint letter of expostulation was sent to Ibrahim, but was returned with the manifestly false answer that he had left Navarino. The admirals, therefore, decided to stand into the bay. A French officer in the Egyptian service, named Letellier, had anchored the vessels of Ibrahim and the Turkish admiral in a horseshoe formation, of which the points touched the entrance to the bay, and there were forts on the lands at both sides of the entry. The allies entered in two lines and began to anchor in the midst of Ibrahim's fleet. Captain Fellowes, commanding the British frigate "Dartmouth," seeing a Turkish fireship close to windward of him, sent a boat to demand that she should be removed. The Turks opened fire on the boat, and the action at once became general. The result was obtained by heavier broadsides and better gunnery. Three-fourths of the Turkish and Egyptian vessels were sunk or fired by their own crews. The allied casualties were 177 killed and 519 wounded. The loss of the Turks and Egyptians was never accurately reported.

*See* Lady Jane Bourchier, *Memoir of the Life of Admiral Sir E. Codrington* (1873). (G. A. R. C.; W. C. B. T.)

**NAVARRE,** a province of northern Spain, and formerly a kingdom which included part of France. The province is bounded on the north by France (Basses Pyrénées) and Guipúzcoa, east by Huesca and Saragossa, south by Saragossa and Logroño and west by Álava. It is traversed from east to west by the Pyrenees and the Cantabrian Mountains. Area 4,056 sq.mi. Pop. (1940) 369,618. From Navarre there are only three practicable roads for carriages into France—by the Puerta de Vera, the Puerta de Maya and Roncesvalles. The highest summit is the Monte Adi (4,931 ft.). The chief river flowing towards the Atlantic is the Bidassoa, which rises near the Puerta de Maya. After flowing southwards through the valley of Baztán it takes a north-easterly course, and for a short distance above its outfall at Fuenterrabia constitutes the frontier between France and Spain (Guipúzcoa); by far the larger portion of Navarre is drained to the Mediterranean through the Ebro, which flows along the western frontier and crosses the extreme south of the province. The hilly districts consist almost entirely of forest and pasture, the most common trees being the pine, beech, oak and chestnut. Much of the lower ground yields grain; the principal fruit is the apple, from which cider is made in some districts; hemp, flax and oil are also produced, and mulberries are cultivated for silkworms. Navarre is one of the richest provinces of Spain in live stock. Game is plentiful.

The Ebro Valley railway traverses southern Navarre and skirts the western frontier. It has several branch lines. Besides Pamplona (*q.v.*), the capital, the only towns with more than 5,000

inhabitants are Baztán (10,326), Corella (5,663), Estella (6,992), Tafalla (6,036) and Tudela (12,873).

**HISTORY**

The kingdom of Navarre was formed out of a part of the territory occupied by the Vascones, *i.e.*, the Basques and Gascons, who occupied the southern slope of the western Pyrenees and part of the shore of the Bay of Biscay. In the course of the 6th century there was a considerable emigration of Basques to the north of the Pyrenees. The cause is supposed to have been the pressure put upon them by the attacks of the Visigoth kings in Spain. The name of Navarre is derived by etymologists from "nava" a flat valley surrounded by hills and "erri" a region or country. It began to appear as the name of part of Vasconia towards the end of the Visigoth epoch in Spain in the 7th century. Its early history is more than obscure. The first historic king of Navarre was Sancho Garcia, who ruled at Pamplona in the early years of the 10th century. Under him and his immediate successors Navarre reached the height of its power and its extension (*see* SPAIN: *History,* for the reign of Sancho el Mayor, and the establishment of the Navarrese line as kings of Castile and Leon, and of Aragon). When the kingdom was at its height it included all the modern province of the name; the northern slope of the western Pyrenees called by the Spaniards the "Ultrapuertos" or country beyond the passes, and now known as French Navarre; the Basque provinces; the Bureba, the valley between the Basque Mountains and the Montes de Oca to the north of Burgos; the Rioja and Tarazona in the upper valley of the Ebro. In the 12th century the kings of Castile gradually annexed the Rioja and Álava. While Navarre was reunited to Aragon—1076–1134—(*see* SPAIN: *History*) it was saved from aggression on the east, but did not recover the territory taken by Castile. About the year 1200 Alfonso VIII. of Castile annexed the other two Basque provinces, Biscay (Vizcaya) and Guipúzcoa. Tarazona remained in possession of Aragon. After 1234 Navarre, though the crown was claimed by the kings of Aragon, passed by marriage to a succession of French rulers. In 1516 Spanish Navarre was finally annexed by Ferdinand the Catholic. French Navarre survived as an independent kingdom till it was united to France by Henry IV. From 1510 until 1833, when it was incorporated with Spain, Navarre was a viceroyalty. Battles between insurgents and loyalists took place in Navarre during the civil war of 1936–39.

*See* Don J. M. Yanguas, *Historia Compendiada de Navarra* (San Sebastian, 1832); J. F. Bladé, *Les comtes carolingiens de Bigorre et les premiers rois de Navarre* (1895–97).

**NAVARRETE, JUAN FERNANDEZ** (1526–1579), surnamed El Mudo (The Mute), Spanish painter of the Madrid school, was born at Logroño in 1526. An illness in infancy deprived him of his hearing, but at a very early age he began to express his wants by sketching objects with a piece of charcoal. He received his first instructions in art from Fray Vicente de Santo Domingo, a Hieronymite monk at Estella, and afterwards he visited Naples, Rome, Florence and Milan. According to the ordinary account he was for a considerable time the pupil of Titian at Venice. In 1568 Philip II. summoned him to Madrid with the title of king's painter and a salary, and employed him to execute pictures for the Escorial. The most celebrated of these are a "Nativity" (in which, as in the well-known work on the name subject by Correggio, the light emanates from the infant Saviour), a "Baptism of Christ" (now in the Madrid Picture Gallery), and "Abraham Receiving the Three Angels" (one of his last works dated 1576). He died at Toledo in February 1579.

**NAVARRO, PEDRO** (*c.* 1460–1528), Spanish military engineer and general. Beginning as a sailor, he became *mozo de espuela,* or running footman, to the cardinal Juan de Aragon. In 1485 he enlisted as a mercenary in a war between Florence and Genoa, and took part in the warfare between the Genoese corsairs and the Mohammedans of northern Africa. He enlisted under Gonzalo de Córdoba when he sailed to Sicily, to take part with the French in the partition of Naples, and in 1500 he laid mines to breach the walls at Cephalonia without much success. He distinguished himself in the campaigns of 1502–03, by the defence of Canosa and of Taranto and by his share in the victory at Cerinola. His mining operation against the castles of Naples, held by French garrisons, in 1503, won him fame as the first military engineer of his age. At the expulsion of the French from Naples, he received from Gonzalo a grant of land and the title of count of Olivetto. In 1508 he took Velez de Gomera, largely by means of a species of floating battery which he invented. He did excellent service in the conquest of Oran (1509), and took Bougie and Tripoli in 1510. At Ravenna he covered the orderly retreat of the Spanish foot, was taken prisoner by the French and imprisoned in the Castle of Loches. Ferdinand, "the Aragonese skinflint," refused to pay his ransom, and after three years of imprisonment, Navarro entered the service of Francis I. in a pique. He distinguished himself in the passage of the Alps, at Marignano, at Milan, and in the siege of Brescia. He was at the battle of Pavia, and in 1522 was taken prisoner at Genoa by the Spaniards. He was confined at Naples till the peace of 1526 and his Olivetto estate was confiscated. His last service was in the disastrous expedition of Lautrec to Naples (1527).

See *Documentos inéditos para la Historia de España,* vol. xxv. (Madrid, 1854).

**NAVASOTA,** a city of Grimes county, Texas, U.S.A., in the southeastern part of the state, 71 mi. N.W. of Houston, near the Brazos river. It is served by the Gulf, Colorado and Santa Fe, the Missouri Pacific and the Southern Pacific railways. Pop. (1940) 6,138. It has cotton gins and cottonseed-oil mills, and is a shipping point for cotton, cattle, grain, watermelons, pecans and other agricultural products. The city was settled about 1820, and incorporated in 1866.

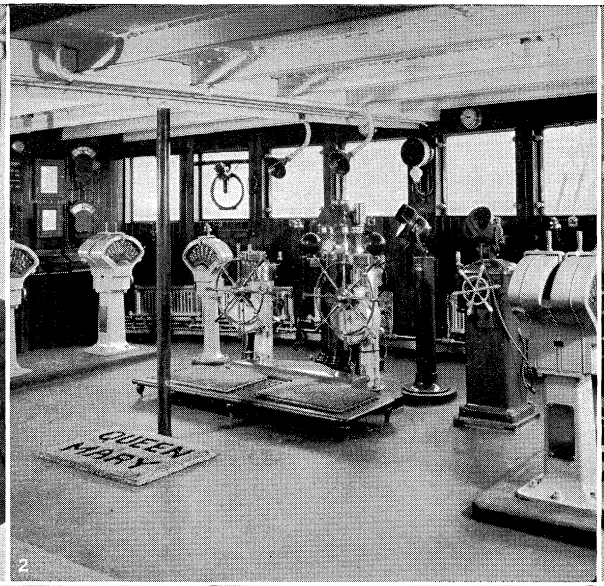
**NAVE,** ecclesiastically considered, that part of a church appropriated to the laity as distinguished from the chancel, the choir or the presbytery, reserved for the clergy. In a 14th century letter (quoted in Gasquet's *Parish Life in Medieval England,* 1906, p. 45) from a bishop of Coventry and Lichfield to one of his clergy, the reason for this appropriation is given. "Not only the decrees of the holy fathers but the approved existing customs of the Church order that the place in which the clerks sing and serve God according to their offices be divided by screens from that in which the laity devoutly pray. In this way the nave of the church . . . is alone to be open to lay people, in order that, in the time of divine service, clerics be not mixed up with lay people, and more especially with women, nor have communication with them, for in this way devotion may be easily diminished." The word "nave" has been generally derived from Lat. *navis,* ship. Salmasius in his commentary on Solinus (1629) finds the origin in the resemblance of the vaulted roof to the keel of a ship. The use of the word *navis* may, however, be due to the early adoption of the "ship" as a symbol of the church (*see* Skeat's note on *Piers Plowman,* xl. 32). The Greek *vaós,* Attic *νεώς* (*valειν,* to dwell), the inner shrine of a Greek temple, the *cella,* has also been suggested as the real origin of the word. This derivative must presume a latinized corruption into *navis,* for the early application of the word for ship to this part of a church building is undoubted.

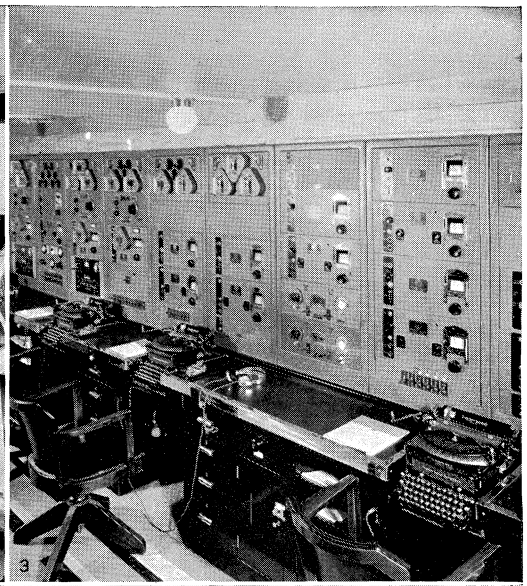
Architecturally considered the nave is the central and principal part of a church, extending from the main front to the transepts, or to the choir or chancel in the absence of transepts. When the nave is flanked by aisles light is admitted to the church through clerestory windows. (*See* BYZANTINE AND ROMANESQUE ARCHITECTURE.) At times, however, a gallery was carried above the side aisles.

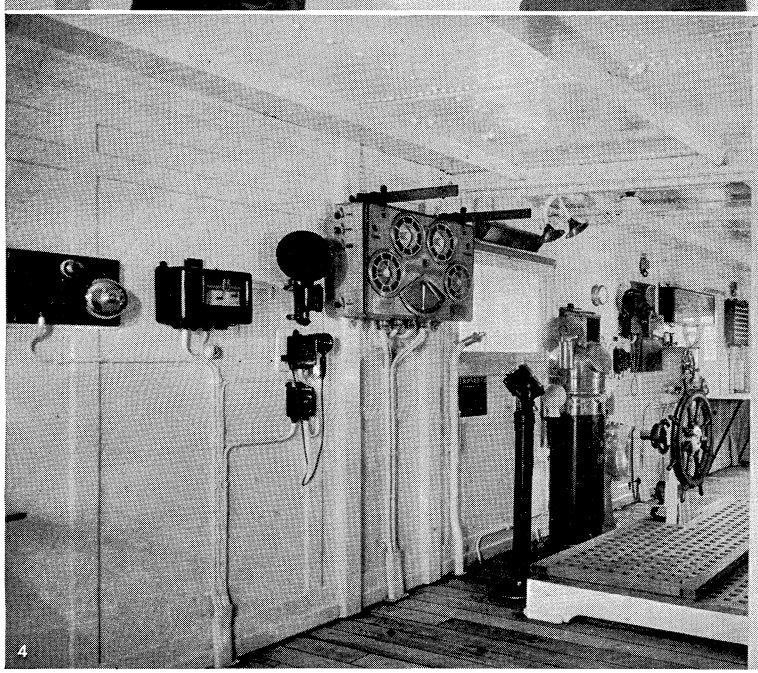
**NAVEL,** in anatomy, the umbilicus, the depression in the abdomen which indicates the point through which the embryo mammal obtained nourishment from its mother. (*See* ANATOMY: *Superficial* and *Artistic.*)

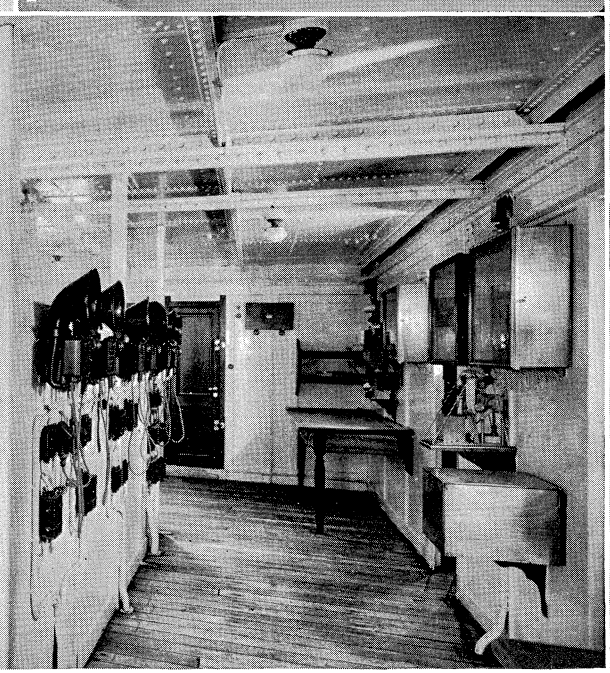
**NAVIGATION.** The science or art of conducting a ship across the sea. The term is also popularly used in connection with boats on rivers and lakes and with flying-machines, although in this latter case the science is often and correctly termed air-navigation. Navigation is technically limited to the art of conducting a ship from one port to another across, and on the surface of, the open sea, and it is in this technical sense that the subject is dealt with below.

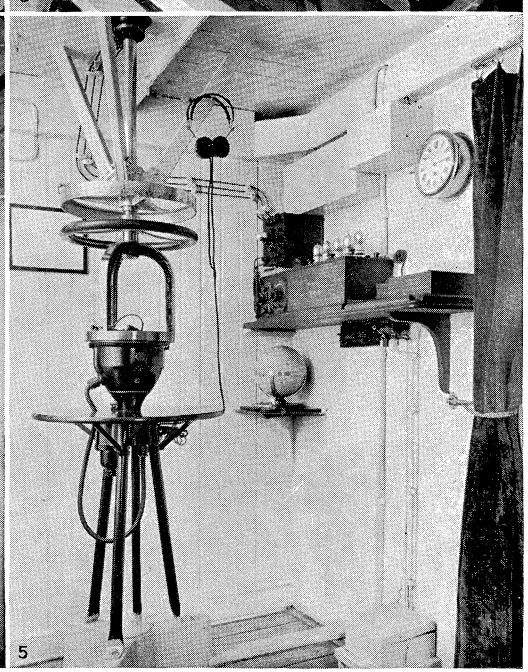
**Historical.**—Before the introduction of the mariners' compass









BY COURTESY OF (1, 4, 5) THE FRENCH LINE, (2, 3) CUNARD WHITE STAR LIMITED

## SCIENTIFIC NAVIGATION AIDS

1. Officers on the bridge of the S.S. "De Grasse," determining the ship's position by means of sextants, through which the sun is sighted. 2. Bridge room of the S.S. "Queen Mary," showing two rudder wheels and magnetic compass between. The gyro-compass, housed below decks, has electrical contact with the gyro-pilot and the steering apparatus in the wheel house. 3. Radio room of the "Queen Mary," with eight operating positions, radio-telephone exchange, and chief accepting office for radiotelegrams of passengers. Control of the entire radio equipment, including transmission on 32 different wave-lengths, is concentrated here. 4. Navigating room of the S.S. "Ile de France." The loud-speakers, on vertical position, are used in establishing rapid communication between the bridge and other portions of the ship, serving as great aids to navigation. The hand-controlled steering wheel, shown in centre, was later supplemented by gyro-pilot control. 5. Radio position finder on the S.S. "Ile de France." The direction from which the land signals are being sent is ascertained by determining from what point of the compass signals are received with maximum intensity

in the 14th century, the only practical means, among western nations, of navigating ships was to keep within sight of land; or to steer for short distances out of sight of land by reference to the sun or stars, more particularly the pole star. In eastern waters, long voyages out of sight of land were possible owing to the steadiness in direction of the monsoons, which enabled vessels in these localities to keep their course by running directly before the wind. The act of fixing positions by astronomical methods progressed far more rapidly on shore than at sea. The few rude appliances available to the navigator were limited, until the 18th century, to finding only the latitude of the ship at sea. No means of finding the longitude was devised, except the very rough method of estimating the run of the ship—known as dead reckoning—until the introduction, for practical purposes, of the lunar problem early in the 18th century. This complicated calculation made the finding of longitude one of considerable difficulty, even after the introduction of the sextant; because the moon passes the stars lying in her course through the heavens at a mean rate of only 33″ in one minute of time, and her motion in regard to the sun being less than this, it is obvious that a very small error in measuring the distance produces a correspondingly large error in the resulting longitude. The rise of what may be termed modern methods of astronomical navigation may be fairly dated from the invention of the chronometer in 1735, although it was not until some 40 years later that extensive trials of Harrison's chronometer proved to navigators the value of this instrument. The method of finding the apparent, or sun, time at the ship's position was well-known; but until the chronometer came into use afloat, and enabled the navigator to carry Greenwich mean time with him on board, it was not possible to find the longitude by simple calculation. (*See* CHRONOMETER.)

Rapid strides were made in the 19th century in the improvement of instruments and the publication of text-books useful to the navigator; also in the production of tables of logarithms compiled to facilitate the solution of trigonometrical problems associated with navigation. The *Nautical Almanac,* first published under authority for the use of seamen in 1767, came into general use. Machines for taking soundings were introduced and various methods were invented whereby the errors of the magnetic compass, due to the permanent and induced magnetism in the iron of the ship, could be very largely eliminated. Methods were applied whereby that important factor in obtaining an accurate position, the speed of the ship through the water, could be serviceably ascertained. The introduction of steam vessels went far to simplify the problems of navigation as the dead reckoning could be calculated with greater accuracy than was the case with sailing vessels. The progress of the art of navigation was, and is, of course, still inseparably connected with chart drawing. The steady and continuous improvement in the number and accuracy of charts is due to the marine hydrographic and coast survey service conducted by the principal maritime nations.

**Modern Navigation.**—With the above brief summary of the progress of navigation, the methods in use at the present time will be described, referring the reader for a more detailed and technical description to the text-books available on the subject. When making a passage from port to port situated at no great distance apart, the navigator ordinarily selects a course on a Rhumb line, which, on a Mercator's chart, the chart normally used, is a straight line. Between ports situated at great distances from one another, and differing widely in longitude, the course followed should be on the Great Circle, which, on a Mercator's chart is a curve, the shortest distance between any two places on the surface of the earth.

**Time at Sea.**—To avoid confusion a system of time zones for time-keeping at sea is in force in the navies of most countries. This system has been adopted so that vessels at sea, within certain defined limits of longitude, shall keep the same time as that used on land. The world is longitudinally divided into 24 zones of 15° each, the centre of the system being the meridian of Greenwich. This centre division lies between the meridians of the $7\frac{1}{2}$° E. and $7\frac{1}{2}$° W. and is known as the zero zone, or zone 0; the zones lying to the eastward being numbered in sequence with a minus (−) prefix; those to the westward being similarly numbered with a plus (+) prefix. The limits of the zones on land are modified somewhat according to the geographical configuration of the country concerned. By this system the same time is kept whether on land or sea throughout each zone except during the periods of summer time. The term Greenwich mean time (G.M.T.) is considered to be the standard time of the meridian of Greenwich, commencing at midnight and reckoned throughout the 24 hours. Both civil and astronomical times are, therefore, reckoned from midnight instead of from midnight and noon respectively. In the *Nautical Almanac* (abridged for the use of seamen) for 1925, and following years, the elements which prior to 1925 were given for every two hours of the astronomical day, which then began at noon, are given for every two hours of G.M.T. commencing at midnight.

**Astronomical Navigation.**—When considering the various methods of fixing the position of a ship at sea by observations of heavenly bodies, it is assumed that the errors of the chronometers are accurately known. Although chronometers have reached a high standard of efficiency they are nevertheless subject to very slight variations in respect to the true Greenwich time. The introduction of wireless time signals enables navigators in ships fitted with wireless telegraphy to obtain accurate time daily in most parts of the world. There are over 50 stations, working on various wavelengths and situated in different countries, for transmitting these signals. It is desirable to refer to the relevant publications for details of the form of transmission, and procedure.

Assuming then, that the true Greenwich time is calculated; that the observer is competent and the instrumental errors are known, the accuracy of a sea position, obtained by the observation of heavenly bodies, depends mainly on the accuracy of the sea horizon. On account of abnormal refraction occasioned by special conditions in the atmosphere, the sea horizon, as seen by an observer, is often displaced from the position which the tables of normal dip of the horizon would assign to it. This refraction is most common in localities where the temperature of the air and water differ widely. By combining the results obtained from observation of bodies situated in opposite quarters of the horizon, the errors in finding the true position of the horizon are largely counteracted. The conditions at dawn and twilight, when the horizon is visible and suitably placed stars can be selected, lend themselves to this purpose. And, moreover, it is in these periods that opportunities are present for another important purpose, that is, the selection, for simultaneous observation, of bodies whose relative bearings are such that the lines of position determined from the observations shall afford a well defined intersection, and thus serve to accurately find the latitude and longitude at approximately the same instant.

The only information that is obtained from one observation of a heavenly body is that the ship is somewhere on the circumference of a small circle, on the earth's surface, the centre of which is the geographical position of the body and the radius of which has the same arc-measure as the zenith distance at the instant of observation. At this instant the heavenly body observed must be vertically over some one point on the surface of the earth. The latitude of this point is equal to the declination of the body and the longitude is equal to the hour angle of the body from the meridian of Greenwich.

Owing to the size of the globe which would be required, it is, of course, not practicable to plot this small circle on a globe, and plotting it on a chart is inconvenient unless the radius is very short and the ship in low latitude. A small circle becomes very greatly distorted when plotted on a Mercator's chart, unless near the Equator. The usual method of plotting, on a chart, is to represent a portion of the small circle as a straight line, a tangent to the circumference; that is, a straight line drawn at right angles to the bearing of the body observed. But, as a straight line represents accurately only a very small portion of the circumference of a circle, it is necessary to select some point through which to draw this line, as near the actual position of the ship as possible. This straight line is the "line of position" somewhere on which the ship must be. If another heavenly body, suitably placed, is now observed or, after a reasonable interval, to allow of a change of

bearing, a second observation of the same body is made, a second line of position is obtained. The intersection of these two lines of position gives the actual position, provided the first line of position has been moved parallel to itself to allow for any run of the ship in the interval. The line of position, being a tangent to the small circle, is at right angles to the radius or bearing of the body observed; it follows, therefore, that the angles at which the several lines of position will intersect one another must be the same as the angles at which the bearings intersect. Bodies should, therefore, be selected which will give a good "cut." Each line of position has precisely the same value, provided the altitude has been observed with equal accuracy. An error of 1′ in the observed altitude, and thence in the zenith distance, produces an error of one mile in the line of position.

Now as to the manner of obtaining the point through which to draw the line of position. Whatever method is used, provided the method is a correct one, the point found will be somewhere on the line of position. There can be only one line of position derived from the observation of one body. Different methods of calculation do not give different lines of position, but give different points through which *the* line of position can be drawn. A point can be found by assuming the latitude and calculating the resulting longitude, which is a procedure applicable to observations of heavenly bodies which have a large azimuth; or by assuming the longitude and calculating the resulting latitude, which is applicable to observations of bodies with a small azimuth. The best method, however, is to assume both latitude and longitude and, therefrom, to calculate the zenith distance of the body observed, or in other words, the radius of the circle of position. Having, at the same instant, observed the actual altitude, and thence the zenith distance, it is at once ascertained whether the ship is on a line which is directly nearer to or directly farther from, the geographical position of the body than the assumed or dead reckoning position.

### MODERN AIDS TO NAVIGATION

**Directional Wireless.**—Determining the position of a ship at sea by means of directional wireless telegraphy (*see* WIRELESS) is of inestimable value to ships in thick weather, when approaching the land. The bearing of the shore station from the ship can be obtained either by means of a directional receiving apparatus carried in the ship, or by the system whereby the bearing of the ship is determined by one or more directional receiving sets on shore and the result being communicated to the ship.

The method of receiving bearings from ashore has the advantage that no additional equipment outside of the ship's ordinary wireless equipment is needed. However, it is subject to the disadvantage that the navigator himself cannot take and check the bearings. Furthermore, the shore stations can give a bearing to only one ship at a time which prevents a constant, repeated check of the ship's position. On the other hand the method of carrying the directional receiving set in the ship, once considered an interesting novelty, has been widely accepted as a necessary aid to navigation. The advantages of this method can be readily appreciated. For the navigator can repeatedly check his bearings upon the shore station with no wait except for the momentary pause in the code signals characteristic of that particular shore station. A knowledge of telegraphy is not required to receive the code signals, and the operation of the ship's wireless direction finding equipment is practically simple.

Either method of course is dependent upon the establishment of wireless direction finding (D/F) stations at points of importance to navigators.

The accuracy of the bearings is affected somewhat when the direction runs approximately parallel to the coast-line. Also bearings sometimes have been found to be unreliable at night. Wireless waves travel along the arc of a great circle as the shortest distance between any two points on the surface of the earth. It follows, therefore, that the true bearing of the ship from the station, or vice-versa, must be corrected for convergency to obtain the mean mercatorial bearing which is required if a chart on Mercator's projection is in use. A simple formula given in text-books enables this to be done. On a chart constructed on the gnomonic projection D/F bearings can be laid down without any correction for convergency, since great circles appear as straight lines on this projection. If, however, a compass "rose" is used it is necessary to have one on the chart for each D/F station, to compensate for the angular alteration of the projection at that station.

**Sound Ranging.**—Sound ranging (*see* also SOUNDING) also enables the position of a ship to be determined with accuracy at a considerable distance from the land.

**Echo Sounding.**—(*See* SOUNDING), by which the depth of water is obtained by the acoustic method, is of value in cases where the depth of water, or the speed of the ship, makes sounding by direct measurement unreliable. To obtain an accurate sounding by this method, a complete and sensitive apparatus is required. The apparatus consists of two microphones, one of which registers the emission of a sonic signal and the other the arrival of the echo reflected by the bottom of the sea. A specially constructed time recorder capable of reading to one-thousandth part of a second is connected to the microphones and enables the depth to be deduced. Sound travels through sea water at an average velocity of 4,800ft. per second. Consequently, by the acoustic method, very great depths can be reached in a brief space of time and the depths nominally required for navigational purposes will be reached in a small fraction of a second.

The highest practical development of the echo sounding principle is a device named the *Fathometer*. (*See* FATHOMETER.)

**The Leader System.**—The Leader system assists vessels to enter or leave harbour or to pass through narrow channels in thick weather. A submarine electric cable is laid along the channel, the shore end being connected to a station producing an alternating current. A simple and inexpensive receiving apparatus on board the ship enables the signals to be heard in telephones, or other form of amplifier, placed at or near the position from which the ship is usually conned. Two sets of coils are fitted, one on either side of the ship and so arranged that they can each be connected up to the receiving telephones. By connecting first one set of coils and then the other, to the receiving telephones, it is an easy matter, when within range, to determine whether the cable is to port or starboard. With practice, the distance of the cable can be estimated with comparative accuracy, because the signals become stronger as the cable is approached, the maximum intensity of the signals occurring when the ship is close to, but not vertically over, the cable. The same cable enables one ship to enter and one to leave harbour at the same time, provided, of course, the navigable channel is of sufficient width; it is a simple matter for each ship to steer to keep the cable a reasonable distance away on her port side, so that the two ships pass safely port to port. If space permits, it is possible to lay two cables, one for entering and one for leaving, the signals produced in each cable being distinctive by their note and character. This system has not come into general use owing presumably to the somewhat heavy cost.

BIBLIOGRAPHY.—Lieut. H. Raper, R.N., *The Practice of Navigation* (1840, 21st ed. 1920); W. R. Martin, R.N., *Navigation and Nautical Astronomy* (1888); *Admiralty Manual of Navigation, 1921;* British Admiralty, Signal Dept., *Technical Notes on the Leader Cable System* (1921); L. H. Walter, *Directive Wireless Telegraphy* (1921); E. J. Willis, *The Mathematics of Navigation* (1921); Rev. W. Hall, R.N., *Modern Navigation;* R. Keen, *Direction and Position Finding by Wireless* (1922); J. W. Norrie, *A Complete Set of Nautical Tables* (1922); Capt. K. Macdonald, *Macdonald's Tables for Correcting Wireless Bearings from Latitude 5 deg. to 70 deg. North or South* (1922); Captain Lecky, *Wrinkles in Practical Navigation* (13th ed., 1927); L. M. Berkeley, *Great Circle Sailing* (1924) and *North Star Navigation* (1925). (J. E. T. H.)

**NAVIGATION LAWS.** Historically this expression refers to laws passed at various times and places to restrict commerce to ships of a particular nationality, but, in another sense, navigation laws are those which lay down rules of the road and in other ways regulate the actual navigation of ships. With these latter all ships are as a rule required to comply, whatever their nationality. The two classes will here be dealt with separately.

**Restriction of Navigation.**—In England the first Navigation act was passed in 1381, during the reign of Richard II. Policy varied from time to time until the 17th century. Then, in 1651, during the period while Oliver Cromwell was in power, the Navi-

gation act was passed in order to strike a blow at the maritime supremacy of the Netherlands. The system set up of requiring the national trade by sea to be carried in ships under the national flag was maintained in force (as varied and amended by a number of further statutes) for a period of two centuries. By the Navigation acts ships under the national flag were required to be owned by British subjects, and shipmasters, and a proportion of the seamen were also required to be British.

"Under the form the Navigation acts had assumed in 1847 no produce of Asia, Africa or America could be imported for consumption into the United Kingdom from Europe in any ships, the object being that the trade should be direct and in British bottoms. The whole of the coasting trade of the United Kingdom was restricted to British ships, and the colonial trade was prohibited to all foreign ships unless under the sanction of a special Order in Council. Various restrictions were imposed on imports except in British ships. Differential dues and restrictions on importations could be imposed by Order in Council on the ships of any foreign country which imposed similar restrictions on British trade. It is to be observed that, with the exception of restrictions on exportation from this country to certain British possessions, the prohibitions of the Navigation acts were entirely restricted to imports. This necessarily followed from certain important trading powers having anticipated Great Britain in the enactment of navigation laws, their refusal to receive our goods except in their own ships preventing the possibility of the British parliament effectually restricting exportation in this direction." (Pulling.)

By an act passed in 1849 (12 & 13 Vict. C. 29) the Navigation laws were repealed, subject to a reservation of the coasting trade, and to a provision, intended to secure reciprocity, whereby, if British ships were subjected in other countries to prohibitions or restrictions, the privilege of the ships of those countries in British ports might be restricted.

Foreign ships were admitted to the coasting trade of the United Kingdom by an act passed in 1854 (17 & 18 Vict. C. 5) the provisions of which have been re-enacted in the Customs Consolidation act 1876, section 141.

While the laws restricting trade to national ships have thus long ceased to operate, British Law still provides that a ship shall not be deemed to be a British ship unless owned wholly by British subjects, or by a body corporate established in some part of the King's Dominions. British ships are required to be registered as such (Merchant Shipping acts). Further, by the British Nationality and Status of Aliens act 1914, an alien cannot be the owner of a British ship, and, by the Aliens Restriction (Amendment) act 1919, no alien may act as the master or as one of the principal officers of a British ship.

In the United States a system of duties discriminating against foreign ships was adopted in 1789. Under various statutes provision was made for relief by way of reciprocity, and consequently, after 1849, British ships were admitted to United States ports on the same terms as American ships were admitted into British trade, but coastwise trade has continued to be limited to ships of the United States.

The treaties of peace entered into at the conclusion of the World War laid down that steps should be taken to secure and maintain freedom of communications and of transit and equitable treatment for the commerce of all members of the League of Nations. At conferences convened by the League several international conventions on these lines were adopted. These included the Maritime Ports convention under which each of the contracting parties undertook, subject to the principle of reciprocity "to grant the vessels of every other contracting State equality of treatment with its own vessels, or those of any other State whatsoever, in the maritime ports situated under its sovereignty or authority, as regards freedom of access to the port, the use of the port, and the full enjoyment of the benefits as regards navigation and commercial operations which it affords to vessels, their cargoes and passengers. The equality of treatment thus established shall cover facilities of all kinds, such as allocation of berths, loading and unloading facilities; as well as dues and charges of all kinds levied in the name or for the account of the Government, public authorities, concessionaries or undertakings of any kind."

This Maritime Ports convention, however, does not apply to maritime coasting trade. The conference at which the convention was adopted passed a resolution recommending that all States should refrain from inequitable economic measures, such as in particular an abusive extension of the scope of the maritime coasting trade. The representatives of nearly 40 countries took part in this conference and the representatives of the United States attended as observers.

**Regulation of Navigation.**—The other class of navigation laws laying down rules of the road and in other ways regulating the actual navigation of ships may apply (1) on the high seas, or (2) within territorial waters, ports, harbours, docks and inland navigable waters. (As to territorial jurisdiction in general *see* WATERS, TERRITORIAL.)

Customary rules of seamanship applicable to navigation on the high seas were gradually developed. In England the Trinity Masters advised the judges as to the rules by which those in charge of a ship should be guided. In 1846 some Trinity House rules of navigation were made statutory. In 1889 an international maritime conference took place at Washington, the ultimate outcome of which was the drawing up of the international regulations for preventing collisions at sea. These have been adopted by all maritime nations, and are thus of universal application. They are operative in respect of British ships everywhere and in respect of foreign ships when within British jurisdiction in the following way. The British Merchant Shipping acts empower the King, by Order in Council, to make regulations of this kind. This was done in 1896. Several further orders were made, and in 1910 the regulations were consolidated and reissued in the form in which they are now in force.

The collision regulations apply in general everywhere but they are subject in certain harbours and inland waters to qualifications introduced by local rules to adapt them to special local circumstances. These were made either in the same way as other national laws or by local authorities under powers given to them by the national legislature having jurisdiction over the place in question. Thus local rules are in force in many British and Irish ports and waterways, in the Danube and port of Sulina, in the Scheldt, at Gibraltar, in the Suez Canal, in United States inland waters and in the Great Lakes, both United States and Canadian.

BIBLIOGRAPHY.—(Restriction): W. S. Lindsay, *History of Merchant Shipping* (1874–76); Alexander Pulling, *The Shipping Code* (1894); L. W. Maxwell, *Discriminating Duties and the American Merchant Marine* (1926). (Regulation): G. Kaeckenbeeck, *International Rivers* (London, 1918); E. S. Roscoe, *Admiralty Practice* (1920); Marsden's *Collisions at Sea* by A. D. Gibb (London, 1923). (S. D. C.)

**NAVY AND NAVIES.** Originally the navy of a country meant the whole of its shipping, whether used for war, the carrying of merchandise or fishing. In modern parlance, however, the word is generally taken to mean a nation's warships and craft of every kind maintained for fighting on, under or over the sea and the personnel which mans them, *e.g.*, the British Navy consists of the surface warships,—battleships, cruisers, aircraft carriers, destroyers, mine-layers, mine-sweepers, gun-boats and other auxiliary craft; the submarines; and the fleet air arm. Behind the actual fighting units there is, necessarily, a vast organization for their administration and upkeep. *See* the sections "Defence" of the articles UNITED STATES, FRANCE, GERMANY and other countries; also such articles as ADMIRALTY, STAFF, NAVAL AND DOCK YARDS and NAVAL BASES.

**History of Navies.**—In early history we find navies in the form of the armed men of a tribe or town putting to sea in such large boats or ships as might be available to give battle to enemies similarly equipped or to raid territory from the sea. The craft themselves were for the most part those used for commerce, fishing or, when occasion served, for war or piracy. It was the exception that they were built especially for fighting purposes. But later we see special types of war craft designed as such beginning to assume a recognized place in the armory of peoples and their sovereigns. Some of the earliest of what we should, to-day, term sea powers were the Phoenicians, Athenians, Carthaginians, Romans, Norsemen, Venetians, French and early English, but navies

in legendary form are to be found 2,000 years before they materialised in accredited records and the adventures of the Argonauts and of Ulysses would seem poetic forecasts of the age of the Vikings. In regard to the vessels themselves, there are definite indications of long ships built for speed as distinguished from round ships for burden from the time of the ancient Greeks and Romans. The Athenian navy was a state force and in 483 B.C. the threat of Persian attack caused Athens to increase her fleet from 50 to 100 long ships which were paid for out of the proceeds of the mines of Laureium (*see* THEMISTOCLES). The effect of this was to make Athens the predominating partner in the league formed by the Greeks for their common naval defence. By the end of the 5th century B.C. the fleet had increased to 300 long ships and later to as many as 360. In peace these war vessels were kept on slips and under cover in sheds; in war a *strategos* was appointed in command and he chose the trierarchs who were deputed to commission the vessels, partly at their own expense, under the supervision of State Inspectors.

In general the organization of the Athenian navy resembled closely that of the British navy in the 16th and 17th centuries. The trierarch, who was either one of a group of citizens assisting to finance one or more war vessels, or someone paid to discharge the duty, answered to the captain; there was a sailing master; a number of petty officers; seamen and oarsmen; while soldiers or marines formed the fighting personnel. The most ancient warships were many-oared galleys (*q.v.*), each requiring a very large number of rowers. The result was that the personnel provided to man a fleet of those times had to be a considerable one. For instance, the Roman and Carthaginian forces in the first Punic War numbered approximately 150,000 men on each side. These great rowing galleys relied for their offensive powers on boarding or ramming, and we see them in great numbers in the Mediterranean as the war fleets of the succession of Alexander, of Carthage, of Rome, of Byzantium, of the Italian Republics, of the Arabs and of Aragon. (*See* also SHIP.)

In the naval organization of ancient Rome we see the beginning of the idea of an Admiralty in the navy commissioners appointed in 311 B.C. It is interesting to note, too, that the Roman Empire was faced, on a small scale, with maritime problems which have assumed such vast importance to the British Empire of to-day. Not only had Rome to maintain a fleet to neutralize the threat arising from rival sea powers, but sea-borne trade was of such importance as to compel her to provide a navy capable of dealing with prevalent piracy and the needful safeguarding of routes. This organization, which was very complete, included two main fleets which guarded the coasts of Italy at Ravenna and Misenum. These were known as the Praetorian. Other squadrons were allocated to Forum Julii, to the mouth of the Orontes, to Alexandria, to Carpathus (between Crete and Rhodes), to Aquileia (at the head of the Adriatic), to the Black Sea and to Britain. River flotillas were stationed on the Rhine and Danube and, later, on the Euphrates. All these squadrons did not exist at the same time, but there was always a highly organized navy with a body of soldiers, the *classici,* specially assigned for service afloat.

The navy of the Eastern Empire may be said to have originated with the foundation of Constantine's New Rome on the site of Byzantium. The threat of attack from the Vandal kingdom of Carthage (from A.D. 428 to 524) compelled the Emperors to attend to their fleet, but with the fall of that kingdom the navy was neglected until the rise of Mohammedan power at the end of the 7th century produced a new menace. The Byzantine navy reached a high state of efficiency under the sovereigns of the Macedonian dynasty (867–1056). It consisted of an Imperial fleet commanded by the Great Drungarios, the first recorded Lord High Admiral, and of provincial squadrons under their *strategoi.* The Imperial Fleet was essentially a war organization, while the provincial or thematic squadrons were smaller but more permanent forces maintained for police purposes. It is interesting to note that this navy included a corps corresponding to the gunnery experts of a modern fleet. These were the *siphonarioi,* who worked the *siphons* used for discharging the "Greek fire."

After the disorganization of the Eastern Empire by Turkish invasions in the 12th century, the Byzantine navy withered. In the middle ages the Italian republics and monarchial states bordering on the Mediterranean possessed appreciable fleets, and their seamen, especially those of Genoa, were regarded as some of the first in the world, so much so that their services were sought by the powers of Western Europe and even by England. Edward III. and the kings of France employed Genoese to assist them in nautical matters.

The Mediterranean navies made their last great appearance in history at the Battle of Lepanto, 1571 (*q.v.*). From thence onwards the scene of naval activity changed and the ships and fleets took upon themselves a new form, and one to fit them for ocean sailing and fighting. The history of the growth of modern great navies will be found under their respective countries. (E. A.)

BIBLIOGRAPHY.—*Ancient and General.*—Accounts of the naval organizations of the ancient world, and of the sea fighting of the time are to be found in the histories of Greece and Rome: G. Corazzini has written a *Storia della marina militare antica* (Livorno, 1882). Valuable details of the Imperial Roman navy and of the Byzantine navy will be found in Prof. J. B. Bury's appendices to his edition of Gibbon's *Decline and Fall,* vol. i. apx. 5, and vol. vi. apx. 5 (1896–1900). *See* also A. T. Mahan, *Influence of Sea Power on History, 1660–1783* (1890).

For *United States* see UNITED STATES OF AMERICA, *Navy.*

*Mediaeval.*—As regards the mediaeval navies the first place may be allowed to the Italians. A general bibliography of Italian nautical literature *Saggio de una bibliografia marittima italiana,* occupying fifty-eight pages, drawn up by E. Celani, will be found in the *Revista marittima,* supplement for 1894. The histories of the different Republics of the middle ages record their maritime enterprises. An excellent book, which gives far more than its title promises, is the *Storia della marina pontificia* of A. Guglielmotti, O.P., in 10 volumes published at different times, and in two editions, at Florence 1856, etc. The general maritime history of the Mediterranean in the middle ages is well illustrated in the *Memorias sobre la marina comercio y artes de Barcelona* (1779–1792) by A. Capmany. The naval enterprises of the Norsemen are dealt with in a scholarly fashion by G. B. Depping, *Histoire des expéditions maritimes des Normands* (1826); and with newer knowledge by C. F. Keary, *The Vikings of Western Christendom* (1891).

*Great Britain.—The History of the Royal Navy to the French Revolution,* by Sir N. Harris Nicolas (1847), is unfortunately incomplete. It ends at the year 1422, but is the work of a most laborious and exact antiquary, who had been a naval officer in his youth. The administrative history of the British navy until 1660 is the subject of the *History of the Administration of the Navy and of Merchant Shipping in relation to the Navy* (1896) by M. Oppenheim—a most valuable collection of materials. *The Naval History of England* (1735) by T. Lediard, is copious and useful. The *Naval Chronology, or an Historical Summary of Naval and Maritime Events from the Time of the Romans to the Treaty of Peace 1802,* by Captain I. Schomberg (1802), contains a mass of valuable information, lists of ships, dates of construction, etc., and some administrative details. A good book is *The Naval and Military Memoirs of Great Britain 1727 to 1783* (1804) by R. Beatson, a very careful and well-informed writer who had seen some service as a marine officer. The *Naval History of Great Britain,* from 1793 to the accession of George IV., by W. James (1827), republished with a continuation by Chamier in 1837, is a standard authority. The *History of the British Navy from the Earliest Period to the Present Time* (1863) by C. D. Yonge, contains some original matter for the naval transactions of the 19th century. *The Royal Navy,* 7 vols. (1897–1903), edited and partly written by Sir W. L. Clowes, is a compilation of unequal value. Some of Sir W. L. Clowes's coadjutors, notably Captain Mahan and Sir C. R. Markham, are of high standing and authority. *The Naval Chronicle,* 1799–1818, a magazine, contains useful matter, for the Revolutionary and Napoleonic Wars. *The Naval Biographical Dictionary; life and services of every living officer* (1846), by W. R. O'Bryne, is a solid book of reference. The publications of the Navy Record Society (1894 and subsequent years) contain large and valuable publications of original matter, with some reprints of old authorities, such as Sir W. Monson's *Tracts,* which were difficult of access. *See* also *A Short History of the Royal Navy,* by D. Hannay; *Official History of the War:* "Naval Operations" (1920, etc.); G. Callender, *The Naval Side of British History* (1924); G. F. S. Bowles, *The Strength of England* (1926).

*France.*—Léon Guérin, *Histoire maritime de la France* (1844). The *Histoire de la marine française* of Le Comte de Bonfils Lablénie (1845), a naval officer, is of value. *La Marine de guerre, ses institutions militaires depuis son origine jusqu'à nos jours,* by Capne Gougeard (1877); the *Essai sur l'histoire de l'administration de la marine française* of Lambert de Sainte Croix (1892); and the excellent little book of M. Loir on *La Marine royale, 1789* (n.d.), may be consulted with pleasure and profit. The three books of A. Jal, *Archéologie navale* (1840), *Glossaire nautique* (1848) and *Abraham du Quesne et la marine de son temps* (1872) are all of high value. *Les Batailles navales de la France* of O. Troude (1867), is a carefully written account of naval actions.

The *Histoire de la marine française, pendant la guerre de l'indépendence américaine* (1877); *Sous la première république* (1886); *Sous le consulat et l'empire* (1886); *De 1815 à 1870* (1900); and *La Marine française et la marine allemande, 1870–1871* (1873) of E. Chevalier, are thorough and critical. G. Lacour-Gayet, Professor at L'École supérieure de la Marine, has published two books of serious research, *La Marine militaire de la France sous le règne de Louis XV.* (1902), and *La Marine militaire de la France sous le règne de Louis XVI.* (1905). The *Recherches sur l'ancien clos des galées de Rouen* (1864) of C. de Robillard de Beaurepaire, and the life of *Jean de Vienne* by the Marquis Terrier de Loray (1878), are valuable monographs on passages of early French naval history. The *Projets et tentatives de débarquement aux Îles britanniques* by E. Desbrière (1900 *seq.*) is a most valuable authority. A very scholarly *Histoire de la marine française* was begun in 1899 by M. C. de la Roncière.

*Miscellaneous:*—The standard authorities for Spanish naval history are, *La Marina de Castilla* (1892), and *La Armada Española desde la union de Castilla y Aragon* (1895–1901), of C. Fernandez Duro. J. C. de Jonghe, *Geschienes van het Nederlandsche Zeewezen* (1858), is an admirable and exhaustive history of the Dutch navy. *The History of the Maritime Wars of the Turks,* by Haji Khalfa (or Hugji Chalifa), tr. J. Mitchell for the Oriental Translation Fund (1831), may be read with curiosity and some profit. There are two general histories of the navy of the United States by Fenimore Cooper (1839), and by E. S. Maclay (1894); the second is the fuller, and the more critical. The monographs by Admiral Jurien de la Gravière, covering the whole field of naval warfare from the Peloponnesian War to his own time, contain much information and sound criticism.

**NAVY DEPARTMENT:** *see* GOVERNMENT DEPARTMENTS.

**NAWABGANJ,** the name of four towns of British India. (1) The most important is the headquarters of Bara Banki district in the United Provinces, 17 mi. E. of Lucknow; pop. (1941) 18,207. It has a considerable trade in sugar and cotton goods. It was the scene of a victory by Sir Hope Grant during the Mutiny. (2) A town in Malda district of Bengal, on the Mahananda near the Ganges, a centre of river trade; pop. (1941) 23,164. (3) A town in Gonda district, United Provinces, pop. (1941) 5,662. (4) A town in Bareilly district, United Provinces, pop. 4,577.

**NAWANAGAR** or JAMNAGAR, a native State of India, in the Western India States Agency, Bombay, situated on the south of the Gulf of Cutch. Area, 3,791 sq.mi. Pop. (1941) 504,006. Tribute, £7,000, to the British Government, the Gaekwar of Baroda and the Nawab of Junagarh. The chief, whose title is Jam, is a Jadeja Rajput of the same clan as the rao of Cutch. The present chief is Maharaja Jam Shri Digvijayasinhji Saheb who succeeded in April 1933. There is a State railway from Rajkot to Tamnagar town. Grain, cotton and oilseeds are exported. Marble and copper are found, and there is a pearl fishery in the Gulf of Cutch. The town of Jamnagar is about 5 mi. from the seaport of Bedi. Pop. (1941) 71,588. Founded by Jam Rawal in 1540, it is built of stone, has manufactures of silk and gold embroidery and locomotive works and is well-known for its dyeing. Its water is supplied from a reservoir covering 600 acres and an aqueduct 8 mi. long.

**NAXOS,** the largest of the Cyclades (about 22 m. by 16 m.), east of Paros, with which, and adjacent smaller islands, it forms an *eparchia.* In early times it was also called Dia or Strongyle. Rich in vines and famous for its wine, it was a centre of the worship of Bacchus. The god found Ariadne asleep on its shore, when she was deserted by Theseus. The sculptors of Naxos were important in early Greek art; unfinished statues are still to be seen in the quarries, notably the colossal one in Apollona Bay, to the N.E. During the 6th century B.C. a tyrant Lygdamis ruled Naxos in alliance with Peisistratus of Athens. In 501 a Persian fleet attacked it unsuccessfully, but in 490 it was captured and treated with severity. Four Naxian ships joined the expedition of Xerxes, but deserted to the Greek side at Salamis in 480. Naxos was a member of the Delian League (*q.v.*); but, revolting in 471, was captured by Athens, and remained in her possession till her fall. In later times after its capture, in A.D. 1207, by the Venetian, Marco Sanudo, the duchy of Naxos flourished till the Turks took the island in 1566. Since the War of Independence it has belonged to the Greek kingdom. The ancient remains of a temple (*Palati*), supposed to be that of Dionysus, are on an island just off the town. Naxos is rich in fruit trees, and exports corn, wine and oil, but its most important product is emery. The population is about 17,000.

**NAXOS,** the earliest Greek colony in Sicily, was founded by Theocles from Chalcis in 735 B.C., on the east coast, south of Tauromenium (mod. Taormina), just north of the mouth of the river Alcantara, where the castle of Schiso now stands. As there were already Sicels at Tauromenium, they cannot have offered any opposition. The adoption of the name of Naxos, the island in the Aegean Sea, may show that there were Naxians among its founders. It soon founded Leontini and Catana. Naxos was the warmest ally of Athens in the Sicilian expedition. In 403 B.C. it was destroyed by Dionysius and its territory given to the Sicels. Its exiles at last found refuge in 358 at Tauromenium. Scanty traces of its walls are to be seen.

**NAYAR** (NAIR), the dominant lay caste in Malabar, on the west coast of southern India. The Nairs were originally a militia, the name being a form of Sanskr. *nāyaka,* "leader," as is Tamil *nāyadu, naidu;* but many Nairs now enter civil professions. The caste is split up into numerous groups of varying status, but all are or were curiously submissive to the Nambūtiri Brahmans. To the Nair, as a soldier or marine, marriage was forbidden, and a Nair woman was therefore ritually married to anyone, even a stranger, merely as a form. After that she could be united to a Nambūtiri or a Nair, not below her in group-status, by the *sambandham* ceremony. It would seem that once she was permitted to have several such "husbands," not necessarily brothers, at a time. But, strictly speaking, polyandry did not exist, and it is now probably as extinct in fact as in theory. The *sambandham* became monogamous and usually permanent. From the custom, however, descent in the female line naturally ensued, and it involved also inheritance in that line, a man's heir-at-law being his (uterine) sister's son. But a woman's property was managed by the senior male of her own kin. To remedy the evils of this system the Malabar Marriage Act of 1896 enabled *sambandhams* to be registered as binding and permanent marriages, but little advantage has been taken of the statute, as it merely legalised the prevailing custom.

E. Thurston, *Castes and Tribes of Southern India,* vol. v. (1905), is exhaustive; Moore, *Malabar Law and Custom* (1905).

**NAYARIT,** a State of Mexico, until 1917 the territory of Tepic, facing on the Pacific ocean and bounded N., E. and S. by Sinaloa, Durango and Jalisco. Area 10,442 sq.mi. Pop. (1900) 150,098; (1910) 171,173; (1940) 216,698. The active volcano of Ceboruco rises in the western part of the territory. The slopes and valleys are densely wooded, the lower regions being very fertile and adapted to tropical agriculture. The rainfall is abundant, and the climate hot, damp and malarial. The Río Grande de Lerma, or Santiago, is the principal river, whose sources are to be found on the high plateau in the State of Mexico. The next largest river is the Mezquital, which has its sources in the State of Durango, not far from the city of the same name. Among the products of the coast lands are sugar, cotton, beans, tobacco, maize, palm oil, coffee, fine woods and medicinal plants. Mining attracts much attention in the sierras, and its mineral deposits are rich. There are cotton and cigarette factories at the city of Tepic, besides sugar works and distilleries on the plantations. The capital of the State is Tepic. Pop. (1910) 16,778, (1940) 17,547. Tepic is attractively situated on a small plateau 3,000 ft. above sea-level, 26 mi. E. by S. of its port, San Blas, with which it is not yet connected by rail. The city is on the Southern Pacific of Mexico railway running between Nogales and Guadalajara.

**NAYLER** or **NAYLOR, JAMES** (1618–1660), English Puritan, was born at Andersloe or Ardsley, in Yorkshire, in 1618. In 1642 he joined the parliamentary army, and served as quartermaster in John Lambert's horse. In 1651 he became a Quaker. He gradually arrived at the conviction that he was a new incarnation of Christ. He gathered round him a small band of disciples, who followed him from place to place. At Appleby in 1653 and again at Exeter in 1655 he suffered terms of imprisonment. In Oct. 1655, in imitation of Christ's procession into Jerusalem, he entered Bristol on horseback riding single—"a rawboned rude figure, with lank hair reaching below his cheeks" —attended by seven followers, some on horseback, some on foot, he in silence and they singing "Hosanna! Holy, holy! Lord God

of Sabaoth!" At the High Cross he and his followers were arrested. His trial occupied the second parliament of Cromwell for several days, and on Dec. 16, 1656, he was convicted of blasphemy and sentenced to be whipped, to be branded in the forehead with "B" (for blasphemer), to have his tongue bored with a red-hot iron, to be whipped through the streets and to suffer imprisonment for two years. On his release he was readmitted into the communion of the Quakers.

**NAZARENES,** an obscure Jewish-Christian sect, existing at the time of Epiphanius (*fl.* A.D. 370) in Coele-Syria, Decapolis, (Pella) and Basanitis (Cocabe). According to him (*Panarion,* xxix. 7) they dated their settlement in Pella from immediately before the siege in A.D. 70; he characterizes them as neither more nor less than Jews pure and simple, but adds that they recognized the new covenant as well as the old, and believed in the resurrection, and in the one God and His Son Jesus Christ. Recent investigation leads to the conclusion that the Nazarenes of the 4th century are to be identified with the Ebionites (*q.v.*).

**NAZARETH,** a town of Lower Galilee, on the northern border of the plain of Esdraelon, 1,600 ft. above sea-level. The population in 1931 was 8,756 (3,226 Muslims, 5,445 Christians); 1939 estimate, 10,100. There are numerous places of worship and charitable institutions in the town. The industries are lace-knitting, and the manufacture of mementoes for sale to tourists.

Nazareth is not mentioned in the Old Testament. It first became known as the place where Jesus spent his youth. The village was the home of Joseph and Mary, and to it they returned after the flight to Egypt. In its synagogue Jesus preached the sermon that led to his rejection by his fellow-townsmen. A mass of legends and precarious identifications has grown up with the ages. A sample of the soil in which they took root and flourished may be here given. Antoninus Martyr, who visited Palestine in A.D. 570, tells us: "In the synagogue there is still the book from which our Lord was set to learn A.B.C. In the synagogue, too, is the bench upon which our Lord sat with the other children. This bench can be moved and lifted up by Christians; but Jews cannot at all stir it, nor does it permit itself to be carried out of doors." Today visitors are shown the church of the Annunciation, the workshop of Joseph, St. Mary's well, Christ's table, the place of precipitation, etc. Only for the well can authenticity be assured.

The Crusaders captured Nazareth in 1100 and transferred there the bishopric of Scythopolis (Beisān). It was taken by Saladin (1187) and re-taken by Frederick II. (1229). On its capture by Beibars (1263), the Christian inhabitants were massacred. In 1517 it came into the possession of the Turks. In World War I Nazareth was the headquarters of the Turco-German army. It was captured by British cavalry Sept. 20, 1918. (E. Ro.)

**NAZARETH,** a borough of Northampton county, Pennsylvania, U.S.A., 7 mi. N.W. of Easton; served by the Lehigh and New England, D. L. & W. railways and bus lines. Pop. 1940 was 5,721. It has cement works and factories for textiles, musical instruments, etc. It was founded by the Moravians in 1740.

**NAZARITE** or, better, **NAZIRITE,** the name given by the Hebrews to a peculiar kind of devotee. The characteristic marks of a Nazarite were unshorn locks and abstinence from wine (Judges xiii. 5; 1 Sam. i. 11; Amos ii. 11 *seq.*); but full regulations for the legal observance of the Nazarite vow are given in Num. vi., where every product of the grape-vine is forbidden, and the Nazarite is enjoined not to approach a dead body. The law contemplates the assumption of the vow for a limited period only, and gives particular details as to the atoning ceremonies at the sanctuary by which the vow must be recommenced if broken by accidental defilement. On the expiry of his vow the Nazarite cuts off his hair and burns it on the altar, thus returning to ordinary life. In the earliest historical case, that of Samson, and in the similar case of Samuel (who, however, is not called a Nazarite), the head remains unshorn throughout life, and in these times the ceremonial observances as to uncleanness must have been less precise: *e.g.*, Samson touches the carcass of a lion.

In the cases of Samuel and Samson the unshorn locks are a mark of consecration to God (Judges xiii. 5) for a particular service. Since, moreover, the Hebrew root *n-z-r* is only dialectically different from *n-d-r*, "to vow," both corresponding to the same original Semitic root (Arab. *n-dh-r*), it would seem that the peculiar marks of the Nazarite are primarily no more than the usual sign that a man is under a vow of some kind. To leave the locks unshorn during an arduous undertaking in which the divine was specially implored and to consecrate the hair after success was a practice among various ancient nations, but the closest parallel to the Hebrew custom is found in Arabia. There the vow was generally one of war or revenge, and, till it was accomplished, the man who vowed left his hair unshorn and unkempt, and abstained from wine, women, ointment and perfume. At one time the Nazarites probably had an importance—perhaps even an organization—parallel to that of the prophets, but of a very different religious type from the Canaanite nature-worship.

BIBLIOGRAPHY.—*See* RECHABITES; *Ency. Bib.*, col. 3362 *seq.*, Hastings, *D.B.*, v. 657; Frazer, *The Magic Art,* i, 28 *sqq.*; W. R. Smith, *Rel. Sem.*[3] index, *s.v.* "hair"; Harper, *Amos and Hosea,* p. li. *sq.*; G. B. Gray, *Numbers,* pp. 56–61; Binns, *Numb.*, pp. 36–41. (W. R. S.)

**NAZI,** a popular abbreviation for a member of Adolf Hitler's National Socialist German Workingmen's party (*Nationalsozialistische Deutsche Arbeiterpartei,* commonly designated by its initials, NSDAP). The nickname originated from the German pronunciation of the first two syllables of "National." The Nazi party was formed by Hitler and six comrades at Munich in 1920. Its original program, drawn up by Gottfried Feder, comprised 25 points. Six of these have been more or less completely realized: equal rights among nations for the German people and abolition of the Versailles treaty restrictions; exclusion of Jews from German political, economic and cultural life; abolition of the "corrupting" parliamentary system of many parties; the replacement of the professional army by a people's army; regimentation of the press, which must be exclusively in the hands of Germans, to prevent "deliberate political lies," and of art and literature, to prevent all tendencies disruptive of German life; and the creation of a strong central government. Six points have been partly carried out: restriction of the immigration of non-Germans and the deportation of non-Germans who immigrated since Aug. 2, 1914; replacement of "materialistic" Roman by German common law; an open road to higher education for all capable Germans; confiscation of war profits; unsparing prosecution of all who injure the common well-being, such as common criminals, usurers and profiteers; and the promotion of health, physical training and sports. Two points are still blocked by Germany's neighbours: the union of all Germans (outside Germany) and more land, including colonies. Five socialistic points seem to be tacitly abandoned, although there is some agitation for them: abolition of unearned income and the breaking of the "slavery of interest"; nationalization of trusts; profit-sharing in big businesses; municipalization of big department stores in the interests of the small shopkeeper; and the expropriation of land for the common good. One point advocates "positive Christianity," without binding the party to any particular creed, but also combats "Jewish materialistic spirit"; in practice minor sects have been suppressed, and Roman Catholics, Lutherans and Calvinists have been severely restricted. The remaining points are vague or of minor importance.

This Nazi program has never been officially revised, but it is no longer of prime importance, and its author, Gottfried Feder, has been shelved with a sinecure. Today, just as Christians draw their faith from the Bible and the words of Jesus, so Nazis find the expression of their faith and beliefs in Hitler's book, *My Battle* (*Mein Kampf*), and in his speeches and decrees.

**NDEBELE:** *see* MATABELE.

**NEAGH, LOUGH,** the largest lake (Irish, "lough") in the British isles, in Northern Ireland, in the province of Ulster, its waters being divided between counties Antrim (north and east), Down (south-east), Armagh (south), Tyrone and Londonderry (west). Its shape is an irregular oblong, its extreme measurements being 18 mi. from north-east to south-west, 16 from north to south, and 11 from east to west. Its circumference, without including minor indentations, is about 64 mi., and its area 98,255 ac. or about 153 sq. miles. The shores are generally flat and marshy, or very gently sloping, but flat-topped hills rise

near the northern shore, where the lake reaches its extreme depth of 102 feet. The mean height above sea-level is 48 feet. The river Bann, flowing northward, is the only outlet. The principal feeders are the Main on the north, the Crumlin (whose waters have petrifying powers) on the east, the Bann and Blackwater on the south, and the Ballinderry and Moyola on the west. Antrim and Toome, at the north-east and north-west respectively, are the only towns immediately on the shores.

**NEALE, EDWARD VANSITTART** (1810–1892), English co-operator and Christian Socialist, was born at Bath on April 2, 1810, the son of a Buckinghamshire clergyman. He studied at Oriel college, Oxford, was called to the bar at Lincoln's Inn in 1837, became a member of the Christian Socialists in 1850 and also joined the council of the Society for Promoting Working Men's Associations. He founded the first co-operative store in London, and advanced the capital for two builders' associations, both of which failed. In 1851, though strongly opposed by other members of the promoting "Council," he started on his own initiative the Central Co-operative Agency, similar in many respects to the Co-operative Wholesale Society of a later day. The failure of this scheme, together with that of the operatives' cause in the engineering lock-out of 1852 is said to have cost him £40,000. He was closely associated with the movement which resulted in the Industrial and Provident Societies Act of 1876, and the passing of the Consolidation Act of 1862 was almost entirely due to his efforts. Besides publishing pamphlets on co-operation he served on the executive committee which afterwards developed into the Central Co-operative Board, and took an active part in the formation of the North of England Co-operative Wholesale Society in 1863. One of the founders of the Cobden mills in 1866, and the Agricultural and Horticultural Association in 1867, he also promoted the annual co-operative congress. He was also a director of the Co-operative Insurance Company and a member of the Co-operative Newspaper Society. He visited America in 1875 with a deputation whose object was to open up a direct trade between farmers of the western States and English co-operative stores. He died on Sept. 16, 1892.

**NEALE, JOHN MASON** (1818–1866), English divine and scholar, was born in London on Jan. 24, 1818, and was educated at Trinity college, Cambridge. He occupies a high place as a hymnologist, but principally as a translator of ancient and mediaeval hymns, the best known being probably "Brief life is here our portion," "To thee, O dear, dear country," and "Jerusalem, the golden," which are included in the poem of Bernard of Cluny, *De Contemptu Mundi,* translated by him in full. He also published *An Introduction to the History of the Holy Eastern Church* (1850, 2 vols.); and other works. His *Collected Hymns* were published in 1914.

See *Letters of John Mason Neale* (1910), selected and edited by his daughter Mrs. C. Towle, who also wrote his *Life* (1907).

**NEANDER, JOHANN AUGUST WILHELM** (1789–1850), German theologian and Church historian, was born at Göttingen on Jan. 17, 1789, of poor Jewish parents named Mendel. He graecized his name into Neander on his baptism in 1806. Educated under Schleiermacher, he became professor at Heidelberg in 1812 and removed to Berlin in 1813. His great learning, his wide sympathies, and a very lovable personality attracted many students, and he did perhaps more than any other teacher to bring a new and less formal spirit into Lutheran teaching. He died on July 14, 1850.

**NEANDERTHAL MAN.** The cave in which the Neanderthal bones were discovered, in 1857, is situated in the valley of the Düssel, a tributary of the Rhine. The fragments then found, the vault of the skull, right and left thigh bones, and portions of the shoulder blade, pelvis and ribs, belonged to a separate species —which is represented by remains found in Jersey, in France, Belgium, Spain (Gibraltar), Czechoslovakia and Palestine. The normal skull of this race was long, wide, and, though low, was capacious. The flattening affected the back part of the skull, so that the head must have appeared as set on a thick bull neck. The brow ridges were massive. The chin was lacking. The teeth and palate were specialized in form and point to a rough vegetable diet. The thigh bones are more simian in character than those of modern man. In sum, the differences between Neanderthal man, toward the beginning of the Old Stone age, and modern man are greater than between modern races.

*See* Sir A. Keith, *The Antiquity of Man,* 2nd ed. (1925); *Journal of the Royal Anthropological Institute* (1928), vol. lviii., pt. 1.

**NEAP,** a word only used of tides in which the high-water mark is at its lowest, as opposed to "spring tides" (*see* TIDE). The word is obscure in origin.

**NEARCHUS,** one of the officers in the army of Alexander the Great. A native of Crete, he settled at Amphipolis in Macedonia. In 325, when Alexander descended the Indus to the sea, he ordered Nearchus to conduct the fleet to the head of the Persian Gulf. Nearchus was then entrusted with the more difficult task of circumnavigating Arabia from the mouth of the Euphrates to the Isthmus of Suez, a project cut short by the death of the king (323). In the troubles that followed Nearchus attached himself to Antigonus, under whom he held the government of his old provinces of Lycia and Pamphylia, and probably therefore shared in the downfall (301) of that monarch.

He wrote a detailed narrative of his expedition, of which a full abstract was embodied by Arrian in his *Indica.*

The text, with copious geographical notes, is published in C. Müller's *Geographi Graeci Minores,* i. (1856); on the topography *see* W. Tomaschek, "Topographische Erläuterung der Küstenfahrt Nearchs vom Indus bis zum Euphrat" in *Sitzungsberichte der K. K. Acad. der Wissenschaften,* cxxi. (Vienna, 1890). *See* also E. H. Bunbury, *Ancient Geography,* i. ch. 13; and ALEXANDER THE GREAT. Ancient authorities.—Arrian, *Anab.,* vi. 19, 21; vii. 4, 19, 20, 25; Plutarch, *Alexander,* 10, 68, 75; Strabo, xv. pp. 721, 725; Diod. Sic., xvii. 104; Justin, xiii. 4.

**NEATH** (Welsh, *Castell-Nêdd*), a municipal borough and market-town of Glamorganshire, South Wales, situated near the mouth of the Neath or Nêdd, on the G.W.R., 7½ mi. E.N.E. of Swansea. Pop. (est. 1938) 31,480. Area, 7.9 sq.mi.

The town perhaps occupies the site of the Roman Nidum on the Julia Maritima from which a vicinal road branched off here for Brecon. At the Norman conquest of Glamorgan, Fitz Hamon gave the district between the Neath and the Tawe to Richard de Granville, who built on the west banks of the Neath first a castle and then in 1129 a Cistercian abbey, to whose monks he later gave all his possessions in the district. All traces of this castle have disappeared. Another castle, built in the same century, on the east bank, was held direct by the lords of Glamorgan, as the westernmost outpost of their lordship. It was frequently attacked by the Welsh, notably in 1231 when it was taken, and the town demolished by Llewelyn ap Iorwerth. The portcullis gate and a tower are all that remain of it; of the abbey there still exist the external walls, with parts of the chapel, vaulted chapter-house, refectory and abbot's house. Neath is a borough by prescription and received its first charter in the 12th century from William, earl of Gloucester, who granted its burgesses the same customs as those of Cardiff. Other charters were granted to it by successive lords of Glamorgan in 1290, 1340, 1359, 1397, 1421 and 1423. By the first of these (1290) the town was granted a fair on St. Margaret's Day (July 20) and as the abbey had extensive sheep walks the trade in wool was considerable. In 1685 James II. granted a further charter. At the Dissolution the abbey and the manor of Cadoxton (part of its possessions) were sold to Sir Richard Williams or Cromwell. Copper smelting has been carried on in or near the town since 1584 when the Mines Royal Society set up works at Neath Abbey; the industry attained huge proportions a century later under Sir Humphrey Mackworth, who from 1695 carried on copper and lead smelting at Melincrythan. With the development of the South Wales coalfield Neath continued its metallurgical associations and concentrated on the by-product industries, thus locally diminishing to some extent the marked depression that characterized this coalfield after the collapse of the post-war boom in 1921–22. Besides the copper works the town possesses tinplate, steel and galvanized sheet works, foundries and engineering works. In the neighbourhood there are numerous collieries. The Neath Canal, from the upper part of the Vale of Neath to Briton Ferry (13 mi.), passes through the town, which is also connected with Swansea by another canal.

One time independent railway lines now form important branches of the G.W.R. to the Rhondda, Aberdare and Brecon respectively.

**NEBO** or NABU ("the proclaimer"), the Accadian translation of various Sumerian ideograms for the god of wisdom and writing, the main seat of whose worship was at Borsippa—south-west of Babylon. It is due to the close association of Borsippa with Babylon after the period when Babylon became the centre of the Babylonian empire that the cult of Nebo retained a prominence only some degrees less than that of Marduk. The amicable relationship between the two was expressed by making Nebo the son of Marduk. In this case the expression of the relationship in this form was intended to symbolize the superiority of Marduk, different, therefore, from the view involved in making Marduk the son of Ea (*q.v.*), which meant that the prerogatives of Ea were transferred to Marduk by the priests of Babylon.

Nebo was the "god of wisdom" to whom more particularly the introduction of writing was ascribed. He takes his place, therefore, by the side of Ea as a cultural deity. The wisdom associated with him had largely to do with the interpretation of the movements in the heavens, and the priests of Nebo at an early age must have acquired widespread fame as astrologers. Assuming now, for which there is a reasonable amount of confirmatory evidence, that the priestly school of Nebo had acquired a commanding position before Babylon rose to political importance we can understand why the worshippers of Marduk persisted in paying homage to Nebo, and found a means of doing so without lowering the dignity and standing of their own god. If Assur-bani-pal, the king of Assyria (668–626 B.C.), in the subscripts to the copies of Babylonian literary tablets invokes as he invariably does Nebo and his consort Tashmit as the gods of writing to whom all wisdom is traced, it is fair to assume that in so doing he was following ancient tradition and that the priests of Marduk likewise were dependent upon the school at Borsippa for their knowledge and wisdom.

The temple school at Borsippa continued to flourish until the end of the neo-Babylonian empire, and school texts of various contents, dated in the reigns of Artaxerxes, Cambyses and Darius, furnish the evidence that the school survived even the conquest of Babylonia by Cyrus. (538 B.C.). Originally this Sumerian deity seems to have been connected with Dilmun and was often identified with the philosophic principle *mummu;* creative word, form. As such he is the son of the water God Enki (Ea), god of the first principle "water." As the god of writing, Nebo has charge of the tables of fate on which he inscribes the names of men and decides what their lot is to be. If in the systematized religious system, Marduk appears as the arbiter of human fates, the conclusion is warranted that Marduk is here imbued with the authority which originally was in the hands of his son. A reconciliation between the rival claims was effected by continuing Nebo in the rôle of scribe, but as writing at the dictation of the gods, thus recording what the divine assembly, gathered in the "chamber of fates" (known as ubshukinna) within the precincts of E-Saggila—Marduk's temple at Babylon—under the presidency of Marduk, had decided.

Nebo also does homage to his father by paying him an annual visit during the New Year celebration, when the god was solemnly carried across to Babylon, and in return Marduk accompanied his son part way back to his shrine at Borsippa. Within E-Saggila, Nebo had a sanctuary known, as was his chief temple at Borsippa, as E-Zida, "the legitimate (or 'firm') house." The kings, and more particularly those of the neo-Babylonian dynasty, devote themselves assiduously to the worship and embellishment of both E-Saggila and E-Zida. In their inscriptions Marduk and Nebo are invoked together and the names of the two temples constantly placed side by side. The symbols of the two gods are similarly combined. On boundary stones and cylinders, when Marduk's symbol—the lance—is depicted, Nebo's symbol—the stylus—is generally found adjacent. In astronomy he was identified with the planet Mercury, and with the principal star of Taurus, Aldebaran. In the official reports of astrologers and in official letters, Nebo is even mentioned before Marduk without fear of thereby offending the pride of the priests of Marduk.

His consort, known as Tashmit, plays no independent part, and is rarely invoked except in connection with Nebo.

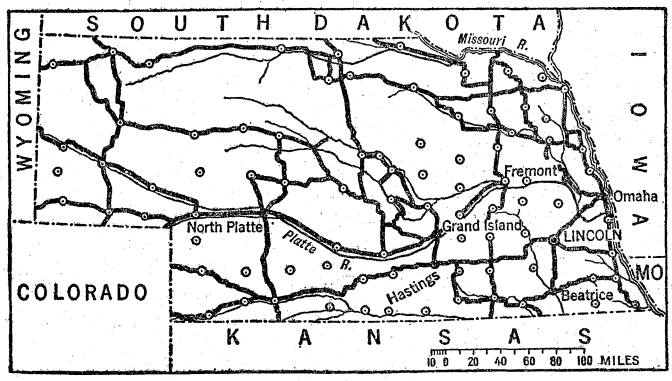
*See* also BABYLON, BORSIPPA, BABYLONIAN AND ASSYRIAN RELIGION.

BIBLIOGRAPHY.—J. Pinckert, *Hymnen und Gebete an Nebo* (Leipzig, 1920), which gives references to earlier monographs on Nebo. He is often mentioned in the Old Testament, for which *see* H. Zimmern, in E. Schrader, *Die Keilschriften und das Alte Testament* (3rd ed. H. Zimmern and H. Winckler, 1903). For prayers, *see* R. Brünnow (vol. iv., 1889) and A. Ungnad (vol. xxii., 1909) in the *Zeitschrift für Assyriologie* (Strassburg); S. A. Strong, in *Proceedings* of the Society of Biblical Archaeology (1898); S. Langdon, *Babylonian Liturgies* (Paris, 1913) and *Oxford Editions of Cuneiform Texts* (Paris, 1927). On Nebo's relation to the metaphysical concept *mummu, see* S. Langdon, "The Babylonian Conception of the Logos," *Journal of the Royal Asiatic Society* (1918, pt. II.). (S. L.)

**NEBRASKA,** styled "The Tree Planters' State" by act of legislature on April 4, 1895, and also known as "The Cornhusker State," is near the centre of the U.S., lying approximately between 40° and 43° N. lat. and 95° and 104° long. W. It is bounded on the north by South Dakota, on the east by Iowa and a corner of Missouri, on the south by Kansas, on the south and west by a corner of Colorado and on the west by Wyoming. The Missouri river flows along the eastern and northeastern border. The extreme length of the state is about 430 mi. and the extreme breadth about 210 mi. The area is 77,237 sq.mi., of which 584 are water surface. Nebraska was named "Tree Planters' State" because Arbor day was originated there by J. Sterling Morton, and forestry was emphasized by its pioneers and their successors.

**Physical Features.**—The main feature of Nebraska topography is a great undulating plain, sloping gradually from the northwest to the southeast, at an average of 10 ft. per mile. This plain is broken along its northern and eastern borders by hilly regions of varied character. The highest point, 5,340 ft., is in Banner county. The point of lowest elevation is 825 ft. in Richardson county, at the southeastern corner. The mean elevation is about 2,500 ft. The United States and state topographical surveys classify Nebraska into four regions: the loess, the sand hills, the high plains and what hitherto has been called the Bad Lands, but is now named the Pierre Shale hills or Gumbo plains.

The loess region includes about 43,000 sq.mi. of the best farming region in the eastern, central and southern parts of the state. In the loess plains the landscapes flow in a series of long gentle waves toward the southeast. Along the Missouri, the Republican, and at some points elsewhere, the waves converge into moderate hills. The sand-hill region lies west and northwest of the loess plains, like an open fan with the handle toward the northeast. The main region includes about 18,000 sq.mi., with outlying areas dotting




MAP SHOWING THE MAIN ROADS IN NEBRASKA

other parts of the state. Scattered through the sand hills are rich valleys, lakes and fertile tablelands. The sand hills themselves are for the most part a series of sloping hills, rising sometimes into pinnacles, at other times stretching in gentle plains. Their present contours are chiefly the result of wind action. Save in rare instances they have long ceased to be shifting dunes; for, with the cessation of prairie fires and the increase of settlement, they have become well grassed over and stable. Their general height is from 25 to 100 ft. above the valleys between.

West and northwest of the sand hills lie the high plains, mostly

level stretches of table-land, broken occasionally by deep canyons. In this region are about 12,000 sq. miles. Included in this region are two areas of evergreen wooded mountains, the Wild Cat range, in Scotts Bluff and Banner counties and the Pine Ridge in Sheridan, Dawes and Sioux counties. A conspicuous feature of these high plains is the buttes, isolated rugged hills, nearly destitute of vegetation, rising hundreds of feet above the surrounding plain. The entire plain-region rises to an average height of from 3,000 to 4,000 ft. with large areas of level rich soil. The North Platte river, with its valley, 10 to 12 m. in width, cuts through the heart of the high plains and is joined near the edge of the sand-hills by the South Platte river entering from Colorado. The Pierre Shale region (or Bad Lands) occupies an area of about 1,000 sq.m. chiefly in Sioux county, with minor sections in Dawes and Sheridan counties. Their weathered slopes and valleys furnish fine grazing and, with water, grow abundant crops. In connection with the Pine Ridge and Wild Cat mountains this section furnishes a region of rare scenic beauty and a sheltered range for stocks.

**Rivers and Drainage Basins.**—All the drainage of the State reaches the Missouri river, which skirts the eastern border for approximately 450 miles. Present navigation is limited to ferry and excursion boats. Chief tributaries of the Missouri in Nebraska are the Platte, with its branches; the Niobrara; the Republican; the Big and Little Blue; the Big and Little Nemaha. The Platte river is the dominant and characteristic Nebraska river. Its wide terraced valley, extending across the entire State and leading to mountain passes, has made it the chief highway across the continent from the beginning. Its channel varies from ½ m. to 1 m. in width, and is filled with islands of varying size and shape. Its waters are shallow with a fall of about 6 to 8 ft. per mile. In the spring its depth varies from 1 to 6 feet. In the late summer use of water for irrigation leaves its middle course in the State entirely dry. The Loup and Elkhorn rivers, principal tributaries of the Platte, head in the sand-hills and are nearly 200 m. long each, with an abundant flow of water through beautiful valleys. Of Nebraska's 77,237 sq.m. about 40,000 are in the drainage basin of the Platte and its tributaries. The Niobrara is a very swift stream over 400 m. in length, running for about half that distance through canyons and hills wooded with pine and cedar. Beautiful waterfalls exist upon the Loup, Niobrara and their tributaries, some of them 70 ft. in height, and the entire region, with its hundreds of lakes scattered over the sand-hills, makes an attractive tourist camping ground. The Republican river is the principal stream along the southern border, as the Niobrara is in the north. The Big Blue and the Little Blue, about 200 m. in length, with their tributaries, drain the south-central part of the State. Their flow is more sluggish, the grade gently sloping back to the surrounding prairie. The Big and Little Nemaha, about 150 m. long, drain the south-east section.

The lake region in Nebraska is chiefly in the sand-hills, on the headwaters of the Elkhorn and Loup, making an area about 200 m. long by 50 m. wide. Several hundred lakes in this district furnish ideal fishing and hunting grounds. The lakes vary greatly in size and in water, from fresh spring-fed bodies to strongly alkaline. Artesian water exists in at least ten different counties with over 1,500 flowing wells.

**Climate.**—The climate of Nebraska is inland or continental. The prevailing wind of the year is north-west; but in the spring, summer and much of the autumn, its predominance is greatly reduced by south and south-west winds from the Gulf of Mexico. Wet and dry years run in irregular cycles with no sufficient data to formulate a rule for them. A curve covering the past 70 years would show dry cycles in 1860–63, 1890–95, 1910–13, 1933–36.

The normal mean annual temperature, as recorded at Omaha up to 1940, is 50·6°. There is a considerable difference in the averages for different months, the normal means of January and July over a period of years being 21·9° and 76·7°. The actual growing season between frosts varies from 165 days in the south-east to 135 in the northwest. The normal mean annual precipitation for the whole state is about 27·77 in. in rain and melted snow, the actual yearly average varying through 50 years from 13·30 to 35·60 in.

**Soil.**—A soil of remarkable fertility is Nebraska's fundamental asset. Silt is the most common and most fertile physical element in the State soils. It is the dominant element in the richest areas and, supplemented by fine sand, forms a combination easily worked by farm implements and responding with quick and sustained growth in the cultivation of the world's staple food crops which are the chief product of Nebraska. The top soils over most of the State are from 1 to 8 ft. in depth, a rich brownish-black vegetable humus. Below this top soil over the largest area is found the loess subsoil, varying from 10 ft. to over 200 ft. in depth. The soil in the sand-hills region is largely very fine sand mixed with silt. It never bakes, it holds moisture and, under favourable treatment, covers itself with vegetation. Fertile valleys and slopes in the sand hills grow exceptional crops. The soils of the high plains and the butte region are chiefly a mingling of silt and fine sand, rich in lime, derived from the decomposing Arickaree strata. These soils produce splendid crops with a minimum of rainfall under modern soil culture methods. The Pierre Shale soils contain elements of great fertility.

**Flora.**—Grasses are the outstanding feature, 200 species growing within the state, a greater variety of native forage species than in any other state. Between 3,000 and 4,000 floral species have been identified within the state, including 64 trees and 77 shrubs growing native. About 1,000,000 ac. out of 49,000,000 are in forest trees. The vast plains of the western portion of the state, when first entered by the white men, were covered with the short perennial grasses that gave the territory its name—"The short grass country." Many plants, once common in Nebraska, are gradually disappearing. Wild pumpkin is limited to the west and is becoming rare.

**Government.**—A constitution adopted in 1875 is the basis of the government. An amendment approved in 1934 substituted a unicameral legislature for the house and senate.

The general election, state and local, is in even-numbered years on the first Tuesday after the first Monday in November, but municipal and school district elections may be held at other times. In 1909 the state legislature enacted a law providing for the nonpartisan nomination of all judges, of all superintendents of public instruction and of regents of the state university.

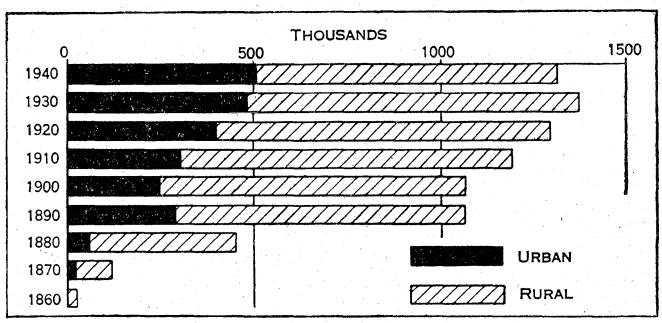
The governor is the chief executive officer of the state, and one of the 10 executive state officers chosen by direct vote of the people. The other 9 executive officers are: lieutenant governor, secretary of state, auditor, treasurer, superintendent of public instruction, attorney general, 3 railway commissioners. The office of commissioner of public lands was abolished in 1936 by constitutional amendment. All officers are elected for two years, except the superintendent of public instruction, who is elected for four and the railway commissioners for six. The governor appoints, with legislative approval, secretaries of the code departments, members of the board of control and a few other officers. He fills vacancies in state offices arising from death, resignation or removal. The governor may remove any officer appointed by him for incompetency, neglect of duty or malfeasance. Legislature, beginning in 1937, consists of a single house of 43 nonpartisan legislators representing geographic areas of about equal population. The chamber is presided over by the lieutenant governor. Except at the governor's request, no bill or joint resolution may be introduced at a regular session after its 20th day.

Administration of justice is vested in a supreme court, 18 district courts, county courts, municipal courts, justices of the peace, police magistrates and certain state administrative officers. The supreme court consists of six associate justices, elected one from each justice district, and one chief justice elected from the state at large, all being chosen for a six-year term. Each district court consists of from one to nine judges, total number 35, elected for a term of four years. County courts have one judge, elected by the voters of the county. Municipal courts have from one to five judges each, elected by voters in the city. Lincoln and Omaha were the only cities with municipal courts until 1927, when the legislature enacted that cities having a population of 9,000 to 25,000 could, by initiative petition and referendum, create munic-

ipal courts. Police magistrates are elected from the municipality at large, justices of the peace from each rural precinct. Police judges and justices of the peace are the only judges paid by fees, all others receiving salaries. The district court is the court of general, original, legal and equity jurisdiction. It is a court of record, and its jurisdiction is unlimited in amount and almost unlimited as to subject matter. Its appellate jurisdiction extends to all appeals from inferior courts. The inferior courts—county, municipal, police magistrates and justices of the peace—all have a limited jurisdiction, both in amount and in subject matter. The supreme court is the court of last resort. Under the constitution, appeal to this court may not be denied in any case.

Voters in each county may choose the district-commissioner system or the township-supervisor system of government. Out of 93 counties, 27 had township supervisor government by 1937. There were 529 incorporated cities and villages in 1941. Under the constitution and the state law there are three possible forms of city government: The mayor and council plan; the commission plan, which may be adopted only by cities of over 2,000 population; the city-manager plan, which may be adopted by any city, except Omaha, having over 1,000 population. Since 1912 any city with a population of more than 5,000 may frame a home-rule charter. Omaha and Lincoln have adopted the home-rule charter plan of government, freeing themselves to a large extent from the control of the legislature.

**Population.**—The population of Nebraska in 1860 was 28,841; in 1880, 452,402; in 1910, 1,192,214; and in 1940, 1,315,834. This last figure represents a decrease of 4·5% from the population in 1930. The population per square mile was 17·2, as compared with 44·2 for the United States as a whole. Of the 1940 population, 514,148, or 39·1%, lived in urban places, that is,




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF NEBRASKA, 1860–1940

in cities of 2,500 or more. The number of occupied dwelling units returned in the housing census of 1940 was 360,811, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 4·0 in 1930 to 3·6 in 1940. The white population of Nebraska formed 98·6% of the total in 1940, as compared with 98·7% in 1930. The population of the state and of its principal cities is summarized for recent censuses in the following table:

| Area | Population | | | Per cent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 1,315,834 | 1,377,963 | 1,296,372 | −4·5 | 6·3 |
| Urban | 514,148 | 486,107 | 405,293 | 5·8 | 19·9 |
| Rural | 801,686 | 891,856 | 891,079 | −10·1 | 0·1 |
| Per cent urban | 39·1 | 35·3 | 31·3 | .. | .. |
| Principal cities: | | | | | |
| Omaha | 223,844 | 214,006 | 191,601 | 4·6 | 11·7 |
| Lincoln | 81,984 | 75,933 | 54,948 | 8·0 | 38·2 |

**Finance and Taxation.**—The general property tax, established in the year 1867, was supplemented by a corporation licence tax in 1909, and by other state licences and fees and special taxes, and by contributions from the United States treasury, to provide for growing expenses of government. In the six-year period from March 4, 1933, to June 30, 1939, Nebraska received a total of $616,131,918 in federal funds. Of this amount, $329,838,075 was in the form of grants and payments and $286,293,843 in direct and co-operative loans.

In the fiscal year ending June 30, 1940, out of a total state revenue of $32,389,112, property taxes supplied $6,545,928; miscellaneous state revenue, $15,852,898; contributions from U.S., $8,895,223; incomes from trust funds, $1,095,062. In the fiscal year, 1940, the assessed valuation of all property was $1,922,271,788, upon which the state placed a rate of $2.57 per $1,000. Total expenditures for 1940 amounted to $30,217,713. Of this $10,116,184 was spent for roads and irrigation; $3,828,679 for the University of Nebraska; and $3,447,310 for penal and charitable institutions.

The legislature, in 1909, passed an act establishing a state guarantee fund "for the protection of the depositors in state banks." The act provided for a levy not to exceed 6/10 of 1% annually on the average deposits of each state bank. This yielded a maximum of $1,500,000 per year, which was used for the payment of the depositors when a bank failed. The banks failed so fast in the '20s that money in the guarantee fund was insufficient to pay the depositors of the failed banks, and the legislature in 1929 passed an act repealing the guarantee act. The number of state banks in Nebraska on Dec. 31, 1940, was 285; amount of deposits, $77,030,179. The number of national banks in Nebraska was 133; amount of deposits, $282,243,000.

**Education.**—The United States endowment of public education embraced 2,834,447 ac. of land for common schools, 89,140 ac. for the College of Agriculture, 45,539 ac. for the University of Nebraska. Under the present law enacted in 1897, this land can be leased but not sold. The endowment of the common schools in 1941 included 1,687,802 ac. of land and $11,310,931 in proceeds of former land sales invested in securities; for the university and agricultural college, 13,688 ac. and $955,348 invested in securities. In addition, the state endowed Peru Normal college with 12,804 ac. of state land. The annual income from these school endowments averages about $930,000. In the common school system in 1940 there were 7,511 schoolhouses with an enrolment of 276,188 and 13,759 teachers. The total investment in school property was $11,876,630 and the annual expenditure $17,916,053.

There are four state normal teachers colleges, with a total attendance, in 1939–40 of 4,617 students and 253 faculty members; one at Peru (opened 1867), one at Kearney (1905), one at Wayne (originally private; purchased by the state in 1909) and one in Chadron (established by an act of 1909). The University of Nebraska at Lincoln was established in 1869 by an act of the state legislature and was opened in 1871. Connected with it and governed by the same regents are the School of Agriculture at Curtis and the agricultural experiment stations at North Platte, Valentine and Alliance. The university in 1940 consisted of ten colleges and three schools, as follows: colleges of agriculture, arts and sciences, business administration, dentistry, engineering, graduate, law, medicine (at Omaha), pharmacy and teachers; and schools of fine arts, journalism and nursing. The total enrolment for the school year 1940–41 was 8,986 students and about 442 faculty members. Nearly all educational institutions in the state are coeducational. In 1929 the legislature authorized the establishment of the Municipal University of Omaha. Under a law of 1931 three junior colleges were established at Hebron, McCook, Scotts Bluff. Among the private educational institutions are: Nebraska Wesleyan university at Lincoln; Union college at College View; York college at York; Doane college at Crete; Creighton university at Omaha; Nebraska Central college at Central City; Hastings college at Hastings; and Midland college at Fremont.

The state board of control and the state department of public welfare exercise a general supervision over charitable and penal institutions. The state institutions maintained in 1941 under direction of the board of control included: Institution for Feeble-Minded, Beatrice; Girls' Training school, Geneva; Soldiers' and Sailors' home, Grand Island; Hastings state hospital, Ingleside; state industrial school, Kearney; hospital for tuberculosis, Kearney; Lincoln state hospital, Lincoln; Orthopaedic hospital, Lincoln; state penitentiary, Lincoln; Nebraska industrial home, Milford; School for the Blind, Nebraska City; Norfolk state hospital, Norfolk; School for the Deaf, Omaha; reformatory for women, York; home for dependent children, Lincoln; reformatory for men, Lincoln; Genoa state farm, Genoa. These institutions in 1941 had 7,852 inmates and 1,438 employees. The appropriations for penal and charitable institutions for the biennium 1939–41 totalled $3,664,780, all paid for out of state tax funds.

**Agriculture and Livestock.**—Of a total of 49,057,920 ac. there were, in 1940, 19,188,525 ac. in actual cultivation, 2,432,885 ac. in wild hay and 21,379,021 ac. devoted to range and pasture. The total crop values, exclusive of fruit, were $142,133,000 in 1940. The total number of farms had decreased from 133,616 in 1935 to 121,062 in

1940. Of the total number of farms, in 1940, 35,064 were operated by owners and 63,947, or 52.8%, by tenants. The value of farm land and buildings in 1940 totalled $1,137,808,019, as compared with $1,562,813,000 in 1935; the average acreage per farm in 1940 was 391, as compared with 349 in 1935 and 345 in 1930. Production of principal crops for the year 1940 is shown in the following table:

*Nebraska Field Crops, 1940*

| | | | |
|---|---|---|---|
| Corn | 6,239,000 acs. | 106,913,000 bu. | $62,010,000 |
| Winter wheat | 2,496,000 " | 33,696,000 " | 21,902,000 |
| Spring wheat | 150,000 " | 1,125,000 " | 698,000 |
| Oats | 1,490,000 " | 35,760,000 " | 10,013,000 |
| Tame hay | 1,029,000 " | 1,366,000 tons | 8,879,000 |
| Barley | 1,409,000 " | 22,544,000 bu. | 8,792,000 |
| Potatoes | 81,000 " | 11,340,000 " | 5,557,000 |
| Sugar beets | 70,000 " | 910,000 tons | 3,822,000 |

The value of livestock in Nebraska in 1940 was $190,345,000, compared to $288,770,000 in 1930. Cattle receipts for 1940 totalled 1,086,000, swine 2,727,000, sheep 992,000. The number and assessed value of domestic animals in the state in 1940 were: 481,000 horses valued at $27,056,000; 56,000 mules valued at $4,299,000; 3,011,000 cattle valued at $124,015,000; 2,498,000 swine valued at $21,764,000; and 1,037,000 sheep valued at $6,616,000. In 1940 there were 662,000 milch cows producing 354,170,000 gal. of milk and 141,668,000 lb. of butter. In 1935 there were 750,000 head of milch cows. In 1939, 22,935,923 chickens were raised, and 71,072,776 doz. of eggs were produced. The total benefit payments made to Nebraska farmers by the Agricultural Adjustment administration, 1933–39, totalled $105,324,534.

During the period 1902–41 the steady progress of irrigation and water-power enterprises made possible a tremendous growth of agriculture and a new industry, beet sugar manufacture, in western Nebraska. The beginnings of irrigation in Nebraska go back to 1856, when a small ditch was taken out of Wood river near the old Boyd ranch in what is now Buffalo county. In 1866 John Burke constructed a ditch four miles long, tapping the Platte river on its south bank 15 mi. west of the city of North Platte. Irrigation in western Nebraska developed rapidly following the drought of 1890. The Kingsley dam, the second largest earth-filled dam in the world, costing $36,000,000, was dedicated July 22, 1941. Against the mass of sand, gravel and dirt will eventually pile up 2,000,000 ac. feet of water, stored 23 mi. up the North Platte, covering 32,000 ac. of land. Projects have also developed in Niobrara, Republican, Loup and Elkhorn basins. In addition to the total acreage of 952,374 irrigated by the diversion of water from streams and reservoirs, there are many thousand acres irrigated from the underground supply. Reports for 1941 showed an increase of 73,374 ac. irrigated, in the following districts: Central Nebraska Public Power and Irrigation district (Tri-County project) 67,525 ac.; Middle Loup project 3,542 ac.; North Loup project 2,307 ac.

**Industries, Mining and Transportation.**—Manufacturing has grown chiefly in the conversion of raw products of agriculture into commodities for market. The United States census of manufactures for 1939 showed 1,161 manufacturing establishments in the state, employing 18,810 wage earners and processing raw materials to the value of $273,524,581. The chief industries in 1939 ranked according to the value of their products were: meat packing, $117,743,576; creamery butter, $21,133,891; flour and other grain mill products, $17,485,317; bread and other bakery products, $9,243,162; and newspaper and periodical publishing and printing, $8,823,378.

On Nov. 1, 1939, oil was discovered approximately two miles east of Falls City. In 1941 there were 16 producing wells in the vicinity. Other mineral production in the state is negligible, and the total value in 1938 was only $4,028,712. Sand and gravel to the value of $1,020,806 were produced in that year, and stone to the value of $780,664. Clay products, other than pottery and refractories, were valued at $327,482 in 1938.

Missouri river navigation was a leading method of transportation until the construction of the railways in the '70s. As a result of railway competition it declined to almost nothing. Railway mileage amounted to 6,105 mi. in 1937. The principal railway construction after 1920 was branch railways for transportation of sugar beets in the North Platte valley. Ten trunk railways radiate from Omaha, five of them with a network of feeders over the state. The Union Pacific was the first railway, beginning construction on July 13, 1865, at Omaha.

There were in 1937 approximately 150 mi. of electric railway operating in the state, chiefly as city street transportation systems. Motor truck transportation has greatly increased.

The most important transportation development in Nebraska in the years 1920–41 was the great extension of improved highways directed from the state engineer's office. An era of road building and road maintenance began in 1917 which was greatly promoted by the rapid increase of motor vehicles. After 1937 the state railway commission required the registration of motor carriers. During the period from Aug. 1937 to Dec. 31, 1939, 63 bus lines were registered. There were in 1941 59 active lines. The total mileage on the state highway system on Jan. 1, 1941, was 11,220. Of this total, 5,027 mi. were gravelled, 3,707 mi. were paved and 2,486 mi. were graded. The total number of motor vehicles registered in 1940 was 462,931, of which 68,016 were motor trucks and tractors. Nebraska is traversed by two great trunk highways, or tourist lines, the Lincoln highway and the Detroit-Lincoln-Denver, each paved the entire distance across the state. North and south gravelled trunk lines include the Kansas City-Omaha, the Cornhusker highway and the Meridian highway. The Yellowstone Park and Oregon Trail highways traverse the North Platte valley.

**History.**—Francisco Vásquez de Coronado, with 30 Spanish horsemen and two Indian guides, crossed the Great plains northeast from the Rio Grande valley in the summer of 1541, seeking the kingdom of Quivira, which they found to be nothing more than Indian villages not far from 40° N. lat. From Coronado's account most historical writers believe that he was the first white man to reach Nebraska and that view has been incorporated into the literature and pageantry of the state. In 1720, a Spanish and Indian command under Col. Pedro de Villasur, marched from Santa Fe to the valley of the Platte for the purpose of conquering and colonizing the Nebraska region. His command was massacred by the Otoe and Pawnee Indian tribes, probably near the present city of Columbus, on Aug. 10. French explorers came up the Missouri river to Nebraska shores in 1700. In 1739–40, the Mallet brothers (French) crossed the region from east to west, naming the Platte river in their report. Nebraska was claimed by France, Spain and England. From about 1700 until 1763 France was the leader in trade and exploration. From 1763 until 1803 Spain exercised authority, but the white population and language of the vast Louisiana province, including Nebraska, remained French. Nebraska passed to the United States in 1803 as part of the Louisiana purchase. American exploration by Lewis and Clark (1804–06); Lieut. Z. M. Pike (1806); Manuel Lisa (1807–20); Major Stephen H. Long (1819–20); Col. Henry Dodge (1835); Lieut. John C. Frémont (1824–44); and Lieut. G. K. Warren (1855–57) made known to the public important facts regarding the region. Major Long's map designated the country as a "great desert," and his report stated that the country was "entirely unfit for agriculture."

Records show the existence of trading posts in 1795, 1802, 1807, 1812, the last two near the present towns of Ft. Calhoun, 16 mi. north of Omaha, and Bellevue. Manuel Lisa, of Spanish descent, was the leading fur trader and first white settler (1807). The most important early white settlement was Ft. Atkinson on the present site of Ft. Calhoun, a military post of 1,000 men, and the centre of the first white industry and agriculture (1819–27). Bellevue (1823) was the first permanent white settlement, and in 1849 the first United States post office in Nebraska. In 1825 the government acquired the first Indian lands and in 1833 the first white missionaries began work among Nebraska tribes. Ft. Kearny was established in 1847 where Nebraska City now stands, and in 1848 it was relocated on the south bank of the Platte about 6 mi. southeast of the present city of Kearney.

The overland trail era was the next important period in Nebraska history. Beginning in 1832 with the Oregon trail which followed the Little Blue and the south bank of the Platte across the state, followed by the Mormon or California trail in 1847 up the north bank of the Platte, and the subsequent Nebraska City cutoff (established 1858–60), Nebraska furnished the principal routes from the Missouri river to the Rocky mountains and Pacific coast. In a single year 50,000 people with nearly as many livestock and 8,000 wagons crossed the region by these highways.

The movement to organize Nebraska territory arose directly from the conflict between the United States and Great Britain for the possession of the Oregon country. The name "Nebraska" derived from the Otoe name, "Ne-brath-ka," or Shallow Water, for the Platte river, was first suggested by Lieut. Frémont in 1843, recommended by Secretary of War Wilkins in 1844 and adopted by Stephen A. Douglas who introduced bills for the organization of the territory in 1844, 1848 and 1852. In 1852–53, a provisional territorial government was formed by Wyandot Indians and licenced white residents on Indian lands. A delegate was elected to congress but not seated. The final Kansas-Nebraska bill, providing for two territories, became the centre

of an intense struggle in Congress between the North and South, involving the extension of slavery, the removal of Indians and rival routes for the proposed Pacific railway. The bill, signed on May 30, 1854, by President Franklin Pierce, repealed the Missouri Compromise of 1820, provided that the new territories should be slave or free as voted by citizens in each, and reopened the fierce sectional conflict between the North and South. The conflict split the Democratic Party, destroyed the Whig Party, led to the organization of the new Republican Party and to the series of events leading to the Civil War.

Nebraska Territory, as organized in 1854, included the vast region from the 40° N. lat. to British America, and from the Missouri and White Earth rivers to the summit of the Rocky mountains. In 1861 and 1863 it was reduced by the creation of other territories to nearly its present boundaries, the only important change since then being the annexation in 1890 of what is now Boyd county. White settlers in the territorial period (1854–67) were chiefly in a narrow strip along the Missouri river, with isolated ranches westward along the Platte valley and the Oregon trail. The enactment by Congress in 1862 of the Union Pacific Railroad Act and the Free Homestead Act aided white settlement, the first claim under the Free Homestead Act being located in Nebraska on Jan. 1, 1863. In 1861 there were probably 30,000 inhabitants in the territory and 3,300 men from Nebraska were enlisted for the Union army in the Civil War. The great industry in this period was transport by the overland trail. Rival routes from Kansas City, St. Joseph, Leavenworth, Atchison, Nebraska City and Omaha, converged at Ft. Kearny on the Platte. Freight carried over these trails amounted to 200,000 tons in 1865. Over them ran the overland stage coaches, carrying passengers, and in 1860–61, the famous "Pony Express," whose service ended with the completion of the overland telegraph in the latter year. This trail transportation business terminated in Nebraska with the construction of the Union Pacific railway in 1865–69.

The legislature first met in Omaha on Jan. 16, 1855, and annually thereafter, during the territorial period. Important early legislation related to land claims, bank charters, schools, prohibition and woman suffrage. A fight for the location of the capital between rival towns of the Missouri river front, Bellevue, Brownville, Nebraska City, Plattsmouth, Omaha and Florence resulted in Omaha holding the capital, but in the creation of a violent feud between the North and South Platte sections which continued for many years. An episode of this fight was the "Florence secession" of 1858, when a majority of the legislature deserted Omaha and adjourned their sessions to Florence. In 1858–59 the South Platte region held a convention, sent delegates and sought annexation to Kansas. Great speculation in town sites and lands culminated in 1857 in general distress and in the failure of all territorial banks but one, $400,000 of bank notes becoming worthless.

**Statehood.**—A proposition to form a State in 1860 was defeated at the polls. Congress passed an Enabling Act on April 19, 1864, but a convention elected in that year to frame a State Constitution adjourned without action. A Constitution was adopted by the legislature in 1866, submitted to the voters on June 2, 1866 and carried by a majority of 100 in a total vote of 7,766. The Republicans favoured statehood in order to help the Republican majority in Congress in its struggle with President Andrew Johnson; the Democrats opposed it. The Constitution, as adopted, limited suffrage to free white males. Congress refused to admit Nebraska until the territorial legislature passed an act pledging that Negroes would not be barred from the ballot. These terms of admission were accepted by Nebraska and carried in spite of President Johnson's veto, and Nebraska was proclaimed the 37th state on March 1, 1867.

The South Platte region had a majority in the first state legislature of 1867 and passed an act providing for the relocation of the capital in that section. Opponents of removal offered an amendment naming the capital "Lincoln," in order to make it distasteful to Democratic members from the South Platte region. The latter accepted the amendment and the capital commission on July 29, 1867, located and named the capital site at the little hamlet of Lancaster, on Salt creek.

The Democratic Party was the sole political party in Nebraska from 1854 to 1858. The only political divisions were factions of that party. The Republican Party was first organized in the campaign of 1858. Slavery domination of the national administration and especially President Buchanan's veto of the Free Homestead Act changed territorial politics, giving the Republicans control in 1860, which was firmly held by them until 1890. In that year the Farmers' alliance organized the Peoples' Independent or Populist party. A three-cornered fight resulted in the Democrats getting the governor, and the Farmers' movement a majority of the legislature. The Populists elected the governor in 1894 and in 1896, by fusion with the Bryan Democrats and Silver Republicans swept the state. The Populist party disintegrated after 1904, and thereafter political control fluctuated between the Democrats and Republicans, although some economic radicalism continued to infuse the local psychology of both parties. Significant in this regard were the career of George W. Norris in the national senate, the election as governor in 1930 and 1932 of C. W. Bryan, brother of W. J. Bryan, and the experiment in unicameral legislation begun in 1937. In 1932 and 1936 the state supported Roosevelt and the Democratic New Deal by overwhelming majorities, but in 1940 all the state offices, the United States senatorship and the state's electoral votes for president were carried by the Republican party.

BIBLIOGRAPHY.—For the geological and physical features, *see* E. H. Barbour, G. E. Condra, and others, *Nebraska Geological Survey Reports* (Lincoln, 1903, *et seq.*); G. E. Condra, *Geography of Nebraska, Resources of Nebraska* and *Conservation of Soil Surveys* (Lincoln, 1906, *et seq.*); U.S. geological survey *Reports* (1857, *et seq.*), consult bibliographies. For early Indian history and folklore, *see* U.S. bureau of ethnology *Reports*, especially 14th, 18th, 27th; also the works of G. A. Dorsey and G. B. Grinnell. For early American exploration, see *Lewis and Clark Journals* (1804–06); Ft. Atkinson military records (1820–27) (ms. in Nebraska State Historical library); and the reports of Z. M. Pike, S. H. Long and John C. Frémont. For the Oregon trail, fur-trading and missionary period, *see* W. E. Connelley and F. A. Root, *The Overland Stage to California* (1901); H. M. Chittenden, *The History of the American Fur Trade of the Far West* (1902), *Early Steamboat Navigation on the Missouri River* (1903) and *The Life, Letters and Travels of Father De Smet* (1905). For the entire historical period: Nebraska State Historical society *Proceedings and Collections* and *Nebraska History Magazine;* H. Johnson, *History of Nebraska* (1880); J. Sterling Morton, Albert Watkins, and others, *Illustrated History of Nebraska* (1902, new ed. 1918). Also A. E. Sheldon, *History and Stories of Nebraska* (1913), *New Standard History of Nebraska* (1928–29), *Nebraska My Home* (1939). For culture, *see* Clarissa Bucklin (ed.), *Nebraska Art and Artists* (1932). Upon Nebraska government, *see* A. E. Sheldon, *Nebraska Constitutional Conventions* (1905–13), *Documents of Nebraska Life* (1923) and *Nebraska Civil Government* (1939); the *Nebraska Blue Book and Historical Register* (biennial, 1915, *et seq.*); and the *Reports* of the state officers and departments (1855, *et seq.*). *See* also *Nebraska, the Land and the People* (1931), not New Standard History of Nebraska (1928–29); *Citizenship Problems for Young Nebraskans* (1939); *Land Systems and Land Policies in Nebraska,* Vol. 22, Nebraska State Historical Society Publications (1936); *Nebraska: A Guide to the Cornhusker State,* WPA (1939); *Reports* of U.S. bureau of the census. (A. E. S.)

**NEBRASKA CITY,** a city of southeastern Nebraska, U.S.A., on the high bank of the Missouri river, 40 mi. below Omaha; the county seat of Otoe county. It is on federal highways 73 and 75, and is served by the Burlington Route and the Missouri Pacific railway systems. The population was 6,279 in 1920 (91% native white); it was 7,339 in 1940 by the federal census. It is the seat of the state Institute for the Blind, and the trading and shipping point for a fine agricultural region. "Arbor Lodge" (formerly the home of J. Sterling Morton, a member of Cleveland's cabinet and the originator of Arbor day) with its fine arboretum, is now a state park. Nebraska City is one of the oldest settlements in the state, and for some years at the height of the migration westward it was the largest city. A fort was established on the site in 1847, but was abandoned the following year for a location farther west. In 1858 several settlements in the vicinity were consolidated and incorporated as Nebraska City, and it was made the headquarters of a great freighting firm which distributed supplies to the army posts between the Missouri and the Rockies (amounting to 2,782,258 pounds in 7 months in 1859).

**NEBUCHADREZZAR** or NEBUCHADNEZZAR, king of Babylon, the Ναβουκοδρόσορος of the Greeks. The first and last are nearer to the original name as it is found on the cuneiform monuments, viz., Nabu-kudurri-uṣur, "Nebo, defend the land-

mark." Nebuchadrezzar seems to have been of Chaldean origin. He married Amuhia, daughter of the Median king, according to Abydenus, and in 605 B.C. defeated Necho at Carchemish, driving the Egyptians out of Asia and annexing Syria to the Babylonian empire. In the following year he succeeded his father Nabopolassar on the Babylonian throne, and continued the restoration of Babylon, which he made one of the wonders of the world. His "new palace" there was built in fifteen days; temples were erected to the gods, the great walls of the city were constructed with a moat surrounding them, the Euphrates was lined with brick and a strong fortress erected. Canals were dug throughout the country and a great reservoir excavated near the capital. Only a fragment of his annals has been preserved, recording his campaign against Amasis (Aḥmosi) of Egypt in his thirty-seventh year (567 B.C.) when he defeated the soldiers of "Phut of the Ionians." Tyre revolted in the seventh year of his reign, and was besieged for 13 years; a contract-tablet dated in his fortieth year shows that at that time it was under Babylonian officials.

After the investment of Tyre Nebuchadrezzar marched against Jerusalem, put Jehoiakim to death and placed Jehoiachin on the throne. Three months later Jehoiachin was deposed and Zedekiah made king in his place. Zedekiah's revolt in 588 B.C. led to another siege of Jerusalem, which was taken and destroyed in 586 B.C. (*See* JEWS and JERUSALEM.) From his inscriptions we gather that Nebuchadrezzar was a man of peculiarly religious character.

*See* Josephus, *Cont. Apion,* i, 19; Eusebius, *Praep. Evangel.* x.

**NEBULA,** in astronomy, the name given to certain luminous, apparently nonstellar patches in the sky. (Latin for mist, Greek *νεφελη.*) Dark nebulae are also known. The smaller luminous nebulae resemble distant comets when seen in a telescope of moderate power but can be easily distinguished from them, because comets, being within the confines of the solar system, appear to move among the stars, while the nebulae, being at stellar distances, have no such motion. With the exception of the two Magellanic Clouds in the southern hemisphere, and the two spirals in Andromeda and Triangulum, nebulae are invisible to the unaided eye, and the combined aid of a very large telescope and the photographic plate are required for the adequate study of these faint objects. The two largest and brightest in the northern hemisphere, and the best examples of the two fundamentally different types of nebulae, are the spiral nebula in Andromeda and the diffuse nebula in Orion.

The nebulae are very numerous, those in the Galaxy being counted in the hundreds, those beyond the Milky Way being reckoned up to 100,000,000, with this number limited only by the penetrating power of the largest telescope in operation, the 100-in. reflector on Mount Wilson. Comparatively few of these millions show much structure even on photographs taken with the most powerful instruments. Since the nebulae exhibit luminous *surfaces,* as opposed to the *point-images* of stars, even the largest telescope, though it makes nebulae appear larger, does not make them any brighter than they are to the unaided eye (*see* PHOTOGRAPHY, CELESTIAL). But the photographic plate has the advantage over the human eye of being able to accumulate the effect of exposure to a faint source of light, and thus by means of long exposures, sometimes extending over many hours or even several nights, it is possible to photograph nebular detail far too faint to be observed visually in any telescope.

**Historical.**—*Earliest Records.* Historical records of luminous patches in the sky are known to go back to Hipparchus (*ca.* 190–125 B.C.), who included in the earliest known star catalogue entries for the double star cluster in Perseus (h and $\chi$ Persei) and for the "Beehive" star cluster in Cancer (Praesepe). Nearly 300 years later Ptolemy (*ca.* 138 A.D.) listed five "cloudy stars" in his *Almagest,* but these objects, apparently nebulous to the eye, are in reality star clusters. The earliest known record of a nebula, as distinguished from a star cluster, is the one for the Andromeda nebula given by Al Sûfi (903–986) in his *Book of the Fixed Stars,* epoch 964. The spiral in Andromeda thus shares with the Magellanic Clouds the distinction of being one of the three nebulae discovered before the invention of the telescope. The Clouds of Magellan, which become visible to travellers to the southern hemisphere soon after the Torrid zone is entered, were known to the Portuguese navigators of the 15th century, and although not discovered by Magellan, the clouds are by common consent associated with his name to honour the great circumnavigator. Soon after the first use of the telescope on celestial objects in 1609 by Galileo (1564–1642), the Orion nebula was discovered in 1610 by the famous French patron of science Nicholas Peiresc (1580–1637). The Jesuit priest Cysatus (1588–1657) who began to survey the sky with a telescope in 1611 and who was the first to make a telescopic observation of a comet in 1618, also discovered the same nebula. It was Christiaan Huygens (1629–1695), however, who not knowing of the earlier discoveries by Peiresc and Cysatus, gave in 1656 the first description and sketch of the brightest part of the Orion nebula around the central star of Orion's sword ($\theta$ Orionis). In the case of the Andromeda nebula, it too was soon rediscovered after the invention of the telescope, in 1611 by Simon Marius (1570–1624) who described it in the oft-quoted poetical words, "Like a candle seen at night through a horn."

*Early Catalogues.*—The first attempt to catalogue nebulae seems to have been made in 1715 by Edmund Halley (1656–1742), after whom is named the famous comet that returns to view every 75 years in accordance with his prediction. Halley listed six "luminous spots or patches," among them the globular star cluster in Hercules—the brightest one in the northern hemisphere—which he discovered in 1714. The next list, in this case of 16 "nebulous stars," was given in 1733 by the English divine W. Derham (1657–1735), apparently as a result of some observations he made in 1732, with a reflecting telescope, of such objects included in an earlier (1690) work by J. Hevelius (1611–1687), who has sometimes been called the founder of the scientific study of the moon's surface (selenography). In the first extensive survey of the southern skies made at the Cape of Good Hope in the years 1751–54 by Nicolas Louis de Lacaille (1713–1762), a total of 42 nebulae were observed and then described in another significant list of such objects published in 1755. Shortly thereafter, another Frenchman, Charles Messier (1730–1817), while following the comet of 1758, noticed a nebulous object near the third-magnitude star $\zeta$ Tauri. His discovery, later to be called the "Crab" nebula in Taurus, is now known to be the expanding gaseous remnant of the 1054 *supernova* (*see* NOVA) which was observed in China and in Japan, and which represents one of nature's greatest cataclysms, compared with which an atomic bomb explosion is less than a match flame. Messier, although much more interested in comets—Louis XV nicknamed him the "ferret of comets"—found that his searches could be more efficiently prosecuted if he noted the positions of those apparently cometary objects which did not move among the stars. In this way Messier discovered most of the brighter nebulae and clusters visible from northern latitudes, and his final catalogue published in 1781 contained 103 entries.

*The Catalogues of William and John Herschel.*—The foregoing early catalogues of nebulae almost pale into insignificance, however, when compared with the systematic sweeps of the skies made by William Herschel (1738–1822) and his son John Herschel (1792–1871). With a reflector of his own making, the elder Herschel began his illustrious career as the founder of sidereal astronomy by observing the Orion nebula in 1774. Its appearance so amazed him that he directed his attention to other nebulae, which then became objects for his life-long study and interpretation. Between 1786 and 1802 he discovered and catalogued, in three lists, more than 2,500 nebulae. The younger Herschel, in one of the most striking instances of inherited talent, proved to be his father's ablest successor in the field of nebular observation and discovery. Like his father, he constructed in 1820 his own telescope, an 18-in. speculum metal reflector, and began in 1825 to reobserve many of the nebulae found by his parent. The outcome of this second survey was a catalogue of 2,300 nebulae, of which 525 were new. John Herschel found the field so fascinating that he resolved to extend his search to southern skies, and in 1834 he began on Table mountain near Capetown, South Africa, a four-year survey that marked a new era in the study of celestial

objects visible in the southern hemisphere. The Magellanic Clouds were for the first time subjected to a detailed examination, with the result that the larger one was found to contain more than 900 member star clusters, nebulae and stars associated with nebulosity, while nearly 250 similar objects were counted in the smaller cloud. In addition to these discoveries, admittedly incomplete, the younger Herschel catalogued more than 1,700 other nebulae in southern skies, and for a number of them he made beautiful drawings. Upon his return to England in 1838, he set about systematizing all his own and his father's discoveries of nebulae, and his labours culminated in the "General Catalogue" of some 5,000 entries published in 1864 in the *Philosophical Transactions* of the Royal society. This great work forms the backbone of J. L. E. Dreyer's *New General Catalogue of Nebulae* (N.G.C.) (1888), which augmented by the *First* (1895) and *Second* (1908) *Index Catalogues* (I.C.), with a combined total of more than 13,000 entries, constitutes the standard reference list for nearly all modern observations of nebulae.

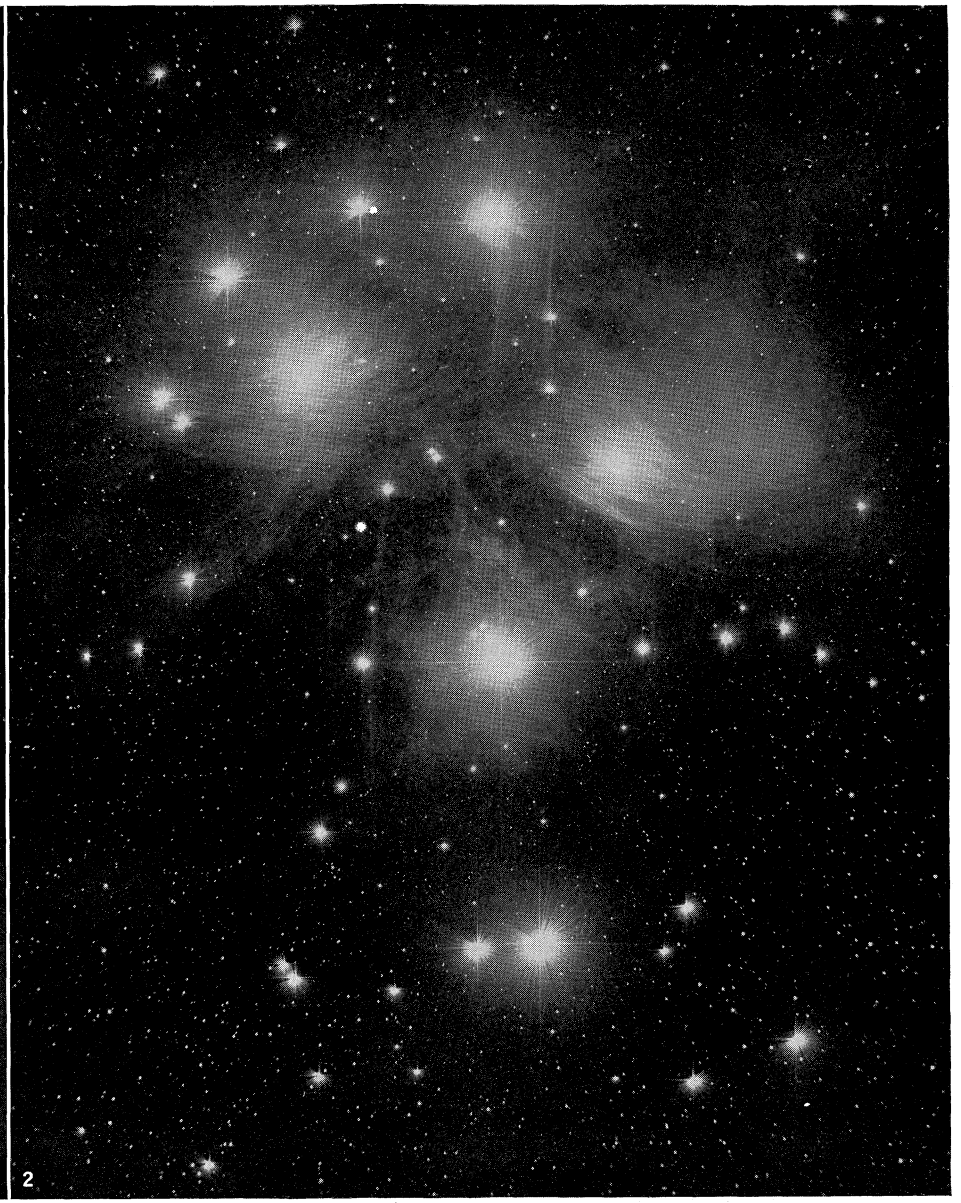
**Development of Nebular Photography.**—With the invention of photography and its application in astronomy, the observation and study of nebulae received an impetus of revolutionary proportions. The first to utilize the technique in this field was a New England physician, Henry Draper (1837–82), who on Sept. 30, 1880 took the first photograph of a nebula, that in Orion. As is usual when a new and powerful means of investigation becomes available, progress is at first very rapid, and widely-separated workers independently and almost simultaneously make the same advances. Thus, while the priority is Draper's, his photography of the Orion nebula quickly found its counterparts in France in 1881 by P. J. Janssen (1824–1907), and in England in 1883 by A. A. Common (1841–1903) and in 1886 by Isaac Roberts (1829–1904), the latter two being pioneers in the use of silver-on-glass reflectors, of apertures of 36 in. and 20 in., respectively. From about 1885 on, nebular photography increased at an accelerated rate, so that only a few of the more important milestones may be mentioned here. The nebulosity around the Pleiades was first recorded photographically by the Henry brothers, Paul and Prosper, in Paris in 1885, though it had been seen visually by W. Tempel in 1859. The faintness of this filmy veil places it near the limit of vision, and even the early photographs showed only the brightest parts around the stars Merope and Maia. The full extent of the nebulosity began to be revealed by an exposure made by Isaac Roberts at Maghull, Lancaster county, England, in 1886, and by later photographs taken in 1888 by the Henrys, but it was not until E. E. Barnard began at the Lick observatory in 1889 to use wide-angle portrait-lens cameras that the Pleiades, and many other Milky Way regions, were shown to be enmeshed in wispy clouds of great complexity and considerable extent. Barnard likewise pioneered in the systematic discovery and listing of the dark nebulae (*see* section below on *Dark Diffuse Nebulae*), and his work did much to direct attention to them as clouds of interstellar dust, with the ultimate result, established by a great deal of modern work, that the astronomical scale of distances for far-away stars needed to be corrected for the dimming of light by obscuring matter concentrated in the galactic plane. Barnard's methods of nebular photography were quickly and widely adopted, notably by H. C. Russell at Sydney in 1890, whose work on the southern Milky Way and on nebulae complemented Barnard's in the north, and by Max Wolf at Heidelberg in 1891, who pioneered in the photographic charting of the small nebulae outside the Galaxy.

Quite a different but highly significant advance in nebular photography was made by J. E. Keeler at the Lick observatory in 1899. Working with a 36-in. reflector donated in 1895 by Edward Crossley, of Halifax, England, Keeler firmly established the advantages, previously suggested by Isaac Roberts' work, of this type of instrument for the detailed investigation of the spiral nebulae. Before the advent of photography, Lord Rosse (1800–67) and his associates at Parsonstown, York, had been able with large speculum metal mirrors (up to six ft. in diameter) to discover visually during the years 1845–50, spiral structure in 14 nebulae, and to resolve into stars a number of hitherto nebulous objects. Keeler's contribution—in a sense a photographic sequel to Rosse's work—was to show that spiral structure was a very common characteristic of nebulae distant from the Galaxy, and that the number of spiral nebulae was at least ten times greater than had formerly been supposed. His conservative estimate made in 1900 placed the number within reach of the Crossley reflector at 120,000 and later work with the same equipment, first by C. D. Perrine, in 1901–03, and then by H. D. Curtis in 1909–19, brought this figure to nearly 1,000,000 nongalactic nebulae.

The manifold possibilities for extensive survey work on nebulae with wide-angle lenses, as exemplified by the pioneer observations of Barnard and Wolf, were soon appreciated by many other astronomers, but perhaps the fullest exploitation of such technique is represented by the modern work in this field initiated by the Harvard college observatory. Beginning approximately in 1900 in the southern hemisphere, originally at Arequipa, Peru, and after 1927 at Bloemfontein, South Africa, Harvard astronomers have used the largest star-camera—the Bruce 24-in. photographic refractor—to investigate nebulae over large areas of the southern skies, while in the north, at Oak Ridge, Mass., the 16-in. Metcalf refractor has been used for similar work. Started about 1930 under the direction of Harlow Shapley, the Harvard surveys of galaxies to nearly the 18th magnitude have recorded many thousands of nebulae, and the program envisions an ultimate census of more than 500,000 objects.

Probably the greatest advances in our knowledge of nebulae have come from the use of reflectors of steadily increasing size. Following Keeler's demonstration that a 36-in. reflector is a powerful means for the study of individual nebulae, G. W. Ritchey at the Mount Wilson observatory constructed and used (1908–17) a 60-in. reflector for the photography of nebulae under the most favourable conditions. Ritchey's pictures, for years unsurpassed in quality, set a new standard in definition, with the result that a number of spirals were partially resolved into stars. This was an achievement of tremendous import, for it pointed the way toward the comparative study of stars in the nebulae with those in the Galaxy, thus leading to a solution of the long-standing problem of the distances of spirals. The promise of still greater advances was foreseen by G. E. Hale, and under his inspiration a 100-in. reflector was installed on Mount Wilson in 1917. With this instrument—the largest in operation in 1946—Edwin Hubble began in 1923 a comprehensive series of researches of nebulae which led to the first firm scale of extragalactic distance and to its extension to distances of the order of hundreds of millions of light-years (1 light-year =6,000,000,000,000 mi.). With these distances, together with certain spectroscopic observations of his colleague, M. L. Humason, and with those of V. M. Slipher at the Lowell observatory, Hubble in 1929 announced one of the most outstanding results of modern astronomy: the more distant a nebula is, the faster it seems to be receding from the earth. Moreover, the speeds of recession, as indicated by the increased wave lengths of spectrum lines (called "red-shifts") in the light from nebulae, became enormous at great distances, the highest speed measured corresponding to about 25,000 mi. per second, or nearly 1/7 the velocity of light. With astronomy in this manner thrusting into cosmology, by providing the observational basis for W. de Sitter's, A. Einstein's and G. E. Lemaitre's mathematical theories of the "Expanding Universe," Hale in 1928 again realized the possibilities offered by increased aperture, and he was able to initiate construction at the California Institute of Technology, Pasadena, of a 200-in. reflector to be placed on Mount Palomar. Completion of this greatest of telescopes was interrupted by World War II, but by 1946 there was good reason to expect that a few years more work would place it in operation.

**Classification of Nebulae.**—The nebulae fall naturally into two groups which are designated the *galactic* and the *extragalactic*. Alternate names for the latter group—by far the largest—are *nongalactic, anagalactic,* or merely *galaxies*. Galactic nebulae are found in or near the plane of the Milky Way (the Galaxy), while extragalactic nebulae or galaxies are seen, for the most part, outside the Milky Way. The division is not merely one of apparent distribution over the sky, for the two classes of objects differ fundamentally in every important respect, such as distance, in-

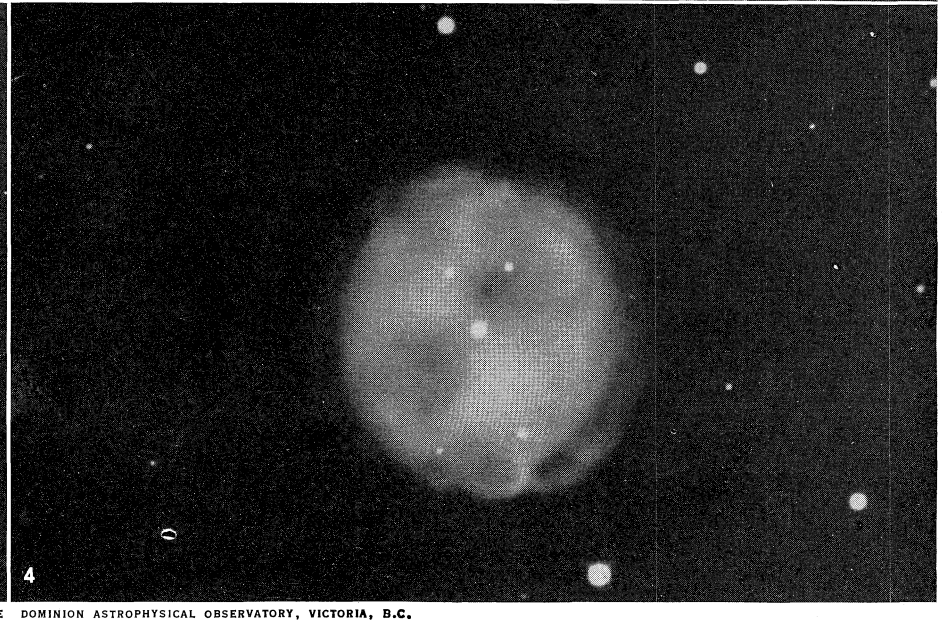


BY COURTESY OF THE LICK OBSERVATORY

## TWO TYPES OF GALACTIC DIFFUSE NEBULAE

1. Great Nebula in Orion (M42, N.G.C. 1976). The light of this nebula consists of bright rays characteristic of the atoms of hydrogen, helium, oxygen and nitrogen. These gases, highly rarefied, are excited to luminosity by ultra-violet radiation emitted by hot (20,000° C.) stars imbedded in the nebula. Approximate distance and size of nebula, 1,000 and 80 light-years, respectively

2. Pleiades (M45). This nebulosity is reflected and scattered starlight. Stars in the cluster provide the light, and surrounding clouds of finely divided dust particles reflect and scatter the rays from the stars. Distance to cluster, 490 light-years

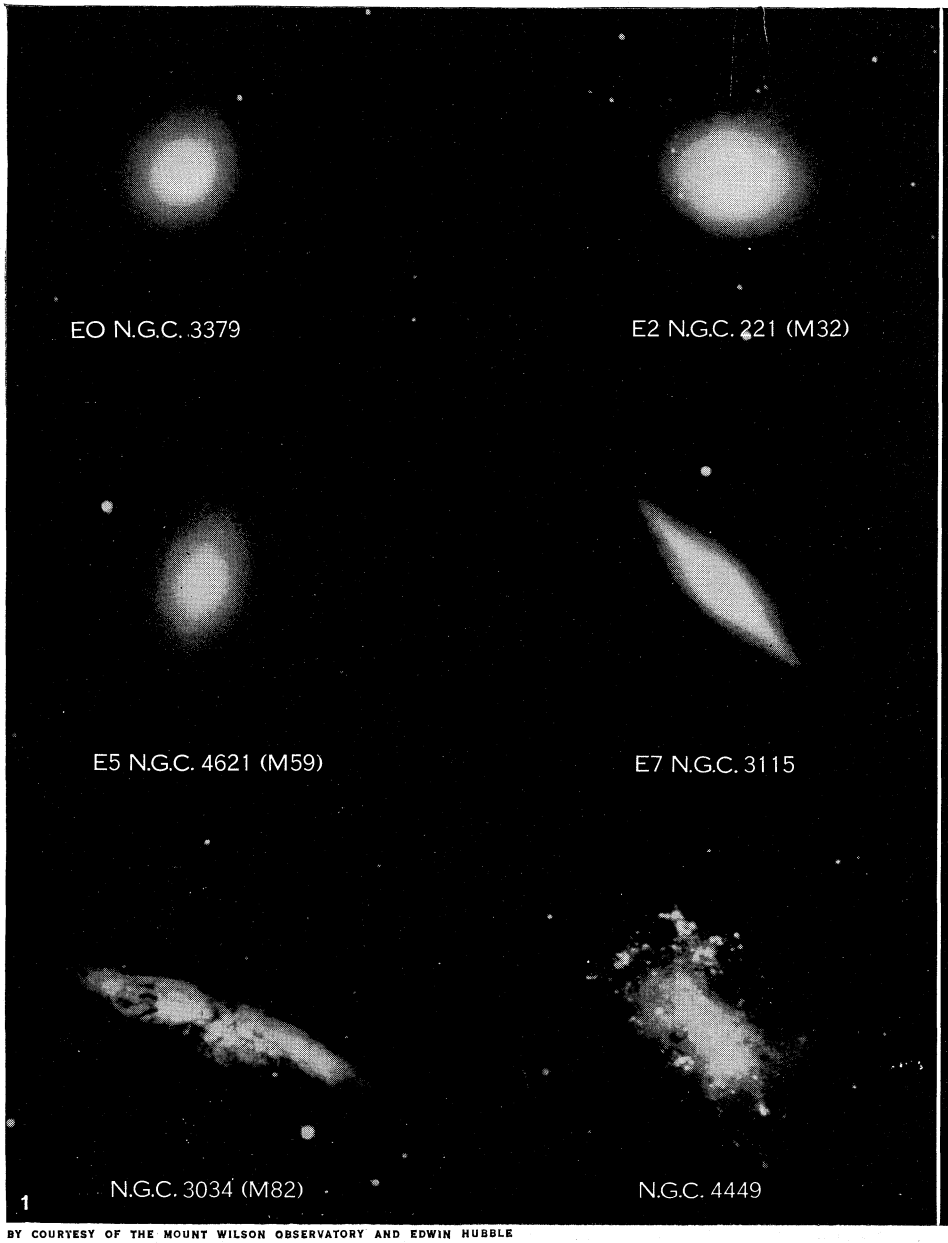


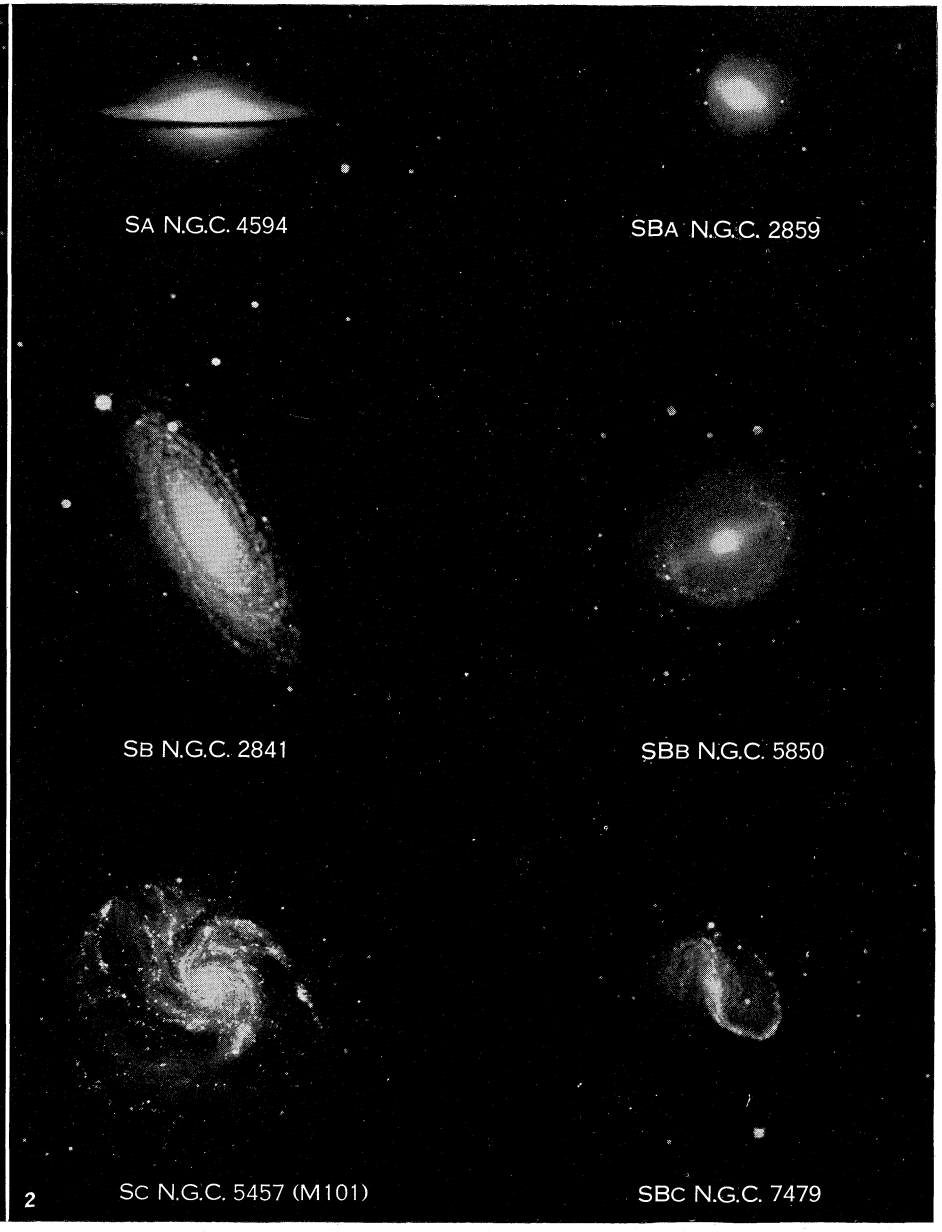
# NEBULA

BY COURTESY OF (1) THE LICK OBSERVATORY, (2, 4) THE DIRECTOR OF MOUNT WILSON OBSERVATORY, (3) THE DIRECTOR OF THE DOMINION ASTROPHYSICAL OBSERVATORY, VICTORIA, B.C.

## GALACTIC DIFFUSE (MIXED BRIGHT AND DARK), AND PLANETARY NEBULAE

1. Lagoon Nebula (M8, N.G.C. 6523) in Sagittarius; an example of a star cluster with mixed bright and dark nebulosity
2. Horse-head Nebula (N.G.C. 2023) south of star Zeta Orionis; a denser part of a dark cloud in front of several stars
3. Ring Nebula (N.G.C. 6720) in Lyra; a shell of gas made to shine by the central, very hot star
4. Owl Nebula (N.G.C. 3587) in Ursa Major; a nearly spherical volume of gas excited to luminosity by the central, hot star

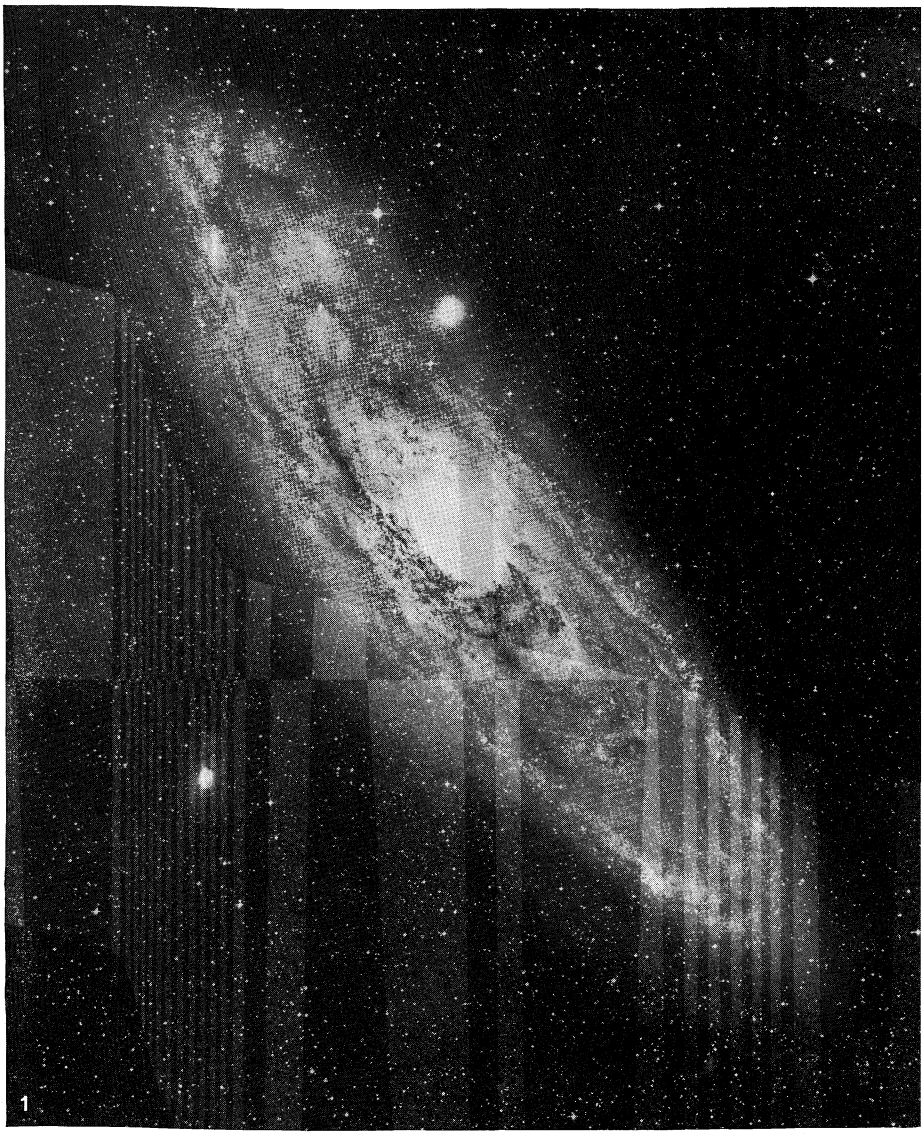



BY COURTESY OF THE MOUNT WILSON OBSERVATORY AND EDWIN HUBBLE

## CLASSIFICATION OF THE TYPES OF EXTRAGALACTIC NEBULAE

**1.** Four typical elliptical (E) nebulae which show the range of flattening (ellipticity) from globular to lenticular, and two irregular (Irr) nebulae which are generally unclassified
**2.** Six typical spiral nebulae which fall naturally into two groups: the normal spirals (S) and the barred spirals (SB). The small letters a, b, c, indicate the degree of resolution into spiral structure, star clouds or clusters, and individual stars



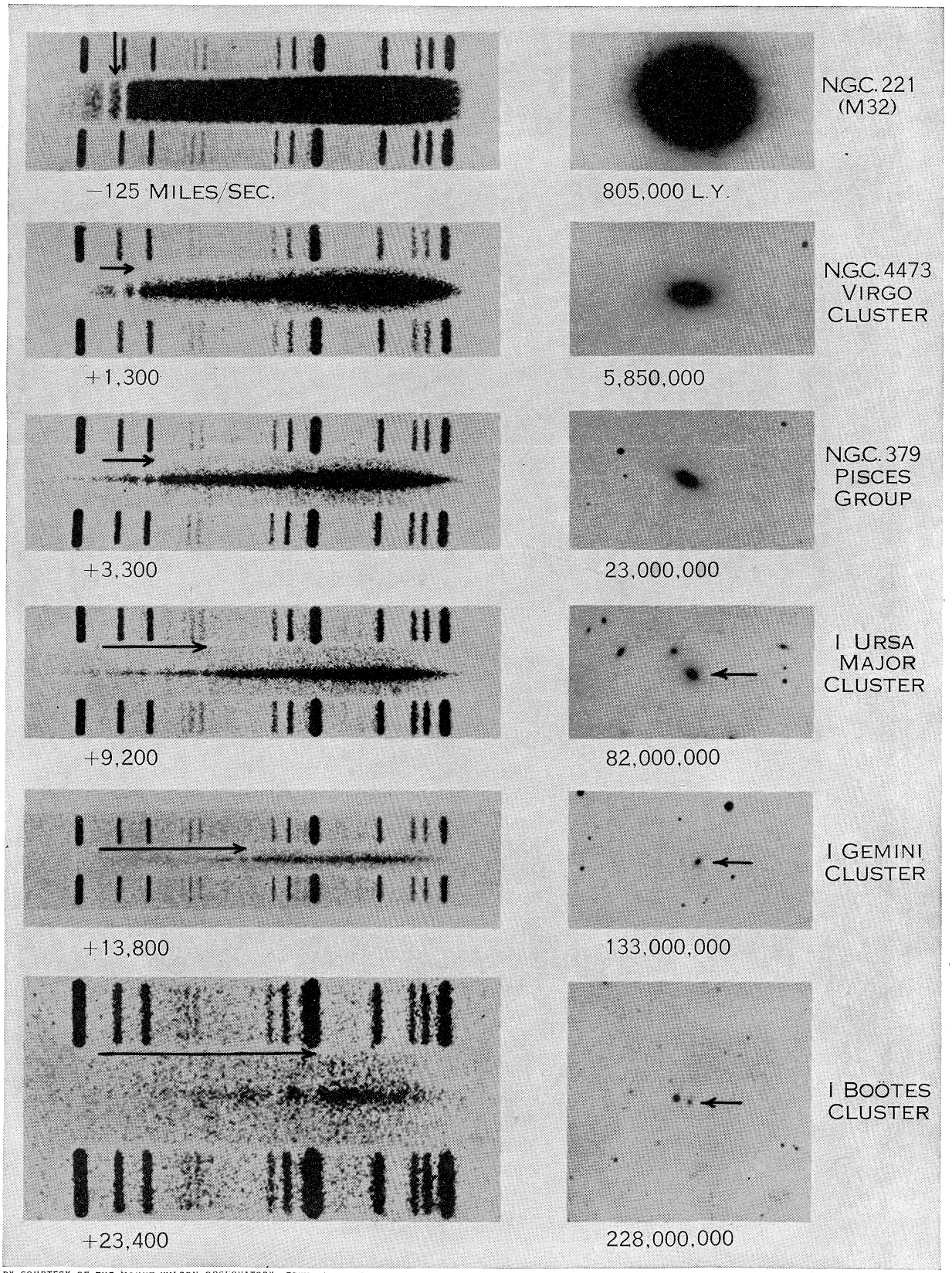
BY COURTESY OF THE LICK OBSERVATORY

## EXTRAGALACTIC NEBULAE:

1. Andromeda Nebula (M31, N.G.C. 224). This is a spiral, giant galaxy of stars, distant 750,000 light-years. Its full size is more than three times that shown in this photograph, or 80,000 light-years in diameter. The spiral contains star clusters, diffuse gaseous nebulae, variable stars, and thousands of millions of stars similar to those found in our own galaxy. If the latter, the Milky Way stellar system, could be viewed from a distance of nearly

## THE TWO NEAREST SPIRALS

1,000,000 light-years, it probably would resemble the Andromeda nebula
2. Spiral in Triangulum (M33, N.G.C. 598). This system, only 14° away from the Andromeda nebula and at the same distance, is a galaxy of more nearly average size and luminosity. It is highly resolved into stars and has many diffuse gaseous nebulae and variable stars



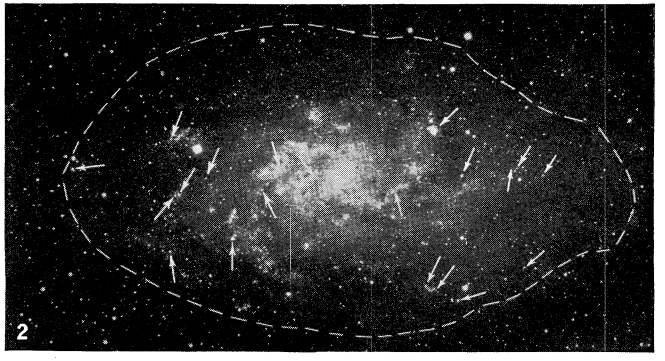

BY COURTESY OF THE MOUNT WILSON OBSERVATORY, EDWIN HUBBLE AND M. L. HUMASON

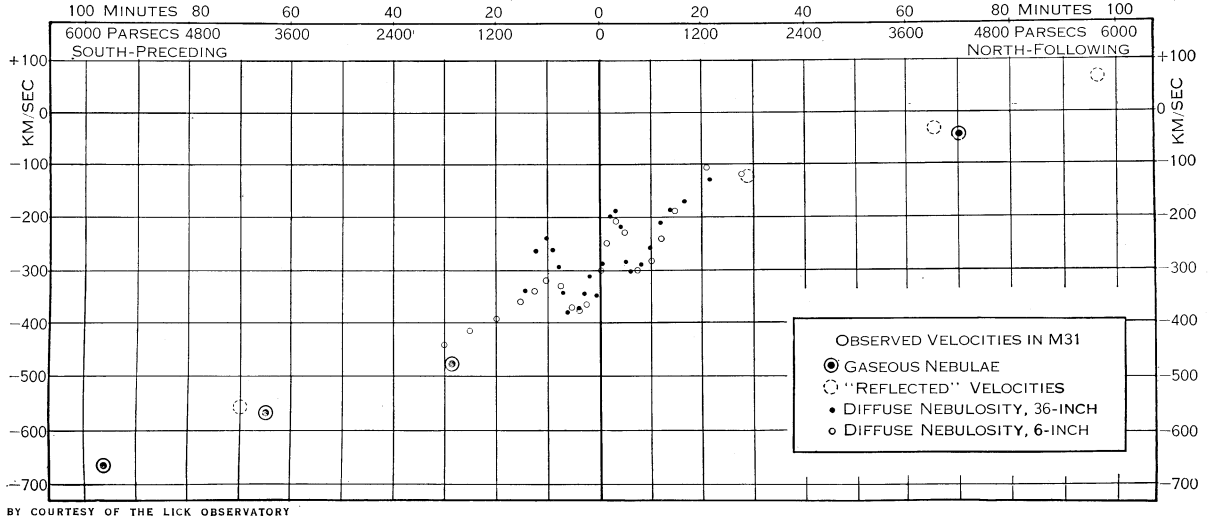
## THE VELOCITY-DISTANCE RELATION

The arrows in the left-hand column of nebular spectra point to the H and K lines of calcium (unresolved in the lowest spectrum). The lengths of the arrows show the amounts the spectrum lines are displaced toward longer wave lengths; *i.e.*, they show the "red-shifts" in the spectra, expressed in miles per second. The comparison spectra are of helium

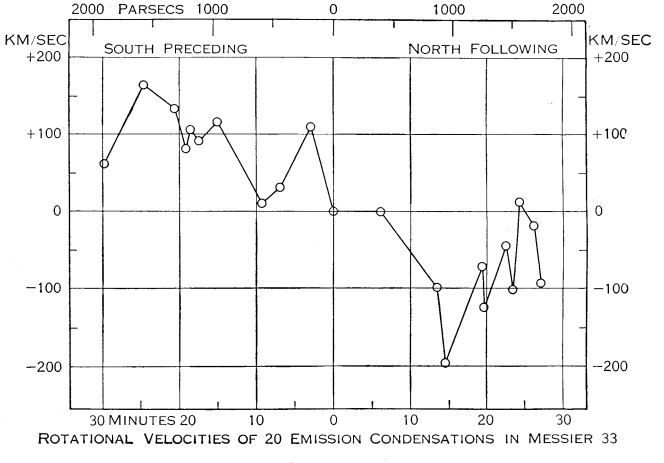
In the right-hand column, direct photographs, of nearly the same scale and exposure time, illustrate the decrease in size and apparent brightness of the nebulae with increasing distance, expressed in light-years (l.y.). When the distances are plotted against the velocities, there is obtained a straight-line relation, known as Hubble's velocity-distance relation

# NEBULA




BY COURTESY OF THE LICK OBSERVATORY




ROTATIONAL VELOCITIES OF 20 EMISSION CONDENSATIONS IN MESSIER 33

## ROTATION OF THE TWO NEAREST SPIRAL NEBULAE

**1. Spiral in Andromeda (M31). 2. Spiral in Triangulum (M33).** The direct photographs above, with the diagrams below, show points in the spirals with their corresponding velocities (in the line of sight), which indicate that these two galaxies are rotating. The objects encircled in M31, and marked with arrows in M33, are all diffuse gaseous nebulae, observed because their bright-line spectra are easiest to record and to measure. The scale of linear distances at the top of the diagrams is in the stellar distance unit called the *parsec*, which equals 3¼ light-years. The velocity scales on the right- and left-hand margins are in *kilometres* per second; multiplication of the numbers shown by 0.621 will express them in *miles* per second

From the velocities observed, it can be shown that different parts of the spirals turn at different rates; thus, the calculated periods of rotation in M31 are 11,000,000 years for the small nuclear region, and 92,000,000 years for the main body. In M33, the main body turns once in 59,000,000 years, and the outer parts once in 60,000,000 to 200,000,000 years

trinsic size and brightness and constitution. In fact, the two categories are so dissimilar that they should logically be separately discussed.

## THE GALACTIC NEBULAE

These are of two types: (1) *Diffuse Nebulae* and (2) *Planetary Nebulae*. The first kind includes *bright* and *dark* nebulae, but with no clear-cut division, since the two are often found thoroughly mixed together. The second kind is a relatively unique group of objects, usually of round or of symmetrical structure, and nearly always having a single star near the centre of the sharply-defined outer edges of the nebula.

**Diffuse Nebulae.**—Modern work on interstellar dust clouds suggests that diffuse nebulae may be regarded from the following very general point of view. Throughout our own stellar system, of which the fundamental plane is the Milky Way, there is a thin layer of nonluminous matter. This material, a mixture of atoms, molecules, dust particles and larger masses, is not uniformly distributed, but is relatively concentrated in some regions, and extremely tenuous or absent in others. In some cases denser clouds are situated in front of a bright, starry background. They are then revealed in silhouette, and photographs such as Barnard's record them as *dark* nebulae. On the other hand, it often happens that single stars, or groups of stars, lie in the denser parts of the stratum. In this case the stars illuminate the surrounding cloud, much like street lights in a fog, and *bright* nebulae may be seen or photographed by the light scattered by the particles composing the cloud. *Mixed bright and dark* nebulae occur in circumstances where a cloud is so large that the light from the involved stars does not penetrate to its boundaries, so that a bright nebula appears to be superposed on a larger dark one; or again, the obscuring matter may be localized in streaks or lanes, which are outlined or contrasted against the brighter and less opaque parts of the cloud.

*Bright Diffuse Nebulae.*—The true character of these objects became known in 1864–68 when William Huggins (1824–1910) examined several of them with his spectroscope and found their light highly concentrated into a few bright radiations, typical of a rarefied gas excited to luminescence. So many more were subsequently found to have a similar spectrum that for nearly half a century it was generally supposed all diffuse nebulae were incandescent gases. In 1912, however, V. M. Slipher of the Lowell observatory announced that the spectrum of the nebulosity around the Pleiades gave an absorption spectrum, which is a continuous, coloured band of light crossed by dark lines. Furthermore, the nebular spectrum was like that of the stars imbedded in the nebula. These results, which were later obtained for a number of other diffuse nebulae, provided evidence for the view that some nebulae shine by *scattered* or *reflected* light directly received from the stars, rather than by *emitted* light indirectly excited in the nebula by ultra-violet radiation from the stars. The latter mechanism was satisfactorily described by I. S. Bowen in 1927, and is of such great astrophysical importance that it is considered in some detail in the section below entitled, *The Gaseous Spectrum of Nebulae*. Before Bowen explained the origin of the nebular emission spectrum, however, Hubble in a systematic and complete investigation of diffuse nebulae published in 1922 discovered two significant properties of these objects: (1) whether a diffuse nebula shines by emitted light (bright-line spectrum) or by reflected or scattered light (absorption spectrum) depends upon the temperature of the star or stars concerned. Although there is some overlapping, in general it is found that stars hotter than about 20,000° C. (spectral type B1 or earlier) can excite an emission spectrum in the nebula, while cooler stars merely illuminate the nebula by reflection and scattering. (2) The luminous area of the nebula extends outward to a distance proportional to the square root of the brightness of the star.

It is possible to determine with considerable accuracy the velocities in the line of sight (*radial* velocities) of those nebulae which show an emission spectrum, because their light though faint is concentrated in a few bright spectral lines. Observations made at the Lick observatory by W. W. Campbell and J. H. Moore, and published in 1918, show that the average motion is some 6 to 7 mi. per second, which is relatively slow by stellar standards. The determination of velocities across the line of sight (*transverse* velocities), on the other hand, is difficult for two reasons: (1) there is a general absence in diffuse nebulae of sharply-defined points suitable for accurate measurement; (2) the diffuse nebulae are so distant, and their internal motions so slow, that no displacements large enough to measure are shown during the relatively few years that have elapsed since the nebulae were first photographed.

*Variable Diffuse Nebulae.*—This is a comparatively rare class of objects comprising less than a dozen known members. They are usually fan-shaped, bowed or arched, with a star of irregularly variable light located at or near the point of the fan or centre of the arches. Without exception, they are found in dark lanes of the Milky Way. Only a few of them have been studied, with somewhat inconclusive results. Photographs of J. R. Hind's and Hubble's variable nebulae (N.G.C. 1555 and 2261, respectively), show marked changes in intensity in different parts of the objects, but there is little evidence that the parts have moved. Moreover, no close correspondence between light variation in the stars and nebulae has been established. The few spectra that have been obtained of these nebulae, by Slipher and by Hubble, show their light to be continuous. The spectra of the involved stars, known as T Tauri variables, have been studied by A. H. Joy at Mount Wilson, who reported in 1945 that their light consists of a bright-line spectrum of varying intensity superposed on an absorption spectrum characteristic of dwarf stars like the sun (temperature 6,000° C.). This latter fact, in view of Hubble's relation mentioned above, is consistent with the fragmentary observations of continuous spectra in the nebulae. Although it is clear that much remains to be done before the puzzle of variable nebulae is solved, H. D. Curtis has pointed out that the lack of correlation between stellar and nebular fluctuations in brightness argues against the explanation of light pulses, or bursts from the associated star, producing an unsteady illumination of the nebula. A more plausible hypothesis would be the interruption or dimming of the nebular light by clouds drifting between the star and nebula, and, under certain circumstances, the interposed, passing material could produce shadow effects on the nebula.

*Dark Diffuse Nebulae.*—There are in the Milky Way a great number of dark patches, some of them almost entirely devoid of stars. A few of these were discovered by the Herschels, who thought them to be holes through which they looked into empty space beyond. Barnard, who catalogued several hundred of them, and whose studies of these dark nebulae finally showed that they were caused by the presence of clouds of nonluminous matter, was at first loath to believe they were other than holes or spaces actually containing no stars. They vary in size from small patches only a minute of arc in diameter to the large lanes in Ophiuchus and Scorpius. Even the huge rift 120° long which divides the Milky Way from Cygnus to Centaurus must be considered to be of a similar nature. An analogous bifurcation is frequently found in spiral nebulae seen edge-on, and comparative studies of them with the Galaxy, carried out by H. D. Curtis, did much to establish the current conception of our own stellar system as one of the giant spiral nebulae.

Although it might be supposed that less could be learned of dark nebulae than of bright ones, because the invaluable spectroscope cannot be directly applied to their investigation, some powerful statistical methods have been devised which lead to the distances of dark nebulae, and to estimates of their absorptive power. At first, distances of these objects were obtained from parallax measurements of the associated stars, but in only a very few instances are the stars close enough to give reliable determinations. A more generally applicable method, first devised by Max Wolf, and later refined and placed on a precise statistical basis by A. Pannekoek of Amsterdam, is one involving star counts in and around a dark nebula. By making counts of stars in two areas of the same size, one in the nebula and the other in a nearby unobscured area, it is found that at first, for the brighter stars, the counts run about the same, but, as the fainter stars are

reached, the numbers in the dark area fall below those outside. The apparent magnitude at which the deficiency becomes noticeable indicates the distance, since as the result of much modern work on stellar statistics, the average distance is known for stars of a given magnitude. Furthermore, the absorptive power is obtained from the percentage deficiency observed for the faintest stars counted. In this way it has been determined that most of the prominent dark nebulae range in distance from a few hundred to a few thousand light-years, which is relatively close on the galactic scale, and that they absorb 30% to 95% of the light.

Considerable information has been obtained about the nature of the obscuring matter in dark nebulae from theoretical investigations of the absorbing and scattering power of finely-divided matter, and from observations of the colours and spectra of the involved stars. In 1901, H. von Seeliger of Münich, as a result of his investigations of the swarm of meteoric bodies composing Saturn's rings, was led to a theoretical consideration of the effects of starlight reflected by small bodies. His work, however, found no immediate application to dark nebulae because it was done so long before Slipher's spectroscopic discovery in 1912 of reflection nebulae in the Pleiades. Ten years after Slipher's significant observations were made, H. N. Russell of Princeton investigated the theory that dark nebulae are composed of extremely fine dust particles. He derived formulae relating the total absorption in such clouds to density and size of the particles, and concluded that the most efficient dimming occurs for particle diameters about $\frac{1}{3}$ the wave length of light, or for sizes of the order of 1/150,000 in. These calculations were very revealing, since they showed that absorptions of several magnitudes could be produced by extensive clouds of matter without the total mass becoming unreasonably large. At approximately the same time as Russell's theoretical work, F. H. Seares and Hubble at Mount Wilson had found numerous cases of reddened stars imbedded in nebulosity. Thus by 1922 it was evident that dark clouds not only dimmed starlight, but that they also absorbed relatively more blue light than red, and this fact constituted additional evidence for the very small size of the material concerned. Russell's absorption theory was extended by Carl Schalén of Upsala, Sweden, who also applied it more powerfully by utilizing the colours and spectra of stars involved in dark nebulae. He found the percentage of reddening to be small, and from the apparently reasonable assumption that the particles are metallic compounds of iron, zinc and copper, concluded that the most effective dimming occurs for a size of 1/300,000 in. Seeliger's reflection theory has also been more fully developed and applied, notably at the Yerkes and McDonald observatories by Otto Struve and his associates L. G. Henyey and J. L. Greenstein. For dust particles large enough to produce more reflection than scattering, Henyey in 1937 developed a theory which allows a determination of the orientation and distance of a reflection nebula from the illuminating star. Application of this theory to some reflection nebulae has indicated separations of several light-years between star and nebula.

If it is true that the process of scattering is more effective than those of absorption or reflection, then a dark nebula might be faintly visible in scattered light. To test this possibility, Struve and C. T. Elvey in 1935 compared the surface brightnesses of dark nebulae with areas between stars in unobscured regions, and from the slight differences detected they concluded that either the reflection was small or the scattering large. The latter explanation was then proved to be the correct one by Elvey and F. E. Roach in 1937 from extensive measures (with the aid of a photoelectric cell) of the radiation from the Milky Way. They found that, after allowing for all the light contributed by the stars, there still remained a considerable amount (50%) which could only have come from scattering by small particles between the stars. Then in 1938, in a notable achievement of spectroscopic observation, Struve and Elvey reported photographs of the spectrum of this extremely faint light, and established the existence of large clouds of dimly-glowing hydrogen and oxygen throughout many regions of the Milky Way. Finally in 1938, in a detailed study of the efficiency of scattering by dust particles, Henyey and Greenstein concluded that the obscuring matter probably does not consist mainly of metallic specks, but that other unknown constituents, perhaps rocklike compounds, are responsible for the appearance of dark nebulae.

**Planetary Nebulae.**—These are so named because their appearance in a telescope resembles that of planets; *i.e.,* they show fairly well-defined disks having definite edges. But that is the only feature which planets and these nebulae have in common, for the planetary nebulae, being distant members of the stellar system, show no appreciable motion among the stars. In general they are much farther away than the diffuse nebulae, are smaller and have a bright-line spectrum which ordinarily readily distinguishes them from other galactic nebulae.

*Numbers and Distribution.*—The planetaries form a rather small and unique group which until about 1940 was presumed to include nearly 130 members, but from photographs taken on Mount Wilson with a specially-designed prismatic camera, R. Minkowski by 1945 had increased the total number known to nearly 200. Since practically all these new additions are indistinguishable from stars even on photographs taken with large reflectors, it thus appears that many more remain to be discovered among the fainter stars of the Galaxy.

Like the diffuse nebulae, the planetaries tend to be distributed within the Milky Way, but in much less degree. In galactic concentration they are intermediate between diffuse nebulae and the globular star clusters, and like the latter, the planetaries are most numerous in Sagittarius and Scorpius, which is the direction to the centre of the galactic system.

*Size and Structure.*—In apparent size the planetary nebulae average less than one minute of arc in diameter, and they range from nonuniform surfaces half the diameter of the moon, down to pointlike stellar images identifiable as planetaries only from their spectra. With few apparent exceptions, and probably with no real exceptions, planetary nebulae have bluish-white central stars whose brightnesses range from the 9th to the 19th magnitude. These central stars are among the hottest objects known, with temperatures in some cases estimated as high as 150,000° C. The high frequency of round or elliptical outlines exhibited by the planetaries means that these nebulae probably are spherical or ellipsoidal in form, and in those numerous cases which show a beautiful arrangement of ring within ring, the true structure may actually be a series of concentric shells.

*Distances and Densities.*—Unfortunately, the distances of the planetary nebulae are not known with any high accuracy. They are so far away that direct trigonometric methods are untrustworthy, and their transverse motions are so small that they are hardly measurable during the relatively short time that has passed since suitable photographs were first obtained. The most that may be said about distances of the planetaries is that they are large, and that they are uncertainly estimated to range from 3,000 to 30,000 light-years. With these distances, the typical bright planetary has a diameter of the order of 10,000 times the distance between the earth and sun, and, according to L. Goldberg and L. H. Aller of the Harvard observatory, the average total amount of matter in a planetary nebula is less than $\frac{1}{5}$ that in the sun. These figures give some notion of the extreme tenuity of the gases composing these nebulae, since the density indicated, several hundred atoms per cu.in., is far less than the best vacuum obtained on the earth.

*Motions.*—Because they have bright-line spectra, the radial velocities of planetary nebulae are easily and accurately determined. Spectroscopic observation has shown that their motions are moderately high, averaging 15 mi. per second, a value intermediate between those for the diffuse nebulae and the globular star clusters. In 1937 L. Berman, from an analysis of the radial velocities of 110 planetaries determined prior to 1918 by J. H. Moore and W. W. Campbell at the Lick observatory, showed that these nebulae participate in the rotation of the stars about the galactic centre 30,000 light-years distant in the direction of Sagittarius. Another significant and valuable result from Campbell and Moore's work was the discovery of turbulence in the gases composing the planetary nebulae. From the fact that the spectrum lines were found to be curved, and in some cases doubled, it may

be concluded that the nebular gases are in motion, and in general expanding from the central star. The velocity of expansion, however, is relatively low, being about 10 to 15 mi. per second. Furthermore, from the fact that some of the bright nebular lines were observed to be inclined, it appears that in these cases the nebulae are not only expanding, but are also slowly rotating. However, the complex structure seen in some planetaries finds no such simple explanation, and it must be admitted that in these instances the turbulence of the nebular gases is still a very puzzling phenomenon.

*Origin.*—The question as to what place, if any, the planetary nebulae take in the scheme of stellar evolution is a difficult one, to which at present there is no certain answer. It has often been suggested that they represent a later stage in the life history of the "new" stars (novae), because: (1) in a number of cases novae have been observed to throw off expanding shells of gaseous matter; and (2) M. L. Humason showed in 1938 for 16 faint, "old" novae that they ultimately tend to become small and extremely hot stars very similar to the central stars in the planetary nebulae. The principal objection to this hypothesis is that the velocities of expansion of the nebular matter usually are of a different order of magnitude, being hundreds of miles per second in novae and only a few miles per second in planetaries. While it can be argued that the nebular shells around novae may slow down in time, there is little evidence that this has occurred in any of the novae observed in modern times; in fact, there seems to be more reason to regard the motion as essentially uniform. On the basis of this assumption, F. L. Whipple of Harvard in 1938 deduced ages for the planetary nebulae of the order of 30,000 years, which is but a fleeting moment in the time-scale of the stars.

**The Gaseous Spectrum of the Nebulae.**—The spectra of all gaseous nebulae, diffuse and planetary, are very similar in appearance, the differences consisting chiefly in the relative intensities of the bright lines. The lines in the spectra are sharp, a fact which indicates a gas of low density; those of hydrogen are prominent and those of helium are usually present. But for more than 60 years following 1864, when William Huggins first observed the spectrum of a nebula, there were several lines (a wide pair in the green at 5007 and 4959 A, and a close pair in the ultraviolet at 3726 and 3729 A), among the strongest in the spectrum, which remained unidentified. Their origin was one of the most puzzling mysteries in astronomy, and for lack of a better name, they were attributed to a hypothetical element called "Nebulium," although it was generally realized, because of advances in chemistry and physics which left no place in the table of known elements for foreign ones, that the occurrence of the strange lines probably was due to some familiar element existing under conditions peculiar to the nebulae. That this explanation is the correct one was established in 1927 by I. S. Bowen. He showed on the basis of laboratory work and reasonable theoretical considerations that the chief nebular lines are due to singly and doubly ionized oxygen atoms, which radiate light under conditions of low density and high excitation unmatched on the earth.

*Forbidden and Permitted Lines.*—To understand why certain lines occur in the nebulae and not in terrestrial sources, and vice versa, it is necessary to mention a few of the fundamental principles of modern atomic theory. In this concept, atoms exist in certain definite energy states, depending on their environment. The energy states correspond to orbits in which electrons move about the nucleus, and when an electron jumps from one orbit to another, energy is absorbed, or emitted, depending on whether the jump is from an inner to an outer orbit, or the other way around. The electrons, however, do not remain in the different kinds of orbits for equal times, and it is this property of the atom, together with its environment, which is responsible for the characteristic nebular radiations. The latter represent jumps to orbits in which electrons can move for seconds, minutes and possibly hours, whereas radiations observed in terrestrial light sources correspond to transitions between orbits in which electrons remain for only 1/100,000,000 of a second. Spectral rays from long-lived orbits are called "forbidden" lines, those from the short-lived orbits "permitted" lines, and the reason only the latter are obtained in the laboratory is that collisions between atoms, even with the lowest obtainable densities, are so numerous (millions per second) that electrons are almost always knocked from the long-lived orbits before they have a chance to jump to an inner orbit, with the resultant emission of a forbidden line. In the nebulae, however, the extremely low densities allow sufficient electrons to accumulate in the long-lived orbits (called "metastable states") to yield intense forbidden lines.

*Physical Processes and Sources of Energy.*—In addition to demonstrating the existence of an almost perfect vacuum in gaseous nebulae, the forbidden lines, being due to ionized atoms (those which have lost one or more electrons), indicate the presence in planetaries of a very high-temperature source of energy. Evidence for this is provided by two apparently unrelated features of the nebular spectrum: (1) the size of a nebula is different in different radiations, and (2) only certain of the permitted lines of neutral oxygen and nitrogen are observed. The first of these properties, originally noted in 1908 by Wolf, and later (1918) extensively studied by W. H. Wright in the most thorough and significant investigation of the spectra of the gaseous nebulae, shows that the smallest nebular diameters correspond to the most highly ionized atoms, and the largest to the least, in just the way to be expected from Bowen's high-temperature theory of the structure of planetary nebulae. The second feature was likewise explained by Bowen as the result of an intense concentration of energy in the far ultraviolet, characteristic of a high-temperature source, which selectively excites the observed lines by a fluorescent mechanism. That the central stars of planetary nebulae are in reality among the hottest objects known was also established by Wright's observations of the spectra of planetary nuclei. Subsequent theoretical investigations by H. Zanstra, A. S. Eddington and D. H. Menzel have fully substantiated Wright's earlier deductions from observations, and Bowen's conclusions from identification of the chief lines, that the dominating physical conditions in gaseous nebulae are extremes of low density in the nebulae and of high temperature in the central stars, which are the ultimate source of all nebular radiations.

*Abundances of the Nebular Gases.*—Following his explanation of the origin of the nebular lines, and the mechanism of their production, Bowen in 1934 concluded that the gaseous nebulae, like most astronomical bodies, are largely made up of hydrogen, with helium the next most abundant element. Further information on their chemical composition was obtained in 1939 by Bowen and A. B. Wyse at the Lick observatory. By using an especially powerful spectrograph in combination with an "image slicer" (invented by Bowen to overcome certain observational difficulties), and exposures of 12 to 20 hours, they were able to record in two planetary nebulae a number of faint radiations due to the metallic and other elements. Analysis of the intensities of these lines, and comparison of results with similar work by H. N. Russell on the sun, led to the conclusion that the abundances of many elements in the nebulae and sun are not significantly different. Wyse in 1942 extended the program to include 10 additional planetary nebulae and the Orion nebula, and deduced that the chemical compositions in both types of nebulae are similar to that of the sun. In an independent and more elaborate theoretical treatment of the problem, D. H. Menzel and a number of associates at Harvard

Average Composition of a Planetary Nebula Compared with that of the Sun

| Chemical Element | Relative Number of Atoms | |
|---|---|---|
| | Nebula | Sun |
| Hydrogen | 1000 | 1000 |
| Helium | 100 | 222 |
| Carbon | 0.6 | 0.04 |
| Nitrogen | 0.2 | 0.12 |
| Oxygen | 0.25 | 0.37 |
| Fluorine | 0.0001 | .... |
| Neon | 0.01 | .... |
| Sulphur | 0.036 | 0.037 |
| Chlorine | 0.002 | .... |
| Argon | 0.0015 | .... |

came to the same conclusion in the last of a long series of papers published in 1945. Their final results, which represent the most modern estimates of the cosmical abundances of the lighter elements, are given in the table on page 187B.

## THE EXTRAGALACTIC NEBULAE

The extragalactic nebulae are found scattered all over the sky except in the Milky Way itself, which they rigidly avoid. This characteristic is, however, by no means the only thing that differentiates them from the galactic nebulae, and the most casual study soon shows them to be objects of quite a different nature. They vary in apparent size from the great spiral in Andromeda, which has been traced to a diameter of more than 6°, to objects so small that even in the largest telescopes they are barely distinguishable from the faintest stars. The number of such nebulae is enormous and depends upon the limiting brightness to which they are counted. For example, there are approximately 1,000 catalogued to the 13th magnitude, and they increase geometrically by a factor of four for each fainter magnitude reached; thus 4,000 could be counted to the 14th magnitude, 16,000 to the 15th, etc., until at magnitude 21.5, which is the limit of the 100-in. Mount Wilson reflector, some 100,000,000 extragalactic nebulae could be photographed. That each one of these objects is now known to be a stellar system, or "island universe," similar in some cases to our own giant Milky Way, is an achievement of modern astronomy which has immeasurably widened our view of the observable universe. The giant systems among the faintest nebulae counted lie at distances of the order of 500,000,000 light-years. With present resources, therefore, we are able to encompass a vast sphere 1,000,000,000 light-years in diameter. This great volume of space is by no means fully explored, but enough has been learned, especially from large reflectors and powerful spectroscopes, to indicate something of its physical properties and of its stellar systems.

**Classification.**—The most generally accepted scheme of classification for the extragalactic nebulae is the one proposed by Hubble in 1926. It is represented schematically in fig 1. This

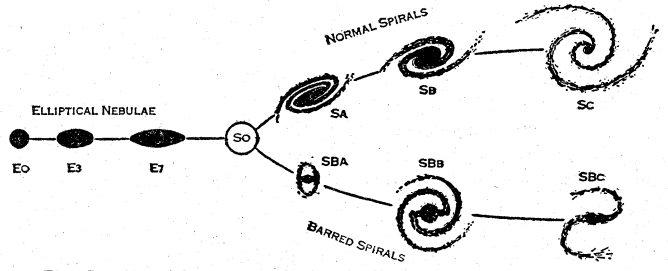



Fig. 1.—Hubble's system of classification for extragalactic nebulae

system arranges in a single homogeneous pattern nearly 98% of the numerous *regular* nebulae which are sufficiently large and bright to show appreciable structure on photographs taken with telescopes of moderate power; the remaining 2% or 3% which do not readily fall into the system are called *irregular* nebulae. The basic feature of the classification is, in Hubble's words, "conspicuous evidence of rotational symmetry about dominating, central nuclei."

As may be seen from fig. 1, the regular nebulae begin the sequence as *elliptical* nebulae, denoted by E. Their forms range from globular to lenticular, with the degree of ellipticity indicated by numerals from 0 to 7, which are obtained from the relation $10(a-b)/a$, where $a$ and $b$ are the major and minor axes, respectively. Statistical analysis of the frequency of occurrence of the different forms shows that there are actually globular or spherical nebulae, and that not all of the apparently round ones can be accounted for as flattened nebulae with polar axes in the line of sight. The analysis shows, however, that the lenticular objects are much more common, and that there is a definite limiting ellipticity with ratio of axes 3 to 1. When the flattening becomes greater, the nebulae no longer appear as smooth, unresolved objects, and, at a certain stage of the sequence, indicated by *So,* they begin to show structure which in general is of *spiral* character. Two different spiral forms are found, however, so that the spiral nebulae are separated into two groups: the *normal* spirals, designated by *S,* and the barred spirals, symbolized by *SB.* The latter, first noted as a distinct class in 1918 by H. D. Curtis who termed them "phi-type" ($\phi$) spirals, are in the minority, for less than 1 spiral in 2 or 3 is barred.

Among the regular nebulae large and bright enough to classify, the spirals outnumber the ellipticals by more than 4 to 1, and this fact stresses the importance of deciding which features in spirals are best suited for further subdivision, such as central concentration, relative size of arms and nucleus, or number and character of condensations. After an examination of hundreds of nebulae on photographs taken with the Mount Wilson reflectors, Hubble concluded that the most significant characteristic for classifying spirals is the *degree of resolution.* Depending upon circumstances, the resolution may be only into spiral structure, into clusters or clouds of stars or, at best, into individual stars. To indicate the degree of resolution the letters *a, b* or *c* are placed after *S* or *SB;* thus, a well-resolved normal spiral would be referred to as *Sc,* a barred one as *SBc.*

**Nebular Evolution.**—The classification described above arranges the extragalactic nebulae into a consistent pattern in which such important features as linear diameters of the main bodies, spectral types, colours and intrinsic luminosities of the brightest stars all vary uniformly along the sequence. It is tempting to suppose that this sequence gives us a picture of an evolutionary process whereby a spiral nebula develops from a structureless globular system into a galaxy of stars by the continued ejection of matter from the nucleus along the spiral arms. That such a process is mathematically possible was first considered in 1928 by J. H. Jeans, and later in 1933–41 by B. Lindblad. According to theory, a nearly spherical, slowly-rotating nebula spins faster as it contracts, thus becoming more flattened. Tides raised on opposite sides of the equator by some external disturbance form protuberances which are then projected as arms. These wind around the central mass and are disintegrated into groups of condensations which ultimately become stars. The process must be an extremely slow one, involving millions upon millions of years, and we cannot expect to see even during many centuries any changes in the form of a particular nebula. Although such theory is invaluable as a logical synthesis of the available data relating to nebular contents and structure, the factual knowledge is still too meager to permit definite conclusions regarding the course of nebular evolution. Hence, while in practise the terms "early-" and "late-type" spirals (*Sa* and *Sc,* respectively) are often employed, it is done only to indicate relative position in the sequence; there is no implication of an underlying time scale. Observational astronomy, at least, is not yet prepared to assert that the direction of nebular evolution is established by classification.

**Distribution.**—As the result of extensive counts of extragalactic nebulae on photographs taken chiefly at the Mount Wilson observatory in the northern hemisphere, and at the Harvard college observatory station in the southern hemisphere, it is known that, on the grand scale, the distribution is approximately *uniform* both over the sky and in depth. This result, of great theoretical and practical value for cosmological studies, was obtained only after much modern work which elucidated the effects of galactic obscuration, and of several great clusters of nebulae, upon the true distribution.

*Distribution Over the Sky.*—Long before the advent of photography it was generally known that the "white" nebulae, now called extragalactic, tended to avoid the Milky Way, and that there was appreciable clustering in high galactic latitudes, especially in Coma and Virgo close to the north pole of the Galaxy. With the development of photography, more and ever more nebulae were counted, and the galactic zone of avoidance and the regions of clustering became more precisely defined. A number of early counts, among them those of J. E. Keeler (1899), E. A. Fath (1914) and H. D. Curtis (1918), suggested the general outlines of the distribution and gave hints as to the total number of nebulae within reach of certain telescopes, but the problem of

nebular counts was not put on a firm quantitative basis until 1934. In that year Hubble published the results of surveys, made with the Mount Wilson reflectors, in which more than 44,000 nebulae were counted in 1,300 sample regions fairly evenly distributed over three-fourths of the sky. For the first time, the counts were calibrated and referred to specified limiting magnitudes. With all the data reduced to standard conditions, it became clear that the numbers of nebulae decreased in a very regular way as the Milky Way was approached. The rate of decrease, in fact, was just that to be expected from a thin obscuring layer in which the absorption is proportional to the light path in the stratum—a familiar analogy is the dimming of stars as they approach the horizon. The zone of avoidance along the Galaxy is thus but the effect of looking in the plane of the stratum, where the absorption is a maximum which approaches complete opacity; toward the galactic poles, the absorption is a minimum, with the light reduced by only 20%. The more populous areas, on the other hand, represent a conspicuous tendency for the nebulae to cluster. They occur in pairs, in small to large groups of several to 100 nebulae, and in great clusters which include more than 500 members, as in the Coma and Virgo aggregations.

*Numbers and Distribution in Depth.*—Of equal or greater importance than the delineation of regions of avoidance and of clustering is the conclusion, first reached by Hubble, that the extragalactic nebulae populate space with an approximately constant density as far as telescopes can reach. This result was obtained from counts of nebulae to successively fainter limiting magnitudes. For the brightest objects, it is only necessary to total to each limiting magnitude the number of nebulae whose magnitudes have been individually determined, as for example, in the extensive Harvard surveys reported by Shapley. For the faintest objects, on the other hand, it is much simpler to count nebulae to limiting magnitudes determined by exposures of different lengths, or by telescopes of different light-gathering power. This indirect procedure is expedient because the faintest nebulae are overwhelmingly too numerous to estimate their individual brightnesses. With the numbers of nebulae established to increasingly fainter magnitudes, it is relatively easy to test the hypothesis of constant space density. This is done by noting whether the numbers of nebulae counted are proportional to the volumes of space in which they are found. More precisely, a simple calculation shows that the rate of increase is by a factor of four when the limiting brightness decreases by one magnitude. On the basis of all the available material, Hubble found that this condition was satisfied when large volumes of space were involved. His numerical results may be transcribed into the following table, which shows how the nebulae increase in number with diminishing brightness, which in turn indicates increasing distance. The numbers tabulated represent average values which do not allow for the effects of galactic absorption or of red-shifts in the nebular spectra. Corrections for these disturbing influences, which reduce the number of nebulae, are important in precise, quantitative studies, but their detailed consideration is beyond the scope of this article.

Distribution of Extragalactic Nebulae in Depth
(Based on the Assumption of Constant Space Density)

| Apparent Magnitude (Photographic) | Average Distance (Light-Years) | Numbers of Nebulae | |
|---|---|---|---|
| | | Per Sq. Deg. | Whole Sky |
| 10 | 3,400,000 | 0.00081 | 34 |
| 12 | 8,600,000 | 0.013 | 540 |
| 14 | 21,500,000 | 0.20 | 8,500 |
| 16 | 54,000,000 | 3.2 | 135,000 |
| 18 | 136,000,000 | 51 | 2,100,000 |
| 20 | 342,000,000 | 810 | 34,000,000 |

*Deviations from Uniform Distribution.*—The Harvard surveys of galaxies to the 18th magnitude, which by 1942 had covered more than half the sky observable from both northern and southern latitudes, contributed significantly to more detailed investigations of the departures from the uniformity of distribution which Hubble proved to exist in a statistical sense. According to Shapley, the Harvard counts disclose the presence of 25 clusters of galaxies at least as rich as the Virgo system, of 100 groups having a dozen or so members, and of thousands of distributional irregularities that suggest physical associations. Comparison of results from the northern and southern galactic hemispheres seems to show a 40% larger average population in the north to the 18th magnitude, but the difference disappears between the 18th to 20th magnitudes. Should further observations prove the inequality to be real, there would be required some such novel explanation as "a great cloud of galaxies 100,000,000 light-years distant beyond the northern constellations, or a major continuous south-to-north density increase." Two other more localized density surpluses were found in one great belt of tens of thousands of galaxies extending from the Milky Way through Andromeda, Triangulum, Perseus and Pegasus, and in another better-defined stratum ranging through the far southern constellations of Pictor and Dorado, in which the average density appears to be 50% higher than elsewhere in the southern sky. Notwithstanding these very interesting belts and clouds of galaxies, whenever very large volumes of space are compared, the unevenness tends to disappear, and in general the Harvard counts over large areas to brighter magnitudes fully substantiate the uniform density deduced from the Mount Wilson counts in small sample areas to very faint magnitudes.

**Distance Determinations.**—Distances of extragalactic nebulae are most accurately determined from studies of their constituent stars. In principle, the procedure is to identify the character of the involved stars, and then to compare their apparent brightnesses with those of corresponding stars in the galaxy. The galactic stars with which the comparison is made have known *absolute magnitudes,* that is to say, their true brightnesses, or luminosities, have been found from trigonometric methods which are similar to those used in surveying. Since the apparent and absolute magnitudes, and the distance, are related to each other by a simple formula based on the assumption that light is weakened inversely as the square of the distance, wherever an object of known absolute magnitude, such as a star, can be identified in a nebula, the latter's distance can be obtained. In practice, however, the use of involved stars as distance indicators is difficult, because large telescopes are needed to resolve nebulae into their brightest stars; also the method is limited to a comparatively small number—several hundred—of the nearer nebulae. In order of decreasing accuracy, but of wider use because of increasing luminosity, those involved stars which are useful as distance indicators are: *Cepheid variables, Supergiant stars* and *Novae.* For the millions of nebulae so distant that none of these stars can be detected in them, distances are estimated from *total magnitudes* of the nebulae, and from *red-shifts* in the nebular spectra. On the basis of these methods, largely developed by Hubble in a series of comprehensive researches from 1924 to 1940, the scale of distances in the observable universe has been extended to 500,000,000 light-years. How this was accomplished is outlined in the following paragraphs.

*Cepheid Variables.* Shortly after the turn of the century, Henrietta S. Leavitt of the Harvard observatory found from studies of certain variable stars in the Magellanic Clouds that the periods of light variation were closely correlated with the apparent magnitudes. Since the Cloud variables were all at nearly the same distance, the relation was actually one between period and real brightness. The significance of Miss Leavitt's discovery was at once realized by Ejnar Hertzsprung and others, who pointed out that these variables are giants, or high luminosity stars, similar to the familiar galactic Cepheids, so named after the prototype $\delta$ Cephei. Since the distances of the galactic Cepheids were approximately known from investigations of their radial and transverse motions, Miss Leavitt's *period-luminosity law* could be calibrated. In other words, the relation could be used to give distances of objects containing Cepheid variables. In this way the distances of the Magellanic Clouds have been found to be about 80,000 light-years. At this distance, Cepheids are fairly easy objects to detect, even with telescopes of moderate power, for variables having a 30-day period are somewhat brighter than the 13th magnitude at maximum light. The case is altogether different, however, for the discovery of these variables in the nearest spirals, those in Andromeda and Triangulum. Cepheids in them are so faint (18th magnitude or fainter) that they were not discovered until 1923, when Hubble began to use the 100-in. telescope to investigate the nature of the extragalactic nebulae. By 1929 he had identified 75 Cepheids in these two spirals, and had established their distances as about 900,000 light-years, without correction for galactic absorption. This result settled once

and for all the long-standing controversy concerning the true nature of the spiral nebulae: they are in reality vast "island universes," or galaxies of stars, far beyond our own Milky Way system. While the Cepheids in this manner supplied the key to the proper scale of the universe, their usefulness as extragalactic distance indicators has been restricted to about a dozen known nearby stellar systems, all of which are less than 1,000,000 light-years distant, and which comprise what is called the Local Group (*see* section below, *The Local Group*).

*Supergiants.*—These are bluish-white, very hot stars which generally appear as the brightest stars in the nearer of the extragalactic nebulae. From an investigation of 150 systems published in 1935, Hubble found that the very brightest stars in "late" spirals (type *Sc*) were about of the same order of luminosity—50,000 times that of the sun. This "supergiant" distance criterion has proved to be of great value, for it provided distances for a sufficient number of nebulae to permit statistical studies of entire nebulae, rather than of their constituent stars. The way was thus opened for the use of a much brighter source as a distance indicator, namely, the light of a whole nebula, discussed in the second paragraph below.

*Novae.* Although these temporary stars first directed attention to the study of the stellar contents of nebulae as distance indicators, and their use for that purpose antedated by a few years the Cepheids, novae originally gave an ambiguous answer to the puzzling question of the distances of the spirals. The trouble arose from the fact that there are two kinds of novae: *normal* novae and *super*novae, the latter several thousand times brighter than the former. The numerous novae in the Andromeda nebula, first photographed by G. W. Ritchey, form the fainter group, while those rarely found in the other and much fainter nebulae make up the other and brighter group. To use either group for distance determinations, however, required their comparison with the galactic novae. The point at issue, therefore, was whether the galactic novae were to be regarded as normal or supernovae. It is now known that both types of novae have occurred in the Galaxy and in the nebulae, and unless the distinction can be made in the individual cases, even the order of distance, whether galactic or extragalactic, is indeterminate. K. Lundmark, of Lund, Sweden, in 1920 pointed out the probability of two separate classes of novae, and contemporaneous discussions by Curtis and Shapley clearly set forth the difficulties of establishing by means of the novae a scale of distances for spirals. It was only after 1936, when F. Zwicky and W. Baade initiated a program on Mount Palomar to discover supernovae (with an 18-in. Schmidt-type telescope), that sufficient data were obtained on these greatest of stellar outbursts to indicate how novae in general may be used to check the order of distance. Because two different luminosity groups of supernovae were identified, and because even normal novae differ considerably in real brightness, the result is that novae as distance indicators are of value mainly as corroborative evidence.

*Total Magnitudes.*—In the case of the sample group of extragalactic nebulae whose distances became known from his study of the supergiant stars within them, Hubble was able to investigate the range, or scatter, in their total *absolute* magnitudes from measures of their total *apparent* magnitudes. It was found, as for the stars, that these nebulae do not have the same luminosity, but that an *average* of a sufficient number, properly selected, provides a valuable criterion of distance. This average value, called the *mean absolute magnitude* of nebulae in general, is undoubtedly the brightest light unit yet used, for it amounts to 85,000,000 suns. With a light source of this intensity, the extragalactic distance scale can be extended to more than 200,000,000 light-years. Distances of this order have been reliably determined for a number of the large clusters of nebulae, for in them it is possible to obtain an accurate average value of the most frequent total *apparent* magnitude. Comparison of the latter with the mean *absolute* magnitude of nebulae then gives, by a simple calculation, the distance to the cluster. The very greatest distances are found when a cluster is so faint that only its brightest members can be photographed. In these cases the mean or most frequent magnitude of cluster nebulae is estimated as ten times fainter than the brightest member, or seven times fainter than the 5th brightest member, which is statistically more accurate. The most remote cluster observed with the spectrograph is estimated in this way to be distant 230,000,000 light-years. Beyond this distance it is difficult to locate true clusters of nebulae, for only the brightest members can be photographed. Nevertheless, among the very faintest nebulae which can be identified on long exposures made with the 100-in. reflector, there are some which are giants. These average more than four times brighter than the normal nebulae, and thus giants can be detected twice as far. In this manner space has been penetrated to distances of the order of 500,000,000 light-years with the largest telescope in operation.

*Red-Shifts.*—In 1912 V. M. Slipher first measured the radial velocity, or speed in the line of sight, of an extragalactic nebula—the spiral in Andromeda. Since his initial spectroscopic observations were of the nearest and brightest objects, the fact that the radial velocities in some cases indicated approach, and in others recession, did not at first excite abnormal interest. It was noted, however, that the velocities were above average, in some cases exceeding the highest known velocities for stars. As Slipher continued his spectrum observations, extending them to include fainter nebulae, he found that the radial velocities were predominantly of recession, and, most remarkably, they were unexpectedly large, up to 1,000 mi. per second. These results naturally aroused great interest, and they provided additional evidence that the extragalactic nebulae were indeed set apart from all other objects in the sky. Attempts to connect these velocities of recession, considered enormous in their time, with other characteristics of the nebulae, met with general failure until suitable distance criteria were developed.

**The Velocity-Distance Relation.**—Following his discovery of Cepheids in the Andromeda nebula in 1923, Hubble proceeded to develop the method of brightest stars as a means of estimating distances of spirals. By 1929 he had deduced distances for 18 nebulae from their supergiant stars, as well as distances for four spirals in the Virgo cluster from the mean luminosity of all nebulae in the cluster. With these 22 objects, for which both radial velocities and reliable distances were available, Hubble announced, in 1929, one of the most outstanding results of modern astronomy: a *velocity-distance relation* for extragalactic nebulae. According to this relation, the more distant a nebula, the greater is its velocity of recession (*red*ward shift of its spectrum lines). In the original formulation, a distance of 6,500,000 light-years was reached, but the range was rapidly extended by additional observations of fainter cluster nebulae, for which Hubble estimated distances from total magnitudes, and for which Humason measured radial velocities by a powerful spectroscope of radically new design. This new and much more extensive material demonstrated by 1936 that the relation between velocity and distance was valid for distances of more than 200,000,000 light-years and for velocities up to 25,000 mi. per second. Moreover, the correlation was so precise it could be used to obtain distances of individual nebulae. Since the rate of increase of recession is closely 100 mi. per second for every 1,000,000 light-years, the distance of a nebula, in millions of light-years, is simply obtained by dividing its radial velocity, in miles per second, by 100. This method of estimating distances from red-shifts is especially valuable for faint nebulae, because for them the error in determining a radial velocity is small compared with their velocities. In fact, the percentage accuracy increases with the distance, and at the point where luminosity methods become increasingly uncertain, the red-shift measures become relatively precise—a most fortunate circumstance for the investigation of the depths of the universe.

**The Local Group.**—Following the establishment by Hubble of a reliable distance scale for extragalactic objects, it soon became evident that the Galaxy is a member of a small group of relatively nearby systems which are conspicuously isolated from the next nearest galaxies. The Local Group includes 13 recognized members, with several other objects, heavily obscured by galactic dust clouds, as possible additions. The group contains the Galaxy with its attendant Magellanic Clouds, the Andromeda nebula with four satellites, the spiral in Triangulum and four dwarf systems. These objects have proved of great value for studies of the structures and stellar constitution of a representative collection of nebulae, with the results from their investigation making possible the development of criteria for further exploration. The characteristics of some individual members are discussed below.

*The Magellanic Clouds.*—Chiefly as the result of observations made at the Harvard observatory's stations in the southern hemisphere, the distances, sizes and nature of their stellar contents have become fairly well known. From the period-luminosity law for Cepheid variables (see above section, *Cepheid Variables*), the distance of the large cloud is found to be 75,000 light-years, and of the small cloud, 84,000 light-years. There remained in 1946 a little uncertainty due to the presence of absorbing matter in our own Milky Way, which, it was estimated, dims the light from the clouds by 13%. The cloud centres are separated by 21°, or by 30,000 light-years. On ordinary photographs each cloud appears to be a concentrated and irregular mass of stars, the large cloud about 10,000 light-years in diameter and the small cloud half as large. On small scale photographs of long exposure, however, the brighter parts seem to be surrounded by a faint haze of stars which nearly doubles the extent of each object; thus there is the possibility that the two clouds may even overlap in some degree. Because of the relative nearness of the clouds, such objects as open star clusters (like the Pleiades and Hyades), globular star clusters, diffuse nebulae, variable stars, several novae and ordinary stars down to a luminosity ten times that of the sun, have been identified and studied. The small cloud appears to be exceptionally rich in variable stars, with 2½% of the stars brighter than the 17th magnitude showing variability; supergiants are exceptionally frequent in the large cloud, which contains the brightest known irregular variable, *S* Doradus, nearly 500,000 times more luminous than the sun. Together with more than 100 giant and supergiant stars, it is located in an enormous mass of diffuse nebulosity, hundreds of light-years across, which dwarfs in size and brilliance the Orion nebula. The radial velocities of both clouds were determined in 1918 by R. E. Wilson at the southern station of the Lick observatory, in Santiago, Chile. The motions are apparently 100 mi. and 170 mi. per second recession, for the small and large clouds, respectively, but they are almost wholly the reflection of the sun's rotation about the galactic centre 30,000 light-years distant in Sagittarius. The Magellanic Clouds have proved to be invaluable as objects in which the giant and supergiant ranges of stellar luminosity may be studied, for in these nearby systems astronomers find the very fortunate circumstance of the same distance for all stars concerned, so that differences in apparent brightness represent differences in real brightness.

*The Andromeda Nebula.*—As the largest and nearest spiral, this has been, and probably will continue to be, one of the most intensively investigated objects in the sky. Since it is a real giant among extragalactic nebulae, comparative studies of it with the Galaxy offer some of the most fruitful means of learning more about our own Milky Way system, so much of which is hidden from view by the stratum of interstellar dust clouds. Since the spiral lies only 21° from the galactic plane, its distance is somewhat uncertain because of galactic absorption, and the best modern estimates place the system at 750,000 light-years, with an uncertainty of perhaps 10%. At this distance the main body of the spiral, as shown on most photographs, is 30,000 light-years in diameter, but photo-electric cell measures reported by Joel Stebbins and A. E. Whitford in 1934, suggested a diameter of at least 70,000 light-years. In 1941, R. C. Williams and W. A. Hiltner, by using a highly sensitive microdensitometer of their own design, traced the outlines of the spiral, on a photograph taken with an 18-in. Schmidt telescope on Mount Palomar, to a distance of 80,000 light-years. This figure is closely comparable with the size of the Galaxy when allowance is made for the effects of galactic obscuration. Despite the large distance to the spiral, Cepheid variables, supergiant stars, normal novae and globular clusters have been detected in considerable numbers with the 100-in. telescope. There are a few gaseous nebulae known, and probably many more remain to be discovered, but because of their faintness, their identification with a spectrograph will require time.

In the most recent photographic work on the Andromeda nebula, W. Baade in 1944 reported the resolution of the amorphous nuclear region into myriads of faint stars. This remarkable achievement was accomplished by using the 100-in. telescope in the most skillful manner under critically good conditions, and by using photographic plates highly sensitive to red light. In addition, and by the same method, he resolved into stars the two close companion nebulae of the spiral. The brightest of these satellites is a typical elliptical nebula, and Baade's demonstration that it is composed of stars settled the question of the constitution of the innumerable similar nebulae. At the same time he showed that two more nearby objects, hitherto unresolved, also are companions of the Andromeda nebula, which is now revealed as a giant accompanied by four dwarfs of decreasing size and luminosity. Baade's unsurpassed photographs not only resolved all five objects, but showed that, in certain systems, especially in the elliptical nebulae, supergiant stars are absent. From a more detailed analysis, Baade was led to conclude that there are two fundamentally different types of stellar populations, which are present in different proportions in spiral, elliptical and dwarf irregular nebulae, with the different frequencies accounting for the character of the observed structures and stellar contents. The discovery was in 1946 as yet too new to be fully appraised, but it seemed likely to serve as a fruitful point of departure for many future investigations of stars in the extragalactic nebulae and in the Galaxy.

*Nearby Dwarf Systems.*—Besides those associated with the Andromeda Nebula, there are known four other relatively close dwarf systems, N.G.C. 6822 and I.C. 1613, which are irregular nebulae having supergiant stars, and two objects in the southern constellations of Fornax and Sculptor reported by Shapley in 1938, which are elliptical nebulae of very low central concentration lacking supergiants. Their distances, which range from 220,000 to 730,000 light-years, and their distribution in the sky, indicate that these dwarfs are essentially isolated from the other members of the Local Group. In the two irregular systems having supergiants, such familiar objects as Cepheids, globular clusters and several gaseous nebulae have been found, those in N.G.C. 6822 by Hubble, and those in I.C. 1613 by Baade. Because of the similarity in stellar contents, these dwarfs may be regarded as replicas in miniature of the Magellanic Clouds. The Sculptor and Fornax dwarfs, on the other hand, are considered to be low luminosity elliptical nebulae because their brightest stars have the same absolute magnitudes as those in the elliptical companions to the Andromeda nebula. By using the 100-in. reflector, Hubble and Baade in 1939 identified two globular clusters in the Fornax system, and found variables which probably are similar to those found in the galactic globular clusters. While the stellar contents of these dwarfs thus are similar to those of globular clusters, there is still a big gap, as yet unbridged, between elliptical nebulae and globular clusters, for the latter are from 40 to 100 times more dense than, and only 1/10 as large as, the Fornax and Sculptor systems. The importance of discovering and investigating these dwarf systems can hardly be overestimated, for such nearby pygmies offer the possibility of learning much about the stellar constitution of extragalactic nebulae in general, which are much too distant for resolution into their full stellar populations. It is interesting to note in this connection, therefore, that a significant beginning has already been made in the discovery of dwarfs among the nearest galaxies beyond the Local Group. In 1940, F. Zwicky, by means of an 18-in. Schmidt telescope on Mount Palomar, found three very faint dwarfs, apparently of the Magellanic Cloud type, in the constellations of Ursa Major, Leo and Sextans. Preliminary observations of the brightest stars (supergiants) in the latter two systems, reported in 1940 by Baade, indicate distances of about 1,200,000 light-years for these two dwarfs. Since they may also be companions to apparently closeby galaxies not yet resolved into stars, these dwarfs may prove useful as distance indicators. In any case, it is evident that far more of these small, low luminosity objects exist in extragalactic space than was hitherto believed to be the case, and the probable discovery of more such objects by means of the large 48-in. Schmidt telescope under construction on Mount Palomar will be awaited with much interest.

**Rotation of Nebulae.**—The most casual glance at a spiral nebula suggests rotation, and for nebulae seen nearly edge-on, the spectrograph readily discloses the component of their rotation in the line of sight. The pioneer observations of V. M. Slipher and of Max Wolf in 1914, together with those of F. G. Pease in 1916, showed that the central parts of several of the brighter nebulae, and the nuclear region of the Andromeda nebula, rotate in the fundamental planes of the systems. Because of the inherent observational difficulties, principally the extreme faintness of the nebular light (Pease's exposures extended more than 80 hours), progress in this field has been slow, and even by 1946 only the two largest and nearest spirals, those in Andromeda and Triangulum, had been studied with any approach to completeness. From observations made at the Lick observatory in 1939 by H. W. Babcock, the general nature of the rotation of the Andromeda nebula became known out to its faintest extensions shown on ordinary photographs. Except for an irregularity of motion near the nuclear region, which appears to spin somewhat faster, the spiral rotates almost as a solid body, with a period of 92,000,000 years. Now this type of rotation—as a solid body—was quite unexpected, because in the solar neighborhood of the Galaxy the stars show a "planetary" type of motion, that is to say, they move more slowly around the galactic centre the farther away from it they happen to be. Similar observations of the spiral in Triangulum, reported in 1942 by N. U. Mayall and L. H. Aller of the Lick observatory, show that this smaller galaxy rotates in both ways, the central part as a solid body, the outer parts like objects in the solar system. In a theoretical treatment of the results for both spirals, A. B. Wyse and Mayall in 1942 considered a hypothetical model having a distribution of matter capable of accounting for the observed motions. Comparison of the mass distributions deduced for the spirals, with that for the sun's region in the Galaxy, gave additional support to the current idea that the sun probably is far out from the main body of the Milky Way system of stars.

In addition to providing material for comparative studies of the dynamics and structure of the nebulae and Galaxy, spectroscopic measures of rotation in spirals offer a direct means for estimating their total masses. Such estimates involve the assumption of circular motion in the fundamental place, but, fortunately, spirals contain diffuse gaseous nebulae whose motions in the Galaxy are believed to meet this condition. On this basis, the rotation measures for the Andromeda nebula suggest a total mass of 95,000,000,000 suns for this giant, while for the Triangulum spiral, which is much more of an average system, the observations indicate matter to the amount of 2,000,000,000 suns. By way of comparison, the Galaxy is estimated to have a combined mass of 200,000,000,000 suns, but because of the many uncertainties involved, the difference by a factor of two from the figure for the Andromeda nebula cannot be considered a serious discrepancy. On the broad scale, both systems probably are comparable giants.

*Direction of Rotation in Spirals.*—Closely allied with the character of the rotational motion of spirals is the question of how the movement takes place with respect to the curvature of the spiral arms; in other words, do the arms appear to be winding or unwinding? Slipher likewise pioneered in this field, and on the basis of his rotation measures and his inferences of the true spatial orientation of the nebulae from their apparent or projected forms, he concluded that all spirals probably rotate in the same manner, namely, that the central part turns into the spiral arms like a coil spring being wound up. The interpretation of photographs of spirals to determine how the systems are located in space is not easy, however, and the criteria used by Slipher—asymmetries in the pattern of dark matter—were later (1934–40) construed in the opposite sense by Bertil Lindblad, whose theory of spiral stellar systems suggested a rotation with the arms leading instead of trailing. The question was completely re-examined in 1942 by Hubble, whose study of the file of hundreds of large-reflector photographs disclosed four spirals suitable as test cases. In these the spiral pattern was plain, and the sense of tilt was unambiguously determined by primary and secondary dark lanes silhouetted against the bright nuclear region. From spectrographic observations of these four crucial-test spirals, made at the Mount Wilson and Lick observatories, it was found that, in each case, the arms trailed. With supporting, but not decisive, evidence provided by similar modern observations of 11 other spirals, Slipher's earlier conclusion now may be accepted as fairly well established, namely, that all spirals rotate in the same way: as the central part turns, the arms lag behind.

**Interpretation of the Red-Shift.**—Although red-shifts in the spectra of extragalactic nebulae are commonly expressed as velocities of recession, the practice is more traditional than scientific, for it is by no means certain that actual motions of such a large order of magnitude—one-seventh the velocity of light—are involved. What the spectrograph records is wave length ($\lambda$), and when the observed wave lengths differ from those of normal value, the difference ($d\lambda$) is, mainly for convenience, expressed as a velocity ($v$) by means of Doppler's principle, which states that $d\lambda/\lambda = v/V$, where V is the velocity of light (186,000 mi. per second). Except for two facts—(1) that the ratio $d\lambda/\lambda$ is found to be constant in a given nebular spec-

trum, which is a necessary condition for a velocity shift, and (2) that the ordinarily small differences of wave length in stellar sources, such as double stars revolving around their common centre of gravity, are due to motion—there is little direct observational evidence that the very large differences from normal wave lengths of the lines in the nebular spectra represent motion in the line of sight. If the measured red-shifts actually do represent velocity, then they should produce certain small effects on the apparent brightnesses of the faintest nebulae counted. Merely the red-shift alone, apart from any motion, tends to make the nebulae too faint; however, if motion also is involved, the nebulae should appear even fainter, but by such a small amount, only a few per cent for the faintest nebulae counted, that the resources of the greatest of telescopes are strained for its detection. Hubble has examined the matter in detail by making special counts of nebulae to the faintest magnitude attainable with the 100-in. reflector, and he concluded in 1936 that either there is a probable uniform distribution of the nebulae with the red-shift *not* representing motion, or if motion is involved, some "vital factors have been neglected in the investigation." Consideration of what some of the factors are likely to be, such as the different times required for light to come from nebulae at different distances, indicated that their evaluation was more properly in the province of relativistic cosmology. In this highly theoretical field attempts have been made to settle the question, but the crucial test of whether the large nebular red-shifts are velocities probably will consist of further observations, possibly those to be made upon completion of the great 200-in. telescope on Mount Palomar.

BIBLIOGRAPHY.—A fairly complete compilation (to 1932) of articles on nebulae, mainly technical but some nontechnical, may be found in a monograph by Heber D. Curtis, "The Nebulae" published in *Der Handbuch der Astrophysik,* vol. v, part 2, pp. 774–936 (1933). For the extragalactic nebulae, a book by Edwin Hubble, *The Realm of the Nebulae* (1936), is the most scholarly, authoritative and semitechnical work available. A more recent, popularly-written book covering the same field, but dealing mainly with the work of the Harvard observatory, is one by Harlow Shapley, *Galaxies* (1943). The diffuse and planetary nebulae are described in detail by L. Goldberg and L. H. Aller in *Atoms, Stars, and Nebulae* (1943); while our own galactic star system is fully treated by B. and P. Bok in *The Milky Way* (1941). (N. U. M.)

**NEBULAR THEORY:** *see* COSMOGONY.

**NECESSITY:** *see* FREE-WILL.

**NECK,** that part of the body which connects the head with the trunk (*see* ANATOMY: *Superficial* and *Artistic*). The word is transferred to many objects resembling this part of the body in shape or function; it is thus applied to an isthmus, or to the narrowest portion of a promontory, to the narrow part of a musical stringed instrument connecting the head and body, as in the violin, or to a narrow pass between mountains, which in the Dutch form *nek,* appears in place-names in South Africa. In architecture, the "neck" is that part of the capital just above the "astragal," and the term "necking" is applied to the annulet or round, or series of horizontal mouldings, which separates the capital of a column from the plain part or shaft. In Romanesque work this is sometimes corded.

In Geology, the term "neck" is given to the denuded stump of an extinct volcano. Beneath every volcano there are passages or conduits up which the volcanic materials were forced, and after the mass has been levelled by denudation there is always a more or less circular pipe which marks the site of the crater. This pipe, filled with ashes or lava, is the characteristic of a volcanic neck. Many instances are furnished by the geological history of the British Isles. In Derbyshire, Fife, the Lothians and the Glasgow district the remains of Carboniferous volcanoes occur in every state of preservation. Some have the conical hills of lavas and ashes well preserved (*e.g.,* Largo Law in Fifeshire); others retain only a small part of the original volcanic pile (*e.g.,* Arthur's Seat, Edinburgh; the Binn of Burntisland) and of the larger number nothing remains but the "neck" which shows where once the crater was situated.

In regions of former volcanic activity necks are the most persistent of all volcanic structures, because the active volcanic magma is located deep within the earth's crust, and the pipe by which it rises to the surface is of great length and traverses a great thickness of strata. This extensive pipe was usually vertical, and nearly uniform in diameter for great depths; when exposed by denudation, it has a circular ground plan, or if shown in vertical section (or elevation) in a cliff is a pillar-shaped mass crossing the bedding planes of the strata nearly at right angles. It terminates upwards in the remains of the volcanic cone and communicates below with the reservoir from which the lavas were emitted, represented in most cases, where it has been exposed, by a large irregular mass (a batholith or boss) of coarsely crystalline igneous rock. The site of such a neck is generally indicated by a low conical hill consisting of volcanic rock, surrounded by sedimentary or igneous strata of a different kind. The low cone is due to the greater hardness and strength of the volcanic materials and is not connected with the original shape of the volcano. Two splendid sugar-loaf cones known as the Pitons of St. Lucia in the West Indies, rising from the sea with almost vertical sides to a height of nearly 3,000ft., are old volcanic necks. In Texas, New Mexico, Arizona, California and many of the western states of North America, geologists have observed conical volcanic hills having all the features which belong to necks.

Where the volcanic rocks are soft and easily disintegrated the position of a neck may be indicated by a cup-shaped hollow; this is the case with some of the diamond-bearing basic pipes of South Africa. Examples are the Kimberley diamond mines. The blue-ground (or serpentine breccia) occupies great pipes or funnels, circular in outline with nearly vertical sides, extending downwards to unknown depths; these are the necks of the old volcanoes.

The size of necks varies considerably; the smallest may be only 20 or 30yd. in diameter, the largest are several miles. In this respect they resemble active craters, but no necks have been met with on the earth's surface with dimensions approaching those of the so-called "craters" of the moon.

Occasionally a whole neck is composed of solid crystalline rock representing the last part of the magma which ascended from the underground focus and congealed within the crater. In Mont Pelée, for instance, the last stage of the eruptions of 1902 to 1905 was the protrusion of a great column of solidified lava which rose at one time to a height of 900ft. above the lip of the crater, but has since crumbled down. The Castle Rock of Edinburgh is a neck occupied by a plug of crystalline basalt. Necks of this kind weather down very slowly and tend to form prominent hills.

After the eruptions terminate gases or hot solutions given out by deep-lying masses of molten rock may find a passage upward through the materials occupying the crater, greatly modifying their mineral nature and laying down fresh deposits. A good example of secondary deposits within a volcanic neck is provided by the Cripple Creek mining district of Colorado. The ore-bearing veins are connected with volcanic rocks and part of these occupy a vertical circular pipe which is a typical volcanic neck. A phonolitic breccia, greatly altered, is the principal rock, and is cut by dikes of phonolite, dolerite, etc. The country rock is mostly granite and gneiss, and blocks of these are common in the breccia. A large volcano was built up in Tertiary times on the granite plateau, and has since been almost entirely removed by denudation. The gold ores were carried upwards by currents of hot water derived from the volcanic magma and were deposited along cracks and fissures in the materials which occupied the crater, and also in the surrounding rocks (*see* VOLCANO). (J. S. F.)

**NECKAM, ALEXANDER** (1157–1217), English schoolman and man of science, was born at St. Albans in September 1157, on the same night as King Richard I. Neckam's mother nursed the prince with her own son, who thus became Richard's foster-brother. He was educated at St. Albans Abbey school, and became schoolmaster of Dunstable, dependent on St. Albans Abbey. Later he went to Paris, where by 1180 he had become a distinguished lecturer of the university. By 1186 he was back in England, where he again held the place of schoolmaster at Dunstable. The assertion that he was ever prior of St. Nicolas, Exeter, seems a mistake, but he was certainly much at court during some part of his life. Having become an Augustinian canon, he was appointed abbot of Cirencester in 1213. He died at Kempsey in Worcestershire in 1217, and was buried at Worcester. Besides theology he studied grammar and natural history, but his name is chiefly associated with nautical science. For in his *De naturis rerum* and *De utensilibus* (the former of which, at any rate, had become well known at the end of the 12th century, and was probably written about 1180) Neckam has preserved to us the earliest European notices of the magnet as a guide to seamen—outside China, indeed,

these seem to be the earliest notices that have survived in any country or civilization. It was probably in Paris that Neckam heard how a ship, among its other stores, must have a needle placed above a magnet (the *De utensilibus* assumes a needle mounted on a pivot), which needle would revolve until its point looked north, and thus guide sailors in murky weather or on starless nights. Neckam has no air of imparting a startling novelty: he merely records what had apparently become the regular practice of many seamen of the Catholic world.

*See* Thomas Wright's edition of Neckam's *De naturis rerum* and *De laudibus divinae sapientiae* in the Rolls Series (1863), and of the *De utensilibus* in his *Volume of Vocabularies*. Neckam also wrote *Corrogationes Promethei*, a scriptural commentary prefaced by a treatise on grammatical criticism; a translation of Aesop into Latin elegiacs (six fables from this version, as given in a Paris ms., are printed in Robert's *Fables inédites*); commentaries, still unprinted, on portions of Aristotle, Martianus Capella and Ovid's *Metamorphoses*, and other works. Of all these the *De nat. rer.*, a sort of manual of the scientific knowledge of the 12th century, is much the most important: the magnet passage herein is in book ii. chap. xcviii. (*De vi attractiva*), p. 183 of Wright's edition. The corresponding section in the *De utensil.*, is on p. 114 of the *Vol. of Vocabs.* Roger Bacon's reference to Neckam as a grammatical writer (*in multis vera et utilia scripsit: sed . . . inter auctores non potest . . . numerari*) may be found in Brewer's (Rolls Series) edition of Bacon's *Opera inedita*, p. 457. *See* also Thomas Wright, *Biographia Britannica literaria, Anglo-Norman Period*, pp. 449–459 (1846: some points in this are modified in the 1863 edition of *De nat. rer.*); C. Raymond Beazley, *Dawn of Modern Geography*, iii. 508–509. (C. R. B.; X.)

**NECKAR,** a river of Germany, 247 m. long, and a right-bank tributary of the Rhine, rises in the Hercynian gneisses of the Black forest, near Schwenningen and close to the headwaters of the Danube. It flows north and then north-east along the foot of the Jurassic scarp of the Swabian Jura, passing Rottweil, Rottenburg, and Tübingen. At Plochingen it changes its course flowing away from the scarp edge to Cannstatt near Stuttgart. The valley is very picturesque, becomes broader and deeper, is now navigable and lies between vine-clad hills being cut into the middle Trias sandstones. Continuing north past hills crowned by feudal castles, it runs by Heilbronn and Wimpfen to Eberbach. It now takes a tortuous westerly course, and the scenery on its bank becomes more romantic. Winding by Neckarsteinach and Neckargemünd between wooded heights, it sweeps beneath the Königsstuhl (1,900 ft.) washes the walls of Heidelberg, and quitting the valley enters the Rhine-trough from the right at Mannheim. (*See* RHINE.)

**NECKER, JACQUES** (1732–1804), French statesman, finance minister of Louis XVI., was born at Geneva in Switzerland. His father was a native of Cüstrin in Brandenburg, and became a citizen of Geneva. Jacques Necker had been sent to Paris in 1747 to become a clerk in the bank of M. Vernet. He soon afterwards established the famous bank of Thellusson and Necker. Thellusson superintended the bank in London, and Necker the Paris branch. Both became extremely rich by loans to the treasury and speculations in grain. In 1763 Necker fell in love with Madame de Verménou, the widow of a French officer. But while on a visit to Geneva, Madame de Verménou met Suzanne Curchod, the daughter of a pastor near Lausanne, to whom Gibbon had been engaged, and brought her to Paris in 1764. Necker married Suzanne before the end of the year. She encouraged her husband to make himself a public position. He accordingly became an able director of the French East India Company, and defended it against the attacks of A. Morellet in 1769. Meanwhile he had made interest with the French government by lending it money, and was appointed resident at Paris by the republic of Geneva. Madame Necker entertained the chief leaders of the political, financial and literary worlds of Paris. In 1773 Necker won the prize of the Académie Française for an *éloge* on Colbert, and in 1775 published his *Essai sur la législation et le commerce des grains*, in which he attacked the free-trade policy of Turgot. His wife believed he could get into office as a great financier, and made him transfer his share in the bank to his brother Louis.

In October 1776 Necker was made finance minister of France, with the title of director of the treasury, which he changed in 1777 to director-general of the finances. He regulated the finances by attempting to divide the taille or poll tax more equally, by abolishing the "vingtième d'industrie," and establishing *monts de piété* (establishments for loaning money on security). But his greatest financial measures were his attempt to fund the French debt and his establishment of annuities under the guarantee of the state. In the operation of funding Necker rather pointed out the line to be followed than completed the operation. He treated French finance rather as a banker than as a political economist, and thus fell far short of Turgot, the greatest economist of his day. His establishment of provincial assemblies was only a timid application of Turgot's great scheme for the administrative reorganization of France. In 1781 he published his famous *Compte rendu*, in which he drew up the balance sheet of France. His dismissal in the same year was not really due to his book, but to the influence of Marie Antoinette, whose schemes for benefiting the duc de Guines he had thwarted.

In 1787 Necker was banished by "lettre de cachet" 40 leagues from Paris for attacking Calonne. In 1788 the country, which had at the bidding of the literary guests of Madame Necker come to believe that Necker was the only minister who could "stop the deficit," as they said, demanded Necker's recall, and in September 1788 he became once more director-general of the finances. Throughout the momentous months which followed the biography of Necker is part of the history of the French Revolution (*q.v.*). Necker put a stop to the rebellion in Dauphiné by legalizing its assembly, and then arranged for the summons of the states general. Throughout the early months of 1789 he was regarded as the saviour of France, but he regarded the states general as an assembly which should grant money, not organize reforms. But as he had advised the calling of the states general, and the double representation of the third estate, and then permitted the orders to deliberate and vote in common, he was regarded as the cause of the Revolution by the court, and on July 11 was ordered to leave France at once.

Necker's dismissal brought about the taking of the Bastille, which induced the king to recall him. He was received with joy in every city he traversed, but in Paris he proved himself unequal to the crisis. After his resignation (Sept. 1790) he lived at Coppet, near Geneva. Madame Necker died in 1794, and he lived with his daughter Madame de Staël (*q.v.*), and his niece, Madame Necker de Saussure. He died in 1804.

AUTHORITIES.—*Mémoires sur la vie privée de M. Necker* (Paris and London, 1818), by his daughter, Madame de Staël-Holstein, and the *Notice sur la vie de M. Necker* (Paris, 1820), by Auguste de Staël-Holstein, his grandson, published in the collection of his works edited by the latter in 1820–1821 (Paris, 15 vols.). The bibliography of his works is as follows:—*Réponse au mémoire de M. l'Abbé Morellet* (1769); *Éloge de J. B. Colbert* (1773); *Essai sur la législation et le commerce des grains* (1775); *Compte rendu au roi* (1781); *De l'administration des finances de la France* (3 vols., 1784); *Mémoire en réponse au discours prononcé par M. de Calonne* (1787); *De l'importance des opinions religieuses* (1788); *Sur l'administration de M. Necker, par lui-même* (1791); *Du pouvoir exécutif dans les grands états* (2 vols., 1792); *Réflexions sur le procès de Louis XVI.* (1792); *De la révolution française*, several editions, the last in 4 vols. (1797), *Cours de la morale religieuse* (1800); *Dernières vues de politique et de finance* (1802); *Manuscrits de M. Necker*, published by his daughter (1804); *Suites funestes d'une seule faute*, published after his death. *See* also *Le Salon de Madame Necker*, by the Vicomte d'Haussonville (2 vols., 1882), compiled from the papers at Coppet; Ch. Gomel, *Les Causes financières de la révolution française* (1892); and for contemporary tracts and pamphlets M. Tourneux, *Bibl. de l'histoire de Paris pendant la révolution* (vol. iv., 1906), also (for the earlier ones) *Collection complète de tous les ouvrages pour et contre M. Necker, avec des notes critiques . . .* (3 vols., Utrecht, 1781); Gambier Parry, *Mme. Necker, her Family and her Friends* (1913).

**NECKING,** in architecture, a narrow, horizontal band around a pier, pilaster, column or similar vertical form; especially the band which circles a Doric capital below the echinus or projecting portion, and above the astragal, or projecting moulding, which marks the junction of shaft and capital.

**NECROPOLIS,** a cemetery (*q.v.*) or burying-place (Gr. *νεκρός*, corpse, and *πόλις*, city).

**NECROSIS,** a term restricted in surgery to death of the whole or a portion of a bone. A severe inflammation, caused by

a violent blow, by the action of pyogenic microbes as in osteomyelitis or by the absorption of various poisons, as mercury and phosphorus, is the general precursor of necrosis. The dead part analogous to the slough in the soft tissues, is called a sequestrum or exfoliation. At first it is firmly attached to the living bone around; gradually, however, the dead portion is separated from the living tissue. The process of separation is a slow one. New bone is formed around the sequestrum, which often renders its removal difficult. As a rule the surgeon waits until the dead part is loose, and then cuts down through the new case and removes the sequestrum. The cavity in which it lay gradually closes, and a useful limb is the result. In pathology the term is given a wider meaning and is used for local death of a portion of any tissue; when the death is of individual cells, and therefore is microscopic, it is often termed molecular necrosis or necrobiosis.

**NECTAR** and **AMBROSIA** (*q.v.*), the nourishment of the gods in Homer and in Greek literature generally. Probably the two terms were not originally distinguished; but usually, both in Homer and in later writers, nectar is the drink and ambrosia the food. On the other hand, in Alcman nectar is the food, and in Sappho and Anaxandrides ambrosia the drink. Each is used in Homer as a fragrant unguent (as *Iliad,* xiv. 170; xix. 38).

**NECTARINE,** a smooth-skinned peach (*Prunus persica,* var. *nectarina*). In tree shape and leaf characters the peach and nectarine are indistinguishable, but the nectarine fruits look more like plums than peaches. There is an outgrowth of fuzz from the skin of peach varieties, while on the skin of nectarine varieties these epidermal hairs are absent. The stones and kernels of the two fruits are alike in appearance. Like peaches, nectarines have red, yellow or white flesh and have a characteristic aroma and flavour. They are adapted to the same soil and climatic conditions suitable for peaches and require the same cultural treatments for successful production. There are clingstone and freestone nectarines. Seeds of peach varieties that carry the factor for smooth skin may give rise to nectarines, while those that do not carry this factor will breed true. This fruit, which has been known for 2,000 years, is often referred to as the classical example of bud and seed variation. (F. P. C.)

**NEED-FIRE** or **WILD-FIRE,** a term of folk-lore to denote a superstition which survived in the Highlands of Scotland until a recent date and had its origin in the early ideas of the purifying nature of flame. The need- or wild-fire is made by the friction of one piece of wood on another, or of a rope upon a stake. It is a practice of shepherd peoples to ward off disease from their herds and flocks; it is kindled on occasions of special distress, and the cattle are driven through it. Its efficacy is believed to depend on all other fires being extinguished.

**NEEDHAM,** town of Norfolk county, Massachusetts, U.S.A., 12 mi. S.W. of Boston, on the Charles river, and served by the New York, New Haven and Hartford railroad. Pop., 1930, 10,845; in 1940, 12,445. It is a residential suburb and has large factories making knit goods and surgical instruments. The town was set off from Dedham and incorporated in 1711.

**NEEDLE.** An instrument adapted for passing a thread through fabrics in sewing, consisting of a thin rod of steel, having a pointed end and pierced with a hole or "eye" to carry the thread.

The modern high quality needle is made from Sheffield crucible cast steel. The type of steel varies according to the purpose of the needle, thus hosiery needles are milder, *i.e.,* softer than sewing needles. In addition to grading the initial hardness of the steel to the particular type of needle there has also been a forward movement in the use of alloy steels for specific purposes. Thus with gramophone needles tungsten alloy steels have proved successful, and the high chromium or rustless steels have a very evident value in the case of surgical and hypodermic needles. The steel is hot rolled down into rod and the rod subsequently cold drawn into wire of the required diameter. The finished drawn wire is fed through straightening machines which also automatically cut the wire into pre-determined lengths. In hand sewing needles the length cut is always that required to form two needles. The cut lengths are packed in packets of a standard weight, according to diameter of wire, for delivery to the needle maker.

The first stage in the making of the needle is to secure absolute straightness and uniformity of physical condition. This is achieved by a method technically termed "rubbing." A number of blanks are heated to a uniform dull red heat, placed within two steel rings, and rubbed to and fro over a flat steel plate. The rotation of the wires within the containing rings results in perfect straightness and the gradual cooling from a dull red heat gives uniformity of physical condition.

The lengths are then automatically pointed by feeding from a container and being rotated over a revolving grindstone by a wheel running at right angles to the stone. The curvature of the face of the grindstone and the inclination of the traversing wheel are adjusted to the requisite contour of point. The lengths are reversed and the process repeated—thus giving a blank with two pointed ends. This automatic grinding applies to all hand sewing needles; it should be noted that machine needle points are swaged, *i.e.,* the points are formed by cold hammering between dies. The double length hand needle is fed into an automatic press which stamps the grooves at the head of each needle and in a second operation pierces the eyes of each needle and nearly separates the two. Complete separation and dressing of the head and eye are now effected mechanically.

The needle thus formed is in its soft state and as with steel cutting tools it requires hardening to bring it into service condition. Hardening is effected by quenching in oil from a red heat and in practice the operation has become nearly automatic. The hardened needles are then tempered by heating to a blue heat in order to give resilience or springiness. As with hardening, tempering in bulk is now an automatic process. The tempered needles are to some extent discoloured by the heating and the final stages are found in scouring to remove this discolouration, and polishing to obtain the silver bright finish. Scouring is effected by packing the needles in flexible containers with various mixtures all having a fine emery base and mechanically rolling the container up and down an iron roller path. Polishing is done in a similar manner with polishing reagents replacing the scouring mixtures. The polished needles are rolled down an inclined plane to bring the heads all in one direction; examined; graded, and made up into packets for sale. (P. Lo.)

**NEEDLE-GUN,** a military breech-loading rifle (Zündnadelgewehr), famous as the arm of the Prussians in 1866 and of the Germans in 1870–71. It was the invention of the gunsmith Johann Nicholas von Dreyse (1787–1867), who, beginning in 1824, had made many experiments, and in 1836 produced the complete needle-gun. From 1841 onwards the new arm was gradually introduced into the Prussian service, and later into the military forces of many other German states. Dreyse was ennobled in 1864. In practice the needle-gun proved to have numerous defects; its effective range was very short compared to that of the muzzle-loading rifles of the day, and conspicuously so as against the chassepot; the escape of gas at the breech was, moreover, very great. A paper cartridge was used. An improved model, giving greater muzzle velocity and increased speed in loading, was introduced later, but this was soon replaced by the Mauser rifle.

**NEEDLEWORK.** This subject may be considered under the two headings: (1) plain needlework, for purely utilitarian purposes; (2) art needlework, for decorative purposes. Plain needlework requires no such further explanation as may be given in the case of art needlework, under which title are included embroidery and other methods of decorative needlework, such as applied or appliqué work, ornamental quilting, patchwork and couching. In these last-mentioned methods the needlework is subservient to the decorative effect, which depends almost wholly upon the materials selected for the purpose; whereas in embroidery the needlework itself constitutes and is the visible decoration. The aim of this article is to indicate briefly different stitches of plain needlework and to show that these stitches are also used in art needlework.

The more necessary stitches in plain needlework for making clothes are tacking, running, hemming, feather-stitching or herringboning (all of which are practically of the same type), and button-holing in which the thread is looped as each stitch is

made. Button-holing is allied to another looped stitch, namely chain-stitching, which though frequently used in embroidery is rarely if ever used in plain needlework. For repairs of clothes and household linen, etc., the principal stitch is darning; grafting, however, is a substitute for it, and varies with the character of the stuff to be repaired, *e.g.*, knitted stockings, damask linen, cloth, etc. Darning is allied to running, and grafting to patchwork. Patchwork as a form of decorative needlework is exemplified in sumptuous canopies and seat covers made several centuries B.C. by Egyptians, and rich hangings made by Italian and French workers in the 16th century.

Long and short stitches, kindred in principle to the running stitch in plain needlework, are perhaps the more frequent of any stitches used in embroidery, and are especially appropriate when the blending of tints with a flat even surface is the effect to be aimed at. Much mediaeval work of this character, as well as that done with chain stitch and its allied split stitch, is regarded as typical of *opus anglicanum*. Chain stitch produces a comparatively broken surface in decided contrast with the smooth one of long and short stitch, split stitch and satin stitch embroidery. Satin stitch is well adapted to express, with even flat surface in designs for colour effects, each mass which is to be of one tint. In this respect, therefore, satin stitch serves a purpose in contrast to that of long and short stitch. A characteristic of satin-stitching is the sheeny effect produced, on both sides of the material embroidered, by parallel stitches taken closely together. Buttonhole stitch in relation to art needlework prevails to a great extent in cut linen and drawn-thread work (often called Greek lace), and predominates in the making of needlepoint lace. In much of the Persian drawn-thread work, however, it is superseded by whipping or tightly and closely twisting a thread round the undrawn threads of the linen. Whipping has been put to another use in certain 16th century art needlework for ecclesiastical purposes, where round the gold threads employed as the ground of a design coloured silks are dexterously whipped, closely and openly, producing gradations of tint suffused with a corresponding variation of golden shimmer.

Another important branch of art needlework with gold and silver threads is couching. When the metallic threads, arranged so as to lie closely together, are simply stitched flatly to the foundation material, the work is called flat couching or laying, a kind of treatment more frequent in Chinese and Japanese than in European art needlework. Flat couching is also carried out with floss silks. When a design for couching includes effects in relief, stout strings or cords as required by the design are first fastened to the foundation materials, and over them the metallic threads or in some cases coloured gimps are laid, and so stitched as to appear in miniature like varieties of willow-twisting or basket work.

Appliqué or applied work belongs as much as patchwork to the mediaeval category of *opus consutum*, or stitching stuffs together according to a decorative design, the greater part of which was cut out of material different in colour, and generally in texture, from that of the ground to which it was applied and stitched. Irish art needlework, called Carrickmacross lace, is for the most part of cambric applied or appliqué to net.

Quilting is also a branch of art needlework rather than embroidery. Indians and Persians using a short running stitch have excelled in it in past times. Some good quilting was done in England in the 18th century with chain-stitching which lay on the inner side of the stuff, the outer displaying the design in short stitches. In the account of his voyage to the East Indies, published in 1655, Edward Terry (1590–1665) writes of the Indians "making excellent quilts of satin lined with taffeta betwixt which they put cotton wool and worked them together with silk." In many of the rural sections of the United States, especially those of the South, great interest has been maintained in making patch quilts for bed covering. Quilting parties are still extant, and the different designs accumulated by the family are the source of much pride. (*See* also LACE; HOME SEWING; TEXTILES AND EMBROIDERIES.)

BIBLIOGRAPHY.—Antrobus and Preece, *Needlework in Religion* (1924); Wheeler, Candace, *Development of Embroidery in America* (1921); E. L. Lowes, *Chats on Old Lace and Needlework*.

**NEEMUCH** or NIMACH, a town of Central India, with a British military cantonment, within the state of Gwalior, on the border of Rajputana. The pop. of the cantonment in 1931 was 4,304. In 1857 it was the most southerly place to which the Mutiny extended.

The brigade of Indian troops of the Bengal army, which was stationed there, mutinied and marched to Delhi, the European officers taking refuge in the fort until relieved by the Malwa field force.

**NEENAH,** a city of Winnebago county, Wisconsin, U.S.A., 100 mi. N. by W. of Milwaukee, on Lake Winnebago at its outlet into the (canalized) Fox river. It is on state highways 114 and 150, and is served by the Chicago and North Western, the Chicago, Milwaukee, St. Paul and Pacific, and the Soo Line railways, and by bus lines. Pop. (1940) 10,645; in 1930 it was 9,151. Neenah and Menasha, across the river, are practically one community. It is the centre of a large paper industry. The city was chartered in 1873. Its name means "running water" or "rapids."

**NEER, VAN DER,** the name of two Dutch painters.

1. AERNOUT VAN DER NEER (1603–1677), commonly called Aert or Artus, was born at Gorkum in 1603. Houbraken states that he had been steward to a Dutch nobleman, and only took up painting seriously when he settled in Amsterdam. From 1658 to 1662 he kept a wine shop, but this venture ended in bankruptcy. Though Van der Neer seems to have made Amsterdam his home, he was evidently familiar with the canals and woods about Haarlem and Leyden and the reaches of the Maes and the Rhine. Occasionally, too, he painted in the neighbourhood of Dort, the home of Albert Cuyp, with whom he drifted into a curious partnership. Cuyp is said to have painted the foreground and cows of Van der Neer's sunset landscape in the Louvre and his signature is seen on the milkmaid's pail near the edge of the Van der Neer in the National Gallery, London. At the Staedel Institute in Frankfurt there is also a landscape in which the figures, a fisherman with a dog and a sportsman, are probably by Cuyp. Van der Neer may be said to have reached maturity with his "Moonlit landscape with a ruined castle" (1646), now in the Max Flersheim collection in Paris. His favourite subjects were the Dutch waterways at sunset; moonlight scenes; daylight icescapes with frozen water, sleighers and fishermen; and paintings of fires after dark.

2. EGLON VAN DER NEER (1634–1703), son of the above, was born at Amsterdam in 1634. He was first taught by his father and afterwards by Jacob van Loo, whom he accompanied or followed to Paris in 1663. In 1666 he went to Rotterdam, from there to Brussels and finally to Düsseldorf, where he entered the service of the elector-palatine Johann Wilhelm. Later, a portrait of the princess of Neuberg led to his appointment as painter to the king of Spain. He painted landscapes in the style of Adam Elsheimer and was one of three painters employed to put figures into the town views of Jan van der Heyden. His portraits are reminiscent of Netscher and his genre pictures come near to those of Ter Borch and Metsu in delicacy of touch. The "Lady with the Book" (1665) was sold together with the Bredel collection in 1875. A young woman in white and red satin at Rotterdam (1669) recalls Mieris, whose style also reappears in Eglon's "Cleopatra" at Buckingham Palace. Two landscapes with "Tobit and the Angel," dated 1685 and 1694, in the museums of Berlin and Amsterdam, illustrate his fashion of setting Scripture scenes in Dutch backgrounds. His most important sacred composition is the "Esther and Ahasuerus" (1696), in the Uffizi at Florence. But Eglon varied his practice also with arrangements of hunting and hawking parties, pastures and fords. The latest of his panels is a mountain landscape of 1702 in the gallery of Augsburg. He died at Düsseldorf on May 3, 1703.

(J. A. C.; X.)

**NEERWINDEN,** a village of Belgium in province Liége, pop. (est. 1939) 891, a few miles E. by S. of Tirlemont; gives name to two battles, the first fought in 1693 between the Anglo-Allied army under William III of England and the French under the duke of Luxemburg (*see* GRAND ALLIANCE, WAR OF THE) and

the second in 1793 between the Austrians under Prince Josias of Coburg and the French under General Dumouriez.

**NEES VON ESENBECK, CHRISTIAN GOTTFRIED** (1776–1858), German botanist and entomologist, was born at Erbach on Feb. 14, 1776, and was educated at Darmstadt and at Jena, where he took the degree of M.D. After practising as a doctor, he was appointed professor of botany in Erlangen in 1816. Three years later he became professor of natural history in Bonn, and in 1831 he was appointed to the chair of botany in the university of Breslau. For his political activities in 1848, he was deprived of his professorship in 1851, and after spending the rest of his life in poverty, he died in Breslau on March 16, 1858.

For some years he edited the *Nova acta* of the "Acad. Leopold-Carolina," in which several of his own papers were published. His best-known works are those that deal with the *Fungi*, the *Hepaticae* and the *Glumiferae*, in all which groups he made valuable additions to knowledge.

**NEGAPATAM,** a seaport of British India, in the Tanjore district of Madras, forming one municipality with Nagore, a port 3 m. N. at the mouth of the Vettar river. Pop. (1941) 52,937. It carries on a brisk trade with the Straits Settlements and coast ports, steamers running fortnightly to the Straits. Ground nuts, cotton goods, tobacco and vegetables are exported. Vessels lie 2 m. off shore. Negapatam is the terminus of a branch of the South Indian railway, with large railway workshops, and has two technical institutes. It is also a depot for coolie emigration. Negapatam was one of the earliest settlements of the Portuguese on the Coromandel coast. It was taken by the Dutch in 1660, becoming their chief possession in India, and by the English in 1781. From 1799 to 1845 it was the headquarters of Tanjore district.

**NEGAUNEE** (nę-gaw′nę), a city of Marquette county, Michigan, U.S.A., 12 m. W. by S. of Marquette, near Lake Superior, at an altitude of 1,564 ft. It is on federal highway 41, and is served by the Chicago and North Western, the Duluth, South Shore and Atlantic and the Lake Superior and Ishpeming railways. The population was 6,552 in 1930 and 6,813 in 1940. It is one of the most important mining centres of the Upper Peninsula, surrounded by iron mines of both the deep-shaft and the open-pit type. A monument marks the spot where iron ore was first found (1844) in the Lake Superior region. Settlement here began about 1870 and the city was chartered in 1873. The name is a Chippewa word meaning "first" or "he goes before," chosen by the Pioneer Iron company as meaning "pioneer."

**NEGLIGENCE,** a ground of civil law liability, and in criminal law an element in several offences, the most conspicuous of which is manslaughter by negligence. In order to establish civil liability on the ground of negligence, three things must be proved —a duty to take care of, the absence of due care, and actual damage caused directly by the absence of due care. The duty may be to the public in general, on the ground that any person who does anything which may involve risk to the public is bound to take due care to avoid the risk. For instance, in the words of Lord Blackburn, "those who go personally or bring property where they know that they or it may come into collision with the persons or property of others have by law a duty cast upon them to use reasonable care and skill to avoid such a collision." Where a special duty to an individual is alleged, the duty must rest on a contract or undertaking or some similar specific ground. Thus, where a surveyor has carelessly given incorrect progress certificates, and a mortgagee who has had no contractual relation with the surveyor has advanced money on the faith of the certificate, the surveyor is not liable to the mortgagee in an action of negligence; because he owed no duty to the mortgagee to be careful. When a duty to take care is established, the degree of care required is now determined by a well-ascertained standard. This standard is the amount of care which would be exercised in the circumstances by an "average reasonable man."

Ordinarily a man is responsible only for his own negligence and for that of his servants and agents acting within the scope of their authority. For the acts or defaults of the servants of an independent contractor he is not liable. But in certain cases a stricter obligation is imposed on him by law. Thus, while the occupier of premises is under no duty whatsoever to trespassers, who must take the premises as they find them, and while he is under no duty to mere licensees other than the duty of seeing that there are no concealed dangers in the nature of traps, he is under a duty to invitees and to all persons entering as of right to see that the premises are in a reasonably safe condition so far as reasonable care and skill can make them so; and from such duties he cannot release himself by employing an independent contractor to maintain or repair the premises. The effect of this doctrine is that the occupier may be liable if it can be shown that the independent contractor or his servant has been guilty of a want of due care. A similar obligation has been enforced in the case of a wreck stranded in a navigable river, and the owner was held liable for damage caused by the carelessness of the servant of an independent contractor who had undertaken to light the wreck. So too any person who undertakes a work likely to cause danger if due care is not taken is liable for damage caused by the carelessness of the servant of an independent contractor, so long as the carelessness is not casual or collateral to the servant's employment.

In an action of negligence a familiar defence is "contributory negligence." This is a rather misleading expression. It is not a sufficient defence to show that the plaintiff was negligent, and that his negligence contributed to the harm complained of. The plaintiff's negligence will not disentitle him to recover unless it is such that without it the misfortune would not have happened, nor if the defendant might by the exercise of reasonable care on his part have avoided the consequences of the plaintiff's negligence. The shortest and plainest way of expressing this rule is, that the plaintiff's negligence is no defence unless it was the proximate or decisive cause of the injury. There was an attempt in recent times to extend this doctrine so as to make the contributory negligence of a third person a defence, in cases where the plaintiff, though not negligent himself, was travelling in a vehicle or vessel managed by the negligent third person, or was otherwise under his control. In such circumstances it was said that the plaintiff was "identified" with the third person. But the case of the "Bernina," decided in 1888, where a passenger and an engineer on board the "Bushire" were killed in a collision between the "Bernina" and the "Bushire" caused by fault in both ships, but without fault on the part of the deceased, exploded this supposed doctrine, and made it clear that the defence of contributory negligence holds good only when the defendant contends and proves that the plaintiff was injured by his own carelessness.

The American law of negligence is founded on the English common law; but the decisions in different States have occasionally contradicted English decisions, and also one another.

*See* T. G. Shearman and A. A. Redfield, *The Law of Negligence* (3rd ed., 1874); S. D. Thompson, *Commentaries on Negligence* (7 vols., Indianapolis, 1901–07); T. Beven, *Negligence in Law* (4th ed., 1928). (A. Ll. D.)

**NEGOTIABLE INSTRUMENT,** in law, a document or other instrument purporting to represent an obligation involving so much money, and the property in which passes, like money, by mere delivery or by endorsement and delivery. Negotiable instruments arise in either of two ways: (1) by statute, (2) by custom of merchants. The most commonly recognized negotiable instruments are bills of exchange, promissory notes, bills of lading, foreign bonds, debentures payable to bearer, and endorsed share certificates, such as are issued in Canada and the United States. Negotiable instruments constitute an exception to the general rule that a man cannot give a better title than he has himself. (*See* BILL OF EXCHANGE.)

**NEGRITOS** (Span. for "little negroes"), the name originally given by the Spaniards to the aborigines of the Philippine Islands. They are physical weaklings, of low, almost dwarf, stature, with very dark skin, closely curling hair, flat noses, thick lips and large clumsy feet. The term is now applied to one of the elements of the population of S.E. Asia, Indonesia and Oceania. The true negritos are always of little stature (the majority under 5 ft.), have rounded forms and their skull is relatively short and broad and of little height. Their skin is dark brown or black,

sometimes somewhat yellowish, their hair woolly (scanty on face and body), and they have the flat nose and thick everted lips and other physical features of the negro. Among negrito peoples are the Andamanese (*q.v.*), the Semang, Malay Peninsula and E. Sumatra (*q.v.*), the best types being the Tapiro (New Guinea) and Aetas (Philippines). There is evidence, physical, cultural and traditional, of a negrito substratum in the population of Assam (*Man in India,* VII. 4. 1927), while traces have been found by Hüsing along the Persian gulf. It is therefore an old element which survives in purity only among the Andamanese.

BY COURTESY OF THE HERLING NEW GUINEA EXPEDITION

NOGULLA NEGRITO OF NEW GUINEA WITH HIS CLUB

*See* A. de Quatrefages, *Les Pygmées* (Paris, 1887; Eng. trans. 1895); A. R. Broman, *The Andaman Islanders* (1922); *Album von Philippinen-Typen* (Dresden, 1885); Blumentritt, *Ethnographie der Philippinen* (Gotha, 1892); A. B. Meyer, *Die Negritos* (Dresden, 1899); A. H. Keane, *Ethnology;* A. C. Haddon, *The Races of Man* (1924); Roland B. Dixon, *Racial History of Mankind* (1923).

**NEGRO,** the designation of the distinctly dark-skinned, as opposed to the fair, yellow and brown races of mankind (from Lat. *niger,* black). In this sense it embraces the dark races, of the intertropical and sub-tropical regions of the eastern hemisphere, from Senegambia, West Africa, to the Fijian islands in the Pacific. It is convenient, however, to refer to the dark-skinned inhabitants of this zone by the collective term of *Negroids,* and to reserve the word *Negro* for the tribes found in Africa south of the Sahara and north of a not very well-defined line running roughly from the gulf of Biafra with a south-easterly trend across the equator to the mouth of the Tana. The Bantu Negroids are south of this line. The yellowish-brown Bushman and Hottentot (*qq.v.*) peoples of South Africa possess certain Negroid characters, the tightly curled hair, the broad nose, the tendency towards prognathism; but the relation is not close. The Negroids of Africa, Melanesia and Australasia have in common a number of characteristics such as:—A dark skin, varying from dark brown, reddish-brown or chocolate to nearly black; dark tightly curled hair, flat in transverse section, of the "woolly" or the "frizzly" type; a greater or less tendency to prognathism; eyes dark brown with yellowish cornea; nose more or less broad and flat; and large teeth. The Negro hair is flat, issues from the epidermis at a right angle, is spirally twisted or crisped, has no central duct, the colouring matter being disseminated through the cortex and intermediate fibres, while the cortex itself is covered with numerous rough, pointed filaments, adhering loosely to the shaft; lastly, the Negro pile will felt, like wool, whereas true hair cannot be felted. The true Negro (western Sudan type) is of tall stature, burly, short-legged, usually long-headed, with bulging forehead. A broad headed element of obscure origin extends across the continent. (For the Negro in the United States *see* NEGRO, THE AMERICAN.)

In Africa three races have intermingled to a certain extent with the Negro; the Libyans (Berbers, *q.v.*) in the Western Sudan; and the Hamitic races (*q.v.*) and Arabs (*q.v.*) in the east. The Bantu-speaking peoples in the southern portion of the continent approach the Hamites in those characteristics in which they differ from the true Negroes, and probably have a proportion of Hamitic blood.

The colour of the skin, which is also distinguished by a velvety surface and a characteristic odour, is due to the greater abundance of the colouring matter in the mucous membrane between the inner or true skin and the epidermis. This colouring matter is not distributed equally over the body, and does not reach its fullest development until some weeks after birth. The dark colour seems to depend neither on geographical position, the isothermals of greatest heat, nor even altogether on racial purity. The extremes of the chromatic scale are found in juxtaposition throughout the whole Negro domain, in Senegambia, the Gabun, upper Nile basin, lower Congo, Shari valley, Mozambique, ranging from dusky or yellow brown to sooty black. Some of the mixed races, such as many Abyssinians, Galla, Jolof and Mandingo, are quite as black as the darkest full-blood Negro. The development of pigment in the dark-skinned races as a natural protection against the ultra-violet rays in which tropical light is so rich must be viewed as merely a part of a many sided modification of the skin under torrid conditions.

In certain of these characteristics the Negro stands on a lower evolutionary plane than the white man, and is closely related to the highest anthropoids. The characteristics are length of arm, prognathism, a heavy massive cranium with large zygomatic arches, flat nose depressed at base and the tendency of the frontal bones to fuse together and form an eminence of peculiar shape. But in respect to the character of the hair, the white man stands in closer relation to the higher apes than does the Negro.

**Mental Qualities.**—In reviewing the comparative studies of the differences between the Negro and the modern European, Carr-Sanders concludes that "there seems to be no marked difference in innate intellectual power. The differences are rather differences in disposition and temperament. . . . The apparent arrest of development may not be so much an inevitable result of the kind of mental faculties which are inherited as the coming into play of a peculiar tradition." (*Population Problem,* 1922, p. 397.)

It is not fair to judge of the Negro's mental capacity by tests taken directly from the environment of the white man, as for instance tests in mental arithmetic; skill in reckoning is necessary to the white race, and it has cultivated this faculty; but it is not necessary to the Negroes, who often surpass white men in acuteness of vision, hearing, sense of direction and topography. Given suitable training, the Negro is capable of becoming a craftsman of considerable skill, particularly in metal work, carpentry and carving. The bronze castings by the *cire perdue* process, and the cups and horns of ivory elaborately carved, which were produced by the natives of Guinea after their intercourse with the Portuguese of the 16th century, bear ample witness to this.

**Social Conditions.**—Generally speaking the Negro is first and foremost an agriculturist. Next in importance to agriculture come hunting and fishing and, locally, cattle-keeping. The last is not strictly typical of Negro culture at all; nearly all the tribes by whom it is practised are of mixed origin, except perhaps the Dinka of the upper Nile, the whole of whose existence centres round the cattle pen. The social conditions are usually primitive, especially among the Negroes proper, being based on the village community ruled by a chief. Where the country is open, or where the forest presents no great obstacle to communication, a chief has often extended his rule over several villages and has ultimately built up a kingdom administered by sub-chiefs of various grades, and has even established a court with a regular hierarchy of officials. This "empire-building" has reached its greatest proportions in the south of the forest belt in the territory of the Bantu Negroids, where arose the states of Lunda, Cazembe, etc.

The domestic life of the Negro is based upon polygyny, so vital an element of the native social system that attempts to abolish plurality of wives would result in the most serious social disorder. Descent in the Negro world is often reckoned through the female, though many tribes with a patriarchal system are found. Traces of totemism are found sporadically. Secret societies are found in their highest development among the Negroes of the west coast.

The Negro is principally a vegetarian. Meat is everywhere regarded as a great delicacy. The cattle-keeping tribes rarely slaughter for food, because cattle are a form of currency. Fish is also an important article of diet in the neighbourhood of large rivers, especially the Nile and Congo. The two cultivated plants which form the mainstay of native life, manioc in the west and centre and mealies in the south and east, are neither of African origin. Cannibalism (*q.v.*) is found in its simplest form in Africa, where the majority of cannibal tribes eat human flesh because they like it. Among the true Negroes it is confined mainly to the

Welle and Ubangi districts, though found sporadically (and due to magical motives) on the west coast, and among the Bantu Negroids in south-western Belgian Congo and the Gabun.

**Religion.**—In the western forests where communities are small the Negro is a fetishist, combined more or less with nature worship. Where communication is easier worship becomes more systematic, and definite supernatural agencies are recognized, presiding over definite spheres of human life. Ancestor-worship appears and often assumes paramount importance, and is typical of all the eastern and southern portions of the continent. Malignant powers receive attention from man, with a view to propitiation or coercion. Beneficent agencies require no attention, since, from their very nature, they must continue to do good. In the western culture area, among both Negro and Bantu Negroid tribes, is the belief that any form of death except by violence must be due to evil magic exercised by, or through the agency of, some human individual; to discover the guilty party the poison ordeal is freely used. Similar ordeals are used in British Central Africa to discover magicians, and the wholesale "smelling-out" of "witches," was well-known among the Zulu-Xosa tribes. Everywhere magic, both sympathetic and imitative, is practised, both by the ordinary individual and by professional magicians, and most medical treatment is based on this, although the magician is usually an herbalist of some skill. Where the rainfall is uncertain, the production of rain by magical means is one of the chief duties of the magician, a duty which becomes paramount in the eastern plains among Negroes and Bantu Negroids alike.

The Bantu Negroids all speak dialects of one tongue (*see* BANTU LANGUAGES). The Sudanic family of languages is spoken in the area recognized as the habitat of the Negro, but Hamitic speech (Nilotic group) is also used by Negroes.

*See* the excellent bibliography in *Africa I.* 3. p. 240 *sqq.* (1928) by Henri Labruret for the most important modern works, and A. B. Ellis, *The Tshi-speaking Peoples* (1887); *The Ewe-speaking Peoples* (1890); *The Yoruba-speaking Peoples* (1894).

**NEGRO, THE AMERICAN.** Negroes represent one tenth of the population of the United States of America. They are the largest single racial group, outside the general Anglo-Saxon population, in a country which is made up of many races. Other peculiarities—notably their existence until 1863 as slaves in a nation founded on the principle of individual liberty—make them a distinctive as well as a numerically important part of American life.

**A New Race.**—The American Negro is a new biological and cultural product. His African ancestors represented tribes as divergent as the several peoples of Europe. They were captured from provinces covering large parts of Central and Western Africa: Guinea, the Ivory, Slave, and Gold Coasts, a great part of what is now French West Africa, the vast stretches of the Niger Valley, the Cameroons, the Congo, the Benguela. Among them were Arabs and Moors from the northerly coasts, the small yellow Hottentots from the South, the Bantu tribes from the equatorial regions, although most of them were the large bodied blacks from the huge area called Guinea. Members of these diverse tribes, captured over an area as large as the whole continent of Europe, were completely mixed in the process of their transport to African slave ports, to the West Indies, to American slave marts, and in their distribution in the New World. Even if there had been no admixture of white or Indian blood, the generations which grew up in America would have been different from any single tribe in Africa and would have represented a mingling of all of them into a new race.

But in addition to the fusing of diverse African strains, white and Indian blood at once began to be poured into the newly forming race. No special odium was attached to the begetting of mulatto children by white slave owners, and there was an economic motive in the value as slaves of children born to slave mothers. The admixture of Indian blood was probably less than that of white, but in the early years of the colonies, marriages between Indians and blacks were not infrequent, and intercourse between them without the formality of matrimony was common. While there are unfortunately no accurate figures obtainable concerning the racial ancestry of American Negroes, such careful scholars as Melville J. Herskovits estimate that less than twenty per cent are of pure African descent.

Definition of so-called racial characteristics, under any circumstances a delicate undertaking, is practically impossible with a "race" which is a combination of races. Many characteristics, such as susceptibility to tuberculosis, syphilis, and other diseases, lack of initiative and responsibility, which were once thought to be typical of the Negro, are now credited by the best students to the conditions of his environment. Physical characteristics, of course, become greatly confused and varied in a race being formed by a fusion of very diverse races. Certain temperamental distinctions may be innate as well as the result of cultural environment: The Negro is typically expressive; he sings and plays and dances and handles language with an abandon and an artistry which hardly can be attributed alone to circumstances in which he has commonly lived.

Culturally also this emerging race is new. The only folkways that had elements in common for all the slaves were those they found about them in America. During his early years in this country, the Negro had to make tremendous changes in all his customs and habits. He dropped his former languages and adopted English. He shifted his religions into the form of Christianity. He was forced from a primitive economy into an industrialized labour system. European clothes were put on him and he completely abandoned his African costuming. It is astonishing how completely the Negro has been cut off from his African home. There are scarcely half a dozen words in any of the American Negro dialects that are traceable to African roots. Superstitions, such as "hants" or ghosts, and "conjur" or a curse, were as characteristic of primitive white peoples in rural America as of coloured. Negro music was a combination of typically African rhythm and the old English and Scotch hymns and ballads which were current in the South.

Although the Negro was quickly forced into the moulds of the new civilization, he left upon them characteristic imprints. He set an agricultural pattern and a drawling manner of speech that marks the whole South. To Christianity he contributed his own peculiar twists and modifications, especially an emotionalism he had been familiar with in Africa, and the great gift of the spirituals, a distinct and beautiful form of religious folk music.

**History in the United States.**—The first slaves to arrive on the mainland of North America were "twenty Negars" brought to Jamestown by a Dutch man of war in 1619, a few months before the Mayflower landed the Pilgrims at Plymouth. These twenty were followed by ever-increasing importations from Africa, over a period of two centuries. In the very early days slaves formed a large part of the colonies, but since the beginning of the nineteenth century the proportion of Negroes has steadily decreased. In 1790, 757,208, or almost one fifth, of the 3,929,214 inhabitants of the United States were Negroes. In 1930, only 11,891,143, less than one tenth of the 122,775,046 population, were Negroes according to the census classification; it must be borne in mind that this includes all persons with Negro blood, however little.

In the early days slaves were used chiefly in the cultivation of tobacco, rice, and indigo. Toward the end of the eighteenth century, when these industries appeared to be on the wane, slavery reached a low ebb. Then suddenly the whole picture of southern industry and the entire future of the race were changed by the invention of the cotton gin in 1793. Cotton culture in the New World surged forward. To plant and cultivate the new crop, slaves were required as never before. Importations to America increased, and the breeding of slaves within this country became almost an industry. Negroes in America increased by 200,000 in the decade ending with 1800, by 300,000 in the decade following, and by over 500,000 in the ten-year period that closed in 1830.

By the middle of the nineteenth century, slavery, from a languishing institution, had become an established industry. The personal contacts which had humanized the relations in the early period broke down on the huge plantations, which were often managed and bossed by "poor white" overseers. The harshness of a system was added to individual subservience.

From the depths of a systematic and often cruel slavery, the Civil War suddenly threw the race into an almost equally terrifying freedom. The Emancipation Proclamation gave nominal liberty to over four million slaves. But no edict could in itself transform a great mass of people long held in ignorance and dependence into self-supporting and competent citizens. The freedmen slowly and painfully had to win every kind of real independence: education, economic status, responsibility, self-development.

After the first excitement of reconstruction was over, the tendency was for the Negro to settle down and work as a tenant the land he had formerly worked as a slave. There was only a very gradual movement of the younger generation toward the cities, which in general paralleled the population movement of the whole country. But disturbed conditions in the country during the World War, as well as the shortage of labour in industry, encouraged a general trek of coloured people to the cities, especially to the industrial centres of the North, a process which has continued to the present and is still going on. The Negro of today is represented in the urban centres as extensively as other elements of the population.

**Population.**—While the total Negro population of the United States has increased in the last century and a half from seven hundred thousand to twelve million, the proportion of Negroes to the total population has steadily decreased. In 1790 there were 239 Negroes per thousand of white population; in 1860, 165; in 1930, 109. In 1860 there were 582 Negroes per thousand whites in the South, only 18 in the North; in 1930 there were 338 in the South, 34 in the North.

There have been notable shifts in the Negro population. In the early days the concentration was in the tobacco-growing state, Virginia, which in 1790 had two fifths of all the slaves. With the development of sugar in Louisiana and of cotton in the far southern states, the slave population moved west and south. Just before the Civil War, Georgia had 465,698 Negroes; Alabama, 437,770; Mississippi, 437,404; Louisiana, 357,456, and every state of the old South had more than 200,000 slaves.

There was little shifting in the Negro population at the time of emancipation. The first spontaneous movement was in 1878–1879, when over two hundred thousand Negroes left their homes to strike out for Kansas, arousing the South by a threat to its labour supply. Although only about a quarter of them ever got beyond the borders of their native states, the coloured population of Kansas was increased from 17,108 to 43,107 in the decade 1870–1880.

Within the last thirty years, Negroes have begun to move into urban areas, in the South as well as in the industrial North. In 1910, 2,684,797 Negroes, or about 27%, lived in towns and cities (that is, centres of population of 2,500 or over); in 1930 5,193,913, or about 43% lived in towns and cities. This urbanization is in accordance with a general trend of the whole population in America. The town and city dwellers for all classes represented 46% of America's total population in 1910, and 56% in 1930. Thus Negro migration to cities has been much swifter during recent decades, although the Negro is still below the average urbanization of the nation.

*Cities with Population of 90,000 or more Negroes*
*Comparative Figures for 1910 and 1930*

| City | 1910 Negro Population | % of Total Population of the City | 1930 Negro Population | % of Total Population of the City |
|---|---|---|---|---|
| New York | 91,709 | 1·9 | 327,706 | 4·7 |
| Chicago | 44,103 | 2·0 | 233,903 | 6·9 |
| Philadelphia | 84,459 | 5·5 | 219,599 | 11·3 |
| Baltimore | 84,749 | 15·2 | 142,106 | 17·7 |
| Washington | 94,446 | 28·5 | 132,068 | 27·1 |
| New Orleans | 89,262 | 26·3 | 129,632 | 28·3 |
| Detroit | 5,741 | 1·2 | 120,066 | 7·7 |
| Birmingham | 52,305 | 39·4 | 99,077 | 38·2 |
| Memphis | 52,441 | 40·0 | 96,550 | 38·1 |
| St. Louis | 43,960 | 6·4 | 93,580 | 11·4 |
| Atlanta | 51,902 | 33·5 | 90,075 | 33·3 |

From this table it is seen that the three northern cities of New York, Chicago and Detroit more than tripled the percentage of their Negro population from 1910 to 1930. In spite of this apparently great influx of Negroes into northern cities, in 1930 the Negro made up only 3.3% of the population of the North, 1% of the West, 24.7% of the population of the States of the old South, and 9.7% in the total United States.

*Geographic Distribution of Negro Population, 1830–1930*

| Section | 1830 | 1860 | 1890 | 1910 | 1930 |
|---|---|---|---|---|---|
| New England | 21,379 | 24,711 | 44,580 | 66,306 | 94,086 |
| Middle Atlantic | 103,835 | 131,290 | 225,326 | 417,870 | 1,052,899 |
| East North Central | 15,883 | 63,699 | 207,023 | 300,836 | 930,450 |
| West North Central | 25,660 | 120,540 | 224,089 | 242,662 | 331,784 |
| South Atlantic | 1,529,283 | 2,058,198 | 3,262,690 | 4,112,488 | 4,421,388 |
| East South Central | 501,587 | 1,394,360 | 2,119,797 | 2,652,513 | 2,658,238 |
| West South Central | 131,015 | 644,553 | 1,378,090 | 1,984,426 | 2,281,951 |
| Mountain | | 235 | 12,971 | 21,467 | 30,225 |
| Pacific | | 4,244 | 14,110 | 29,195 | 90,122 |

**Economic Status.**—The new race grew up in America about field labour, and on the farm it has been concentrated both in slavery and in freedom. In spite of all migrations and shifts in labour and industry, today about one third of all Negroes gainfully employed are in agriculture. In 1930, 882,850 Negro farm operators constituted 14% of all farm operators, while the Negro population represented 9·7% of the total population. Of all Negro farm operators, 98·7% were in the South.

The Negroes' struggle to possess and to make a living from farms, on which formerly they were slaves, has been against keen competition. When the Negro gained freedom, all fertile land was already owned. While many of the plantations were abandoned by the former masters or seized from them during the troublous times of war and reconstruction, the freedmen were among the weakest and least experienced of the claimants for the expropriated farms. A fifth of the Negro farmers are owners or part owners of the land they work. In the South in 1935, over 40% of the Negro farm operators (698,839 farm families) were tenants or share-croppers, working under a system whereby the landlord parcels out land, and with it tools, machinery, and seed, and in return receives a share of the crop. Usually the tenant must borrow supplies of food and clothing (and seed and fertilizer) from the landlord before the crop is harvested, and at the year's end, fairly or unfairly, there is usually no share left for the tenant. The whole scheme is a vicious circle of borrowing and catching up, which usually leaves the tenant constantly slipping behind. The system, inefficient as it is even for the plantation owner, is so bound up with tradition as to be almost impossible to change.

In the trades and industry, the Negro has not yet established a firm foothold. But it is here that he has been making his greatest recent progress. In 1930 18·6% of gainfully employed Negroes were in the manufacturing and mechanical industries, as compared with 28·9% of whites; comparable figures for 1910 are 12·6% for Negroes, 27·9% for whites. Domestic and personal service is still a large part of the Negro's work (28·6% of all gainfully employed).

In commerce Negroes have as yet made little headway. The most important businesses are banks, insurance companies, restaurants and lunchrooms, groceries and other stores, undertaking establishments, contracting and building, real estate, and printing. Although there has been an increase in this type of Negro enterprise in the last fifteen years, it employs but a very small part of the population.

While the Negro professional classes have been steadily increasing, their ranks are still small. There are 3,805 Negro physicians, or about one for three thousand Negroes in the population; for the country as a whole, there is one physician for about 840 of

the total population. Negroes make up a correspondingly low proportion of other professions, except for the clergy, in which there are twice as many in proportion to the population as there are among whites.

Outside of farm labour and domestic service, Negroes as a group are still marginal workers. They have gained little recognition from trade unions and are discriminated against in many lines of employment. In recent years the C.I.O. has welcomed Negroes into its unions and, with the breakdown of the caste barriers of the older labour movement, there is a general trend toward organizing all the workers of any industry regardless of race. The steel industry of the Birmingham area as well as the automobile, packing, and heavy industries of northern cities are unionizing Negroes to the benefit of the Negroes themselves and to the greater solidarity of labour as a whole. In periods of depression Negroes are apt to be the first to be displaced and therefore represent a disproportionate share of the relief rolls of cities and counties.

**Political Status.**—Although Negroes were given the right to vote by constitutional amendment at their emancipation from slavery, after a transient glimpse of extravagant political activity during reconstruction, a large proportion of them have been effectively kept from voting by state laws such as those requiring the voter to have education and property, with the proviso that this requirement should not apply to those whose grandfathers were eligible to vote. With their increasing movement into the northern states, which do not have such election laws, the Negroes have increased their political influence, and in certain cities their votes represent the balance of power. Several of the northern states have had Negro members in their state legislatures in recent years, and there have been numerous Negro aldermen in New York, Baltimore, Chicago, and other cities. In the District of Columbia and Chicago, Negroes have served for years on the bench of the municipal courts. Since 1929 Illinois has had one Negro representative in Congress, the first such instance since the last of the reconstruction congressmen (George White, representative from North Carolina, who retired in 1901).

**Education.**—The old order in the American South had no place for Negro education. It had little place for public schools of any sort, even for the poorer whites. Following the Civil War, the reconstruction governments of the several southern states, however ill-advised in other directions, did the heroic task of establishing a system of tax-supported free schools for all races. After a period of experimentation with schools open to both white and coloured, the system began to make a cleavage between the races and to develop a dual set of public schools, one for white pupils, the other for coloured. This dual system of public schools has continued in seventeen southern states to this day. Although at the beginning the Negro received a fair share of public funds, the strain of taxes caused public officials to devise ways of curtailing the expenditures for Negro schools. While there has been great improvement in all school facilities in the South during the first third of the present century, the gap between expenditures for white and coloured schools has continued and even increased. The South spends annually in public education an average of $44.31 for every white child enrolled in school and $12.57 per Negro pupil. The nation as a whole spends an average of $99 a year on every child enrolled in school.

The public school system in the northern states, which is much more nearly adequate than in the South, makes no official discrimination between the races.

Negro education has not had to depend entirely upon tax funds and political control. It has had from the beginning the ardent support of church boards and private agencies and individuals. The Freedmen's Bureau, established by Act of Congress to look after ex-slaves, began to establish classes for these wards of the government before the close of the Civil War. The great national foundations have also been active in Negro education. The General Education Board, founded by John D. Rockefeller, and the Peabody Fund have interested themselves in public education in the South for both whites and Negroes. The John F. Slater and Anna T. Jeanes Funds and the Phelps-Stokes Fund were established expressly to aid Negro Schools. The Julius Rosenwald Fund, in addition to many activities in general education and health, has made a distinctive contribution to Negro schools by co-operating with the several southern States and local communities in the building of over five thousand rural schools for coloured children and by large gifts to universities and other aspects of Negro education.

The accomplishments of seventy years in Negro education are striking. The reduction of illiteracy, in a racial group now numbering twelve million, from 95% in 1865 to less than 15% in 1935 is a measure of the achievement at the most elementary level. In 1934, out of 3,100,000 Negro children of school age in the southern States, 2,350,000 were enrolled in school, being taught by some 56,000 Negro teachers. Of about 900,000 Negroes in the 17 southern states and the District of Columbia aged 14 to 17 inclusive, 163,185 (18%) were enrolled in secondary schools in the year 1933–34. This is a striking increase over earlier years but is far below the percentage (over 60%) for the nation as a whole.

Negro progress in college and professional education has naturally been slower than that in the elementary and secondary grades. Up to 1880 there had been only 686 Negroes graduated from colleges and professional schools throughout the whole history of America. By 1920 this figure had slowly grown to 15,000; by 1936 it had swept up to a total of 43,821. Of the degrees given, 85% came from colleges specifically for Negroes in the South, though during the past two decades an increasing number have been graduated from the general colleges and universities of the North.

A number of Negro colleges are growing in strength, notable among which are Howard University in Washington, Fisk University and Meharry Medical College in Nashville, Atlanta University and affiliated colleges in Atlanta, Dillard University, representing a recent merger of denominational colleges in New Orleans.

**Cultural Contributions.**—The Negro's contributions to folk art and folk music grow out of the combination of the African background and the American environment. They are not importations from Africa nor from the European sources of America, but are fresh contributions. They carry over features from the African background but they are set in American forms and have taken this colouring from the peculiar life the race has led in America. The spirituals, original contributions both to folk art and to religious music, are an illustration. The rhythm and the emotionalism are largely African; the language, the musical setting, and the religious form are European-American; the peculiar cadence and imagery of escape from an intolerable world into a lovely and gorgeous heaven grow out of the toil and torment of the race's position during its entire history in America. The case is similar in the realm of profane music, with jazz and the blues, one a syncopated staccato of frustration and rebellion, and the other syncopated moaning. This troubled, jumpy, neurotic music expresses so poignantly the bafflement not only of Negroes but of all human beings in the stress and strain and tempo of industrial and urban life, that jazz and the jazz age have come to be regarded as belonging to America generally and to the whole world of western industrialism. These rhythmic contributions of the Negro are characteristic gifts to America, which otherwise has been remarkably barren in folk art and folk music. This emotional exuberance, which has flowed for a century in folk art, is now finding expression in more recondite forms: literature, drama, music, painting, sculpture.

BIBLIOGRAPHY.—Frederic Bancroft, *Slave-Trading in the Old South* (1931); Benjamin G. Brawley, *The Negro in Literature and Art in the United States* (1930); *A Short History of the American Negro* (1931); Sterling Brown, *Negro Poetry and Drama* (1937); *Negro in American Fiction* (1937); Chicago Commission on Race Relations, *The Negro in Chicago* (1922); Horace R. Cayton and George S. Mitchell, *Black Workers and the New Unions* (1939); W. E. B. DuBois, *The Souls of Black Folk* (1903); *The Gift of Black Folk* (1924); *Black Reconstruction* (1935); Edwin R. Embree, *Brown America* (1931); *The Collapse of Cotton Tenancy* (1935); E. F. Frazier, *Negro Family in the United States* (1939); Harold Gosnell, *Negro Politicians* (1935); M. J. Herskovits, *The American Negro* (1928); Charles S. Johnson, *The Negro in American Civilization* (1930), *Shadow of the Plantation* (1934); *The Negro College Graduate* (1938); James Weldon Johnson, *The Book of American Negro Poetry* (1922); *The Book of American Negro Spirituals* (1925); Alain Locke, *The New Negro* (1925); R. R. Moton, *What the Negro*

*Thinks* (1929); Ulrich B. Phillips, *Life and Labor in the Old South* (1929); E. B. Reuter, *The Mulatto in the United States* (1918); *The American Race Problem* (1927); *Race Mixture* (1931); Sterling Spero and Abram Harris, *The Black Worker* (1931); United States Bureau of the Census, *Negro Population 1790–1915* (1918); *Negroes in the United States 1920–1932* (1934); Rupert Vance, *Human Factors in Cotton Culture* (1929); Booker T. Washington, *Up From Slavery* (1901); Doxey A. Wilkerson, *Special Problems of Negro Education* (1939); Carter Woodson, *A Century of Negro Migration* (1918); *The Negro in our History* (1922); T. J. Woofter, *Negro Migration* (1920); *Negro Problems in Cities* (1928); *Black Yeomanry* (1930); M. N. Work, *Bibliography of the Negro in Africa and America* (1928); *Negro Year Book* (1912 seq.). (E. R. E.)

## NEGRO ECONOMIC LIFE

In 1910 about 71% of Negroes in the United States ten years old or over were gainfully employed compared with 48·4% native whites of native parentage, 50·4% native whites of foreign or mixed parentage and 60·3% foreign-born whites. In 1930 about 59·2% of the Negroes ten years old and over were gainfully employed compared with 47% of the native and 56·1% of the foreign-born white population. Similar comparisons probably obtained in other years due partly to differences in proportions of women and children employed.

Of 5,503,535 Negroes ten years old and over reported gainfully employed in 1930 there were 36·1% in agriculture, 28·6% in domestic and personal service, and 30·5% in manufacturing and mechanical pursuits, mining, trade, transportation and communication; 2·5% in professional service, and the remaining 2·3% in forestry and fishing, public service (not otherwise classified) and clerical occupations.

There was considerable change in the above figures due to shifts in occupations and unemployment during the great economic depression of 1930–40. For example, a study by the U.S. Department of the Interior in 1936 of 213,983 white-collar and skilled workers in 85 cities in all sections of the United States disclosed that only 66·1% were employed in 1930 in their usual occupations, as shown by the census of 1925, and that only slightly over one-half of this group remained so employed in 1936.

Out of 78,330 male Negro skilled workers in the group, 84·7% of whom were usually employed in 23 skilled occupations in 81 cities in different sections of the United States, only 74·5% of those usually so employed in 1925 were in skilled pursuits in 1936. Unemployment in the group increased from 8·4% in 1930 to 17·7% in 1936. The actual increase was probably larger, because of those reporting "no employer" 90% were less than 19 years old at the earlier date, while only 1·1% were under 20 years of age at the later date.

**Agriculture and Domestic Service.**—There has been a steady decrease in the proportion of Negro workers ten years old and over in agriculture since 1910 when there were 54·6% so occupied. There was a comparative decrease from 33·8% to 21·4% of the native white population engaged in agriculture. In 1930, Negro farm operators comprised 14% of all operators, although the Negro population was 9·7% of the total. Of 882,850 Negro farm operators (98·7% of them in the South), owners were 15·8%, part-owners, 4·7%, cash renters 11·1%, and share-croppers and other tenants 68·2%. More than two-fifths of Negro farm operators in the South in 1930 were croppers. Negro farm operators decreased 4·6% and white farm operators 2·3% between 1920 and 1930. In the South in 1929, about 32·4% of the cotton crop was produced on farms operated by Negroes, and 3·8% of this by Negro owners. The average value of farms operated by Negro tenants was $1,503 in 1930 compared with $1,848 for farms operated by Negro owners.

Negro workers in domestic and personal service increased from 21·6% in 1910 to 28·6% in 1930. In the North 42·7% and in the South 24·1% of Negro workers were so occupied in 1930. A study of Negroes at work found 52·5% in New York and 57% in New Jersey in 1930 in domestic and personal service. Native white workers in domestic and personal service remained nearly stationary in the same period, 6·7% in 1910 and 6·6% in 1930, and foreign-born white workers increased slightly from 11·8% to 12·7%.

**Industrial Workers and Artisans.**—Between 1840–60 there were cases of slaves manning cotton factories and working successfully in iron mines, furnaces and tobacco factories. The post-war development of the southern cotton mills, however, turned to white workers. Even before the Revolutionary War Negro slaves were employed in New Jersey as iron workers, sawmill hands, wheelwrights, tanners, coopers, shoemakers, etc., and as early as 1708 white mechanics felt the competition of slaves in Pennsylvania. Employment in the North before 1865 was mainly in semi-skilled and unskilled occupations, Negroes following the prevailing occupations of the locality; barbers, bakers, carpenters, clothiers, domestics, hairdressers, labourers, seamen, and waiters. There were a few physicians, clergymen, merchants and traders and saloon and restaurant keepers. Some of these in Philadelphia, New York, and Boston enjoyed popularity. The slave artisan became the main factor in skilled labour in the antebellum economic organization of the South.

Negroes have slowly increased in the occupations of the building trades, clothing and textiles, lumber and furniture, metals, food and allied industries during the past 40 years. In 1910 in the United States there were 655,906 Negro workers in manufacturing and mechanical pursuits; in 1930 there were 1,024,656. In transportation and communication in 1910 there were 256,098; in 1930 there were 397,645. In trade in 1910 there were 119,775 and in 1930 there were 183,809 Negro workers. Most of this gain was in unskilled labour.

In 1935 about three-fourths of the Negro population of the northern States were living in about 10 industrial districts where prior to 1914 immigrant labour had largely supplied the surplus of workers. However, the depression years 1930–40 saw greater unemployment among Negroes than their proportion of those gainfully employed. For example, in New York State in 1937, Negroes totally unemployed were approximately 40% of all Negro workers compared with "slightly over 15%" for all others. In 1935 about 26% of the families on relief in New Jersey were Negroes, who comprised only 5% of the total population. In the United States in 1932–39 a larger proportion of Negroes were on relief than their proportion in the total population.

Wages paid Negroes in the North are on the whole higher than those paid them in the South for the same occupations and less than those paid whites. In the North, industrial wages of Negroes are about the same as white workers in those occupations to which they are admitted. Negro workers are handicapped in both sections by greater difficulty in obtaining employment, by restrictions on promotion to higher jobs, by restrictions on union membership and apprenticeships and by less security of tenure. The movement among Negro skilled workers to a lower job status and the decline of apprenticeship have been greater than among other skilled workers. In the building trades, in the steel, mining and automobile industries, and in New York City in the needle and fur trades and related industries, increasing numbers of Negroes have been admitted to unions and are thus overcoming some of these barriers.

**Trade and Life Insurance.**—*The Negro Year Book* estimated 4,000 Negroes in business in 1866. These were usually small service enterprises such as those of blacksmiths, shoemakers, caterers, etc. Here and there Negroes of marked ability developed enterprises of proportions before 1860 such as foundries, rope and cordage factories, dry goods and grocery stores and similar retail establishments. The intervening decades showed slow but substantial growth. The United States Census reported that in 1935 there were 23,490 retail stores operated by Negro owners with $48,987,000 in sales and 12,322 employees; and Negro proprietors of 22,172 service establishments with $27,281,000 receipts and 13,975 employees.

Life insurance among Negroes arose after more than 100 years of religious and fraternal sick and death beneficial societies. It has grown steadily in 30 years, in the face of many handicaps and some reverses, and is now the largest business of the group. The first legal reserve Negro life insurance company was organized in Mississippi in 1909. There were already several industrial companies; and several white companies were carrying Negro risks.

In 1937, there were 44 Negro companies covering ordinary, industrial, sick and accident insurance. The National Negro Insurance Association in 1937 enrolled 28 of these with business in force of $272,527,288, of which $67,906,561 was legal reserve, and $204,620,727 industrial, sick and accident insurance; total gross assets were $21,433,643.97 and admitted assets $20,092,955.76, covering a net reserve for policyholders of $14,719,178.64; death claims (ordinary, industrial, health and accident) paid in 1937 were $2,362,909.06; sick and disability claims $1,756,753.09. These 28 companies employed 8,186 officers, medical examiners, managers, agents and clerical force.

**Professional Class.**—Before the Civil War the Negro's church was from 1795 onward his only free institution. It is still the principal group organization. There were Negro teachers who conducted private schools in the North and occasionally in the South for Negro children. Law and custom forbade teaching slaves. With freedom, the great outreach of Negroes was for education and organized religion. Teachers and clergymen increased accordingly. There were 29,727 Negro school teachers, professors and college presidents in 1910 and 56,585 in 1930; 5,606 musicians and teachers of music in 1910 and 10,583 in 1930. There were 17,495 Negro clergymen in 1910 and 25,034 in 1930. In 1860 there were 14 Negro physicians and a Negro dentist in Massachusetts; 5 dentists in Philadelphia and 1 physician in St. Louis. The number of Negro physicians, surgeons

and dentists has steadily increased; in 1910 there were 3,553 and in 1930 there were 5,578. There were also 3,433 trained Negro nurses in 1910 and 5,728 in 1930. There were 798 lawyers, judges and justices in 1910 and 1,247 in 1930. In all there were 81,771 Negroes in professional service in 1930 and 50,203 in public service (not elsewhere classified).

**Banks and Real Estate.**—In 1938 *The Negro Year Book* reported 23 Negro banks capitalized at about $2,000,000 with resources of about $15,000,000 and an annual business of about $50,000,000. They are principally savings banks and 16 are located in the southern States. In 1926 there were about 33 savings and commercial banks. Negroes have cherished their churches and put large funds into them. In 1926 the value of 37,347 Negro church edifices was $205,782,628 or $5,510 per church; 23·5% of these churches reported debts on their edifices which averaged $2,496 per church. About 15·4% of all Negro churches reported parsonages with an average value per parsonage of $2,770; about one-fifth of these parsonages had debts which averaged $1,304.

Of the total 2,803,756 Negro homes in 1930 about 65% were non-farms and 35% were farm homes; 23·9% of all types of homes were owned and 73·1% were rented. Between 1900 and 1930 the number of Negro homes owned increased 79·3%; rented increased 53·5%. The median value of Negro-owned non-farm homes in 1930 was $1,341.00; the median monthly rental of non-farm homes was $13.04.

BIBLIOGRAPHY.—Thomas M. Campbell, *The Movable School Goes to the Negro Farmer* (Tuskegee Institute, 1936); Horace R. Cayton and George S. Mitchell, *Black Workers and the New Unions* (Univ. of N.C. Press, 1939); W. E. B. DuBois and A. G. Dill, eds., "Negro American Artisan," in *Atlanta University Publications*, No. 17 (1912); Dean Dutcher, *The Negro in the Modern Industrial Society* (Science Press Publishing Co., 1930); Abram L. Harris, *The Negro as Capitalist* (1936); E. R. Haynes, "Negroes in Domestic Service in the United States," *Journal of Negro Life and History*, vol. viii., No. 4, pp. 384–442; George Edmund Haynes, *The Negro at Work in New York City* (Columbia University Press, 1912); Gladys L. Palmer and Katherine D. Wood, *Urban Workers on Relief*, Works Progress Administration Research Monograph IV, Parts 1 and 2 (1936); R. B. Puchbach, *Virginia Negro Artisans and Tradesmen* (1926); Sterling D. Spero and Abram L. Harris, *The Black Worker* (1931); W. J. Trent, Jr., *Development of Negro Life Insurance Enterprises*, Master's Thesis, University of Pa. (1932); U.S. Bureau of the Census, *Negro Population: 1790–1915* (1918), *Negroes in the United States: 1920–1932* (1935); U.S. Department of Labor, *Negro Migration in 1916–17* (1919), *The Negro at Work During the World War and During Reconstruction* (1921); Robert C. Weaver and Ira DeA. Reid, *The Urban Negro Worker in the United States, 1925–1936* (U.S. Dept. of the Interior, 1938–39); C. H. Wesley, *Negro Labor in the United States, 1850–1925* (1927); T. J. Woofter, Jr., *Negro Problems in Cities* (1928); M. N. Work, edit., *The Negro Year Book* (Tuskegee Institute, 1937–38). (G. E. HA.)

## NEGRO EDUCATION

Prior to the emancipation of Negroes in the United States in 1865 there were isolated instances in both the North and South of the establishment of schools for free Negroes. Negligible effects attended these efforts, however, because of opposition in the North and legislative enactments in the South forbidding the education of Negroes enslaved or free. Despite these barriers, a few Negroes entered northern white academies and universities and some graduated. Any discussion, however, of Negro education in America must begin substantially with the adoption of the reconstruction Constitutions by the former slave States.

Social factors not considered, mixed schools would have been the most economical and effective educational instrument and probably were the only means of ensuring equal education for the two races. Several States considered the idea more or less seriously and for a short period South Carolina adopted it. But certain political, social and biological theories concerning the race placed the Negro at the bottom of the social scale, and tended to restrict the amount, quality and kind of education considered assimilable by the Negro and necessary to fit him for the place assigned him in the social structure.

The extreme biological theory assumed the Negro incapable of education; the extreme social attitude held that education "spoiled" the Negro for useful pursuits; while the liberal attitude is expressed by these words in the doorway of a Negro school in Alabama: "It is the duty of the South to train the descendants of the former slaves to become intelligent, productive, industrial units in the commonwealth." The Negroes bitterly resented these restrictions and their feelings were shared to a considerable degree by many white people interested in Negro education. Private schools for Negroes sprang up all over the South, supported largely by northern philanthropy and conducted by northern white educational missionaries, though many were maintained by Negroes. These schools supplied most of their secondary education and practically all of their collegiate training.

About 1905 a general educational revival began in the South with a new emphasis on education for both races. The Negro had proved his capacity for education. Increasing industrial prosperity in the South and the lessening of isolation effected a general willingness to provide more liberally out of public taxation for Negro education. Since 1915 this tendency has grown steadily. The National Association of Teachers in Colored Schools organized in 1903 and the State associations of Negro teachers have done much to stimulate more liberal public sentiment. Negro college attendance increased 150% from 1923 to 1928; this indicates the reaction to increased facilities for education.

BIBLIOGRAPHY.—Booker T. Washington, *My Larger Education* (1911); W. E. Knight, *Public Education in the South* (1922); W. A. Robinson, *State Accredited High Schools for Negroes*, see *Bulletin* of the National Association of Teachers in Colored Schools (June 1926 and June–July 1927); Jackson Davis, "Recent Developments in Negro Schools and Colleges, *Morehouse Journal of Science* (Jan. 1928); publications on Southern Education and Negro Education by J. F. Slater Fund and General Education Board. (W. A. Ro.)

## NEGRO ART

Negro art, in the broader sense, may be said to include work portraying Negro life by other than Negro artists; in a narrower sense, to include all work of Negro artists. The American Negro, though possessing a strong African heritage in decorative and plastic art, was hampered in his expression in the field of the formal arts by conditions of the slave system, and the sudden displacement by Christianity of the pagan background in which the original African arts flourished. However, in favourable centres like Philadelphia, Charleston and New Orleans, craft artisans of exceptional skill in wood and ironwork flourished until the breakdown between 1840–50 of craft skill by the factory system. Of these the most famous were the Negro art-smiths of New Orleans.

In formal painting, the pioneer Negro artist was Edward Bannister (Providence, R.I.), a landscape-painter, prize winner at the Centennial Exposition at Philadelphia (1876) and founder of the Providence Art club. At the same exhibition, Edmonia Lewis, pioneer sculptor, exhibited her busts of William Story, Charles Sumner and Frederick Douglass. Other early Negro artists between 1865 and 1885 were Edward Stidham (Philadelphia), portraitist; William Dorsey (Philadelphia), landscape-painter; and Robert Duncanson (Cincinnati), figure-painter.

These were followed, after a dead interval, by the two Negro artists who achieved rank in American painting and sculpture, Henry Ossawa Tanner (1859–1937) and Meta Warrick Fuller. Tanner's painting, mostly of biblical subjects, in addition to the romantic realism of his French masters, reflects the mysticism and religious faith of his Negro parentage and, like the work of Israels, combines utmost sophistication of technique with naive simplicity of theme. His technical skill was attested by many prize awards and also by his inclusion in the Luxembourg, Wilstach, Pennsylvania Academy of Fine Arts, Carnegie Institute, Chicago Art Institute and other collections. A school of formal academic painting followed Tanner: William Harper (1874–1910), landscape painter of note; William Edouard Scott (b. 1884), portraitist and mural painter; William Farrow (b. 1885), landscapist and etcher; Charles Dawson (b. 1889), portrait painter and engraver; Edward Harleston (1890–1931), portraitist and figure painter of merit; and Laura Wheeler Waring (b. 1887), type portraitist and decorative illustrator.

In sculpture, the outstanding Negro has been Meta Warrick Fuller (b. 1877), educated at the Pennsylvania School of Industrial Art, and pupil of Colarossi academy, St. Gaudens and Rodin. She achieved recognition in the Paris salons of 1903 and 1904 with her forceful symbolic works,—"Oedipus," "Secret Sorrow," "The Wretched," "The Impenitent Thief" and "John the Baptist." Later she turned to the delineation of Afro-American types with her series of 14 groups representing the history and progress of the Negro, for the Jamestown Exposition (1907) and her "Ethiopia Unbound," executed for the New York Emancipation Semi-

Centennial (1913). Later still she turned to portrait sculpture and to abstract symbolic groups. In similar vein but with slightly more attention to racial types, May Howard Jackson (1878–1931) did meritorious work in sculpture. Though occasionally racial in theme and feeling, the work of the foregoing artists has been traditional in ambition, sympathy, and technique, and their success has come to them primarily as artists.

Since 1920 the younger Negro artists have broken largely with academic tradition and style, and there has emerged, along with considerable modernism, a school of Negro art more distinctive and original and devoted more consciously to racial portrayal and expression. This activity has focused mainly in a New York or Harlem group, including M. Gray Johnson (1896–1934), Palmer Hayden (landscapist), Aaron Douglas (1898– ) figure painter and illustrator, Albert Smith (1896–1939), William H. Johnson (1902– ), Lesesne Wells (1902– ), Augusta Savage (1900– ) sculptor, Richmond Barthé (1901– ) sculptor; and in a Chicago group, including Archibald J. Motley (1891– ), Hale Woodruff (1900– ), Charles Seebree; and in the West, Sargent Johnson (1888– ) sculptor. Modernist trends, together with liberal participation in the Federal art projects, have since 1935 integrated the Negro artist more closely with contemporary American art.

One trend has been toward using African motifs and symbolization of the African and West Indian backgrounds, another toward abstraction and modernistic primitivism, and later, realistic genre of the urban scene and a use of Negro life as art of social interpretation and social protest.

BIBLIOGRAPHY.—W. E. B. DuBois, *The Gift of Black Folk* (1924); Alain Locke, *The New Negro* (1925), *Negro Art: Past and Present* (1936); Benjamin Brawley, *The Negro Genius* (1937); P. Guillaume and T. Munro, *Primitive Negro Sculpture* (1926); A. Locke, "African Art," in *The Arts* (March 1928), *American Magazine of Art*, (Sept. 1931 and May 1935). (A. LeR. L.)

## NEGRO DRAMA

Negro drama in the United States represents the same tendency toward the development of race or group drama as is to be found among other cultural minorities. It exemplifies the development of a group consciousness and the consequent urge for artistic expression of a people possessing a common tradition and race experience. Negro drama is likewise a recognized phase of American drama.

In the period previous to the Civil War the Negro appeared as a minor character in L. Beach's *Post Free* (1807) and in Anna Cora Mowatt's *Fashion* (1845). In the '40s the minstrel show was making its appearance. Charles Callender, Lew Dockstader and Primrose and West, in turn presented caricatures of the Negro that have persisted in the American theatre. Following the Civil War the novel by Harriet Beecher Stowe, *Uncle Tom's Cabin*, was dramatized and produced throughout the North, soon to be followed by another drama of the same type, *The Octoroon*, by Dion Boucicault. These plays accustomed the public to Negro drama designed to appeal to its sympathy rather than its ridicule. The minstrel characterization of the Negro continued until 1895, when John W. Isham organized a musical show, *The Octoroons*, the first of a long line of musical comedies which have opened the doors of opportunity to a group of notable Negro actors, including Williams and Walker, Cole and Johnson, S. H. Dudley, T. Leubie Hill, Ernest Hogan, Sissle and Blake, Miller and Lyles, Florence Mills and Adelaide Hall. These musical shows have contributed little to the direct stream of Negro drama, yet they have demonstrated the exceptional histrionic talents of the race. They may yet furnish the material for the evolution of new dramatic forms in the future. Witness the interesting experiment of Laurence Stallings and Frank Harland in the jazz opera *Deep River*, in *Show Boat*, and the folk-operas, *The Emperor Jones* and *Porgy and Bess*.

In 1910, Edward Sheldon's *The Nigger* was produced, and in 1913, the first important Negro pageant, *The Star of Ethiopia* written by W. E. B. DuBois, and in 1916, the first successful problem drama written by a Negro, *Rachel*, a three-act play by Angelina Grimke.

The first important step in the development of an authentic Negro drama was taken on April 5, 1917, when Mrs. Norman Hapgood, in association with Robert Edmond Jones, presented a group of Negro actors in three one-act plays written for the Negro theatre by the American poet, Ridgely Torrence.

In the years immediately after the World War Negro drama suddenly assumed a place of major importance in American drama. The production of Eugene O'Neill's, *The Emperor Jones* (1919), proved a landmark. Charles Gilpin, a Negro, who played the title rôle, was selected by the New York Drama League as one of the ten persons who had contributed the most to the American theatre during that year.

The Ethiopian Art theatre was organized by Raymond O'Neill in co-operation with Mrs. Sherwood Anderson, in Chicago in 1923. Its main contribution to Negro drama was the presentation of a one-act folk play, *The Chip Woman's Fortune*, written by a Negro playwright, Willis Richardson, who has contributed a number of meritorious one-act plays to Negro drama.

Supplementing these Little Theatre groups, a definite movement for the establishment of an experimental laboratory of Negro drama and for the development of a national Negro theatre was instituted in 1920 at Howard university, in Washington. The organizer of this undertaking was Montgomery Gregory, who was assisted by Alain Locke, Marie Moore Forrest, Cleon Throckmorton and the university authorities. Their leading idea was that the medium of dramatic expression offered the Negro race one of its best means both of developing its own traditions and of making a substantial contribution to American culture. The Howard Players successfully produced several one-act plays written by members of the group. Hampton, Tuskegee, Atlanta university and the Gilpin Players, Cleveland, have done effective work in educational and experimental race drama.

The Carolina Playmakers of the University of North Carolina, under Frederick Koch, have made notable contributions to Negro drama. Prof. Paul Green of this university ranks with Eugene O'Neill as the leading dramatist of Negro life. *White Dresses, Granny Boling, The No 'Count Boy* and the Pulitzer prize play, *In Abraham's Bosom*, are among his successful dramas. The awakened national interest in Negro drama chiefly occasioned by the production of *The Emperor Jones* has resulted in a succession of plays of Negro life on the New York stage. Some of these plays were: *Goat Alley* by E. Howard Culbertson, *Roseanne* by N. Stephens, *Taboo*, by Mary Hoyt Wiborg, *All God's Chillun Got Wings*, by Eugene O'Neill, *Porgy*, by Du Bose Heyward, *The Green Pastures* by Roark Bradford and Marc Connelly, *Run, Little Children* by Hall Johnson, *Stevedore* by Paul Peters and George Sklar, *Mulatto* by Langston Hughes, *Mamba's Daughters* by Du Bose Heyward. These successes have brought forward the stellar Negro acting talents of Richard B. Harrison, Paul Robeson, Rose McClendon, Abbie Mitchell, Rex Ingraham and others.

BIBLIOGRAPHY.—M. Gregory and A. Locke, *Plays of Negro Life* (1927); A. Locke, "The Negro in the American Theatre" in *Theatre Arts Monthly* (1927) and in *Essays on the Art of the Theatre* (1927); B. Brawley, *The Negro Genius* (1937); J. Weldon Johnson, *Black Manhattan* (1930); Sterling Brown, *Negro Poetry and Drama* (1937). (X.)

## NEGRO MUSIC

Early American Negro music consists almost entirely of folk-music, the proportion written by individual composers being comparatively small. This music is of many kinds but it may be divided into two general classifications, sacred and secular. The sacred music consists of the well known spirituals, while the secular is work, play and love songs, the blues and dance music—ragtime and jazz. The great bulk consists of songs; ragtime and jazz, however, are instrumental as well as vocal.

The spirituals rank first in value and beauty. They, indeed, constitute one of the finest bodies of folk songs in the world. Just how far back the making of spirituals by the Negro in America goes cannot be exactly determined, but it is safe to say more than 150 years, since he began creating these songs shortly after his adoption of Christianity, along with the establishment of his own separate places of worship.

The spirituals are primarily a fusion of African music and Christian sentiments. They possess the fundamental characteristics of African music, its strong rhythmic quality, and show a marked similarity to African songs in verse forms and intervalic structure. However, the spirituals, upon the base of the primitive rhythms, rise a step beyond African music through a higher melodic and an added harmonic development. The spirituals remain distinctive Negro folk-songs.

The texts of the spirituals are based almost exclusively upon the Bible. The stories in the Bible gave the Negro bards great scope for the play of their imagination and are often told dramatically and in vivid and gorgeously coloured pictures.

It is probable that many of these songs are irretrievably lost, for no systematic effort to record them was made before the Civil War. They were first introduced to the public of America and Europe in 1871 by the Fisk Jubilee singers. They have recently been given a new vogue on the concert stage by Harry T. Burleigh, Roland Hayes, Paul Robeson, J. Rosamond Johnson, Taylor Gordon, Marian Anderson, and other famous Negro singers.

Negro secular music, unlike the spirituals, has gone through many changes and developments. Most of the various styles of Negro secular music have successively been taken over, adapted and made national. And so it appears that as one style of the Negro's secular music became lost to him he set about creating another. Before and for a while after the Civil War the Negro made many plantation songs both of the ballad and the patter type. The plantation songs

became the mainstay of the black-face minstrel stage; they were adapted and imitated and remained popular for several decades.

In the last decade of the past century ragtime, a highly syncopated form of music, came into notice. It is fundamentally an instrumental form, and was the result of experiments by Negro players on the piano—then a new instrument to them. Words were adapted to these syncopated rhythms and gave birth to the ragtime song, which achieved great popularity in the first decade or so of the present century. The Negro dialect text of the ragtime song was ultimately discarded for straight English, and this form of Negro music took on a national character, and so remains.

About 1910 a distinctly new type, the blues, was invented in the South and rapidly spread over the country. They are as truly folk-songs as the Spirituals; basic differences being that they are an expression of the individual and not of the group, and that they follow a rigid verse form and are less varied and rich than the Spirituals. This "blue" note has become one of the main elements of American popular music and has been experimented with by serious composers. (*See* BLUES.) Jazz (*q.v.*) is somewhat a combination and culmination of ragtime and the blues.

Another class of Negro folk-songs are the work-songs. These, originated by gangs of men at work, call for rhythmic motions performed in unison; the picks or the hammers rising, falling and resting in perfect rhythm with the music.

Outstanding among early Negro composers of note was James Bland (1851–1911), who wrote *Carry Me Back to Old Virginia* and *In the Evening by The Moonlight,* songs which have attained a semi-classic niche. Later Negro composers of note have achieved distinction in the fields of symphonic and chamber music, opera, and oratorio; among them: Will Marion Cook, Harry T. Burleigh, J. Rosamond Johnson, R. Nathaniel Dett, Clarence Cameron White, William L. Dawson, Florence B. Price, and William Grant Still.

BIBLIOGRAPHY.—H. E. Krehbiel, *Afro-American Folksongs* (1914); J. W. Work, *Folk Song of the American Negro* (Nashville, 1915); N. Curtis-Burlin, *Negro Folk-Songs* (Hampton Series, 1918–19); J. W. Johnson and J. Johnson, *The Book of American Negro Spirituals* (1925) and *The Second Book of American Negro Spirituals* (1926); N. G. J. Ballanta, *Saint Helena Island Spirituals;* W. A. Fisher, *Seventy Negro Spirituals* (Boston, 1926); W. C. Handy and A. Niles, *Blues* (1926); H. W. Odum and G. B. Johnson, *The Negro and His Songs* (Chapel Hill, 1925) and *Negro Workaday Songs* (Chapel Hill, 1926); M. Cuney Hare, *Negro Musicians and Their Music* (1936); Alain Locke, *The Negro and His Music* (1936).

*See* BLUES and JAZZ, also COLERIDGE-TAYLOR, SAMUEL.

## NEGRO POETRY

As early as the year 1760 Jupiter Hammon, a slave belonging to a Mr. Lloyd of Queens village, Long Island, N.Y., published a poem 88 lines in length, entitled *An Evening Thought, Salvation by Christ, with Penitential Cries.* Hammon published several other poems, all of them religious. However, it is with Phillis Wheatley (*c.* 1753–84), a young slave, that American Negro poetry properly begins.

Between Phillis Wheatley and Paul Laurence Dunbar there were about 30 Negroes who published poetry, the publications ranging in size from pamphlets to books of from 100 to 300 pages. These writers must be considered more in the light of what they attempted than of what they accomplished. A number of them showed marked talent and feeling, but barely a half-dozen demonstrated more than mediocre mastery of technique. Such were George Horton (1797–1880), Frances E. Harper (1825–1911), Charles Reason (1818–98), James Madison Bell (1826–1902) and Albery Whitman (1851–1901).

Paul Laurence Dunbar (1872–1906) (*q.v.*) was the first American Negro poet to show real poetic talent. Contemporary Negro poets were: James Edwin Campbell, Daniel Webster Davis, George M. McClellan, J. Mord Allen, James D. Corrothers (1869–1917), William H. A. Moore and Joseph S. Cotter, Sr.

The decade after the death of Dunbar was fallow, but William Stanley Braithwaite (b. 1878) achieved recognition as a poet, critic and anthologist. His work, however, is not in subject-matter or form related to race. In general, his poems are mystic in tone.

Immediately after the entry of the United States into the World War (1917) there emerged a group of poets who almost completely discarded dialect and the traditional material of Negro poetry, including pathos and humour. The distinguishing notes of their poetry were disillusionment, protest and challenge. In this group were Claude McKay, Fenton Johnson, Joseph Cotter, Jr., Georgia Douglas Johnson, Roscoe Jamison, Lucien Watkins and James Weldon Johnson (1871–1938). This period of protest found its most powerful voice in Claude McKay (1890– ).

A half-dozen years after the beginning of the period of protest, American Negro poetry began discarding propaganda for propaganda's sake, and essayed a more purely artistic use of racial art material and cultural background. Two new poets arose in this latest period. They were Countee Cullen (1903–1946) and Langston Hughes (b. 1902). Cullen was a poet of lyrical power and beauty. He wrote only in the well approved forms of literary English, but many of his best poems contain a racial note of deep poignancy. In 1925 he published his first volume, *Color;* this was followed in 1927 by *The Ballad of the Brown Girl* and *Copper Sun.* Hughes is more the folk poet in the selection of subject-matter and forms. Much of his material is taken from the humbler strata of life, and he has made effective use of the form of the Blues (see *Music,* p. 219). He is the author of *The Weary Blues* (1926) and *Fine Clothes to the Jew* (1927). In this period James Weldon Johnson published *God's Trombones—Seven Negro Sermons in Verse* (1927), founded on the oldtime Negro plantation sermons. The newer Negro poets writing distinctive verse are: Jean Toomer (1894– ), Anne Spencer, Arna Bontemps, Angelina Grimke (1880– ), Lewis Alexander, Jessie Fauset, Sterling Brown, Waring Cuney, and Frank M. Davis.

BIBLIOGRAPHY.—A. A. Schomberg, *A Bibliographical Checklist of American Negro Poetry* (1916); J. W. Johnson, *The Book of American Negro Poetry* (1931); T. W. Talley, *Negro Folk Rhymes* (1922); R. T. Kerlin, *Negro Poets and Their Poems* (1923); N. I. White and W. C. Jackson, *An Autobiography of Verse by American Negroes* (Durham, 1924); C. Cullen, *Caroling Dusk* (1927); B. Brawley, *The Negro Genius* (1937); Sterling Brown, *Negro Poetry and Drama* (1937).

(J. W. J.; A. LER. L.)

## NEGRO FOLKLORE

The folk-lore of the Negro of the United States, for all its surface appearance of naïve simplicity, is a complex thing. Its origins are mixed, and often lost in obscurity. Some elements are clearly African in their beginnings, while others are as definitely related to the lore of the whites. The "big house" of colonial days, as well as the jungle of Africa has had its share in shaping Negro folk-lore. The transplanted race cherishes the superstitions, the ballads, the stories of both the new home and the old, and what it borrows makes its own as distinctly as what it originated.

There is a rich body of folk-tales current among the American Negroes, some of which have been preserved in print, and many of which are transmitted orally by the firesides and door-steps of the south. A still greater mass, no doubt, has been lost for lack of chroniclers and tellers. The best-known body of their published folk-tales is that collected by Joel Chandler Harris—made familiar by the name of Uncle Remus.

In his songs and stories the Negro shows his fondness for animals, his admiration for their craft, his interest in their prowess. He endows them with human attributes of thought and speech, and gives them greater cunning than natural history would authorize, often similar to the fable-forms of African sagas.

The Negro shows great variety in his songs, contrary to the popular conception that he sings only spirituals. The spirituals, which are melodious and haunting in their tunes, and which express humility and sweetness of spirit, owe something at least to the hymns and religious songs heard on the southern plantation. There are various groups of secular songs. There are numerous work songs, for the Negro, a truly rhythmic person, works better and faster when he sings at his task.

The American Negro has had his part in transmitting the traditional songs and ballads of England and Scotland, and has made them his own. There are many ballads that the Negro has made for himself, owing nothing to the whites. There are lullabies, old dance songs or "reels," children's game songs, counting songs, songs of love, of war and of other themes.

There is a mass of folk-beliefs, of superstitions, current among the southern Negroes, belief in ghosts, in witches, in the power of "voo-doo" and so forth. In fact, the Negro folk-lore constitutes the largest and most varied body of lore to be found in America to-day.

(D. Sc.)

BIBLIOGRAPHY.—Thos. Talley, *Negro Folk Rhymes* (1922); Dorothy Scarborough, *On the Trail of Negro Folk Songs* (1928); John A. and Alan Lomax, *Negro Folk Songs as Sung by Lead Belly* (1936); *Zora Hurston* (1935).

## HARLEM

Harlem was originally a village on Manhattan island, now the local name for that part of the borough of Manhattan, New York city, beginning at 106th street and extending north between the East and Harlem rivers and Eighth avenue. Its settlement, on the site of what is now Mount Morris park, dates from 1636. In 1658 Peter Stuyvesant named the village New Haarlem, after Haarlem, the town in Holland from which many of its inhabitants came. The old village is charmingly described by Washington Irving in his *Knickerbocker's History of New York.* Harlem retained its quiet aspect, surrounded by farms, until 1836, when daily communication by horse railroad was established with New York. Thereafter, by degrees, the village became a populous suburb and was finally transformed into a densely built residential section of the metropolis. The name now refers more specifically to the district north of 116th street, which since 1920 has become the most populous urban Negro community in the world.

**The Negro Metropolis.**—During the World War about 500,000 Negroes, taking advantage of the restrictions placed upon European immigration, and lured by war-time wages, turned from agricultural pursuits in the South to the highly specialized industries of the North. In New York city the migrants, uniting their fortunes with a stream of 60,000 Negroes coming from Central America and the West Indies, swept uptown and formed above 125th street a fabulous Negro city of 250,000 souls. This district does not constitute, however, the only

point of Negro mass contact on Manhattan Island. On the crest of "San Juan Hill" is a colony of 5,000 to 6,000 Negroes which in point of density and hardihood easily outstrips Harlem. Within the shadow of the old Fifty-third street elevated are remnants of a Negro settlement which antedates by at least a quarter of a century the glamorous "Mecca of the New Negro." But the concentration of the Negro population in Harlem has dwarfed the various settlements of the race in other parts of New York city. In the evolution of Negro communities in the north the dominating motive has always seemed to be economic, until Harlem arose as an exception with a mixed metropolitan population of professional, mercantile, semi-industrial and working class elements.

**Economic Status.**—In Harlem, unlike other Negro urban communities, there are few banks, insurance companies or large realty firms under Negro management. There is little outlet for the young Negro trained in business or finance. The highly-organized and competitive character of metropolitan business is largely responsible, but it is also true that the Harlem district has been slow in awakening to the necessity of the co-operative spirit in business. Lately, particularly since the Harlem riots of 1935, labour organization, mass pressure for increased employment, and participation in civic improvements have shown marked increase, due in part to an increase in group solidarity and in part to the added pressure of the economic depression. Harlem is still as a community, however, precariously unbalanced economically, between a top-heavy professional class and the underpaid and economically exploited masses there is very little middle-class buttressing. The majority of business enterprises in Harlem are not owned or operated by Negroes.

**Cultural Ascendancy.**—In spite of this curious showing, Harlem's ascendancy over the rest of the Negro communities of the country is a striking and vital one. Harlem is, to begin with, the goal of the Negro artist, poet, painter, musician or writer. Because Harlem is a part of New York it has done most to focus attention on the creative gifts of the American Negro. Likewise, because of the welter of native Negro races simmering in its orbit, it is a sort of market place for all sorts of ideas concerning Negro life, and the history and the future of the race.

BIBLIOGRAPHY.—For historical data *see* Washington Irving, *Knickerbocker's History of New York* (1809); J. G. Wilson, *Memorial History of the City of New York* (1892–93); C. H. Pierce, *New Harlem, Past and Present* (1903); James Riker, *Revised History of Harlem* (1904); James Weldon Johnson, *Black Manhattan* (1930); New York Federal Writers Project, chapters on Harlem in *New York Panorama* (1938). (A. LER. L.)

**NEHEMIAH,** governor of Judaea under Artaxerxes (generally thought to be the first, but more probably the second, of that name, 404–359 B.C.). The book of Nehemiah forms the concluding portion of the great compilation, Chronicles–Ezra–Nehemiah. Nehemiah's own account, written throughout in the first person, and confined to chapters i–vi, is the only authentic information which we possess in regard to his life and work. (*See* further EZRA AND NEHEMIAH, BOOKS OF; JEWS.)

**NEHRU, JAWAHARLAL** (1889– ), an Indian national leader. Born Nov. 14 in Allahabad, a son of a rich lawyer of Kashmir descent. He went in 1905 to England where he studied in Harrow and Cambridge. He became thoroughly at home in English and European civilization, writing an English style of great distinction, and conversant with the literature and history of most leading European countries. In 1912 he was called to the bar and returned to India where he joined the Indian National congress and became active in Indian politics. Soon he was prominent as a follower of Gandhi and was for the first time arrested and sentenced to imprisonment in 1921. The vicissitudes of the Indian national struggle have brought him since several times into jail, for as a result of his brilliant education and his exemplary devotion to the cause he became second in rank to Gandhi himself. He was elected for the first time in 1929 president of the Indian National congress, an office he occupied three times. Though he remained always loyal to Gandhi, he did not share the latter's traditionalist, conservative and pacifist views. His outlook was world wide and cosmopolitan, he is a socialist, outspokenly anti-fascist, and from the beginning opposed the policy of appeasement of German or Japanese fascism. He has been deeply interested in agrarian reforms and in the improvement of the living conditions of the Indian masses. He found an enthusiastic following in the Indian youth and has visited Europe, the soviet union and China several times. He wrote an autobiography which was published in England in 1936 and which became there a best-seller. An American edition appeared in 1941 under the title *Toward Freedom.* While in jail he wrote letters to his daughter published later as *Glimpses of World History* (Eng. ed. 1934, Am. ed. 1942). His addresses and articles were collected as *The Unity of India.* (H. Ko.)

**NEHRU, PANDIT MOTILAL** (1861–1931), Swarajist leader, a Kashmiri Brahman, was born on May 6, 1861. At the Allahabad bar he came to the front, earning a large income, and exercising hospitality and friendly intimacy with European society. He was for some years a member of the United Provinces legislative council. After World War I, through repression of disorder in the Punjab in 1919, his views changed. In 1919 he founded the *Independent,* an aggressively Nationalist paper, and accepted the presidentship of what was now the extremist Indian national congress. His support of Gandhi's campaign of non-co-operation took the form of suspension of his lucrative practice at the bar and the abandonment of luxurious western habits. At the close of 1921 he was imprisoned for six months for breaking the law against seditious assemblies. He so far modified his non-co-operation attitude as to accept election to the second legislative assembly at the close of 1923, and took his place there as leader of the Swaraj party. On the death of C. R. Das in 1925 he was elected president of the all-India Swaraj party, and under his guidance it was fused in the following year into the National Congress party. This organization promoted a boycott of the Simon commission and led in formulating under his chairmanship the All Parties Conference Report, or Nehru Report. It lays down a scheme of dominion status for India. (F. H. BR.)

**NEILL, JAMES GEORGE SMITH** (1810–1857), British soldier, was born near Ayr, Scotland, on May 26, 1810, and educated at Glasgow university. Entering the service of the East India company in 1827, he received his lieutenant's commission a year later. When the Indian Mutiny broke out Neill, who was in command of the 1st Madras Europeans, left Madras with his regiment at a moment's notice, and proceeded to Benares. The day after his arrival he completely and ruthlessly crushed the mutineers (June 4, 1857). He next relieved Allahabad, which became the place of concentration for Havelock's column. The two officers, through a misunderstanding in their respective instructions, disagreed, and when Havelock went on from Cawnpore (which Neill had reoccupied shortly before) he left his subordinate there to command the lines of communication.

The famous march from Cawnpore to Lucknow began on September 19; on the 21st there was a sharp fight, on the 22nd incessant rain, on the 23rd intense heat. On the 23rd the fighting opened with the assault on the Alum Bagh, Neill at the head of the leading brigade recklessly exposing himself. Next day he was again heavily engaged, and on the 25th he led the great attack on Lucknow itself. The fury of his assault carried everything before it, and his men were entering the city when a bullet killed him.

*See* J. W. Kaye, *Lives of Indian Officers* (1889); and J. C. Marshman, *Life of Havelock* (1867).

**NEISSE,** a town in the province of Prussian Silesia, Germany, at the junction of the Neisse and the Biela, 32 mi. by rail S.W. of Oppeln. Pop. (1939) 37,893. Neisse, one of the oldest towns in Silesia, is said to have been founded in the 10th century, and afterward became the capital of a principality of its own name, which was incorporated with the bishopric of Breslau about 1200. Its first walls were erected in 1350, and it was thrice besieged during the Thirty Years' War. The end of the first Silesian War left Neisse in the hands of Frederick the Great. The Roman Catholic parish church of St. James (Jakobikirche) dates mainly from the 13th century, but was finished in 1430. The chief secular buildings are the old episcopal residence, the old Rathaus (1499) and the beautiful Renaissance *Kämmerei* (exchequer) with a high gabled roof ornamented with frescoes.

**NEISSE,** three rivers of Germany. (1) The Glatzer Neisse, 121 mi. long, rises on the Schneeberg, at an altitude of 1,400 ft., flows north past Glatz, turns east and pierces the Eulengebirge in the Wartha pass, then continues eastward past Neisse until it joins the Oder (left) between Oppeln and Brieg. It is navigable to any appreciable extent only in the lowest 11 kilometres. (2) The Lausitzer or Görlitzer Neisse, 140 mi. long, rises near Reichenberg in Bohemia, on the south side of the Riesengebirge, flows north past Reichenberg, Görlitz, Forst and Güben, and enters the Oder above Fürstenberg. Less than 40 mi. are navigable. (3) The Wütende Neisse is a tributary of the Katzbach.

**NEJD,** a country of Arabia, occupying the core of that ancient land-block. The old block has been uptilted on the west, consequently Nejd tends to slope very gradually from west to east. The name itself implies an upland, and this is its distinc-

tive character as compared with the adjoining coastal districts of Hejaz and al-Hasa, representing the shelving down of the plateau on the west and east respectively.

In general elevation Nejd varies from 5,000 ft. on its western border to 2,500 in Qasim in the northeast, and somewhat less in the southeast. In the north Jabal Shammar, and in the east J. Tuwaiq and J. 'Aridh rise about 1,500 ft. above the general level, but, on the whole, Nejd may be described as an open steppe, of which the western and southern portion is desert, or at best pasture land only capable of supporting a nomad population; while in the north and east, owing to greater abundance of water, numerous fertile oases are found with a large settled population. (*See* ARABIA.)

Nomadic tribes, following their flocks and herds over the steppe, have roamed over the territory from time immemorial, raiding the settled dwellers of the oasis in times of difficulty or scarcity. The four most prominent tribes of Bedouin are the Shammar, Harb, 'Utaiba and Mutair. The first-named represent that part of the great Shammar tribe which has remained in its ancestral home on the southern edge of the Nufud (the northern branch long ago emigrated to Mesopotamia); many of its members have settled down to town life, but the tribe still retains its Bedouin character. The Harb are probably the largest of the Bedouin tribes in the peninsula, and are divided into a number of sections. Their territory is the steppe between Qasim and Medina. The 'Utaiba territory extends from near Mecca along the road leading thence to Qasim. The Mutair occupy the desert from Qasim northward toward Kuwait.

Nejd became nominally a dependency of the Turkish empire in 1871, when Midhat Pasha established a small garrison in al-Hasa, and created a new civil district under the government of Basra, under the title of Nejd, with headquarters at Hufuf. Its real independence was not, however, affected, and the emirs, Mohammed Ibn-Rashid, at Ha'il, and 'Abdallah Ibn-Sa'ud, at Riyadh, ruled in western and eastern Nejd respectively, until 1892, when the former, by his victory at 'Unaiza, became amir of all Nejd. His successor, 'Abd-al-'Aziz Ibn-Rashid, was, however, unable to maintain his position, and in spite of Turkish support, sustained a severe defeat in 1905 at the hands of Ibn-Sa'ud, who thus became the dominant power in Nejd. By 1914 Ibn-Sa'ud, with his Wahhabi followers had wrested the province of Hasa from the Turks, and his power thus reached the Persian gulf. Remaining inactive during World War I, Ibn-Sa'ud in 1920 had captured and annexed Abha and other parts of 'Asir, leaving only the coastal strip. In 1921, Ha'il and the dominion of the amir of Jabal Shammar were in his possession, and by the end of 1925 he had overthrown the new Hashimite kingdom of the Hejaz. He was proclaimed at Jidda, in 1926, as king of Hejaz and sultan of Nejd. From Riyadh, Ibn-Sa'ud ruled over the new kingdom called, after 1932, Saudi Arabia, comprising Hejaz, 'Asir, Nejd and al-Hasa.

His administration is patriarchal and his law the *sharī'a,* administered by Wahhabi officials. A few simple taxes on cattle and possessions are collected. The chief administrative regions of the sultanate are Hasa; 'Aridh, with the town of Riyadh; Wadi Dawasir; Aflaj; Kharj; Sudair; Mahmal; Washm; Qasim; Jabal Shammar, with the town of Ha'il; Jauf; and numerous scattered oasis-groups, each ruled by an amir.

Of the towns, Hufuf and Riyadh have a population of about 30,000 each; Ha'il, Hauta, 'Unaiza, Buraida, Jauf, Mubarraz, Shaqra and Sakaka have populations between 10,000 and 20,000. The entire population of Nejd is estimated at 2,320,000. Besides the population of the towns mentioned above, and the nomadic tribes, there are many villages in hollows of the valleys of the tableland, wherein is concentrated the fertility and much of the population of Nejd. Gardens, houses, cultivation and villages lie hidden from view among the depths while one journeys over the dry flats, till one comes suddenly on a mass of emerald green beneath.

The products of Nejd include dates, wheat, barley, hides, wool, fruit, *samn* (clarified butter), camels, sheep, horses, etc. The export of camels to Syria and Egypt has been much reduced. Tea, coffee, sugar, rice, motor vehicles and piece-goods are imported.

BIBLIOGRAPHY.—Lady Anne Blunt, *Pilgrimage to Nejd* (London, 1881); C. M. Doughty, *Arabia Deserta;* J. Euting, *Reise in inner Arabien* (Leyden, 1896); Alois Musil, *Northern Neǧd* (1928); H. St. J. B. Philby, *The Heart of Arabia* (2 vols., 1922); *Arabia of the Wahhabis* (London, 1928).

**NEKRASOV** or **NEKRASSOV, NIKOLAI ALEXEYEVICH** (1821–1877), Russian poet, was born on Nov. 22 (O.S.) 1821, in Podolia, the son of a landowner in the government of Yaroslávl, where the boy was brought up. He studied at St. Petersburg, against the will of his father, who left him to his own resources. At the age of 19 he published a small volume of poems (*Dreams and Sounds*), most of which had appeared in periodicals, and in 1846 he bought from Pletnev the *Sovremennik,* which in his hands became from 1856 onwards the favourite organ of young radical writers. It was suppressed in 1866, but in 1868 Nekrasov acquired, with Saltykov, the *Otechestvennye Zapiski,* in which the traditions of the *Sovremennik* were maintained. He died at St. Petersburg on Dec. 27 (O.S.) 1877.

Nekrasov was a people's poet, and expressed the sorrows and sufferings of the common people in poems which made him the idol of the reformers, and the joy and humour of everyday life in admirable adaptations of folksong, and in charming poems for children. Among the most famous of his works are *The Red-Nosed Frost* (1863), depicting a heroic peasant woman, and the great satirical work *"Who can be happy and free in Russia?"* (1879, Eng. trans. J. M. Soskice, 1901.) The latter is a species of *Canterbury Tales,* though with a definite purpose running through the series. Seven peasants make their way on foot throughout Russia to solve the question of who is happy. They are told a series of tales, by typical characters, landowners, priests, peasants and others, and Nekrasov concludes on a note of hope for the future. This last canto, owing to the censorship, did not appear until 1881. His work includes love poems, elegies and narrative poems. The most recent edition of his poems was published in 2 vols. in 1919, and they have been translated into German by H. J. Köcher (2 vols. Leipzig, 1885–88). English translations of some of his poems, including *The Red-Nosed Frost,* are to be found in C. T. Wilson's *Russian Lyrics* (1887); and J. Pollen, *Rhymes from the Russian* (1891). *See* also a French translation of some of his poems *Poésies populaires,* by E. Halperine-Kaminsky and C. Morice, with a preface by E. M. Vogüé.

**NEKTON,** the name applied collectively to the larger, actively swimming animals of the open sea (mainly fishes), in contradistinction to the passively drifting plankton (*q.v.*), and the sedentary, bottom-living benthos (*q.v.*). (*See* MARINE BIOLOGY.)

**NELEUS,** in Greek legend, son of Poseidon and Tyro, brother of Pelias. The two children were exposed by their mother, who afterwards married Cretheus, king of Iolcus in Thessaly. After the death of Cretheus, the boys, who had been brought up by herdsmen, quarrelled for the possession of Iolcus. Pelias expelled Neleus, who migrated to Messenia, where he became king of Pylos (Apollodorus i, 9; Diod. Sic. iv, 68) and ancestor of the Neleidae, who are historically traceable as the old ruling family in some of the Ionic states in Asia Minor, after the Dorian migration. By Chloris, daughter of Amphion, Neleus was the father of 12 sons (of whom Nestor was the most famous) and a daughter Pero; *cf.* MELAMPUS. According to Pausanias (ii, 2. 2, v. 8. 2) Neleus restored the Olympian games and died at Corinth, where he was buried on the isthmus.

**NELLORE,** a town and district of India, in the Madras presidency. The town is on the right bank of the Penner river, and has a station on the East Coast railway, 109 mi. N. of Madras city. Pop. (1941) 56,315. There are Lutheran, American Baptist and Roman Catholic missions, and a college.

The DISTRICT OF NELLORE has an area of 7,942 sq.mi. It comprises a tract of low-lying land extending from the base of the Eastern Ghats to the sea. Its general aspect is forbidding: the coast line is a fringe of blown sand through which the waves occasionally break. Farther inland the country begins to rise, but the soil is not naturally fertile, nor are means of irrigation readily at hand. About one-half of the total area is cultivated; the rest is either rocky waste or is covered with low scrub jungle. Nellore, with the other districts of the Carnatic, passed under

direct British administration in 1801. The population in 1941 was 1,617,026. The principal crops are millets, rice, and pulses. The breed of cattle is celebrated. The East Coast railway runs through the length of the district.

**NELSON, HORATIO NELSON,** VISCOUNT (1758–1805), duke of Bronte in Sicily, British naval hero, was born at the parsonage house of Burnham Thorpe, in Norfolk, on Sept. 29, 1758. His father, Edmund Nelson, was rector of the parish and his mother, Catherine Suckling, was a grandniece of Sir Robert Walpole (1st earl of Orford). This connection proved useless to the future admiral, who, in a letter to his brother, the Rev. William Nelson, written in 1784, speaks of the Walpoles as "the merest set of cyphers that ever existed—in public affairs I mean." His uncle, Captain Maurice Suckling later became comptroller of the navy.

**Early Life.**—Horatio, who had received a summary, and broken, education at Norwich, Downham and North Walsham, was entered on the "Raisonnable" when Captain Suckling was appointed to her in 1770 on an alarm of war with Spain. The dispute was settled, and Captain Suckling was transferred to the "Triumph," the guardship at Chatham, whither he took his nephew. In order that the lad might have more practice than could be obtained in a harbour ship, his uncle sent him to the West Indies in a merchant vessel, and on his return gave him constant employment in boat work on the river. In a brief sketch of his life, which he drew up in 1799, Nelson says that in this way he became a good pilot for small vessels "from Chatham to the Tower of London, down the Swin, and the North Foreland; and confident of myself among rocks and sands, which has many times since been of great comfort to me." Between April and October of 1772 he served with Captain Lutwidge in the "Carcass," in an expedition to the Arctic seas under the command of Captain Phipps (Baron Mulgrave). On his return from the north he was sent to the East Indies in the "Seahorse," in which vessel he met his lifelong friend Thomas Troubridge. At the end of two years he was invalided home. In after times he spoke of the depression under which he laboured during the return voyage, till "after a long and gloomy reverie, in which I almost wished myself overboard, a sudden glow of patriotism was kindled within me, and presented my king and my country as my patron. My mind exulted in the idea. 'Well then,' I exclaimed, 'I will be a hero, and, confiding in Providence, I will brave every danger.'" He spoke to friends of the "radiant orb" which from that hour hung ever before him, and "urged him onward to renown." On his return home he served during a short cruise in the "Worcester" frigate, passed his examination as lieutenant on April 9, 1777, and was confirmed in the rank next day. He went to the West Indies with Captain Locker in the "Lowestoft" frigate, was transferred to the flagship of Sir Peter Parker (1721–1811), and was then promoted in rapid succession to the command of the "Badger" brig, and the "Hinchinbrook" frigate. By this appointment, which he received in 1779, he was placed in the rank of post captain (from which promotion to flag rank was by seniority), at the age of twenty. In the main he owed his rapid rise to his power of winning the affection of his comrades or superiors. Parker and his wife remained his friends through life.

**Active Service.**—In 1780 he saw his first active service in an expedition to San Juan de Nicaragua; he was brought to death's door by fever, and invalided home once more. In 1781 he was appointed to the "Albemarle" frigate, and after some convoy service in the North Sea and the Sound was sent to Newfoundland and thence to the North American station. "Fair Canada," as he has recorded in one of his letters, gave him the good health he had so far never enjoyed. From Quebec he sailed for the West Indies where he made the personal acquaintance of Admiral Lord Hood. The admiral presented him to the duke of Clarence, afterwards King William IV., as an officer well qualified to instruct him in "naval tactics"—a marked compliment to a very young officer from one of the greatest exponents of the art. He appeared, says the Prince, "to be the merest boy of a captain I ever beheld; and his dress was worthy of attention. He had on a full-laced uniform; his lank unpowdered hair was tied in a stiff Hessian tail of an extraordinary length; the old-fashioned flaps of his waistcoat added to the general quaintness of his figure, and produced an appearance which particularly attracted my notice; for I had never seen anything like it before, nor could I imagine who he was or what he came about. My doubts were, however, removed when Lord Hood introduced me to him. There was something irresistibly pleasing in his address and conversation; and an enthusiasm, when speaking on professional subjects, that showed he was no common being." The slight oddity of appearance, the power to arouse affection, and the glow indicating the fire within, are noted by all who ever looked Nelson in the face.

The Peace of Versailles which closed the American War gave him leisure to visit France, there to study the language of his "country's enemies" and their writings on the subject of naval warfare. And now when the vast majority of naval officers were condemned to idleness on shore, he had the good fortune to be appointed to the command of the "Boreas" frigate, for service in the West Indies. Nelson signalized his arrival in the West Indies by refusing to acknowledge a half-pay officer acting as commissioner of the dockyard at Antigua as his superior. He insisted on enforcing the Navigation Laws against the Americans, who by becoming independent had become foreigners. He called the attention of the government to the corruption prevailing in the dockyard of Antigua. His line impressed the admiralty as somewhat assuming, and his strong measures against the interloping trade brought on him many lawsuits, which, though he was defended at the expense of the government, caused him much trouble for years. In the West Indies on March 12, 1787, he married Frances Nisbet (1761–1831), the widow of a doctor in Nevis, whose favour he first gained by being found romping on all fours with her little boy under the drawing-room table. The marriage was one of affection and prudence, rather than of love.

**Outbreak of War.**—When war broke out with revolutionary France, Nelson was appointed (Nov. 30, 1793) captain of the "Agamemnon" (64), and joined his ship on Feb. 7. From this date till June 1800, rather more than seven years, he was engaged on continual active service, with the exception of a few months when he was invalided home. This period is the most varied, the busiest, the most glorious and the most debated of a very full career. It subdivides naturally into three sections: (1) From the date of his appointment as captain of the "Agamemnon" till he was disabled by the loss of his arm in the unsuccessful attack on Santa Cruz de Tenerife on July 24, 1797, he served as captain, or commodore, under Hood, Hotham and Jervis, successive commanders-in-chief in the Mediterranean. (2) After an interval of nine months spent at home in recovering from his wound, and from the effects of a badly performed operation, he returned to the Mediterranean, and was at once sent in pursuit of the great French armament which sailed from Toulon under the command of Napoleon for the conquest of Egypt. His victory of the Nile (*q.v.*), on Aug. 1, 1798, placed him at once in the foremost rank among the warriors of a warlike time, and made him a national hero. (3) From his return to Naples after the battle of the Nile until his return to England in the summer of 1800, he was immersed in Mediterranean affairs which, owing to his own presence there, tended to centre round the shores of Naples and Sicily.

**The Mediterranean.**—The first of these three passages in his life is full of events which must, however, be told briefly. In May he sailed for the Mediterranean with Hood, and was engaged under his orders in the occupation of Toulon by the allied British and Spanish forces. In August 1793 he was despatched to Naples to convoy the troops which the Neapolitan government had undertaken to contribute towards the garrison of Toulon. It was on this occasion that he made the acquaintance of Emma Hamilton (*q.v.*), the wife of Sir William Hamilton, minister at the Court of Naples. References to Lady Hamilton begin to appear in his letters to his wife, but, as might be expected, they indicate little beyond respectful admiration, and he makes a good deal of her kindness to his stepson, Josiah Nisbet, whom he had taken to sea. After the allies had been driven from Toulon by

Napoleon, Nelson was employed throughout 1794 in the operations connected with the occupation of Corsica. In April and May he was engaged in the capture of Bastia, and June and July in the taking of Calvi. During the operations at Calvi, Nelson received a wound in his right eye which healed without leaving disfigurement, though the sight gradually faded. From the date of the occupation of Corsica till the island was evacuated (1794–96) he was incessantly active. He served under Hotham, who succeeded Hood in the command, and was engaged in the indecisive actions fought by him in the Gulf of Lyons in March and July 1795. The complacency of the new admiral fretted the eager spirit of Nelson, who declared that, for his part, he would never think that the British fleet had done very well if a single ship of the enemy got off while there was a possibility of taking her. Happily he was detached to the Riviera of Genoa, where, first as captain, and then as commodore, he had an opportunity to prove his qualities for independent command by harassing the communications of the French, and co-operating with the Austrians. In Sir John Jervis, who superseded Hotham, he found a leader after his own heart. When Spain, after first making peace with France at Basel, declared war on England, and the fleet under Jervis withdrew from the Mediterranean, Nelson was despatched to Elba on a hazardous mission to bring off the small garrison and the naval stores. He sailed in the "Minerve" frigate, having another with him. After a smart action with two Spanish frigates which he took off Carthagena on Dec. 20, and a narrow escape from a squadron of Spanish line of battle ships, he fulfilled his mission, and rejoined the flag of Jervis on the eve of the great battle (Feb. 14, 1797) off Cape St. Vincent. (*See* ST. VINCENT, BATTLE OF.) The judgment, independence and promptitude he showed in this famous engagement revealed him to the nation as one of the heroes of the navy. Nelson receiving the swords of the Spanish officers on the deck of the "San Josef" became at once a popular figure.

**Blockade of Cadiz.**—A few days after the victory he became rear-admiral by seniority, but continued with Jervis, who was made a peer under the title of Earl St. Vincent. Nelson's own services were recognized by the K.B. During the trying months in which discontent in the fleet was developing toward the mutinies at Spithead and the Nore, he remained with the flag, and in the blockade of Cadiz. In July 1797 he was sent to Santa Cruz de Tenerife and made a desperate attempt to capture the place. The enterprise was, in fact, rash in the last degree, for the soldiers from the garrisons of Elba and Corsica having gone home, no troops were available for the service, and a fortified town was to be taken by man-of-war boats alone. The Spaniards were on the alert, and the attack, made with the utmost daring on the night of July 24, was repulsed with heavy loss. Some of the boats missed the mole in the dark and were stove in by the surf, others which found the mole were shattered by the fire of the Spaniards. Nelson's right elbow was shot through, and he fell back into the boat from which he was directing the attack. The amputation of his arm was badly performed in the hurry and the dark. He was invalided home, and spent months of extreme pain in London and at Bath. On April 10, 1798, he came back to the fleet off Cadiz as rear-admiral, with his flag in the "Vanguard" (74).

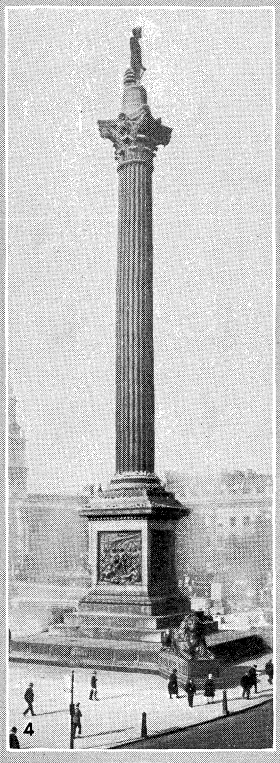
He was now one of the most distinguished officers in the navy. Within the next six months he was to raise himself far above the heads of all his contemporaries. A great armament was preparing at Toulon for some unknown destination. To discover its purpose, and to defeat it, the British government resolved to send their naval forces again into the Mediterranean, and Nelson was chosen for the command not only by Jervis, with whom the immediate decision lay, but also by ministers.

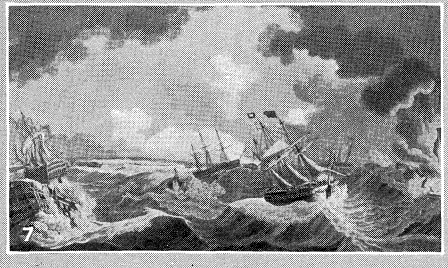
**Command in the Mediterranean.**—Having joined the flag of Lord St. Vincent outside of the straits of Gibraltar on April 30, Nelson was detached on May 2 into the Mediterranean, with three line-of-battle ships and five frigates, to discover the aim of the Toulon armament. Napoleon had, however, enforced rigid secrecy, and beyond the fact that a powerful combined force was collected in the French port he could learn nothing. On May 20 the "Vanguard" was dismasted in a gale. "I ought not," wrote Nelson, "to call what has happened by the cold name of accident; but I believe firmly that it was the Almighty's goodness to check my consummate vanity." The "Vanguard" was saved from going on shore by the skill of Captain Ball of the "Alexander," for whom Nelson had henceforth a peculiar regard. The "Vanguard" was refitted under cover of the little island of San Pietri off Sardinia. In the meantime the frigates attached to his command had returned to Gibraltar, in the erroneous belief that the liners would be taken there to make good the damage suffered in the gale. "I thought Hope would have known me better," said Nelson. On April 30 he was off Toulon again, only to find that the French were gone. Deprived of his best means of obtaining information by the disappearance of his frigates, he remained cruising till he was joined, on June 7, by Troubridge with ten sail of the line. And now he started on his fierce pursuit of the enemy, seeking him in the dark, for there were no scouts at hand; exasperated at being left without the eyes of his fleet; knowing that St. Vincent would be blamed for choosing so young an admiral; but resolved to follow the enemy to the antipodes if necessary. From Sardinia to Naples, from Naples to Messina, from Messina to Alexandria, from Alexandria, where he found the roadstead empty, back to Sicily, and then when at last a ray of light came to him, back to Alexandria—he swept the central and eastern Mediterranean. Unlike most admirals of his time, he freely discussed his plans with his captains. He had his reward in their devotion and perfect comprehension of what he wished them to do. At the same time he acquired an absolute confidence in the efficiency of his squadron, the magnificent force which had been formed by years of successful war, and by the careful training of his predecessors. The captains were the band of brothers he himself had made them.

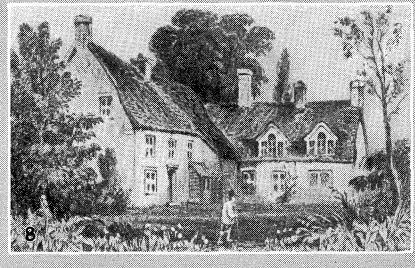
The great victory of Aug. 1, 1798 (*see* NILE, BATTLE OF), brought Nelson yet another wound. He was struck on the forehead by a langridge shot, and had for a time to go below. For this victory he was made a baron.

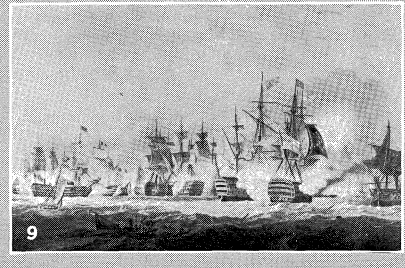
**Blockade of Naples.**—After providing for the blockade of what remained of the French in Alexandria, Nelson set sail for Naples and arrived there on September 22nd. Pitt's Second Coalition against France was then on the point of completion, and Naples, naturally enough in view of the French behaviour on her borders, was preparing to side with Austria and Russia in the defence of monarchy; indeed she was already organising an army under the direction of the Austrian general, Mack, but no decision as to how the troops should be used had as yet been arrived at. Nelson immediately tried to enliven the proceedings and suggested what should have been a perfectly feasible plan, by which the Neapolitan Army was to advance northwards against the French front, while the fleet was to capture Leghorn, thus cutting the French communications. Leghorn was duly taken, but the army showed little aptitude for fighting, soon becoming a mere disorderly rout, pursued by the French. This had the effect of rousing all the Jacobins in the country which was soon in such an uproar that the royal family found it necessary to retreat to Palermo—an evacuation carried out of course by Nelson and his ships, with the valuable co-operation of Lady Hamilton (*q.v.*), wife of the British Ambassador. From Palermo, Nelson kept up a double blockade—one squadron under Captain Ball was detached to force Malta to capitulate, and another, under Captain Troubridge, was sent to the Bay of Naples to operate against the Neapolitan Jacobins.

The King and Queen, however, found this method of blockade too slow, and determined to appeal to the conservative instincts of many of their subjects, who had lazily acquiesced in the Jacobin coup d'état, through the agency of an eminent ecclesiastic—Cardinal Ruffo. His Eminence landed in Italy, and his appeal for an "Army of the faith" was soon answered by thousands flocking to his banner, and he was even joined by a detachment of Russians and Turks. While these events were taking place, a French fleet of 26 vessels, under Admiral Bruix, set out from Brest and was joined by 17 Spanish warships at Cartagena. Such a force constituted a threat to Nelson who called up his ships






BY COURTESY OF (1) THE METROPOLITAN MUSEUM OF ART, NEW YORK, (2) THE NATIONAL PORTRAIT GALLERY, (3, 6, 7, 9) THE DIRECTOR OF THE PARKER GALLERIES; PHOTOGRAPHS; (4) EWING GALLOWAY, (5) PACIFIC AND ATLANTIC, INC., (8) RISCHGITZ

## PORTRAITS OF LORD NELSON AND SCENES RELATING TO HIS LIFE

1. "Lord Nelson in the cabin of the 'Victory'," after a painting by C. Lucy
2. Admiral Lord Nelson, after the portrait by L. F. Abbott
3. "Lord Nelson being carried below in the 'Victory' after being fatally wounded at the Battle of Trafalgar, Oct. 21, 1805." Engraved by James Walker after a painting by J. A. Atkinson
4. The Nelson Monument, Trafalgar Square, London. This monument, consisting of a granite column 168½ feet high surmounted by a statue of Nelson, was completed in 1849 and stands in the southern side of the square, which is named in commemoration of the admiral's last victory. On the base are represented four battle scenes in bronze, cast from the metal of captured French cannon
5. The "Victory," Nelson's flagship at Trafalgar, which underwent a complete restoration, completed in 1928
6. "Rear Admiral Sir Horatio Nelson." Engraved in 1798 by W. Barnard after a painting by L. F. Abbott
7. "Destruction of the French and Spanish prizes after the victory of Trafalgar." Engraved in 1806 by L. Hall after a painting by J. T. Serres
8. The rectory at Burnham Thorpe, Norfolk, where Nelson was born Sept. 29, 1758. The building was pulled down in 1802
9. "Representation of the Memorable Battle of Trafalgar," an engraving by Jos. Jeakes after a contemporary painting, showing the British fleet engaging the combined fleets of France and Spain. The flagship "Victory" is second from the right

from Malta and Naples and prepared for resistance. He managed, however,—and this was important in view of Ruffo's successful beginning—to maintain the blockade of the latter by means of a squadron of small ships placed under Captain Foote of the frigate "Seahorse."

The Franco-Spanish threat proved an idle one and the allied fleet soon retired, but, in the meanwhile, Ruffo was driving all before him and finally shut up the French in the Castle of St. Elmo, in the city of Naples, and the native insurgents in the sea-washed castles of Uovo and Nuovo. From this commanding position he began to parley with the enemy, and the king, hearing of this, and nervous of what the Cardinal might do—he had not been empowered to make terms of peace—asked Nelson to proceed to Naples and take matters into his hands.

**Ruffo's Treaty of Peace.**—Nelson sailed for Naples, with Sir William and Lady Hamilton on board, on June 21st, and arrived there on the 24th to find the white flag flying from the castles and from his own flotilla. Supposing this to indicate an armistice, he at once made signal for the resumption of hostilities, only shortly to be informed by Captain Foote that matters had gone further and that a treaty of peace had been signed by which the native insurgents were to be allowed to leave their strongholds with all the honours of war, and were to be carried by ship to countries that would be glad to receive them. In making such a treaty there can be no doubt that Ruffo had greatly exceeded his instructions, though it is probable that he was actuated by motives of humanity since his control over his bloodthirsty army was incomplete. Nelson refused to listen to Ruffo's arguments or to admit the validity of his undertakings. Furthermore, he argued, there was no need for the insurgents, if they unconditionally surrendered as he proposed to make them, to trust themselves to the mob on shore, since they could be accommodated in boats without being taken to friendly countries. He agreed to let the armistice run its course, but let it be known that at the end of it he would expect unconditional surrender. This he received, and the rebels were placed in boats. One, Carraciolo, reached the hills, only to be caught at last and brought to Ruffo who, in his turn, because Carraciolo was a naval officer, handed him over to Nelson in his capacity as Commander-in-Chief of the Neapolitan fleet. Nelson at once convened a court martial of Neapolitan officers to try the rebel. The Court sentenced him to death by a majority vote, and this sentence was duly carried out.

For refusing to carry into effect Ruffo's peace terms and for not interfering to prevent the execution of Carraciolo, Nelson has been violently, and at times virulently, attacked, but it cannot be said that his traducers had ever succeeded in making out a very strong case against him. The whole matter is too involved to be fully discussed here; the conclusions which have been reached by scholars on either side have almost invariably reflected the political *parti pris* of the writers.

The whole question of Nelson's conduct at Naples is of course bound up with his friendship with Lady Hamilton. No one denies that it was now that Nelson's friendship for this woman ripened into the intimacy that was eventually to separate him from his wife. But that a private attachment, culpable as it may have been, warped his judgment in public matters no one has yet shown, nor has anyone explained why it should.

**Return to England.**—These events were shortly followed by the reduction of the French and by the restoration of the Neapolitan royal family in July, while in the same month Nelson laid himself open to a sharp rebuke from the Admiralty for disobeying the orders of Lord Keith who had been appointed to succeed Lord St. Vincent in the Mediterranean command. Keith, puzzled as to the objective of a combined Franco-Spanish fleet, decided that Minorca was in danger, and ordered Nelson to its defence. Nelson decided that it was not in danger and did not go. His judgment was correct, but his disobedience was inexcusable. On Jan. 20th, 1800, having in the meantime been created Duke of Bronté by the King of Naples, Nelson joined Keith at Leghorn to take part in an attempt on Corsica, during which he captured "Le Généreux" which had escaped him at the Nile. Shortly afterwards he obtained leave to go home and, not being spared a battleship, he travelled overland with Sir William and Lady Hamilton, being greatly fêted on the way. He landed in England in November.

**Battle of Copenhagen.**—His leave, though it was long enough to promote the final separation between him and his wife, was short. He became Vice-Admiral on Jan. 1, 1801, and soon after was offered the post of second-in-command to Sir Hyde Parker in the fleet which was to break up the armed neutrality of the northern powers. It is difficult to see why such a brilliant man was subordinated to one of such ordinary gifts as Parker, who appears at the beginning to have been suspicious of the abilities of his second-in-command. Nelson, however, choked down his natural disgust, and treated Parker with such tact that the Admiral's hostility soon melted into something approaching friendship. Indeed Nelson had his Commander-in-Chief to some extent under his thumb by the time they reached Copenhagen, and so was permitted, with rather more than half the fleet, to carry out his famous attack on the city and its defences that resulted in the battle of Copenhagen (*q.v.*). This battle showed up strongly Nelson's ability to hit upon the weak point in a defensive scheme, and is famous also for his action in putting his telescope to his blind eye when, in the middle of the fight, his attention was directed to Parker's signal ordering his withdrawal, and declaring he could not see it. It was an order that could not be obeyed without serious consequences to the fleet. In May, Parker was recalled and Nelson assumed the command, but the armed neutrality was dissolved and this left him with little to do. His health, too, was bad and in June he came home, his services being recognised by the bestowal of the title of Viscount. In the interval, before the Peace of Amiens, he was in command of a flotilla of small ships that were to combat Napoleon's threat of invasion. More in the hope of satisfying public opinion than for any other reason, an attack was launched on Boulogne with the object of destroying the flat-bottomed boats situated there. The port, however, was too strongly defended even for a Nelson.

During the short period of the Peace of Amiens (1802–3), Nelson, in company with Sir William and Lady Hamilton, lived at his house and estate that he had purchased at Merton in Surrey. Here he passed his days in quiet country pursuits, and his happiness was added to by a reconciliation with his father who had at first found it impossible to overlook his son's association with Lady Hamilton. This, probably the happiest period of his life, was all too short. War reopened in May, and Nelson was at once selected for the Mediterranean Command.

**The Mediterranean Command, 1803.**—He arrived off Toulon in July 1803, and instituted a strict blockade of that port. The French under Latouche-Tréville continually tried to lure him into indecisive actions in which, by damaging some of his ships, they might force him to withdraw, but Nelson consistently refused such offers and the French Admiral, writing to Napoleon, stated that he had offered battle but the English had withdrawn. Nelson declared that if he captured Tréville he would make him eat the letter, but he never had the chance to fulfil his boast, even figuratively, for Tréville died and was succeeded by Villeneuve. In the spring of 1805 the French eluded the blockade and made for the West Indies. This move was part of a large scheme directed towards the invasion of England and its details are too numerous for discussion. The series of naval movements arising from it are known as the Trafalgar Campaign, and the whole matter will be found fully dealt with under NAPOLEONIC CAMPAIGNS. Nelson, after searching the Mediterranean, decided, more by intuition than anything else, that Villeneuve had gone to the West Indies, and thither he followed him. On hearing of his enemy's arrival, Villeneuve returned precipitately to Europe, again pursued by Nelson, and got into Ferrol and then into Cadiz where he was blockaded by Collingwood, Nelson having meanwhile gone home on leave to enjoy again the rural delights of Merton. His enjoyment was indeed brief. No sooner had the news reached England that the allied fleet was in Cadiz than, with the approval and encouragement of Lady Hamilton, he offered his services, "to give M. Villeneuve a drubbing." They were immediately accepted, and he left Merton for the last time

on Sept. 13th and on the 29th was off to Cadiz.

**Trafalgar.**—The victory of Trafalgar (*q.v.*) which followed on Oct. 21 set the seal on his fame. Tactically it was a masterpiece and his famous signal "England expects that every man will do his duty," made as the fleet moved into battle, together with his death in the moment of victory, added, and still add, to its lustre. The "Victory," after passing through the French line, was engaged with the "Bucentaure" and the "Redoutable," and Nelson, as he walked up and down his quarter-deck with his flag-captain, Thomas Hardy, was struck by a bullet from a sharp-shooter firing from the top of the last-named ship. His spine was broken, and he was carried below to the cockpit, suffering great pain. Here, amidst the din and racket of battle and the groans of the injured and dying, he lingered for a few hours. To the last he retained his interest in the battle and Hardy came to him from time to time to tell him of its progress. As his sight grew dimmer and he felt the end approaching he asked Hardy to kiss him. "Now I am satisfied," he said, "Thank God I have done my duty." "These words," says Southey in his moving account, "he repeatedly pronounced and they were the last he uttered." His body was brought home and laid in state in the Painted Hall at Greenwich Hospital, and was buried in St. Paul's.

So died the most famous of English seamen, and, indeed, the most famous of all seamen. He was more than merely a tactically and strategically brilliant Commander; he was a true leader of men—and men of all types, for the common seamen trusted and venerated him as much as did his officers. These latter were, in their turn, trusted by him and were ever in his confidence—his "band of brothers" he called them. No officer under Nelson could ever complain that he went into action not knowing his Commander's plans and intentions—and it is as much to this as to his tactical ability that his successes were due. The common seamen he always treated with humanity and kindness and these qualities were extended to his junior officers whom, remembering his own misery during his first days at sea, he was ever willing to encourage. On the other side it has been said that he was vain, liked flattery, and was an egotist. This is merely to say that he had the common faults of genius.

Nelson had no children by his wife. In November 1805, in recognition of Nelson's great services to his country, his brother William (1757–1835) was created Earl Nelson of Trafalgar, an annuity of £5,000 being attached to the title.

BIBLIOGRAPHY.—Southey's *Life of Nelson* edited by Professor Geoffrey Callender (1922). C. E. Forester, *Lord Nelson* (1929). (D.H.; X.)

**NELSON,** a city in British Columbia, situated at the head of navigation on the west arm of Kootenay lake. Pop. (1941) 5,912. It is the commercial and administrative centre of a mining, lumbering, fruit-growing district and is the headquarters of the Kootenay division of the Canadian Pacific. It is also a station on the Great Northern railway. Manufactures: match-blocks and plywood.

**NELSON,** a municipal borough in the Nelson and Colne parliamentary borough, Lancashire, England, 32½ mi. N. from Manchester by L.M.S.R. Pop. (est. 1938) 35,110. Area 5.4 sq.mi. Of modern growth, it possesses a town hall, market hall, free library, technical school, park and recreation ground. The transport services are controlled by a committee including Burnley and Colne. Nelson's chief products are cotton and synthetic fibres. It was incorporated in 1890.

**NELSON,** a seaport of New Zealand, the seat of a bishop and capital of a provincial district of the same name; at the head of Tasman bay on the northern coast of the South Island. Pop. (1941 est.) 11,400 (13,800 with suburbs). It has a mild climate. The town and the district surrounding are famous for apple orchards; and hops are extensively cultivated. Christ Church cathedral is finely placed on a mound which was originally intended as a place of refuge from hostile natives. The harbour is protected by the long and remarkable Boulder Bank, whose southern portion forms the natural breakwater to that anchorage. The chief industries are meat- and fruit-preserving and timber milling. Nelson is connected by rail with Blenheim and Christchurch, and by steamer and air service with Wellington. The settlement was established by the New Zealand company in 1841.

**NELSON,** a river of Keewatin district, Canada, discharging the waters of Lake Winnipeg in a northeasterly direction into Hudson bay. It drains an area of 360,000 sq.mi. and, including its tributary the Saskatchewan, is 1,450 mi. long. It is navigable for small steamers for a distance of about 80 mi., after which it is unnavigable except for canoes. It has a total fall between the lake and sea of 710 ft. Here its chief tributary is the Burntwood. Norway house at its source and York factory at its mouth are important stations of the Hudson's Bay company.

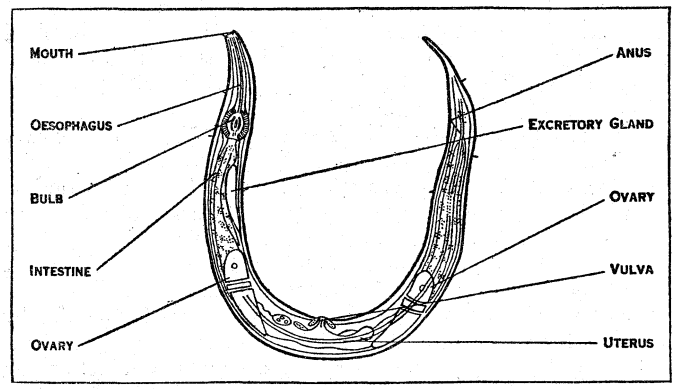
**NELSON,** a hold in wrestling. *See* WRESTLING.

**NELSONVILLE,** a city of Athens county, Ohio, U.S.A., 62 m. S.E. of Columbus, on the Hocking river and the Hocking Valley railway. Pop. (1930) 5,322; and 5,368 in 1940. It is an important coal-mining centre, and makes brick and tile from the clay which abounds in the vicinity. The city was founded in 1818 and incorporated in 1838. It was named after Elisha Nelson, who built the first house.

**NEMATHELMINTHES,** a term employed in zoology to denote a phylum of animals comprising the round-worms (Nematoda, *q.v.*) hook-worms (Acanthocephala), Nematomorpha (*q.v.*), to which are sometimes added the arrow-worms (Chaetognatha, *q.v.*), and various other groups of minor importance and doubtful affinities. Nemathelminthes is probably, even in its most restricted sense, an artificial group.

**NEMATODA,** a group of unsegmented worms ("thread-worms"), frequently regarded as forming, with the Nematomorpha and Acanthocephala (*qq.v.*), a phylum Nemathelminthes, but of extremely doubtful affinities. The form of the body is generally cylindrical, and the worms vary in length from a fraction of a millimetre to about a metre. A large number of nematodes (mostly of very small size) are free-living, and occur in water (fresh and marine), soil, moss or decaying substances; while many others are wholly or partly parasitic on plants or in the bodies of other animals, and may be of considerable economic or medical importance.

**General Morphology.**—The body-wall consists of (1) a tough, elastic, homogeneous cuticle, sometimes provided with spines or bristles; (2) a thin syncytial subcuticular layer; and (3) a single layer of muscle-cells which vary considerably in form and arrangement, but act only in a longitudinal direction. The musculature is divided into four longitudinal strips by internal thickenings of the subcuticular layer, the lateral "fields" and dorsal and ventral lines. The body-cavity, bounded by the muscles, contains a fluid in which the internal organs lie free. The mouth, situated at the anterior end, leads either into a buccal




FROM DE MAN, "DIE NEMATODEN" (E. J. BRILL)

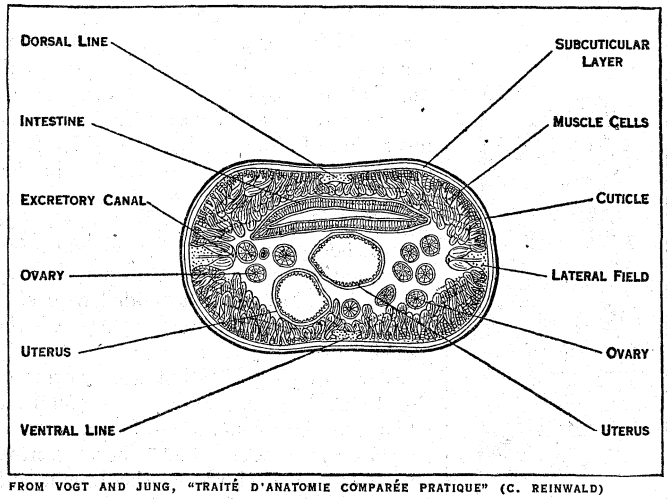
FIG. 1.—LATERAL VIEW OF FREE-LIVING FEMALE NEMATODE

cavity lined with cuticle or directly into the oesophagus, which is usually a three-sided muscular organ, but occasionally consists of a single column of cells surrounding a cuticular tube. The intestine is usually straight, and generally opens through a short rectum and an anus near the hinder end of the body.

The nervous system consists of a perioesophageal ring giving off nerves anteriorly and posteriorly. The chief sense organs are tactile papillae or bristles on the cuticle, situated mainly near the extremities. In certain free-living forms ocelli or "eye-spots" are present internally in connection with the oesophagus, and

sometimes possess lenses. A pair of special lateral cephalic organs, or "amphids," of uncertain function, exists in most free-living forms.

The excretory system consists either of a simple unicellular gland, connected with a minute ventral pore in the oesophageal region, or (in parasitic forms) of a pair of canals running in the

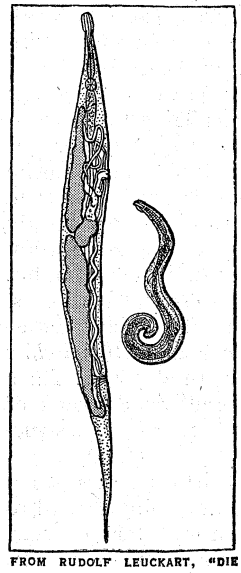



FROM VOGT AND JUNG, "TRAITÉ D'ANATOMIE COMPARÉE PRATIQUE" (C. REINWALD)

FIG. 2.—TRANSVERSE SECTION THROUGH THE BODY OF A FEMALE (ASCARIS LUMBRICOIDES), SHOWING THE BODY CAVITY, BOUNDED BY MUSCLES, IN WHICH THE INTERNAL ORGANS ARE SUSPENDED

lateral fields and joining anteriorly to open by a ventral pore. These canals are without cilia or flame-cells. Special respiratory and circulatory organs are absent.

The sexes are usually distinct. In the male the genital canal and the intestine open into a common cloaca. In the female the anus and genital aperture (vulva) are separate, the latter opening on the ventral surface at a very variable distance in front of the former. The males are usually smaller and less numerous than the females. The reproductive glands are blind, tubular and often much-coiled organs, continuous with their ducts. In the male there is most often a single testis (occasionally two). The spermatozoa are usually tailless, rounded or amoeboid cells. Secondary male organs in the form of chitinoid copulatory spicules and one or more "accessory pieces" are usually present in connection with the cloaca. The vagina of the female leads into a uterus with usually two (sometimes more, or only one) long branches, acting as egg-reservoirs, and each connected distally with its own ovary. The ova are fertilized in the uterus, and here also, in oviparous species, a firm chitinoid shell is usually formed round them before oviposition.



FROM RUDOLF LEUCKART, "DIE PARASITEN DER MENSCHEN"

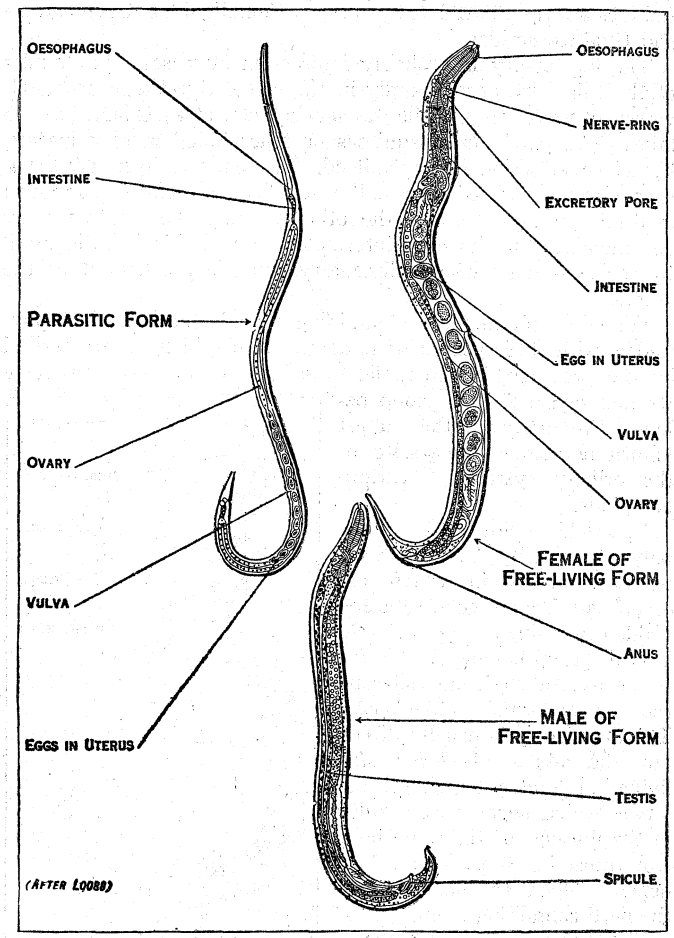
FIG. 3.—ENTEROBIUS VERMICULARIS, MALE ON RIGHT, FEMALE ON LEFT (HIGHLY MAGNIFIED)

**Development.**—The development of the nematodes is direct and without well marked metamorphosis, the young larvae, when hatched, having the typical cylindrical form of the adults. Four moults usually take place between the growth-periods of the larva, at which the entire cuticle is shed, together with the linings of the mouth, oesophagus and rectum. Changes in the form of the buccal cavity and oesophagus may accompany these moults, but the sexual organs do not become fully differentiated until after the third moult. In many forms the cuticle of the second moult is not immediately shed, but serves as a loose protective sheath until the larva finds its proper habitat. This is especially the case with the "infective" larvae of many parasitic forms, which do not shed the second cuticle until they find their way into the host At this "ensheathed" stage larval nematodes are often very resistant to low temperatures and to desiccation, and may remain in a state of latent vitality for long periods.

Nematodes may be oviparous, ovoviviparous or viviparous. The free-living forms commonly produce relatively few and large eggs or young. Most of the parasitic forms, however, produce eggs or young, of much smaller relative size, in enormous numbers. These generally reach the exterior with the faeces of the host. The life-history of parasitic species may involve only one host, in which case the larvae (sometimes still in the egg-shell), may be taken in passively by the mouth with contaminated food or water, or may actively penetrate the skin or mucous membranes. On the other hand, an intermediate host (usually an arthropod or lower vertebrate) may be required, in whose tissues or body-cavity the third-stage larva remains encapsuled until swallowed, along with its host, by the final or definitive host.

**Classification and Life-Histories.**—The nematodes may, for the most part, be classified in five main groups, as follows:

I. Ascaroidea. Free-living or parasitic forms having normally three lips (one dorsal and two subventral). This group embraces several well marked families of parasitic forms (Ascaridae, Heterakidae, Oxyuridae, etc.) as well as almost all the purely free-living forms (Trilobidae, Alaimidae, Chaetosomatidae, Desmoscolecidae, Oncholaimidae, etc.), together with the families




BY COURTESY OF THE EGYPTIAN SCHOOL OF MEDICINE

FIG. 4.—STRONGYLOIDES STERCORALIS

Rhabditidae and Mermithidae, which are partly parasitic, and the Anguillulinidae (Tylenchidae), many of which attack plants.

The life-history of the Ascaroidea is usually direct, though some of the Ascaridae require an intermediate host. The infective larvae of *Ascaris* and some other genera have a complex migration within the body of the final host, travelling by way of the blood-stream to the lungs, whence they return by the trachea to the mouth, before finally settling in the intestine. In the Oxyuridae—*e.g.*, the common "threadworm" or "pinworm" (*Enterobius vermicularis*) of man—the eggs, as soon as laid,

commonly contain infective larvae, rapid infection of new hosts, or constant reinfection of the same host, thus being possible. In some of the Rhabditidae (including the human parasite, *Strongyloides stercoralis*) a free-living bisexual generation alternates with a parasitic generation consisting of "female" forms only. In the Mermithidae the sexual forms are free-living, the larval stages parasitic, chiefly in insects.

II. Strongyloidea. Parasitic forms in which the male is provided with a caudal "bursa" supported by a definite system of "rays." The more important families are the Strongylidae, Ancylostomidae (hookworms), Metastrongylidae and Trichostrongylidae.

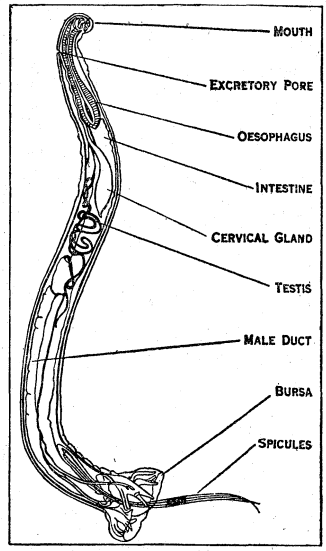
The life-history is usually direct, the infective larvae usually being taken in by the mouth, but in some cases—*e.g.*, the hookworms—being able to penetrate the skin. Migration within the host's body is frequent. In the case of the hookworms it follows a similar course to that of *Ascaris*. The adults of the Metastrongylidae inhabit chiefly the air-passages and blood-vessels of mammals, and are often responsible for bronchial and other disorders. The adults of the other families inhabit mainly the alimentary canal, with the exception of one small group which includes the "gape-worms" (*Syngamus*) of birds and mammals.

III. Filarioidea. Parasitic forms with paired lateral lips, or with or without secondary lip-like structures. The principal families are the Filariidae, Spiruridae, Camallanidae, Cucullanidae and Gnathostomidae.

The life-history is probably indirect in all cases. The adults of the Filariidae occur mainly in the connective tissue or blood-vessels of vertebrates, while the development of their larval stages takes place partly in mosquitoes or other blood-sucking insects, by which infection is transmitted. The Guinea-worm (*Dracunculus*) is transmitted by small water-fleas (*Cyclops*) contained in drinking-water. Among the other families the larvae usually become encapsuled in some intermediate host liable to be ingested by the final host, whose alimentary canal is the habitat of the adults.

IV. Dioctophymoidea. Containing a single family, Dioctophymidae, with three genera of parasitic forms chiefly characterized by the presence, in the male, of a caudal bursa-like structure without rays. To this group belongs *Dioctophyme*, the largest known nematode, a parasite of the urinary system of various mammals.

V. Trichinelloidea. Containing only the family Trichinellidae, parasitic forms in which the oesophagus is a cuticular tube embedded in a single chain of cells. To this group belong *Trichinella*, the cause of "trichinosis," and the "whipworms" (*Trichuris*). The life-history is usually direct, but the adults of *Trichinella*, living in the intestine, give rise to larvae which become encapsuled in the muscles of the same host, and transmission to a new host depends upon the ingestion of the flesh containing them.



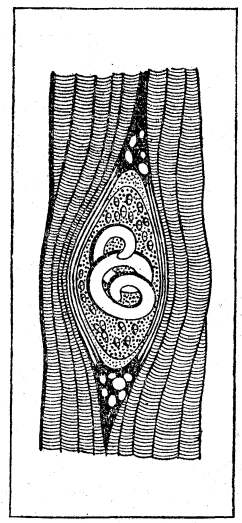

FROM SCHUTHER, "ANATOMIE ANCYLOSTOMA DUODENALE" (WM. ENGELMANN)

FIG. 5.—LATERAL VIEW OF MALE HOOKWORM (ANCYLOSTOMA)

**Economic Importance.**—Many of the nematodes parasitic in man and animals are of considerable medical and veterinary importance. Their ill effects, generally inappreciable in animals living in a state of nature, tend to become more marked in the artificial conditions under which man and his domestic animals live. Over-crowding and insanitary conditions are the chief causes of heavy infestation with such parasites, and their incidence in man is greatest in tropical and subtropical countries.

The parasites themselves may cause lesions of the tissues in various ways, or their presence may lead to secondary invasion by pathogenic organisms of other kinds. Sometimes the presence of the worms may merely cause mechanical irritation, and so lead to inflammatory conditions. But in many cases they appear to secrete toxic substances which react detrimentally upon the host, and nervous and other disturbances, apart from local effects, may result.

Perhaps the most important of the forms occurring in man are the hookworms (*Ancylostoma* and *Necator*), which are probably responsible, in some countries, for more disease, both physical and mental, than any other single cause. Their ravages are due in part to the ulceration of the intestine caused by their blood-sucking and tissue-destroying habits, but probably in part also to toxic properties. "Hookworm campaigns," having as one of their principal objects the education of the natives in the use of proper sanitary precautions, have been attended with considerable success in many parts of the world.



FROM RUDOLF LEUCKART, "DIE PARASITEN DER MENSCHEN"

FIG. 6.—TRICHINELLA SPIRALIS, SHOWING LARVA ENCYSTED

Filariasis, or infestation with worms of the Filariid group, is another condition which may be of considerable importance. As has been mentioned, these worms, whose larvae circulate in the blood, and several species of which occur in man, are transmitted by mosquitoes and other blood-sucking flies. There is reason for believing that at least one of these species is concerned in the causation of elephantiasis, a terrible and disfiguring disease of wide occurrence in hot countries. Others cause tumours of the skin and other parts of the body.

Ascariasis, or infestation with Ascarids, has assumed a new importance during recent years, since it has been realized that the migrating larvae, on their passage through the lungs, are capable of inducing a form of pneumonia in their hosts when present in sufficient numbers. This is a frequent cause of death in young pigs, and deserves consideration in connection with human disease. Certain respiratory diseases in domestic animals, more especially "husk" in sheep and calves, are due to various species of lungworms (Metastrongylidae); while "gapes," a disease annually responsible for the death of large numbers of young poultry, is due to the invasion of the trachea and bronchii by a nematode (*Syngamus*). Parasitic gastritis and enteritis in cattle, sheep and horses are commonly due to nematodes, mostly belonging to the order Strongyloidea. The stomach-worm (*Haemonchus*) of sheep and cattle is one of the best known, but several others seem to be also, at times, responsible for losses.

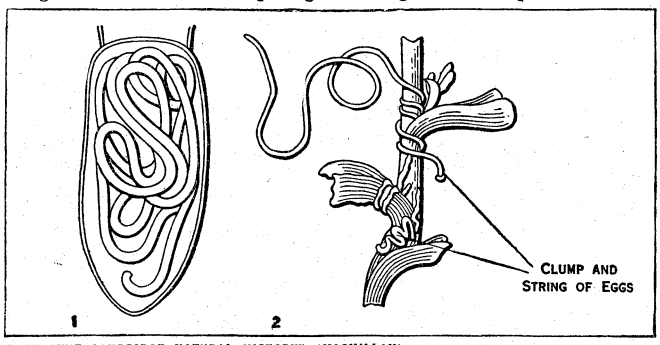
Lastly, mention should be made of certain "free-living" forms, mainly belonging to the genera *Heterodera* and *Anguillulina* (*Tylenchus*), which are important as agricultural pests. These attack the roots, stems, leaves or ears of cultivated plants of various kinds, and may cause great deterioration or even destruction of the crops. (H. A. B.)

**NEMATOMORPHA** (Gordiacea or "hairworms"), a group of elongate, thread-like, unsegmented worms, probably related to the Nematoda (*q.v.*), but differing from them in certain respects. The adults occur mainly in fresh water (occasionally in wet earth), and are sometimes found in tangled masses. The species vary in length from a few inches to two or three feet, but none are thicker than whipcord. They are usually of a brownish colour.

The body-wall consists of (1) a stout cuticle, with an outer layer (smooth or with shagreen-like "areoles," sometimes bearing spines or bristles of various kinds) and an inner layer of obliquely crossed fibres; (2) a single subcuticular layer of cells; and (3) a layer of longitudinal muscle-fibres. Most of the space within the body-wall is filled with parenchymatous tissue, in which the internal organs are embedded. There is an alimentary canal, opening posteriorly into a cloaca together with the genital ducts. A

mouth is usually absent in the adult. No circulatory or excretory organs are known. There is a single ventral nerve-cord, with anterior and posterior ganglia.

The sexes are separate, the males being usually smaller than the females and, in some genera, distinguishable by having the tail bifurcate. The tail of the female is usually undivided, but in *Paragordius* it has three prongs. The gonads are paired in both




FROM "THE CAMBRIDGE NATURAL HISTORY" (MACMILLAN)

FIGS. 1 AND 2.—GORDIID WORMS (MAGNIFIED)

1. Abdomen of a beetle (*Pterostichus niger*), with the terga removed, showing a Gordiid worm within
2. A female Gordiid worm depositing its eggs on a water plant

sexes, and are continuous with their ducts. In the gravid female the ovaries give off thin-walled lateral pockets, which ultimately break down and discharge the ova into spaces in the parenchyma. The eggs, held together by a cement-like substance, are laid in strings or masses, usually on plants or stones under water. The first larval stage is a minute creature armed with spines and having a boring organ anteriorly, by means of which it enters a host (usually an aquatic animal). In species which attack insects such as grasshoppers, the second larval stage may apparently be reached without change of host. In others it may develop in a second host, usually a beetle, which preys upon the first. The second larval stage is elongate and worm-like, and develops directly into the adult form. Pigment is developed, and the larval cuticle shed, just before emergence from the host. This usually takes place on contact with water, the worm bursting its way out through a soft place in the body-wall.

The group includes the genera *Gordius, Paragordius, Chordodes* and *Parachordodes,* to which a fifth, *Gordionus,* has been added by G. W. Müller. It is still uncertain whether *Nectonema* (a pelagic marine form provided with rows of bristles) is more closely related to this group or to the Nematoda. (H. A. B.)

**NEMEA, BATTLE OF, 394 B.C.** This was the decisive battle, in the sense that it broke the force of the hostile offensive, of the "Corinthian War," against Sparta, waged by the coalition of Thebes, Corinth, Athens and Argos, but instigated by Persia. In its initial pattern it was the typical frontal battle of the time, and both lines as they advanced experienced the characteristic "drift" to the right, so that each right wing overlapped the opponent's left wing. Thus on one flank the Spartans dispersed the Athenians, and on the other Sparta's allies were shattered by the Argives and Corinthians. Then, however, the Spartans, instead of pursuing blindly ahead like Clearchus and his men at Cunaxa, checked their pursuit and caught in flank three successive bodies of the enemy as they were marching back to their base. With this success the menace to Sparta waned, and the initiative in further operations passed to her. (*See* further CUNAXA, BATTLE OF, 401 B.C.; CORONEIA, BATTLE OF.)

**NEMERTEA** (NEMERTINEA). The nemerteans, or nemertines, commonly called ribbon worms, which constitute the invertebrate phylum Nemertea, are characterized by the soft, extensible, ciliated body, without external indication of segmentation and without distinct body cavity, the internal organs being separated by gelatinous parenchyma; the body is provided with a highly specialized eversible proboscis and a usually straight intestine opening at the posterior end of the body (fig. 1). There are no external appendages except the caudal cirrus, sucker and tentacles, found in a few species.

Nemerteans vary greatly in size and shape; some are long, flattened and ribbonlike and may grow to a length of 1 to 4 metres (fig. 3); others are threadlike and from a few millimetres to several metres in length when mature; some are cylindrical (fig. 2); others are broad and flat. In nearly all forms the body may be contracted to a small fraction of the length which it has in full extension.

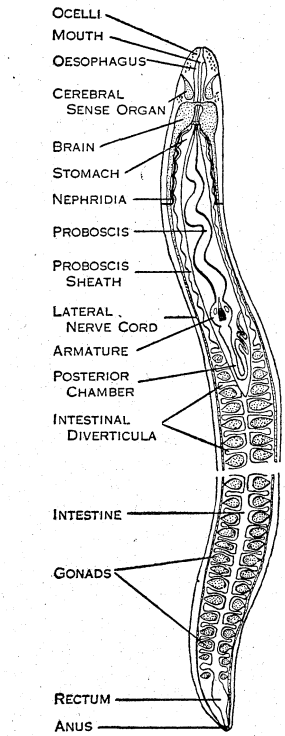



FIG. 1.—ORGAN SYSTEMS OF A HOPLONEMERTEAN

Most of the species are marine and littoral; many of them burrow in sand or mud; others hide beneath stones or creep about among algae and other growths between tide marks or in shallow water. The members of the tribe Pelagica are strictly bathypelagic, with flattened, gelatinous bodies adapted for floating idly or swimming sluggishly far beneath the surface of the deep oceans. A few species inhabit fresh-water streams and lakes; others have migrated to the land, living in moist earth or beneath fallen logs, stones or dead foliage. Certain species live as commensals in the mantle cavities of pelecypods or of tunicates, in the canals of sponges or beneath actinians; and finally there are several species which are parasitic on the gills and among the egg masses of crabs.

The nemerteans are all carnivorous, feeding on protozoa, turbellarians and other worms, molluscs, crustaceans and the young of all the invertebrates with which they come in contact. Some have such distensible mouths that they can devour animals of almost their own diameter. Others have small mouths and suck in only the juices of their prey.

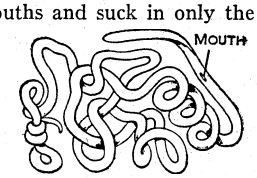



FIG. 2.—A PALEONEMERTEAN, PROCEPHALOTHRIX SPIRALIS

When food is not obtainable the nemertean is able to live for a long time upon the nourishment to be obtained from its own tissues. Individuals of some species may thus survive starvation for a year or more. In the meantime the body may have shrunk to a small fraction ($\frac{1}{20}$ or less) of its former size. Some of the small forms may survive unfavourable conditions by coiling their bodies in a firm cyst of secreted mucus, to resume activity at a later time.

Many of the species are brightly coloured in life, with shades of red, orange, yellow, green, gray and brown predominating. Some have a uniform coloration, while others have definite patterns or markings of contrasting colours, with rings, longitudinal lines, spots or reticulations. The physical basis of the colour patterns consists of pigment granules secreted within the epithelial cells of the integument or in the underlying connective tissue cells or both.

**Morphology and Physiology.**—The morphological characteristics of a nemertean are shown in fig. 1. Although there is no external indication of segmentation, most of the internal organs are arranged metamerically. The body is covered with a layer of ciliated epithelial cells, interspersed with mucous and sensory cells. The epithelium is supported on a basement layer of firm gelatinous tissue, beneath which, in the Heteronemertea, is a thick layer of mucous glands and connective tissue, the cutis. The musculature of the body wall consists of two or more layers of circular, spiral and longitudinal muscles which enable the worm to carry on rapid changes in body form. Locomotion is accomplished by creeping or gliding, by alternate elongation and contraction, by twisting spirally or, in a few species, by swimming.

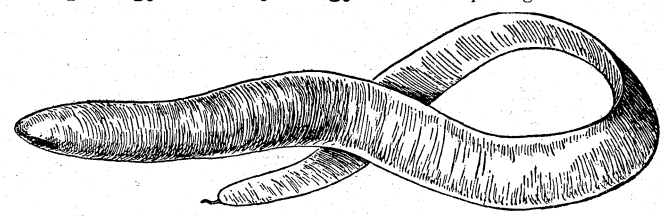


FIG. 3.—A HETERONEMERTEAN, CEREBRATULUS MELANOPS

The proboscis is sometimes used as an aid in creeping or burrowing.

The *proboscis* is formed by an invagination of the anterior body wall and consequently has essentially the same muscular and epithelial layers but in reverse order. In its normal position within the body it lies within the proboscis sheath, which forms a closed, saclike cavity, the rhynchocoel, filled with a corpusculated fluid. In a few species of hoplonemerteans the sheath is provided with paired diverticula. The anterior end of the proboscis is anchored firmly into the tissues of the head near the brain, while the posterior end commonly terminates in a long retractor muscle attached to the proboscis sheath or in some species to the musculature of the body wall in addition. The proboscis is everted through the rhynchodeum by the combined action of its own muscles and such contractions of the musculatures both of the sheath and body walls as will exert pressure on the fluid in the rhynchocoel. It is withdrawn by reducing this pressure, aided by its own musculature and by the retractor muscle, if present. In the Anopla the tenacious mucus and paralyzing secretions of the everted proboscis aid in capturing the prey, while in the Enopla the stylet is also used. Most of the Enopla have two or more pouches of accessory stylets which may replace the central stylet if lost or broken (fig. 4). In the heteronemertean *Gorgonorhynchus* the proboscis is dichotomously branched.

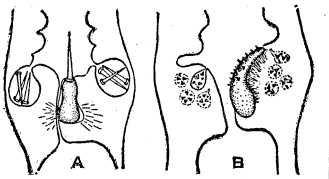



FIG. 4.—PROBOSCIS ARMATURE IN (A) AMPHIPORUS GRISEUS, A REPRESENTATIVE OF THE MONOSTYLIFERA AND IN (B) PELAGONEMERTES BRINKMANNI, A REPRESENTATIVE OF THE POLYSTYLIFERA

The *digestive system* consists of an anterior mouth which may either open ventrally posterior to the brain or terminally in connection with the proboscis opening. In the Bdellonemertea and some Hoplonemertea the mouth joins the rhynchodeum to form an atrium. The mouth leads to a slender œsophagus and thence to a more spacious stomach. The intestine continues as a straight tube, usually with numerous paired lateral diverticula, from the stomach to the rectum, which opens at the posterior end of the body (fig. 1). Some forms have a large caecum, with caecal diverticula, which extends forward from the anterior end of the intestine, while in some of the Paleonemertea and all of the Bdellonemertea there are no intestinal diverticula whatever (fig. 5). Digestion of the food materials is accomplished mainly by enzymes secreted into the stomach and intestine, although the fats are taken by phagocytosis directly into the cells of the lining epithelium. In these cells also the nutrients are stored in vacuoles until needed in the body metabolism.

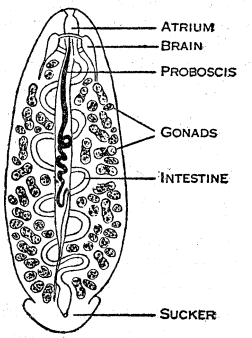



FIG. 5.—ORGAN SYSTEMS OF A BDELLONEMERTEAN

The *circulatory system* consists typically of three longitudinal blood vessels, united at both ends of the body, and in most species with reservoirs, or lacunae, in the head and œsophageal region and with numerous anastomosing cross branches throughout the body.

The *excretory system* is highly diversified. Typically there is a pair of profusely branching nephridia in close proximity with the lateral blood vessels and having one or more pairs of efferent ducts leading to the exterior of the body (fig. 1). Each of the numerous minute branches originates from a multinucleate terminal organ (metanephridium) or from a single cell (protonephridium) with long flagella which draw fluid from the surrounding parenchyma into the nephridial canal. Other cells in the walls of the canals excrete metabolized waste products. In the terrestrial nemerteans (*Geonemertes*) there are several thousand separate nephridia, each with its own efferent duct. Excretory organs have not been found in any of the bathypelagic species.

*Nervous System.*—The central nervous system consists of a four-lobed brain, from which a pair of large lateral nerve cords extend to the posterior end of the body. Many species have in addition a dorsomedian and a ventromedian nerve with branches communicating with the lateral nerve cords. Connected with the central nervous system are one or more pairs of proboscidial nerves and numerous, often paired, peripheral nerves associated with the muscular and digestive systems, integument, ocelli and such other sense organs as may be present.

*Sense Organs.*—In addition to the sensory epithelium everywhere present in the integument, some of the species have other specialized sense organs, including ocelli, cerebral, lateral and frontal sense organs, cephalic grooves and pits. In a single family (Ototyphlonemertidae) there is a pair of statocysts connected with the brain. With the exception of these organs of equilibrium and the ocelli very little experimental evidence has been obtained as to the precise nature of the sense organs. Chemical senses, including the recognition of food substances, positional sense, tactile sense and a certain degree of light sense must be located in the epithelium on all parts of the body, for headless fragments respond to the corresponding stimuli.

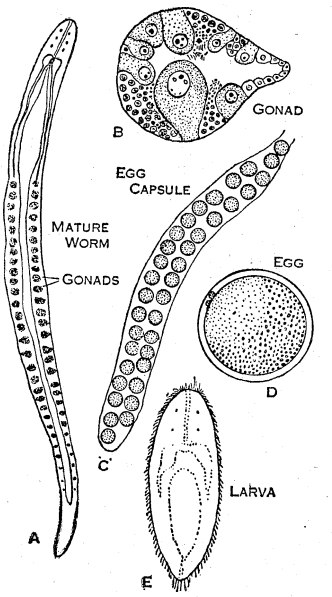



FIG. 6.—DEVELOPMENT WITHOUT METAMORPHOSIS IN A HOPLONEMERTEAN, PROSTOMA RUBRUM

**Reproduction.**—In most nemerteans the sexes are separate, although a few species are hermaphroditic. The gonads are simple sacs which usually alternate with the intestinal diverticula and may therefore be very numerous (figs. 1 and 6). In most species the sexual cells from each gonad are discharged directly into the water. Fertilization is thus external except for the few cases of viviparity in which the development of the embryo takes place within the body of the parent. There is evidence of sex recognition in some species, for a male and a female may be found side by side in a sheath of mucus. After ovulation and fertilization the parents leave the sheath which then forms a capsule for the developing embryos (fig. 6). In a few of the bathypelagic nemerteans the spermaries have been shifted to the head, and in the parasitic *Carcinonemertes* there is a common sperm duct which opens into the rectum.

Embryonic development may be direct, leading to the formation of a larva similar to the adult (fig. 6), or it may be indirect, with a free-swimming, hemispherical larva of complicated pattern known as the pilidium (fig. 7). The young worm later develops by metamorphosis within the pilidium. Increase in length occurs by constant additions to the posterior end of the body.

**Regeneration.**—Enemies are numerous, particularly annelids, crustaceans and fishes. Contributing to survival, however, is the tendency of most individuals with long bodies to break in fragments whenever any part of the body is seized. If only the posterior portion of the body is lost the missing parts are soon restored by regeneration. In certain species, any small fragment of the body, with or without the head, will regenerate into a minute worm of normal proportions (fig. 8). Fragmentation thus becomes a method of asexual propagation. Only a few species, however, have the capacity of restoring a missing head, but a lost or injured proboscis is promptly replaced.

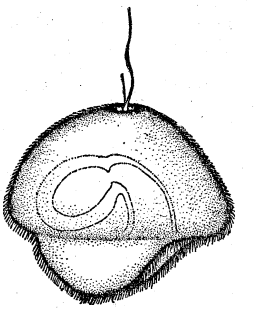


FIG. 7.—PILIDIUM OF A HETERONEMERTEAN, CEREBRATULUS

**Classification.**—Approximately 570 species of nemerteans had been described previous to 1946. Nearly 200 of these are found along the coasts of Europe, 100 on the Pacific coast of North America, 54 on the Atlantic coast of North America and 57 are bathypelagic, floating far beneath the surface of the oceans.

The phylum is conveniently divided into two classes, each of which consists of two orders.

CLASS 1. ANOPLA. Mouth posterior to brain; central nervous system imbedded in body wall, either between the muscular layers or external thereto; proboscis not armed with stylets.

Order 1. PALEONEMERTEA. Body musculature of either two or three layers; cutis absent. Example, *Procephalothrix* (fig. 2).

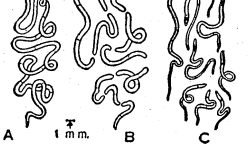



FIG. 8.—ASEXUAL REPRODUCTION BY FRAGMENTATION, LINEUS SOCIALIS

Order 2. HETERONEMERTEA. Body musculature of three layers, to which a thin inner circular and an outer spiral layer are sometimes added; cutis well developed. Examples, *Lineus* (fig. 8), *Cerebratulus* (fig. 3).

CLASS 2. ENOPLA. Mouth anterior to brain; central nervous system situated in parenchyma internal to body musculature; proboscis (except in Bdellonemertea) armed with one or more calcareous stylets.

Order 3. HOPLONEMERTEA. Proboscis with armature; intestine straight, with paired lateral diverticula; sucker absent.

Suborder 1. Monostylifera, with single stylet on awl-shaped basis. Examples, *Amphiporus* (fig. 4A), *Prostoma* (fig. 6).

Suborder 2. Polystylifera, with several stylets on curved basis.

Tribe 1. Reptantia, adapted for creeping or burrowing.

Tribe 2. Pelagica, adapted for swimming or floating in the ocean depths. Example, *Pelagonemertes* (fig. 4B).

Order 4. BDELLONEMERTEA. Proboscis without armature; intestine convoluted, slender, without diverticula; with sucker at posterior end

of body. Commensal in marine pelecypods. Example, *Malacobdella* (fig. 5).

**Geographical Distribution.**—Nemerteans are found along all the seacoasts of the world and off the shores to depths of hundreds of metres. Some of the species are circumpolar, extending southward along the coasts as far as Madeira, southern New England, California and Japan. A few species live in both the northern and southern hemispheres. Some are limited to the polar seas and others to the tropics. Some of the bathypelagic species live at depths of 1,000 to 2,000 metres or more and the population may be carried for thousands of miles by the deep ocean currents, reproducing generation after generation in their endless circuits throughout the great oceans.

BIBLIOGRAPHY.—O. Bürger, "Die Nemertinen," *Fauna und Flora des Golfes von Neapel* (1895); W. R. Coe, "Nemerteans of the West and Northwest Coasts of North America," *Bull. Museum Comp. Zoology*, vol. 47 (1905); W. R. Coe, "The Pelagic Nemerteans," *Mem. Museum Comp. Zoology*, vol. 49 (1926); L. Böhmig, "Die Nemertini": in Kükenthal and Krumbach, *Handbuch der Zoologie*, vol. 2 (1929); W. R. Coe, "Biology of the Nemerteans of the Atlantic Coast of North America," *Trans. Connecticut Acad. Arts and Sciences*, vol. 35 (1943).

(W. R. CE.)

**NEMESIANUS, MARCUS AURELIUS OLYMPIUS,** Roman poet, a native of Carthage, flourished about A.D. 283. He was a popular poet at the court of the Roman emperor Carus (Vopiscus, *Carus*, 11). He wrote poems on the arts of fishing (*Halieutica*), aquatics (*Nautica*) and hunting (*Cynegetica*), but only a fragment of the last, 325 hexameter lines, has been preserved. It is neatly expressed in good Latin, and was used as a school text-book in the 9th century. Four eclogues, formerly attributed to Titus Calpurnius (*q.v.*) Siculus, are now generally considered to be by Nemesianus, and the *Praise of Hercules*, generally printed in Claudian's works, may be by him.

Complete edition of the works attributed to him in E. Bährens, *Poetae Latini Minores*, iii. (1881) and J. P. Postgate's *Corpus Poetarum Latinorum*, ii.; *see* also L. Cisorio, *Studio sulle Egloghe di N.* (1895) and *Dell' imitazione nelle Egloghe di N.* (1896); and M. Haupt, *De Carminibus Bucolicis Calpurnii et N.* (1853), the chief treatise on the subject.

**NEMESIS.** (1) A goddess worshipped at Rhamnus in Attica. She is closely connected with Artemis, probably a local form of her or of some other very similar goddess. In mythology (posthomeric; the story is told in the cyclic *Cypria*) she is loved by Zeus who catches her after a transformation-race; she lays an egg, from which Helen (*q.v.*) is hatched out, generally by Leda (*q.v.*), it is a disputed point whether Leda or Nemesis is the mother of Helen in the original form of the story. There seems also to have been a legend (Catullus, lxiv., 393) that on some occasion (Marathon?) she appeared in person to encourage her worshippers in battle. (2) The indignant disapproval felt at wrong-doing; in particular, such disapproval on the part of the gods, and the consequent punishment of a sinful (or over-prosperous) man, hence (first in Hesiod) that disapproval personified. There was an old cult of "the Nemeseis" at Smyrna (Pausanias, ix., 35–36) but whether of this abstraction or of the fertility-goddess of Rhamnus, is not clear. That the abstraction was worshipped, at least in later times, is beyond doubt, however; a fragment of Antimachus (in Strabo, xiii., 1, 13) says that Adrastus was the first to erect an altar to her. In Rome especially her cult was very popular, particularly among soldiers, by whom she was worshipped as patroness of the drill-ground (Nemesis campestris); associated with Fortune, she seems also to have been adored as presiding over races; she had a cult-association, the Nemesiaci.

BIBLIOGRAPHY.—L. R. Farnell, *Cults of the Greek States*, ii. (1896); O. Rossbach in Roscher's *Lexikon, s.v.* (bibl.); G. Wissowa, *Religion und Kultus* (2nd ed., 1912).

(H. J. R.)

**NEMESIUS** (*fl. c.* A.D. 390), a Christian philosopher, author of a treatise περὶ φύσεως ἀνθρώπου (*On Human Nature*), was, according to the title of his book, bishop of Emesa (in Syria). His book is an attempt to compile a system of anthropology from the standpoint of the Christian philosophy. Moses and Paul are put side by side with Aristotle and Menander, and there is a clear inclination to Platonic doctrines of pre-existence and metempsychosis. In physiology he is in advance of Aristotle and Galen, though we can hardly assert—as has sometimes been thought—that he anticipated Harvey's discovery of the circulation of the blood.

Editions: Antwerp 1575; Oxford, 1671; Halle, 1802; Migne's *Patrol. Gr.* vol. 40. Versions: Latin by Alsanus, ed. Holzinger (1887); by Burgundio, ed. Burkhardt (1891–96). Literature: Bender, *Untersuch. über Nemesius* (1898).

**NEMOPHILA,** a genus of North American herbs of the water-leaf family (Hydrophyllaceae), comprising some 20 species found chiefly in the Pacific coast region, 13 of which are native to California. They are more or less diffuse annuals, with parted, divided or lobed leaves, and delicate blue or white flowers, blossoming in early spring. Several are grown as border plants, especially the baby blue-eyes (*N. insignis*) and the five-spot (*N. maculata*). Other interesting species are the climbing nemophila or fiesta-flower (*N. aurita*), the small white nemophila (*N. heterophylla*) and the small flowered nemophila (*N. parviflora*), the last named ranging from California to Washington.

**NEMORENSIS LACUS** (mod. *Nemi*), a lake in the Alban hills, in an extinct subsidiary crater in the outer ring of the ancient Alban crater, east of the Lake of Albano. It is about $3\frac{1}{2}$ m. in diameter and some 110 ft. deep; the precipitous slopes of its basin are over 300 ft. high, and are mainly cultivated. In ancient times it was included in the territory of Aricia and bore the name "Mirror of Diana." The worship of Diana here was originally celebrated with human sacrifices; even in imperial times the priest of Diana was a man of low condition, a gladiator or fugitive slave, who won his position by slaying his predecessor in fight, having first plucked a mistletoe bough from the sacred grove. The temple itself was one of the richest in Latium; Octavian borrowed money from it in 31 B.C. The remains of its precinct are situated a little above the level of the lake, on the north-east—a large platform, the back of which is formed by a wall of concrete, with niches, resting against the cliffs. Excavations (now covered in again) led to the discovery of the temple itself, a comparatively small building, 98 by 52 ft., containing objects, none earlier than the 4th century B.C. A road descended to it from the Via Appia from the south-west. The lake is drained by a tunnel of about 2 m. long, of Roman date.

On the west side of the lake remains of two ships (really floating palaces moored to the shore) have been found, one belonging to the time of Caligula (as is indicated by an inscription on a lead pipe), and measuring 210 ft. long by 66 wide, the other even larger, 233 by 80 feet. The first was decorated with marbles and mosaics, and with some very fine bronze beamheads, with heads of wolves and lions having rings for hawsers in their mouths (and one of a Medusa), now in the Museo delle Terme at Rome. Various attempts have been made to raise the first ship, from the middle of the 15th century onwards, and the ancient emissarium has now been cleared in order to lay bare the remains of the ships. Caesar had a villa constructed there.

*See* J. G. Frazer, *The Golden Bough* (1913–14); L. Morpurgo in *Monumenti dei Lincei*, xiii. (1903), 297 *sqq.*

**NEMOURS, LORDS AND DUKES OF.** In the 12th and 13th centuries the lordship of Nemours, in Gâtinais, France, was in possession of the house of Villebeon, a member of which, Gautier, was marshal of France in the 13th century. The lordship was sold to King Philip III. in 1274 and 1276 by Jean and Philippe de Nemours, and was then made a county and given to Jean de Grailly, captal de Buch in 1364. In 1404 Charles VI. of France gave it to Charles III. of Evreux, king of Navarre, and erected it into a duchy in the peerage of France (*duché-pairie*). Charles III.'s daughter, Beatrix, brought the duchy to her husband Jacques de Bourbon, count of La Marche, and by the marriage of their daughter, Eleanor, to Bernard of Armagnac, count of Pardiac, it passed to the house of Armagnac. The duchy reverted to the French crown in 1505, after the extinction of the house of Armagnac-Pardiac. In 1507 it was given by Louis XII. successively to his nephew, Gaston de Foix (d. 1512), Guiliano de Medici and his wife Philiberta of Savoy in 1515, to Louise of Savoy in 1524, and to Philip of Savoy, count of Genevois, in 1528, whose descendants possessed the duchy until its sale to Louis XIV. In 1572 Louis gave it to his brother Philip, duke of Orleans, whose descendants possessed it until the Revolution. The title of duc de Nemours was afterwards given to Louis Charles, son of King Louis Philippe, who is dealt with separately below.

The following are the most noteworthy of the earlier dukes of Nemours.

JAMES OF ARMAGNAC, duke of Nemours (*c.* 1433–1477), was the son of Bernard d'Armagnac, count of Pardiac, and Eleanor of Bourbon-La Marche. As comte de Castres, he served under Charles VII. in Normandy in 1449 and 1450, and in Guienne. Louis XI. loaded him with honours, married him to his god-daughter, Louise of Anjou, and recognized his title to the duchy of Nemours in 1462. Sent by Louis to pacify Roussillon, Nemours felt that he had been insufficiently rewarded for the rapid success of this expedition, and joined the League of the Public Weal in 1465. The king's patience eventually became exhausted by his intrigues; his château at Carlat was attacked, and he was condemned by the parlement, and beheaded on Aug. 4, 1477.

*See* B. de Mandrot, *Jacques d'Armagnac, duc de Nemours* (1890).

CHARLES EMMANUEL (1567–1595), son of James, duke of Nemours and Anne of Este, widow of Francis, duke of Guise, was called in his youth prince of Genevois. Involved in political intrigues by his relationship with the Guises, he was imprisoned after the assassination of Henry, duke of Guise, and his brother the cardinal of Lorraine, in 1588, but escaped. He was governor of Paris when it was besieged by Henry IV. After quarrelling with his half-brother Charles of Lorraine, duke of Mayenne, he withdrew to his government of Lyonnais, where he endeavoured to make himself independent. He was imprisoned, however, in the château of Pierre-Encise by the archbishop of Lyons. After his escape he attacked Lyons, but was defeated owing to the intervention of the constable de Montmorency. He died at Annecy in July 1595.

His brother HENRY (1572–1632), called originally marquis de Saint-Sorlin, succeeded him as duke. In 1588 he took the marquisate of Saluzzo from the French for his cousin, the duke of Savoy. The princes of Guise, his half-brothers, induced him to join the League, and in 1591 he was made governor of Dauphiné. He made his submission to Henry IV. in 1596. After quarrelling with the duke of Savoy he joined the Spaniards in their war against Savoy. After peace had been proclaimed on Nov. 14, 1616, he retired to the French court. He died in 1632, and was succeeded by his eldest son, Louis, and on the death of the latter in 1641 by his second son, CHARLES AMADEUS (1624–1652), who served in the army of Flanders in 1645, and in 1646 commanded the light cavalry at the siege of Courtrai. In 1652 he took part in the war of the Fronde, and was wounded at the Faubourg St. Antoine. On July 30, 1652, he was killed in a duel by his brother-in-law, François de Vendôme, duke of Beaufort. He had two daughters, Marie Jeanne Baptiste (d. 1724), who married Charles Emmanuel of Savoy in 1665; and Marie Françoise Elisabeth, who married Alphonso VI., king of Portugal, in 1666. His brother Henry (1625–1659), archbishop of Reims, withdrew from orders and succeeded to the title.

In 1657 Henry married MARIE D'ORLEANS-LONGUEVILLE (1625–1707), daughter of Henry II. of Orléans, duke of Longueville. This duchess of Nemours is a famous personage. At an early age she was involved in the first Fronde, which was directed by her father and her stepmother, Anne Geneviève de Bourbon-Condé, the celebrated duchesse de Longueville; and when her husband died in 1659, leaving her childless, her life was mainly spent in contesting her inheritance with her stepmother. She left some interesting *Mémoires*, which are published by C. B. Petitot in the *Collection complète des mémoires* (1819–1829).

**NEMOURS, LOUIS CHARLES PHILIPPE RAPHAËL,** DUC DE (1814–1896), second son of the duke of Orleans, afterwards King Louis Philippe, was born on Oct. 25, 1814. In 1830 he became a chevalier of the order of the Saint Esprit and entered the chamber of peers. As early as 1825 his name was mentioned for the throne of Greece, and in 1831 he was elected king of the Belgians, but Louis Philippe declined the honour for his son. In Feb. 1831 he accompanied the French army which entered Belgium to support the new kingdom against Holland, and took part in the siege of Antwerp. He accompanied the Algerian expeditions against the town of Constantine in the autumn of 1836, and again in 1837, taking it by assault on Oct. 13. He sailed a third time for Algeria in 1841, and served under General Bugeaud. On his return to France he became commandant of the camp of Compiègne. He had been employed on missions to England in 1835, 1838 and 1845, and to Berlin and Vienna in 1836. His marriage in 1840 with Victoria, daughter of Duke Ferdinand of Saxe-Coburg, was marked by a check to Louis Philippe's government in the form of a refusal to bestow the marriage dowry proposed by Thiers in the chamber of deputies. The death of his elder brother, Ferdinand, duke of Orleans, in 1842 gave him a position of greater importance as the natural regent in the case of the accession of his nephew, the young count of Paris, but he was not popular. On the outbreak of the revolution of 1848 he held the Tuileries long enough to cover the king's retreat, but took no active measures against the mob. He followed his sister-in-law, the duchess of Orléans, and her two sons to the chamber of deputies, but was separated from them by the rioters, and only escaped in the uniform of a national guard. He then settled with his parents in England. His chief aim was a reconciliation between the two branches of the house of Bourbon, as indispensable to the re-establishment of the French monarchy in any form. These wishes were frustrated on the one hand by the attitude of the comte de Chambord, and on the other by the determination of the duchess of Orléans to maintain the pretensions of the count of Paris. Lengthy negotiations ended in 1857 with a letter, written by Nemours, in which he insisted that Chambord should adhere to the tricolour flag and to the principles of constitutional government.

Nemours had lived at Bushey House after the death of Queen Marie Amélie in 1866. In 1871 the exile imposed on the French princes was withdrawn, but he only returned to Paris after their disabilities were also removed. In March 1872 he was restored to his rank in the army as general of division, and placed in the first section of the general staff. In 1881 new decrees against the princes of the blood led to his withdrawal from Parisian society. He died at Versailles on June 26, 1896, the duchess having died at Claremont on Nov. 10, 1857.

*See* R. Bazin, *Le Duc de Nemours* (1907); Paul Thureau-Dangin, *Histoire de la monarchie de juillet* (4 vols., 1884, etc.).

**NEMOURS,** a town of France, in the department of Seine-et-Marne, on the Loing and its canal, 26 mi. S. of Melun, by rail. Pop. (1936) 4,942. Nemours derives its name from the woods (*nemora*) in which it formerly stood, and discoveries of Gallo-Roman remains indicate its early origin. It derives its historical importance from the lordship of Nemours.

**NENADOVIĆ, MATEYA** (1777–1854), Serbian patriot, was born in 1777. He is generally called Prota Mateya, since as a boy of 16 he was made a priest, and a few years later became archpriest (Prota) of Valyevo. His father, Alexa Nenadović, *Knez* (chief magistrate) of the district of Valyevo, was one of the prominent Serbs murdered by the Janissaries of the Belgrade Pashalik to intimidate the people (1804). The result, on the contrary, was a general popular rising. Prota Mateya became the deputy-commander of the insurgents of the Valyevo district, but soon exchanged this post for that of chief diplomatic envoy of the insurgents. In the years 1814–15 he visited Vienna to plead the cause of Serbia to the Congress. Prota Mateya's memoirs are the most valuable authority for the history of the first and second Serbian wars of independence. The best edition is that of the Serbian Literary Association in Belgrade (1893).

**NENAGH,** a town of co. Tipperary, Eire, near the river Nenagh, 96½ mi. S.W. from Dublin by the Ballybrophy and Limerick branch of the Great Southern railway. Pop. (1936) 4,902. Of the old castle, Nenagh Round, dating from King John, there still exists the circular donjon or keep. There are no remains of the hospital founded in 1200 for Austin canons, nor of the Franciscan friary, founded in the reign of Henry III. Nenagh was one of the ancient manors of the Butlers, who received for it the grant of a fair from Henry VIII. In 1550 the town and friary were burned by O'Carroll. In 1641 the town was taken by Owen Roe O'Neill, but shortly afterwards it was recaptured by Lord Inchiquin. It surrendered to Ireton in 1651, and was burned by Sarsfield in 1688.

**NENNIUS** (*fl.* 796), a Welsh writer to whom we owe the *Historia Britonum,* wrote in Brecknock or Radnor. His work exists in 30 manuscripts, the earliest of which is not much earlier than the year 1000. All are defaced by interpolations which give to the work so confused a character that critics were long disposed to treat it as an unskilful forgery. A new turn was given to the controversy by Heinrich Zimmer, who, in his *Nennius vindicatus* (1893), traced the history of the work and, by a comparison of the manuscripts with the 11th-century translation of the Irish scholar, Gilla Coemgim (d. 1072), succeeded in stripping off the later accretions from the original nucleus of the *Historia.* Zimmer follows previous critics in rejecting the *Prologus maior* (§§ 1, 2), the *Capitula,* or table of contents, and part of the *Mirabilia* of the concluding section. But he proves that Nennius is the compiler of the *Historia* proper (§§ 7–65). The only part of the *Historia* which deserves to be treated as a historical document is the section known as the *Genealogiae Saxonum* (§§ 57–65). This is merely a recension of a work composed *c.* 679 by a Briton of Strathclyde. The author's name is unknown; but he is, after Gildas, our earliest authority for the English conquest of England. Nennius himself gives us the oldest legends relating to the victories of King Arthur; the value of the *Historia* from this point of view is admitted by the severest critics. The chief authorities whom Nennius followed were Gildas' *De excidio Britonum,* Eusebius, the *Vita Patricii* of Murichu Maccu Machtheni, the *Collectanea* of Tirechan, the *Liber occupationis* (an Irish work on the settlement of Ireland), the *Liber de sex aetatibus mundi,* the chronicle of Prosper of Aquitaine, the *Liber beati Germani.* The sources for his notices of King Arthur (§ 56) are unknown.

*See* J. Stevenson's edition of the *Historia Britonum* (English Hist. Soc., 1838), based on a careful study of the mss.; A. de la Borderie, *L'Historia Britonum* (Paris and London, 1883), which summarizes the older negative criticism; H. Zimmer, *Nennius vindicatus* (Berlin, 1893); T. Mommsen in *Neues Archiv der Gesellschaft für ältere deutsche Geschichtskunde,* xix. 283. (H. W. C. D.)

**NEODYMIUM,** the third commonest metallic element belonging to the rare-earth group (symbol Nd, atomic number 60, atomic weight 144·3), was discovered by von Welsbach in 1885 when he split "didymium" into praseodymium and neodymium. This metal occurs along with cerium, lanthanum, praseodymium, etc., in the minerals monazite, cerite, allanite, etc. It is best prepared by the fractional crystallisation of the double magnesium nitrate from water. The oxide, $Nd_2O_3$, is usually obtained as a light blue powder, but traces of praseodymium give it a yellow-brown tint. The oxide is rapidly dissolved by hydrochloric and nitric acids, giving amethyst solutions which show a very intense and characteristic absorption spectrum. The metal is prepared by the electrolysis of the fused anhydrous chloride, $NdCl_3$. It slowly oxidizes in air and is gradually attacked by cold water. It melts at 840° C. (*See* RARE EARTHS.) (C. J.)

**NEOGNATHAE,** the term now used in ornithology (*q.v.*) instead of the older term Carinatae (*q.v.*) to denote the section of the class Aves to which the majority of modern birds belong.

**NEO-GREC,** in architecture and the allied arts, a style developed in the second quarter of the 19th century in France, in which an attempt was made to instil into generally classic design a spirit at once modern, original and yet full of the restraint, delicacy and perfection of Greek details. It was largely the result of the efforts of three men—J. Duban, H. Labrouste and L. Duc. It found its most complete expression in Paris, especially in the Colonne de Juillet (1831–40) by Duc; the Library of S. Geneviève (1843–50) by Labrouste; the École des Beaux Arts (1820–39) by Duban; and the west wing of the Palais de Justice (1857–68) by Duc. The style is important, less for these complete works, than for its tremendously widespread influence throughout the middle of the 19th century, not only in Europe, but also in America. Its chief characteristics are modified orders; imaginatively modernized classic detail; much use of simple, flat surfaces, often with chamfered edges; pediment forms without horizontal cornices; and delicate, refined, incised ornament.

**NEO-HEGELIANISM.** For a decade or a decade and a half after 1860 the history of British and American philosophy is the story of a growing revolt against the empirical method of John Stuart Mill and his school. The movement might have died had it not found something positive to feed upon. But it happened that a wide field of historical thought, largely unexplored by English thinkers, was there for it to turn to, namely, the German philosophy of the opening of the century, both the "criticism" of Kant and the idealistic continuation of Kantianism by Fichte, Schelling and Hegel; and "Neo-Hegelian" is the epithet attached, largely against their will, to the English group who gave the lead in this direction.

Of course no one can be prevented from using the word in other senses. Good precedent can be quoted for applying it indifferently to any revived interest in idealistic ways of thinking occurring in any country since the time of Hegel. The strongest instance in favour of an extension of meaning is the Croce-Gentile school, the most noteworthy product of contemporary thought in Italy. But on the one hand the Italian declarations of independence whenever Neo-Hegelianism is imputed to them have been so emphatic that it is hard for the historian to persist in calling them by the name; and on the other hand custom certainly sanctions the position adopted here, that Neo-Hegelianism used as a quasi-technical term is normally applied to a movement in the recent history of Anglo-Saxon thought. Perhaps the readiest conspectus of the movement will be had by treating it under two heads: its historical background and its essential teaching.

**Its Historical Background.**—It is important to distinguish the historical setting of the Neo-Hegelian thinkers, which is British, from the story of German thought which bulks most largely in their own account of their historical setting. The latter is a chapter in what they saw; the former yields the reason for their seeing it.

As is well known the scepticism of David Hume provoked a native Scottish reply as well as a German one. This, descending through Reid and Hamilton to Calderwood, Ferrier, Fraser and others in the 19th century set up an independent movement towards idealism which by 1860 had become pronounced especially in Scottish philosophy.

But important as it is for the historian to recognize how the Neo-Hegelian thinkers were thus provided with a reception in advance, it is even more important to consider the historical place in which they saw themselves to be standing, namely, the Kantian succession. When Kant came on the philosophical stage he found philosophy at an impasse. It was precisely the impasse to which they believed the doctrines of the empiricists Mill, Bain, Lewes, Spencer and others had brought it back. The work of Kant had been to examine the assumptions which led philosophy thither; and they held that further progress was impossible until the principle of the Kantian criticism was understood.

When Kant called attention to knowledge his interest was centred upon that which knowledge discloses, the "Nature" with which man is conversant in science and in everyday experience. There were two obvious features of it. First, its constituents were not things as they are in themselves but things as they appear to the human senses. Secondly,—and this was his problem—these appearances were not disconnected sensations. They had a certain order. They displayed themselves before us as objective. Kant asked how such objectivity was possible; and his answer consisted in saying that there was a logic of the process. The original use of the understanding whereby it arranged those appearances as an orderly world proceeded according to a logic which Kant distinguished as synthetic from the traditional formal or analytic logic, and which he called transcendental.

The idealistic successors of Kant—Fichte, Schelling and Hegel—saw in the critical philosophy a principle of reconciliation. The gulf fixed for common sense between mind and the world could be bridged. Kant had bridged it only imperfectly, leaving as he did things-in-themselves quite as much cut off from mind as the objects of common sense seemed to common sense to be. The post-Kantians sought, each in his own way, to bring the wheel full circle. Their instrument, with whatever differences, was still Kant's instrument, logic, the new "transcendental" logic, the logic of synthesis whereby the world is put together, as distinct from the formal analytic logic of the Aristotelian tradition. As

Hegel takes it over this logic has suffered two changes. It has ceased to be a mere theory of thought and become a theory of being; and it has learnt to move by dialectical procession. So reconstituted, logic emerges as an abstract version of the literal process by which the absolute spirit reveals itself as the universe, by dint of breaking forth into all the forms which the universe wears to human consciousness, nature, history, society, art, religion.

The dominion which his principle gave to Hegel over intellectual Europe at the beginning of the 19th century is one of the romances of philosophical history. There were three impressive features of him and his system. First, here was a thinker with apparently sufficient range to confront the entire field of man's then recorded experience of himself and the universe; in the second place he seemed to succeed in throwing whole territories of experience for the first time into some sort of order; and thirdly—the really remarkable circumstance—these results precipitated themselves in obedience to the assumption that the universe was the expression of spirit. It may be difficult to account for the currency of these beliefs about Hegel, but granted their currency there is nothing surprising in the impression he made.

**Its Essential Teaching.**—The mere existence of the Hegelian *corpus* doubtless touched the imagination of the Neo-Hegelian thinkers. It was there to show what a spiritual view of the world could be; and its presence helped to temper their disbelief in its particulars with a general belief in the possibility of "something of the kind." None of them were disciples in the way in which the original Hegelians had been. Green, more sensitive than most others to the error in some of Hegel's substantial results, even mistrusted the method by which they were obtained. To the Neo-Hegelians, Hegelianism was powerful as criticism. Green in particular was convinced by the critical regress which shows self-consciousness to be the only starting point for philosophy. He sets forth the argument in his *Prolegomena to Ethics* published posthumously in 1883 (5th ed. 1906).

This is one of the important works of the school. It is initially a constructive criticism of the empirical standpoint in ethics, its interest being to show the impossibility of either, with materialism, deriving self-consciousness from something other than itself or, with hedonism, defining the moral end by reference to something other than itself. Against the objection, almost inevitably arising, that Green is here eliminating the possibility of a logical or rational account of these matters at all, there is but one resource. It is to inquire what logic is and how far the new meaning which Kant threw into it is defensible.

Neo-Hegelianism is thus at heart a logical doctrine, and Bosanquet, whose *Logic* (1896, 2nd ed. 1911) together with Bradley's *Principles of Logic* (1883, 2nd ed. 1922) may be said to provide the technique of the whole way of thinking, expresses the spirit of it equally accurately and simply when he suggests that a colour-harmony may have logical necessity as well as a syllogism. The logic which permits such a saying is a logic of coherence. Stress upon coherence is a leading feature of Bosanquet's mind and writing. He does not, in vindicating his general position, press upon his reader the logical compulsiveness of the Kantian starting-point as Green does. He is content to exhibit the coherence which comes into our view of things when we decide to read the universe in the light of our highest experiences in it. Only in those is the coherence of the world revealed to us. And when we see how it coheres we see it as it is.

In the logical doctrine of coherence a metaphysical doctrine is involved, that of "degrees of reality." What we call our "highest" experiences occur only intermittently; and they suggest rather than express what is meant by coherence. As will, I seek the good; I rarely if ever actually find it in realizing the social will. On the other side, as intelligence, I seek the true; I shall only comparatively seldom find it in the propositions which were supremely important to my human nature as it is. None the less these rare experiences are those showing reality, giving reality in proportion as they are full and unqualified. This coincidence of reality with what man encounters when "at his fullest stretch" is the theme of the two volumes of Gifford Lectures in which Bosanquet's long term of philosophical activity culminates, *The Principle of Individuality and Value* (1912, 2nd ed. 1927) and *The Value and Destiny of the Individual* (1913, 2nd ed. 1923).

But since man is not always at his fullest stretch, and since what he encounters and experiences in his casual moods must also be real, a doctrine of grades or degrees of reality is involved. This vital implication of Neo-Hegelianism is bared to the bone only in the metaphysical essay by F. H. Bradley, *Appearance and Reality* (1893, 8th impression, 1925) usually allowed to be the greatest work emanating from the Neo-Hegelian school.

Bradley argues for one ultimate system of experience which is reality, and shows that nothing finite is real taken as it stands. For reasons equally compelling, however, he must insist that the finite is real somehow. "Anything that in any sense 'is' qualifies the absolute reality and so is real." The solution of the antinomy lies in the relativity of everything finite. No exception to this law offers itself. "There is no mere appearance or utter chance or absolute error, but all is relative." The absolute or infinite experience, therefore, which logically must be, can in fact be; and so we are entitled to say that it is. The absolute is vindicated and the finite defended through the admission of degrees in truth and reality.

Bradley's essay made history both within the school and without. All three features of the finite stressed by him, the defects which condemn it, the "relativity" which suggests salvation for it and the absolute in which it is saved, have bitten into contemporary thought. For example, both his line of attack upon the finite and his line of defence have brought mathematics and physics into the idealistic argument. Apropos of his line of defence, we find the "relativity" of recent mathematical theory regarded by Viscount Haldane as a particular case of the general principle of relativity involved in the idealistic construction of experience. Apropos of his attack, we find Royce reducing all Bradley's charges against the finite to one, namely that it involves an infinite regress; and, thinking the very possibility of idealism to be at stake, he evolves a mathematical counter-argument. Besides bringing up mathematical argument in defence of idealism Bradley's dialectical attack on the finite has also provoked mathematical resistance. This has come from Russell and the realists. Curiously enough it takes exactly the same form, a defence of the finite against the charge of involving an infinite regress of a self-contradictory kind. Still deeper has been the bite of the Bradleian Absolute. Intended by him as the saviour of the finite, it has everywhere been taken as annihilating it. It has in consequence drawn upon itself almost the whole resistance of a generation, to that conception of a quiescent absolute, to which the Western mind seems constitutionally averse. Thus it generated Pragmatism in England, and played a great part in differentiating such Neo-Hegelianism as has appeared in America from the English type.

The earliest Neo-Hegelian influences which reached America found, as in England, an idealism already there, one derived largely from the same Scottish sources. There were such teachers as Noah Porter of Yale and Thomas McCosh, of Princeton. A channel through which the Neo-Hegelian interest in America found important expression was the *Journal of Philosophical Studies,* edited by W. T. Harris (1835–1909) of St. Louis (Mo.).

The note of American idealism is its solicitude for personality and the individual. This is conspicuous in Howison and still more where the influence of Lotze was stronger, as in Bowne. The feature of Royce's central work, *The World and the Individual* (1901) is its combination of a doctrine of the absolute with a doctrine of the unique individual. The substance of reality is experience, and every finite idea of which it is composed has an "internal meaning" embodying a purpose which, in the absolute, is fulfilled. The absolute is needed in order that all ideas may reach fulfilment, both those within the experience of individuals and those beyond.

Royce's absolutism can hardly be said to have survived as a school. Yet it would be untrue to say that in America the idealism which recognizes an absolute has merely disappeared, leaving its empty room to be divided between a pragmatism which emphasizes

human values and a realism which thirsts for facts. There are signs of a younger idealistic thought ambitious to vindicate the absolute realistically by touching it, so to speak, at the very nadir of fact, through the perception that all knowledge of objects is necessarily also a revelation of subject, and therefore a traffic with mind. On some such assumption seems to rest the work of W. E. Hocking (*The Meaning of God in Human Experience,* 1912), and it is possibly in a note such as this, not without its echoes on both sides of the Atlantic that the eventual issue of the Neo-Hegelian incident in the history of philosophy is to be discerned.

BIBLIOGRAPHY.—Sir Henry Jones, *Idealism as a practical creed* (1909); James Seth, *English Philosophers and Schools of Philosophy* (1912); R. B. Perry, *The Philosophy of the Recent Past;* Macran, *Hegel's Doctrine of Formal Logic* (1912); H. A. Reyburn, *Hegel's Theory of Ethics* (1921). (J. W. S.)

**NEO-KANTIANISM.** The philosophical movement called Neo-Kantianism commenced in Germany in the 1860's. Beginning with certain epistemological enquiries, it extended gradually over the whole field of philosophy. The individual thinkers who belong to this movement differ from each other in their interpretation of the Kantian doctrine as well as in the results which they reach from the Kantian premises. But, notwithstanding differences of detail, there is a certain methodical principle common to all of them. They all see in philosophy not merely a personal conviction, an individual view of the world, but they enquire into the possibility of *philosophy as a science* with the intention of formulating its conditions. They take their cue from the *most general* statement of the Kantian problem in the preface to the *Critique of Pure Reason* and in the *Prolegomena.* But in returning to the fundamental aim of Kant, to lead philosophy "into the safe road of a science," Neo-Kantianism finds itself confronted with a new task inasmuch as it must face a different state of science itself.

**Helmholtz.**—The first decisive impetus towards the reception and revival of Kant's fundamental ideas started within the circle of natural science itself. Hermann von Helmholtz' particular mentality and his significance for the development of natural science in the nineteenth century is determined by the fact that he is both a physicist and a physiologist. His main work, the *Handbuch der physiologischen Optik* (1856, 3rd ed. 1909–11), shows both methods of enquiry in their mutual interdependence and ideal union. Here the fundamental problem of Kant's *Transcendental Aesthetics,* the question of the epistemological significance of space and spatial perception, is emphatically restated. For the solution of this question, Helmholtz goes back to the researches and results of *Johannes Müller* in the field of the physiology of the senses.

In his *Vergleichende Physiologie des Gesichtssinns* (1826), Johannes Müller had developed the doctrine of the "specific energy" of sense organs; he had shown that the quality of the individual sense data,—the constitution of colour, tone, smell, etc.—is not to be explained from the constitution of the external stimulus, but from the peculiarity of the organ that conveys the sensation. This result is taken up by Helmholtz in his lecture *Ueber das Sehen des Menschen* (1855), and interpreted as an empirical confirmation of that which Kant had determined by general *a priori* considerations. The true and permanent achievement of Kantian philosophy, according to this interpretation, consists in having shown the participation of the innate laws of the mind in the formation of our ideas.

This interpretation was accepted by contemporary philosophers, especially by *Friedrich Albert Lange* (1828–1875). Lange, in his *History of Materialism* (1866), propounds as the essence of Kantian philosophy the proposition that what we call the "reality" of things is in truth nothing but their "appearance for the human species." Thus, the concept of causality, for instance, being rooted, according to this theory, in our psycho-physical organization, is prior to all experience, an *a priori* disposition of the human mind. Accordingly, it has within the field of human experience unlimited validity; but beyond this no significance whatever. By extending this interpretation to all parts of the Kantian system, Lange arrives at the conclusion that not only is the concept of the "thing-in-itself" the "concept of a perfectly problematical something" having significance only as a "limiting term" (*Grenzbegriff*), but that even the "intelligible world," which was used by Kant as the foundation of *ethics,* is a "world of poetry." This poetry, to be sure, is, according to Lange, "a necessary fruit of the mind, issuing from the inner and most vital roots of the species." But in this very implication, which threatened to transform the Kantian transcendental idealism into a *fictionism* of the type developed later by Vaihinger, the deficiencies of the empirico-physiological interpretation of Kantian Apriorism became clearly apparent.

**Zeller.**—In the meantime, the attempt had already been made in German philosophy to put Kantian Apriorism on a basis broader and more solid than that which the doctrine of the specific energy of sense organs was capable of affording. In a lecture which Eduard Zeller had delivered in the year 1862 as an introduction to his course on logic and epistemology in Heidelberg, he had pointed out that epistemology formed the formal basis of philosophy as a whole, that it was epistemology "from which the final decision on the correct method in philosophy and science generally had to come." Hegel's *Wissenschaft der Logik* and his *Phaenomenologie des Geistes* had been the last grandiose attempts to comprise the whole of knowledge in its content and to develop it constructively from one unifying idea. Zeller tries to show that the attempt did not reach its goal and could not reach it, "because it overlooks the conditions of human knowledge, for it purports to grasp with one swoop from above the ideal of knowledge which, in reality, we can approach only gradually through complicated labour from below." But the magic circle of the Hegelian system—so he says—will not allow itself to be broken, so long as the presuppositions of the latter are not investigated anew and more thoroughly than before; and this very investigation necessarily leads back to Kant.

What is here expressed as a purely programmatic idea, Otto Liebmann (1840–1912) tried to carry out in his main philosophical writings. The very first of Liebmann's writings, *Kant und die Epigonen* (1865), attempts to show that the successors of Kant all missed the way which he had clearly recognized and indicated. In an intensive criticism of the "idealistic," the "realistic" and the "empirical" tendencies of post-Kantian philosophy, Liebmann tries to point out that all these movements—the systems of Fichte, Schelling and Hegel, as well as the systems of Herbart, Fries and Schopenhauer—suffer from a common fault. They all assign to the concept of the "Absolute" or of the "thing-in-itself" a central place and make it the fundamental concept of metaphysics, whereas Kant's doctrine, if rightly understood and further developed, implies the very opposite, namely, that this concept is a non-concept, that all cognition moves within the realm of mere relationships, but can never grasp or positively determine an "Absolute."

**Hermann Cohen.**—However, it was only in Hermann Cohen (1842–1918) that neo-Kantianism reached its climax. In his three great works on Kant: *Kants Theorie der Erfahrung* (1871, 2nd ed. 1885); *Kants Begründung der Ethik* (1877, 2nd ed. 1910); *Kants Begründung der Aesthetik* (1888), Cohen gave for the first time a critical interpretation of the entire Kantian system which, with all its penetration into the specific detail of Kant's fundamental doctrines, sets, nevertheless, one single systematic idea into the centre of the investigation. This idea is that of the "transcendental method."

From Friedrich Albert Lange, with whom Cohen was closely connected by ties of personal friendship, Cohen differs especially in that he rejects any psychological interpretation of Kant's Apriorism, any explanation of the *a priori* by the "psycho-physical organization" of man.

In his study *Das Prinzip der Infinitesimal methode und seine Geschichte* (1883), he tries to prove that the concept of the "infinitely small," as it was established in the Leibnizian differential calculus, and in the Newtonian calculus of "fluxions," is, at the same time, the indispensable and basic intellectual means for any scientific cognition of "reality." Reality is never "given" in any sense, neither in sensation nor in mere intuition, but it must

be produced by means of pure thought. The various ways and directions in which thought moves in this "production of the object" are the problems which logic has to trace.

This idea found its development in Cohen's main systematic work, the *Logik der reinen Erkenntnis* (1902, 2nd ed. 1914), to which were added, as a second and third part of his system of philosophy, the *Ethik des reinen Willens* (1904), and the *Aesthetik des reinen Gefühls* (1912).

**Natorp.**—In closest personal and scientific contact with Cohen, Paul Natorp (1854–1924) further pursued and carried out the fundamental methodical idea of "critical idealism." For him, too, the object of knowledge is not given in itself as a ready-made thing, but "becomes" only in the eternal process of knowing, in a constantly renewed production of objects. This process never lies completed before us, as a firm and final result, an "Absolute" in the dogmatic-metaphysical meaning of the term; it is, however, possible to recognize the direction in which it moves, the general form of the production of the object. Natorp developed this main idea of his theoretical philosophy especially in his study, *Die logischen Grundlagen der exakten Wissenschaft* (1910) and in a more concentrated survey in the essay, *Philosophie, ihr Problem und ihre Probleme* (1911). Of especial importance, furthermore, is his *Allgemeine Psychologie nach kritischer Methode* (1912), which established an entirely new view of its aim and method and anticipated in decisive points Husserl's Phenomenology.

**Riehl.**—Cohen's insistent reference to the doctrine of Kant as the basis of all scientific philosophy and his account of the "transcendental" had a great effect even on thinkers who ultimately differed from Cohen in the conception of the critical system. Thus, for instance, the main work of Alois Riehl: *Der philosophische Kritizismus und seine Bedeutung für die positive Wissenschaft* (1876, 1879, 1887) is in its first edition still under the influence of Cohen's view of the transcendental.

Riehl, too, emphasizes that the question of the objective stock and the objective validity of knowledge should not be confounded with the question of the formation of ideas within the subjective consciousness. Kant's decisive achievement, according to Riehl, consists just in this, that he distinguished clearly the two questions, the "transcendental" and the "psychological," that he separated the problem of the objective significance of knowledge from the *genetic* question of its derivation.

But this idealism of the *general* forms of pure intuition and pure understanding constitutes, according to Riehl, only *one* phase of the Kantian doctrine, which has its counterpart in another equally legitimate and equally indispensable one. For the particulars of experience, the definite spatial and temporal order of empirical phenomena, as well as the specific causal laws subsisting between them, are never to be deduced from those general forms. Here we find ourselves necessarily referred to that other factor which Kant called the "material" factor of knowledge. The concepts of understanding as well as the pure forms of space and time give only the universal and necessary *form* of experienced reality, while its *content* can never be given to us otherwise than through *sensation,* through immediate sense-perception. Thus the latter forms the specific and indispensable basis of our conviction regarding the reality of things.

Riehl characterizes this view as "critical realism" and sees in it the specific kernel of Kant's teaching. "For the specific and definite forms of things as given in empirical intuition, that is, the position, shape, size, the definite and determinate duration and sequence of things, there must be, according to the explicit teaching of Kant, a source in the things themselves. For they cannot be derived from the universal form of intuition which originates solely in the mentality of the subject. . . . The things-in-themselves, with their proportions as expressed in the specific forms of intuition and the empirical laws of nature, are for Kant a presupposition just as essential as the *a priori* elements of cognition. The necessary combination of both, their union in experience, is the upshot of his teaching. Our knowledge of things is a mediate cognition of the things themselves through the appearances of the things to our senses" (*Zur Einführung in die Philosophie der Gegenwart,* 4th edition, 1913, p. 109f).

**The Positivistic View.**—Among all the thinkers of the Neo-Kantian movement, Riehl is the one who is most strongly influenced by the *positivistic* view of the nature and the task of philosophy. Scientific philosophy, in the strict sense of the word, is for him almost synonymous with pure epistemology and the methodology of the special sciences.

Hence, there remains no special field of study reserved as its proper domain; rather it is merely the texture and the logical structure of knowledge, of science itself, with which philosophic reflection can be concerned. "Instead of things, it investigates the understanding which recognizes things; instead of nature, the science of nature; instead of phenomena, their presuppositions in the consciousness of man." However, through this confinement of philosophy to the *pure science of knowledge,* Riehl ends by allowing the *theory of values* to fall out of it entirely.

To be sure, Riehl admits that there must be a "teleology of human life" for which mere knowledge of nature is not sufficient; but he himself did not study systematically the problems of this teleology, especially the ethical and aesthetic problems and the philosophy of history; he touched upon them only occasionally. "Views of the world" (*Weltanschauungen*)—so he declares explicitly—are not a matter of mere understanding; and they are for that reason subjective in the main; they do not belong to science but to *faith.* This separation of knowledge from faith carried with it the danger that scientific value was attributed to natural knowledge exclusively, while the pure *sciences of the mind* (*Geisteswissenschaften*), the sciences of the historical reality of man's mental achievements, were deprived of their specific methodical foundation.

**Windelband and Rickert.**—Here lies the problem from which started that tendency of Neo-Kantianism which was founded by Wilhelm Windelband and carried on by Heinrich Rickert. The epochal works of Wilhelm Dilthey (1833–1912), especially his *Einleitung in die Geisteswissenschaften* (1883), had led the attention of 19th century German philosophy back to the foundations of the historical world in the sciences of the mind. In trying to present, and to solve, this problem in the spirit of the strictly critical philosophy, it was first of all necessary to draw a sharp line between the form of science exemplified by history and that represented by natural science.

This is the task which Windelband sets himself in his address: *Geschichte und Naturwissenschaft.* The pure "sciences of laws" are here contrasted with the "sciences of events," the "nomothetic" procedure of natural science with the "ideographic" procedure of history. Rickert elaborates this distinction in his work, *Die Grenzen der naturwissenschaftlichen Begriffsbildung,* which he calls a logical introduction to the historical sciences (1896–1902, 2nd ed. 1913). In this justification, the isolated place which the pure science of knowledge had received with Riehl is abolished.

For Windelband and Rickert (*cf.* especially Rickert's *Der Gegenstand der Erkenntnis,* 1892, 2nd ed. 1904) the theory of knowledge, too, is included in the group of the *sciences of values,* because it is a science of *"oughts,"* of the universally valid *norms* of truth. In this respect, it stands on the same level as the other studies of values, especially with ethics and aesthetics. Philosophy, as a general theory of values, as the science of the "consciousness of norms" (*Normalbewustsein*), is essentially a philosophy of culture. Its task may be said to consist in establishing a connection between the realm of "reality" and the realm of values. It is only the concept of value that makes history possible as a science: for only through the values attached to culture can we obtain a definite principle of selection within the infinite manifold of the historical facts, and thus establish the conception of an historical individuality which is capable of description. If we now survey the path of the Neo-Kantian movement from its first beginnings to its present stage, we may say by way of summary that it has gradually encircled the total orbit of knowledge by trying to advance more and more from the "abstract" to the "concrete," from the general principles of knowledge to the specific content of mental culture. (E. Cr.)

**NEOLITHIC:** *see* Archaeology.

**NEON,** one of the "rare gases" of the atmosphere (*q.v.*), in which it occurs to the extent of about ten parts per million. (Symbol Ne, atomic number 10, atomic weight 20·2.) It was discovered in 1898 by Sir W. Ramsay and M. W. Travers, and has acquired publicity owing to its use for advertising signs. Of recent years it has become of great scientific importance owing to the part it has played in the investigation of isotopes (*q.v.*).

**NEOPHYTE,** a word used in the Eleusinian and other mysteries to designate the newly initiated, and in the early church applied to newly baptized persons. These usually wore the white garments which they received at their admission to the church (*see* BAPTISM) for eight days, from Easter eve till the Sunday after Easter (hence called *Dominica in albis*), but they were subject to strict supervision for some time longer.

*See* Bergier, *Dict. de théologie,* s.v.; Martigny, *Dict. des antiquités,* pp. 433–435; Siegel, *Christliche Alterthümer,* iii. 17 *seq.;* Riddle, *Christ. Antiquities,* pp. 313, 522; Walcott, *Sacred Archaeology,* s.v., and the *Catholic Encyclopaedia,* s.v.

**NEOPLATONISM,** the name given specially to the last school of pagan philosophy, which grew up mainly among the Greeks of Alexandria from the 3rd century onwards. The term has also been applied to the Italian humanists of the Renaissance, and in modern times, somewhat vaguely, to thinkers who have based their speculations on the Platonic metaphysics or on Plotinus, and incorporated with it a tendency towards a mystical explanation of ultimate phenomena.

**Historical Position and Significance.**—Just as the Later Roman empire was at once the supreme effort of the old world and the outcome of its exhaustion, so Neoplatonism is in one aspect the consummation, in another the collapse, of ancient philosophy. Never before in Greek or in Roman speculation had the consciousness of man's dignity and superiority to nature found such adequate expression; never before had real science and pure knowledge been so undervalued and despised by the leaders of culture as they were by the Neoplatonists.

It is a proof of the strength of the moral instincts of mankind that the only phase of culture which we can survey in all its stages from beginning to end culminated not in materialism, but in the boldest idealism. This idealism, however, is also in its way a mark of intellectual bankruptcy. Contempt for reason and science leads in the end to barbarism—its necessary consequence being the rudest superstition. As a matter of fact, barbarism did break out after the flower had fallen from Neoplatonism. The philosophers themselves, no doubt, still lived on the knowledge they repudiated; but the masses were trained to a superstition with which the Christian church, as the executor of Neoplatonism, had to reckon and contend. By a fortunate coincidence, at the very moment when this bankruptcy of the old culture must have become apparent, the stage of history was occupied by barbaric peoples. This has obscured the fact that the inner history of antiquity, ending as it did in despair of this world, must in any event have seen a recurrence of barbarism. The present world was a thing that men would neither enjoy nor master nor study. A new world was discovered, for the sake of which everything else was abandoned.

Such is Neoplatonism. The pre-Socratic philosophy took its stand on natural science, to the exclusion of ethics and religion. The systems of Plato and Aristotle sought to adjust the rival claims of physics and ethics (although the supremacy of the latter was already acknowledged); but the popular religions were thrown overboard. The post-Aristotelian philosophy in all its branches makes withdrawal from the objective world its starting-point. It might seem, indeed, that Stoicism indicates a falling off from Plato and Aristotle towards materialism, but the ethical dualism, which was the ruling tendency of the Stoa, could not long endure its materialistic physics, and took refuge in the metaphysical dualism of the Platonists. But this originated no permanent philosophical creation. From one-sided Platonism issued the various forms of scepticism, the attempt to undermine the trustworthiness of empirical knowledge. Neoplatonism, coming last, borrowed something from all the schools. First, it stands in the line of post-Aristotelian systems; it is, in fact, as a subjective philosophy, their logical completion. Secondly, it is founded on scepticism; for it has neither interest in, nor reliance upon, empirical knowledge. Thirdly, it can justly claim the honour of Plato's name, since it expressly goes back to him for its metaphysics, directly combating those of the Stoa. Yet even on this point it learned something from the Stoics; the Neoplatonic conception of the action of the Deity on the world and of the essence and origin of matter can only be explained by reference to the dynamic pantheism of the Stoa. Fourthly, the study of Aristotle also exercised an influence on Neoplatonism. This appears not only in its philosophical method, but also—though less prominently—in its metaphysic. And, fifthly, Neoplatonism adopted the ethics of Stoicism; although it was found necessary to supplement them by a still higher conception of the functions of the spirit. Philosophy as represented by Neoplatonism, its sole interest being a religious interest, and its highest object the supra-rational, must be a philosophy of revelation.

This is not a prominent feature in Plotinus or his immediate disciples, who still exhibit full confidence in the subjective presuppositions of their philosophy. But the later adherents of the school did not possess this confidence; they based their philosophy on revelations of the Deity, and they found these in the religious traditions and rites of all nations. The Stoics had taught them to overstep the political boundaries of states and nationalities, and rise from the Hellenic to a universal human consciousness. Through all history the spirit of God has breathed; everywhere we discover the traces of His revelation. The older any religious tradition or mode of worship is, the more venerable is it, the richer in divine ideas. Hence the religions of the East had a peculiar interest for the Neoplatonist. Neoplatonism seizes on the aspiration of the human soul after a higher life, and treats this psychological fact as the key to the interpretation of the universe. Hence the existing religions, after being refined and spiritualized, were made the basis of philosophy.

Neoplatonism thus represents a stage in the history of religion; indeed this is precisely where its historical importance lies. In the progress of science and enlightenment it has no positive significance, except as a necessary transition which the race had to make in order to get rid of nature-religion, and that under-valuing of the spiritual life which formed an insuperable obstacle to the advance of human knowledge. Neoplatonism, however, failed as signally in its religious enterprise as it did in its philosophical. While seeking to perfect ancient philosophy, it really extinguished it; and in like manner its attempted reconstruction of ancient religions only resulted in their destruction. For in requiring these religions to impart certain prescribed religious truths, and to inculcate the highest moral tone, it burdened them with problems to which they were unequal. And further, by inviting them to loosen, though not exactly to dissolve, their political allegiance—the very thing that gave them stability—it removed the foundation on which they rested.

There is one other question which we are called upon to raise here. Why did not Neoplatonism set up an independent religious community? Why did it not provide for its mixed multitude of divinities by founding a universal church, in which all the gods of all nations might be worshipped along with the one ineffable Deity? The answer to this question involves the answer to another—Why was Neoplatonism defeated by Christianity? Three things were wanting in Neoplatonism; they are admirably indicated in Augustine's *Confessions* (vii. 18–21). First, and chiefly, it lacked a religious founder; second, it could not tell how the state of inward peace and blessedness could become permanent; third, it had no means to win those who were not endowed with the speculative faculty. The philosophical discipline which it recommended for the attainment of the highest good was beyond the reach of the masses; and the way by which the masses could attain the highest good was a secret unknown to Neoplatonism.

Yet the influence of Neoplatonism on the history of our ethical culture is immeasurable, above all because it begot the consciousness that the only blessedness which can satisfy the heart must be sought higher even than the sphere of reason. That man shall not live by bread alone, the world had learned before Neoplato-

nism; but Neoplatonism enforced the deeper truth—a truth which the older philosophy had missed—that man shall not live by knowledge alone.

**Origin.**—As forerunners of Neoplatonism we may regard, on the one hand, those Stoics who accepted the Platonic distinction between the sensible world and the intelligible, and, on the other hand, the so-called Neopythagoreans and religious philosophers like Plutarch of Chaeronea and especially Numenius of Apamea. The Jewish and Christian thinkers of the first two centuries approach considerably nearer than Numenius to the later Neoplatonism. Here we have Philo, to begin with. Philo, who translated the Old Testament religion into the terms of Hellenic thought, holds as an inference from his theory of revelation that the divine Supreme Being is "supra-rational," that He can be reached only through "ecstasy," and that the oracles of God supply the material of moral and religious knowledge. The religious ethics of Philo—a compound of Stoic, Platonic and Neopythagorean elements—already bear the peculiar stamp which we recognize in Neoplatonism. While his system assigns the supremacy to Greek philosophy over the national religion of Israel, it exacts from the former, as a sort of tribute to the latter, the recognition of the elevation of God above the province of reason. The claim of positive religion to be something more than the intellectual apprehension of the reason in the universe is thus acknowledged. Religious syncretism is also a feature of Philo's system, but it differs essentially from what we find in later Neoplatonism. For Philo pays no respect to any cultus except the Jewish; and he believed that all the fragments of truth to be found amongst Greeks and Romans had been borrowed from the books of Moses. The earliest Christian philosophers, particularly Justin and Athenagoras, likewise prepared the way for the speculations of the Neoplatonists—partly by their attempts to connect Christianity with Stoicism and Platonism, partly by their ambition to exhibit Christianity as "hyperplatonic." In the introduction to his *Dialogue with Trypho,* Justin follows a method which bears a striking resemblance to the later method of Neoplatonism: he seeks to base the Christian knowledge of God—that is, the knowledge of the truth—on Platonism, Scepticism and "Revelation." A still more remarkable parallel to the later Neoplatonism is afforded by the Christian Gnostics of Alexandria, especially Valentinus and the followers of Basilides. Like the Neoplatonists, the Basilidians believed, not in an emanation from the Godhead, but in a dynamic manifestation of its activity. The same is true of Valentinus, who also placed an unnameable being at the apex of his system, and regarded matter, not as a second principle, but as a product of the one divine principle.

But were the oldest Neoplatonists really acquainted with the speculations of Philo, or Justin, or Valentinus, or Basilides? Did they know the Oriental religions, Judaism and Christianity in particular? And, if so, did they really derive anything from these sources?

To these questions we cannot give definite answers. Since Neoplatonism originated in Alexandria, where Oriental modes of worship were accessible to every one, and since the Jewish philosophy had also taken its place in the literary circles of Alexandria, we may safely assume that even the earliest of the Neoplatonists possessed an acquaintance with Judaism and Christianity. But if we search Plotinus for evidence of any actual influence of Jewish and Christian philosophy, we shall search in vain. We have to come down to Iamblichus and his school before we find complete correspondence with the Christian Gnosticism of the 2nd century; that is to say, it is only in the 4th century that Greek philosophy in its proper development reaches the stage at which certain Greek philosophers who had embraced Christianity had arrived in the 2nd century. The influence of Christianity—whether Gnostic or Catholic—on Neoplatonism was at no time very considerable, although individual Neoplatonists, after Amelius, used Christian texts as oracles, and put on record their admiration for Christ.

**History and Doctrines.**—The founder of the Neoplatonic school in Alexandria is supposed to have been Ammonius Saccas (*q.v.*). But the *Enneads* of his pupil Plotinus are the primary and classical document of Neoplatonism. The doctrine of Plotinus is mysticism, and like all mysticism it consists of two main divisions. The first or theoretical part deals with the high origin of the human soul, and shows how it has departed from its first estate. In the second or practical part the way is pointed out by which the soul may again return to the Eternal and Supreme. Since the soul in its longings reaches forth beyond all sensible things, beyond the world of ideas even, it follows that the highest being must be something supra-rational. The system thus embraces three heads—(1) the primeval Being, (2) the ideal world and the soul, (3) the phenomenal world.

The primeval Being is, as opposed to the many, the One; as opposed to the finite, the Infinite, the unlimited. It is the source of all life, and therefore absolute causality and the only real existence. It is, moreover, the Good, in so far as all finite things have their purpose in it, and ought to flow back to it. But one cannot attach moral attributes to the original Being itself, because these would imply limitation. It has no attributes of any kind; it is being without magnitude, without life, without thought; in strict propriety, indeed, we ought not to speak of it as existing; it is "above existence," "above goodness." It is also active force without a substratum; as active force the primeval Being is perpetually producing something else, without alteration, or motion, or diminution of itself. This production is not a physical process, but an emission of force; and, since the product has real existence only in virtue of the original existence working in it, Neoplatonism may be described as a species of dynamic pantheism. Directly or indirectly, everything is brought forth by the "One."

The original Being first of all throws out the *nous,* which is a perfect image of the One and the archetype of all existing things. It is at once being and thought, ideal world and idea. As image, the *nous* corresponds perfectly to the One, but as derived it is entirely different. What Plotinus understands by the *nous* is the highest sphere accessible to the human mind, and, along with that, pure thought itself.

The image and product of the motionless *nous* is the soul, which, according to Plotinus is, like the *nous,* immaterial. Its relation to the *nous* is the same as that of the *nous* to the One. It stands between the *nous* and the phenomenal world, is permeated and illuminated by the former, but is also in contact with the latter. The *nous* is indivisible; the soul *may* preserve its unity and remain in the *nous,* but at the same time it has the power of uniting with the corporeal world and thus being disintegrated. It therefore occupies an intermediate position. As a single soul (world-soul) it belongs in essence and destination to the intelligible world; but it also embraces innumerable individual souls; and these can either submit to be ruled by the *nous,* or turn aside to the sensual and lose themselves in the finite.

The human souls which have descended into corporeality are those which have allowed themselves to be ensnared by sensuality and overpowered by lust. They now seek to cut themselves loose from their true being; and, striving after independence, they assume a false existence. They must turn back from this; and, since they have not lost their freedom, a conversion is still possible.

Here, then, we enter upon the practical philosophy. Along the same road by which it descended the soul must retrace its steps back to the supreme Good. It must first of all return to itself. This is accomplished by the practice of virtue, which aims at likeness to God, and leads up to God. In the ethics of Plotinus all the older schemes of virtue are taken over and arranged in a graduated series. The lowest stage is that of the civil virtues, then follow the purifying, and last of all the divine virtues. The civil virtues merely adorn the life, without elevating the soul. That is the office of the purifying virtues, by which the soul is freed from sensuality and led back to itself, and thence to the *nous.* By means of ascetic observances the man becomes once more a spiritual and enduring being, free from all sin. But there is still a higher attainment; it is not enough to be sinless, one must become "God." This is reached through contemplation of the primeval Being, the One—in other words, through an ecstatic approach, the soul may see God, the fountain of life, the source of being, the origin of all good, the root of the soul. In that

moment it enjoys the highest indescribable bliss; it is as it were swallowed up of divinity, bathed in the light of eternity. Porphyry tells us that on four occasions during the six years of their intercourse Plotinus attained to this ecstatic union with God.

Such is the religious philosophy of Plotinus, and for himself personally it sufficed, without the aid of the popular religion or worship. Nevertheless he sought for points of support in these. God is certainly in the truest sense nothing but the primeval Being; but He reveals Himself in a variety of emanations and manifestations. The *nous* is a sort of second god, the λόγοι which are wrapped up in it are gods, the stars are gods.

Amongst his pupils, Amelius and Porphyry are the most eminent. Amelius modified the teaching of Plotinus on certain points; and he also put some value on the prologue to the Gospel of John. To Porphyry (*q.v.*) belongs the credit of having recast and popularized the system of his master Plotinus. He was not an original thinker, but a diligent student, distinguished by great learning, by a turn for historical and philological criticism, and by an earnest purpose to uproot false teaching, especially Christianity, to ennoble men and train them to goodness. The system of Porphyry is more emphatically practical and religious than that of Plotinus. The object of philosophy, according to Porphyry, is the salvation of the soul. The origin and the blame of evil are not in the body, but in the desires of the soul. Hence the strictest asceticism (abstinence from flesh, and wine, and sexual intercourse) is demanded, as well as the knowledge of God. As he advanced in life, Porphyry protested more and more earnestly against the rude faith of the common people and their immoral worships. His work *Against the Christians* was directed, not against Christ, nor against what he believed to be Christ's teaching, but against the Christians of his own day and their sacred books, which, according to Porphyry, were the work of deceivers and ignorant people. In his trenchant criticism of the origin of what passed for Christianity in his time, he spoke bitter and severe truths, which have gained for him the reputation of the most rabid and wicked of all the enemies of Christianity. His work was destroyed, it was condemned by an edict of the emperors Theodosius II. and Valentinian in the year 448, and the copious extracts which we find in Lactantius, Augustine, Jerome, Macarius Magnus and others show how profoundly he had studied the Christian writings, and how great was his talent for real historical research.

Porphyry marks the transition to a new phase of Neoplatonism, in which it becomes completely subservient to polytheism, and seeks before everything else to protect the Greek and Oriental religions from the formidable assault of Christianity. In the hands of Iamblichus (*q.v.*), the pupil of Porphyry, Neoplatonism is changed "from a philosophical theory to a theological doctrine."

The numerous followers of Iamblichus—Aedesius, Chrysanthius, Eusebius, Priscus, Sopater, Sallust, and, most famous of all, Maximus (*q.v.*), rendered little service to speculation. Some of them (Themistius in particular) are known as commentators on the older philosophers, and others as the missionaries of mysticism. The work *De mysteriis Aegyptiorum* is the best sample of the views and aims of these philosophers. Their hopes rose high when Julian ascended the imperial throne (361–363). But the emperor himself lived long enough to see that his romantic policy of restoration was to leave no results; and after his early death all hope of extinguishing Christianity was abandoned.

But undoubtedly the victory of Christianity in the age of Valentinian and Theodosius had a purifying influence on Neoplatonism. During the struggle for supremacy, the philosophers had been driven to make common cause with everything that was hostile to Christianity. But now Neoplatonism was thrust from the great stage of history. The church and church theology, to whose guidance the masses now surrendered themselves, took in along with them their superstition, their polytheism, their magic, their myths, and all the machinery of religious witchcraft. The more all this settled and established itself—certainly not without opposition—in the church the purer did Neoplatonism become. While maintaining intact its religious attitude and its theory of knowledge, it returned with new zest to scientific studies, especially the study of the old philosophers. If Plato still remains the divine philosopher, yet we can perceive that after the year 400 the writings of Aristotle are increasingly read and valued. In the chief cities of the empire Neoplatonic schools flourished till the beginning of the 5th century; during this period, indeed, they were the training-schools of Christian theologians. At Alexandria the noble Hypatia (*q.v.*) taught, to whose memory her impassioned disciple Synesius, afterwards a bishop, reared a splendid monument. But after the beginning of the 5th century the fanaticism of the church could no longer endure the presence of "heathenism." The murder of Hypatia was the death of philosophy in Alexandria, although the school there maintained a lingering existence till the middle of the 6th century. But there was one city of the East which, lying apart from the crowded highways of the world, had sunk to a mere provincial town, and yet possessed associations which the church of the 5th century felt herself powerless to eradicate. In Athens a Neoplatonic school still flourished.

The most distinguished teachers at Athens were Plutarch (*q.v.*), his disciple Syrianus (who did important work as a commentator on Plato and Aristotle, and further deserves mention for his vigorous defence of the freedom of the will), but above all Proclus (411–485). Proclus is the great schoolman of Neoplatonism. Forty-four years after the death of Proclus the school of Athens was closed by Justinian (A.D. 529); but it had already fulfilled its mission in the work of Proclus. The works of Proclus, as the last testament of Hellenism to the church and the middle ages, exerted an incalculable influence on the next thousand years. They not only formed one of the bridges by which the mediaeval thinkers got back to Plato and Aristotle; they determined the scientific method of thirty generations, and they partly created and partly nourished the Christian mysticism of the middle ages.

The disciples of Proclus are not eminent (Marinus, Asclepiodotus, Ammonius, Zenodotus, Isidorus, Hegias, Damascius). The last president of the Athenian school was Damascius (*q.v.*). When Justinian issued the edict for the suppression of the school, Damascius along with Simplicius (the painstaking commentator on Aristotle) and five other Neoplatonists set out to make a home in Persia. They found the conditions were unfavourable and were allowed to return (*see* CHOSROES I.).

At the beginning of the 6th century Neoplatonism had ceased to exist in the East as an independent philosophy. Almost at the same time, however—and the coincidence is not accidental—it made new conquests in the church theology through the writings of the pseudo-Dionysius. It began to bear fruit in Christian mysticism, and to diffuse a new magical leaven through the worship of the church.

In the West, where philosophical efforts of any kind had been very rare since the 2nd century, and where mystical contemplation did not meet with the necessary conditions, Neoplatonism found a congenial soil only in isolated individuals. C. Marius Victorinus (*q.v.*) translated certain works of Plotinus, and thus had a decisive influence on the spiritual history of Augustine (*Confess.* vii. 9, viii. 2). It may be said that Neoplatonism influenced the West only through the medium of the church theology, or, in some instances, under that disguise. Even Boetius (it may now be considered certain) was a catholic Christian, although his whole mode of thought was certainly Neoplatonic (*see* BOETIUS).

**Neoplatonism and the Theology of the Church.**—The question as to the influence of Neoplatonism on the development of Christianity is not easily answered, because it is scarcely possible to get a complete view of their mutual relations. The answer will depend, in the first instance, upon how much is included under the term "Neoplatonism." If Neoplatonism is understood in the widest sense, as the highest and fittest expression of the religious movements at work in the Graeco-Roman empire from the 2nd to the 5th century, then it may be regarded as the twin-sister of the church dogmatic which grew up during the same period; the younger sister was brought up by the elder, then rebelled against her and at last tyrannized over her. In so far as Neoplatonism and the church dogmatic set out from the felt need of redemption, in so far as both sought to deliver the soul from sensuality and recognized man's inability without divine

aid—without a revelation—to attain salvation and a sure knowledge of the truth, they are at once most intimately related and at the same time mutually independent. It must be confessed that when Christianity began to project a theology it was already deeply impregnated by Hellenic influences. But the influence is to be traced not so much to philosophy as to the general culture of the time, and the whole set of conditions under which spiritual life was manifested. When Neoplatonism appeared, the Christian church had already laid down the main positions of her theology; or if not, she worked them out alongside of Neoplatonism—*that* is not a mere accident—but still independently. It was only by identifying itself with the whole history of Greek philosophy, or by figuring as pure Platonism restored, that Neoplatonism could stigmatize the church theology of Alexandria as a plagiarism from itself. These assumptions, however, were fanciful. Although our sources are unfortunately very imperfect, the theology of the church does not appear to have learned much from Neoplatonism in the 3rd century—partly because the latter had not yet reached the form in which its doctrines could be accepted by the church dogmatic, and partly because theology was otherwise occupied. Her first business was to plant herself firmly on her own territory, to make good her position and clear away old and objectionable opinions. Origen was quite as independent a thinker as Plotinus; only, they both drew on the same tradition. From the 4th century downwards, however, the influence of Neoplatonism on the Oriental theologians was of the utmost importance. The church gradually expressed her most peculiar convictions in dogmas, which were formulated by philosophical methods, but were irreconcilable with Neoplatonism (the Christological dogmas); and the further this process went the more unrestrainedly did theologians resign themselves to the influence of Neoplatonism on all other questions. The doctrines of the incarnation, the resurrection of the flesh and the creation of the world in time marked the boundary line between the church's dogmatic and Neoplatonism; in every other respect, theologians and Neoplatonists drew so closely together that many of them are completely at one. In fact, there were special cases, like that of Synesius, in which a speculative reconstruction of distinctively Christian doctrines by Christian men was winked at. If a book does not happen to touch on any of the above-mentioned doctrines, it may often be doubtful whether the writer is a Christian or a Neoplatonist. In ethical precepts, in directions for right living (that is, asceticism), the two systems approximate more and more closely. But it was here that Neoplatonism finally celebrated its greatest triumph. It indoctrinated the church with all its mysticism, its mystic exercises and even its magical cultus as taught by Iamblichus. The works of the pseudo-Dionysius contain a gnosis in which, by means of the teaching of Iamblichus and Proclus, the church's theology is turned into a scholastic mysticism with directions on matters of practice and ritual. And as these writings were attributed to Dionysius, the disciple of the apostles, the scholastic mysticism which they unfold was regarded as an apostolic, not to say a divine, science. The influence exercised by these writings, first on the East, and then—after the 9th (or 12th) century—on the West, cannot be overestimated. It is impossible to enlarge upon it here; suffice it to say that the mystical and pietistic devotion of our own day, even in the Protestant churches, is nourished on works whose ancestry can be traced, through a series of intermediate links, to the writings of the pseudo-Areopagite.

In the ancient world there was only one Western theologian who came directly under the influence of Neoplatonism; but that one is Augustine, the most important of them all. It was through Neoplatonism that Augustine got rid of scepticism and the last dregs of Manichaeism. In the seventh book of his *Confessions* he has recorded how much he owed to the perusal of Neoplatonic works. On all the cardinal doctrines—God, matter, the relation of God to the world, freedom and evil—Augustine retained the impress of Neoplatonism; at the same time he is the theologian of antiquity who most clearly perceived and most fully stated wherein Neoplatonism and Christianity differ. The best ever written by any church father on this subject is to be found in chaps. ix.-xxi. of the seventh book of the *Confessions*.

Why Neoplatonism succumbed in the conflict with Christianity is a question which the historians have never satisfactorily answered. As a rule, the problem is not even stated correctly. We have nothing to do here with our own private ideal of Christianity, but solely with catholic Christianity and catholic theology. These are the forces that conquered Neoplatonism, after assimilating nearly everything that it contained. Further, we must consider the arena in which the victory was won. The battlefield was the empire of Constantine and Theodosius. It is only when these and all other circumstances of the case are duly realized that we have a right to inquire how much the essential doctrines of Christianity contributed to the victory, and what share must be assigned to the organization of the church.

In mediaeval theology and philosophy mysticism appears as the powerful opponent of rationalistic dogmatism. The empirical science of the Renaissance and the two following centuries was itself a new development of Platonism and Neoplatonism, as opposed to rationalistic dogmatism, with its contempt for experience. Magic, astrology and alchemy—all the outgrowth of Neoplatonism—gave the first effectual stimulus to the observation of nature, and consequently to natural science, and in this way finally extinguished barren rationalism. Thus in the history of science Neoplatonism has played a part and rendered services of which Plotinus or Iamblichus or Proclus never dreamt. So true is it that sober history is often stranger and more capricious than all the marvels of legend and romance.

BIBLIOGRAPHY.—J. Drummond, *Philo Judaeus* (1888); C. Bigg, *The Christian Platonists of Alexandria* (1886) and *Neoplatonism* (1895); Rufus M. Jones, *Studies in Mystical Religion* (1909); C. Schmidt, *Gnostische Schriften in Koptischer Sprache* (1892); K. P. Hasse, *Von Plotin zu Goethe* (1909); Thomas Whittaker, *The Neo-Platonists* (1901); W. R. Inge, *The Philosophy of Plotinus* (1923).

(A. HA.; J. M. M.)

**NEOPTOLEMUS** (also called PYRRHUS), in Greek legend, the son of Achilles (*q.v.*) and Deïdameia. He was brought up by his grandfather Lycomedes in the island of Scyros, and taken to Troy in the last year of the war by Odysseus, since Helenus had declared that the city could not be captured without the aid of a descendant of Aeacus. He distinguished himself by his valour and took part in the capture, slaying Priam. He was the ancestor of the Molossian kings, who therefore claimed to be of pure Hellenic stock. He was murdered by Orestes at Delphi, where he was buried, and a festival held in his honour every 8th year.

**NEOPYTHAGOREANISM,** a Graeco-Alexandrian school of philosophy, which became prominent in the 1st century A.D. Very little is known about the members of this school, and there has been much discussion as to whether the Pythagorean literature which was widely published at the time in Alexandria was the original work of 1st-century writers or merely reproductions of and commentaries on the older Pythagorean writings. The only well-known members of the school were Apollonius of Tyana and Moderatus of Gades. In the previous century Cicero's learned friend P. Nigidius Figulus (d. 45 B.C.) had made an attempt to revive Pythagorean doctrines, but he cannot be described as a member of the school. Further, it is necessary to distinguish from the Neopythagoreans a number of Eclectic Platonists, who, during the 1st century of our era, maintained views which had a similar tendency (*e.g.* Apuleius of Madaura, Plutarch of Chaeronea and, later, Numenius of Apamea).

Neopythagoreanism was the first product of an age in which abstract philosophy had begun to pall. The Stoics discovered that their "perfect man" was not to be found in the luxurious, often morbid society of the Graeco-Roman world; that something more than dialectic ethics was needed to reawaken a sense of responsibility. A degenerate society cared nothing for syllogisms grown threadbare by repetition. Neopythagoreanism was an attempt to introduce a religious element into pagan philosophy in place of what had come to be regarded as an arid formalism. The founders of the school sought to invest their doctrines with the halo of tradition by ascribing them to Pythagoras and Plato, and there is no reason to accuse them of insincerity. They went back to the later period of Plato's thought, the period when Plato endeavoured to combine his doctrine of Ideas with the Pythag-

orean number-theory, and identified the *Good* with the *One*, the source of the duality of the Infinite and the Measured (*τὸ ἄπειρον* and *πέρας*) with the resultant *scale of realities* from the *One* down to the objects of the material world. They emphasized the fundamental distinction between the Soul and the Body. God must be worshipped spiritually by prayer and the will to be good, not in outward action. The soul must be freed from its material surrounding, the "muddy vesture of decay," by an ascetic habit of life. Bodily pleasures and all sensuous impulses must be abandoned as detrimental to the spiritual purity of the soul. God is the principle of Good; Matter the groundwork of Evil. In this system we distinguish not only the asceticism of Pythagoras and the later mysticism of Plato, but also the influence of the Orphic mysteries and of Oriental philosophy. The Ideas of Plato are no longer self-subsistent entities; they are the elements which constitute the content of spiritual activity. The Soul is no longer an appanage of *οὐσία*, it is *οὐσία* itself: the non-material universe is regarded as the sphere of mind or spirit.

Thus Neopythagoreanism is a link in the chain between the old and the new in pagan philosophy. It connects the teaching of Plato with the doctrines of Neoplatonism and brings it into line with the later Stoicism and with the ascetic system of the Essenes. A comparison between the Essenes and the Neopythagoreans shows a parallel so striking as to warrant the theory that the Essenes were profoundly influenced by Neopythagoreanism. Lastly Neopythagoreanism furnished Neoplatonism with the weapons with which pagan philosophy made its last stand against Christianity.

*See* PYTHAGORAS, NEOPLATONISM, ESSENES; and Zeller's *Philosophie d. Griechen*. For members of the school *see the article* APOLLONIUS OF TYANA.

**NEPAL,** an independent State, situated on the north-eastern frontier of India, lying between 80° 15′ and 88° 10′ E., and 26° 20′ and 30° 10′ N.; area, 54,000 square miles. Its extreme length is about 525 m., and its breadth varies from 90 to 140 miles. It is bounded on the north by Tibet; on the east by Sikkim; on the south by Bengal and the United Provinces; on the west by Kumaon from which it is separated by the Kali river. Its population is locally estimated at about 5,500,000.

**Physical Features.**—Nepal consists physically of two distinct territories: (1) the *tarai,* or strip of level, cultivated and forest land lying along the southern border; and (2) the great mountainous tract stretching northwards to Tibet. Along the northern frontier stand many of the highest peaks of the Himalayan range, such as Mount Everest (29,002 ft.), Makalu (27,790), Kinchinjunga (28,146), Dhaulagiri (26,800), Gaurishankar (23,440), and numerous peaks varying from 20,000 to 24,000 feet. In clear weather this magnificent snowy range may be seen in an almost continuous line from the top of some of the lower ranges near Kathmandu. South of these are numerous parallel lower ranges, varying from 16,000 to 6,000 ft. in height, which are broken up by cross ranges.

These mountain ranges determine the course of the rivers, which are divided by the cross ranges into four groups. The first of these extends from Kumaon eastward as far as Dhaulagiri, and consists of the affluents of the Kali (Sarda), Sarju, Kurnali, Eastern Sarju and Rapti, all of which ultimately form the Gogra or Gogari, and flow into the Ganges. The second group, known to the Nepalese as the Sapt Gandaki, rises from the peaks between Dhaulagiri and Gosain Than, and unites at Tribeni Ghat to form the Gandak. The third is a group of smaller rivers draining the great valley of Nepal, the valleys of Chitlong, Banepa and Panouti, and portions of the tarai around the Churiaghati range of hills. These are the various branches of the Bara Gandak, the lesser Rapti, the Baghmati and Kumla. East of this again is the fourth group, known to the Nepalese as the Sapt Kosi, rising from the peaks between Gosain Than and Kinchinjunga, and uniting to form the Sun Kosi, which falls into the Ganges. There is thus a natural division of the country into four portions. The most western is the country of the Baisi (twenty-two) rajas, and contains the towns of Jumla, Doti and Sulliana. The second is the country of the Chaubisi (twenty-four) rajas, and contains the towns of Malebum, Palpa, Gorkha and Nawakot. The third is the district containing Nepal proper, with the capital and many large towns. The fourth is the eastern portion of Nepal, comprising the country of the Kiratis, and many small towns, such as Dhankota, Ilam and Bijapur.

The only portion of Nepal (with the exception of some portions of the *tarai* country which lies at the foot of the hills), ever visited by Europeans is the Valley of Kathmandu, and even this can only be entered by special permission of the Nepal Government. A narrow gauge railway was opened by the Nepal Government in Feb. 1927 and now runs to Amlekhganj, 25 m. from the British Indian border at Raxaul, a small junction on the Bengal and North-West railway in the Champaran district in northern Bihar, due south of Kathmandu. The road from Raxaul to Kathmandu is 75 m., the first 50 of which lie across the alluvial plain of the tarai through a sal forest to the foot of the hills, whence the road follows the beds of rivers and across low ridges till the small hamlet of Bhimphedi is reached. Up to this point the road is practicable for wheeled traffic. Motor-cars run over it throughout the year except when abnormal rains cause breaches of the road. From Bhimphedi there is only a mountain track, which crosses two ridges (elevation about 8,000 ft.), and reaches the valley of Kathmandu some 9 m. from the city, whence a fair carriage road is available. A ropeway has been constructed from near Bhimphedi to the Kathmandu valley operated by electricity from the power station in the valley, which also supplies electric light to the city.

In and around the Nepal valley the year may be divided into the rainy, cold and hot seasons. The rains begin in June and last till October, the average fall being about 60″ annually. The cold season extends from the middle of October to the middle of April. From April to the beginning of the rains is the hot season, but the thermometer seldom exceeds 90° in the shade. The mean temperature is 60°. Violent thunderstorms are common, and occasionally severe earthquakes occur.

**Flora and Fauna.**—The flora and fauna are very varied. Nepal may again be divided into three zones: (1) the *tarai* and lower ranges of hills up to 4,000 ft. in height; (2) the central ranges and high-lying valleys, up to 10,000 ft.; and (3) the alpine region, from 10,000 to 29,000 ft. in height.

The low alluvial land of the tarai is the granary of Nepal; but the greater portion consists of swamps, jungles and forests. Considerable stretches of land are, however, being reclaimed from year to year. The productions here are those of British India—cotton, rice, wheat, pulse, sugar-cane, tobacco, opium, indigo and some fruits and vegetables. The forests yield a magnificent supply of sal, sisu and other valuable forest trees, and acacias, mimosas, cotton tree (*Bombax*), dak (*Butea frondosa*), large bamboos, rattans, palms, and numerous ferns and orchids. On the Churiaghati range the common *Pinus longifolia* grows freely. Tea can be grown at a height of from 2,000 to 4,000 feet. The middle zone supplies rice, wheat, maize, barley, oats, ginger, turmeric, chillies, potatoes, Cucurbitaceae, pineapples and many varieties of European fruits, vegetables and flowers. The forests contain tree rhododendrons, *Pinus longifolia,* oaks, horse-chestnuts, walnuts, maples, hill bamboos, wild cherry, pear, allies of the tea plant, paper plants (*Daphne*), roses, and many other inhabitants of temperate climes, and orchids, ferns and wild flowers. In the alpine zone exist Coniferae of many kinds, junipers, yew, box, hollies, birch, dwarf rhododendrons and other alpine flora.

The fauna follows a similar distribution. In the lowest zone are found the tiger, leopard, wolf, hyena and jackal, the elephant and rhinoceros, the gaur (*Gavaeus gaurus*), gayal (*Gavaeus frontalis*) wild buffalo or arna, many species of deer, and the black bear (*Ursus labiatus*), pea-fowl, francolins, wild jungle fowl, and the smaller vultures, etc. In the middle zone the leopard, the Himalayan black bear (*Ursus tibetanus*), the wild dog, cats of many sorts, squirrels, hares, porcupines, the pangolin, and some species of deer and antelope, the larger vultures and eagles, pheasants (*Gallophasis*), *chikor,* hill partridges, etc. In the alpine zone are found the true bear (*Ursus isabellinus,* or brown bear), the yak, musk deer, wild goats and sheep, marmots, the eagle-

vulture (*Gypaetus*), the blood pheasant (*Ithaginis cruentus*), snow pheasant (*Tetraogallus himalayensis*), snow partridge (*Lerwa nivicola*), the horned pheasant (*Ceriornis saiyra*), crested pheasant (*Catrens wallichi*), etc. Geese, ducks, waders of all sorts, and other migratory birds abound in the two lower zones.

**Minerals.**—The lowest zone abounds in fossils; and deposits of lignite, and even of true coal, are met with, the latter notably at a place south of Palpa. The middle zone is rich in limestone, marbles and minerals, such as iron, copper, zinc, lead and sulphur. Copper is found near the surface in many places, and there are remains of mines both at Markhu and in the great valley of Nepal. Mineral springs, hot and cold, are numerous. Traces of silver and gold have been found in the alpine zone.

**People.**—The races occupying Nepal are of mixed Mongol origin. To the north, in the higher mountains and valleys, dwell the Bhotias or Tibetans, to the west the Gurungs and Magars. The Murmis, Gorkhalis and Newars occupy the central parts, the Kiratis, Limbus and Lepchas the eastern. There are also Brahmans and Chhatris in the hills. There are other lesser tribes in the *tarai* and other malarious districts, known as Kumhas, Tharus, Manjis, etc., but generally classed together by the Nepalese as Aoulias, or dwellers in the districts where the *aoul*, a special type of malaria prevails. The Gorkhalis or Gurkhas are descendants of the Brahmans and Rajputs who were driven out of India by the Muslims, and took refuge in the western hilly lands, where they ultimately became dominant, and intermarried with the other races.

**Religions and Languages.**—The Bhotias, Newars, Limbus, Keratis and Lepchas are all Buddhists, but their religion has become so mixed up with Hinduism that it is now hardly recognizable. The Newars have entirely abandoned the monastic institutions of Buddhism, and have in great measure adopted the rules of caste, though these sit but lightly upon them. They burn their dead, eat the flesh of buffaloes, goats, sheep, ducks and fowls, and drink beer and spirits. The Gorkhalis, Magars and Gurungs are Hindus, but the last two are by no means strict in the observance of their religion. Where temples are so numerous (there are 2,733 shrines in the valley) priests both Hindu and Buddhist abound. The festivals too are many, and holidays incessant. The Raj Guru, or high priest, is an influential person in the State, a member of council, and has a large income from Government lands as well as from fines for offences against caste.

The various races have separate languages, or at least dialects. The Gorkhalis and western tribes use Parbatia (*see* PAHARI), which, unlike the other dialects, is of Sanskrit origin. The Newars have a distinct language and alphabets, of which three are known to their pandits, though only one is now in use. Their language, called Gubhajius, resembles Tibetan, but is interspersed with many Sanskrit words. The Bhotias use the Tibetan language and alphabet.

**Education and Health.**—There is a college at Kathmandu affiliated to the Patna university, and many schools in the valley of Nepal. This central institution has three departments, English, Sanskrit and Persian—or more correctly perhaps Urdu.

Kathmandu is a storehouse of ancient Sanskrit literature, and some of the oldest mss. in that language known to scholars have been found there. There is also a fair English library.

All families of good position have at least one *baid*, or medical man, in constant attendance, and there are also many general practitioners. There are two large central hospitals, civil and military, at Kathmandu and other smaller hospitals distributed over the country, with free beds, and provision for outdoor treatment. There is also a small hospital for the British Legation.

**Towns.**—There are three large towns in the Nepal valley, Kathmandu, the capital, said to contain approximately 108,800 inhabitants, Patan (104,928), and Bhatgaon (93,176). The houses are from two to four storeys in height, built of brick and tiled. The windows and balconies are of wood, and many are elaborately carved. There are numerous handsome temples in all the towns, the majority of which are pagoda-shaped and built of brick, with roofs of tiles or copper, which is sometimes gilt. The streets are narrow, many of them paved with brick or stone.

**Agriculture.**—Military service is the main occupation of the Gorkhalis: the agriculture of the valley is carried on chiefly by the Newars. The soil varies from light micaceous sand to dense ferruginous clay. The whole valley is cultivated and irrigated where practicable, and the slopes of the hills are terraced, so that there is little grazing ground, and few sheep or cattle are kept. There are some milch cows and buffaloes, which are stall-fed or grazed in the jungles at the foot of the hills. Animals for food and sacrifice are all imported, and are consumed as fast as they are brought in. In the cold season the Bhotias bring large flocks of sheep and goats laden with bags of borax, salt and saltpetre. These are sold for food except for a few that are retained to carry back the bags. Poultry are kept and used by the Newars, especially ducks, the eggs of which are in great demand even among the orthodox Hindus. The crops grown in the valley consist of rice, wheat, pulse, murwah, maize, buckwheat, chillies, radishes, mustard, garlic, onions, ginger, turmeric, sugar-cane, potatoes, ground nuts, cucumbers and pumpkins, etc. Only foodstuffs may be grown in the valley; hence its suitability for producing tea, cotton and tobacco is unknown. These, however, are grown in other parts of the country, both in the hills and the *tarai*. Large cardamoms are extensively grown in the eastern hills, and form an important article of export. The hemp plant (*Cannabis indica*) grows wild.

Many European fruits, flowers and vegetables have been introduced and grow freely. The country is famous for its oranges and pineapples. Garden and wild flowers are sold for use as religious offerings, and for wear in the hair. Apples and pears, of English stock; apricots, peaches and plums do well; grapes grow freely, but seldom ripen before the rains begin, when they rot.

**Trade and Manufacture.**—All the trade and manufactures of the country are in the hands of the Newars, and a few Kashmiris and natives of India. The trade in European goods is chiefly carried on by the latter, whilst the Newars deal in corn, oil, salt, tobacco and articles of domestic manufacture. The trade with India is carried on at numerous marts along the frontier, at each of which a customs station is established, and the taxes are collected by a *thikadar* or farmer. The Newars also carry on the trade with Tibet, through a colony which has been for many years established at Lhasa, but this trade has diminished since the opening of the Lhasa-Darjeeling route. There are two principal routes to Tibet. One runs north-east from Kathmandu to the frontier station of Kuti or Nilam, crossing the Himalayan range at a height of 14,000 ft.; the other passes out of the valley at the north-west corner, and runs at first upwards along the main branch of the Gandak, crossing the Himalayas, near Kerung, at 9,000 ft. All goods on these routes are carried on men's backs, except the salt, etc., carried in bags by the Bhotia sheep and goats.

The Newars are skilful workmen. Their bricks are good, as is also their pottery. There are excellent carpenters, though the use of the large saw is still unknown, and planks are cut with chisel and mallet. Many of the wood carvings on the temples are of the highest artistic excellence. The modern coinage is struck by machinery, a regular mint having been established by Sir Jung Bahadur at Kathmandu, and since improved by his successors.

**Government.**—Till the fall of the Chinese Empire Nepal maintained relations with China and sent periodically an embassy with presents to Peking. The country is entirely independent as regards its foreign relations and domestic affairs. The British Envoy at the court is a purely diplomatic official. Theoretically the Government of Nepal is a despotism, and His Majesty the Maharajadhiraj or king is paramount. In practice, all the real power has long been in the hands of His Highness the Maharaja or prime minister, who is also supreme commander-in-chief. Under the prime minister there is a council, consisting of the relatives of the king, the Raj Guru, the generals, and a few other officials known as *Kajis, Sirdars* and *Bhardars,* which is consulted on all important business, and which forms a court of appeal for disputed cases from the courts of law. There are civil and criminal courts.

The old savage legal code with its ordeals by fire and water, and its punishments by mutilation and torture was abolished by the prime minister Sir Jung Bahadur after his return from England in 1851. Treason, rebellion and desertion in war-time are punishable by death. Murder and the killing of cows are capital offences. Manslaughter and maiming of cows are punishable by imprisonment for life, and other offences against the person, property or caste by imprisonment or fine. Brahmans and women are exempt from capital punishment. Bankruptcy laws have been recently introduced. The marriage laws are peculiar. Among the Gurkhas the laws resemble those of other Hindus as regards the marriage of widows, polygamy, etc., but among the Newars every girl while still an infant is married with much ceremony to a bel fruit, which is then thrown into some sacred stream. As the fate of the fruit is unknown, a Newari is supposed never to become a widow. At the age of puberty a husband is selected, but the woman can at any moment divorce herself by placing a betel-nut under her husband's pillow. Slavery was completely abolished throughout the kingdom in 1925 by the prime minister, General Sir Chandra Shumshere Jung.

The revenue is mainly drawn from the land-tax, customs, mines, forests and monopolies. About 10% of the *tarai* lands, and 20% of the hill lands, are private property. Some lands were assigned by the Gorkhali rajas to Brahmans, soldiers and others, and these are untaxed. Others, which were the gifts of the old Newar kings, pay from 4 to 8 annas *per bigha*. A considerable revenue in the shape of royalty is obtained from mines of copper, iron, etc. The taxes on merchandise amount to from 12 to 14% on the value of the goods carried to and from British India, and from 5 to 6% on goods exported to Tibet.

**Army.**—The Gorkhalis are a military race. The standing army consists of about 45,000 men, in a fair state of efficiency. There is also a reserve, consisting of men who have served for a few years and taken their discharge, but can be called on again to enter the ranks. These would probably raise the strength to between 70,000 and 80,000 men. The regiments are formed on the British system, and similarly drilled and officered. Each man carries in addition to a bayonet a *kukri* or native knife. There is practically no cavalry, the country not being suited for horses. The artillery is on a larger scale, and consists nearly entirely of mountain guns. There is a large arsenal well provided with supplies of gunpowder and military stores. Rifles and ammunition are for the most part obtained from India.

In addition to its own army, Nepal supplies to the British army in India a large force of splendid soldiers. (H. Wn.; X.)

## HISTORY

Nepal and the somewhat similar country of Kashmir are peculiar among the Hindu states of India in possessing an historical literature. The Nepalese *Vamçāvalī* professes to start from a very early period in the Satya Yuga, when the present valley was still a lake. The earlier portion of it is devoted to the Satya and Treta Yugas, and contains mythological tales and traditions having reference to various sacred localities in the country. During these two Yugas, and also the Dwapara Yuga, the *Vamçāvalī* deals in round numbers of thousands of years.

In the beginning of the Kali Yuga, the Gupta dynasty is said to have been founded by Ne-Muni, from whom the country takes its name of Nepal. Lists are then given of the various dynasties, with the lengths of the reigns of the rajahs. The dynasties mentioned are the Gupta, Ahir, Kirāti, Somavanshi, Suryavanshi, Thakuri or first Rajput, Vaishya Thakurī, second Rajput and Karnataki dynasties. The country was then invaded by Mukundasena, and after his expulsion various Vaishya Thakurī dynasties are said to have held the throne for a period of 225 years. The chronology of the *Vamçāvalī* up to this period is very confused and inaccurate; but the records begin to be clearer from the time of the invasion and conquest of the country by Harisinha-deva, the rajah of Simraun, 1324. He was driven from Simraun by Tughlak Shah of Delhi, but seems to have found little difficulty in the conquest of Nepal. There were only four rajahs of this Ayodhya dynasty, and then the throne was occupied by Jayabhadra-Malla, a descendant of Abhaya-Malla, one of the Rajput dynasty, who reigned in the 13th century. The seventh rajah of this dynasty, Jayastithi-Malla, who reigned for 43 years (1386–1429), instituted legal codes and introduced the caste system to the Newars. In the reign of the eighth rajah, Yaksha-Malla, the kingdom was divided into four separate states—Banepa, Bhatgaon or Bhaktapur, Kantipur or Kathmandu, and Lalitapur or Patan. The Malla dynasty in the other three branches continued in power up to the conquest of the country by the Gurkhas in 1768. (*See* Gurkha.)

The Gurkhas were driven out of their own country by the victorious Muslims, and took refuge in the hilly districts about Kumaon, whence they gradually pushed their way eastwards to Lamjung, Gurkha, Noakote, and ultimately to the valley of Nepal, which under Rajah Prithwi Narayana they finally captured. In the struggle which took place at Bhatgaon, Jayaprakasa (the rajah of Kathmandu) was killed. Ranjit-Malla, the aged rajah of Bhatgaon, retired to Benares, where he died. Tej Narsinha, the rajah of Patan, died in confinement. During the latter years of the war Jayaprakasa applied to the British for assistance, and a small force, under Captain Kinloch, was sent into the tarai in 1765, but it was repulsed by the Gurkhas.

Prithwi Narayana died in 1774. He left two sons, Pratapasinha Sah and Bahadur Sah. The former succeeded his father, but died in 1777, leaving an infant son, Rana Bahadur Sah, and his brother, who had been in exile, returned to Nepal as regent. The mother of the infant king, however, was opposed to him, and he had again to flee to British territory, where he remained till the death of the rani, when he again became regent. In 1790 the Gurkhas invaded Tibet, and were at first successful; but they were brought into contact with the Chinese, who in 1791 sent a large force to invade Nepal. In 1792 the Chinese advanced as far as Noakote, and there dictated terms to the Nepalese. In 1791 the Gurkhas had entered into a commercial treaty with the British and Kirkpatrick was therefore despatched to Nepal, and reached Noakote in the spring of 1792, after the conclusion of peace. This embassy resulted in the ratification of another commercial treaty on March 1, 1792.

In 1795 Rana Bahadur removed his uncle, Bahadur Sah, from the regency, and two years later put him to death. From this time up to 1799 the king, who seems to have been insane, perpetrated the most barbarous outrages and his conduct became so intolerable that he was forced to abdicate in favour of his infant son, Girvan-yuddha Vikrama Sah. Rana Bahadur recovered the throne in 1804, but was assassinated in 1805.

In Oct. 1801 another treaty was signed by the British and Nepalese authorities, and a British resident was sent to the Nepalese court, but was withdrawn in 1803, from which time the Nepalese carried on a system of encroachment and outrage on the frontier, which led to a declaration of war by the British in Nov. 1814. The fortunes of war were not constant on either side, and fighting was almost continuous. A treaty was concluded in March 1816 by which the Nepalese relinquished much of their newly acquired territory and agreed to allow a British residency to be established at Kathmandu. In November the rajah died and was succeeded by his infant son, Surendra Bikran Sah, General Bhimsena Thapa acting as regent.

In 1839 Bhimsena's enemies succeeded in driving him from power, and he committed suicide, or was murdered, in prison. The Kala Pandry faction then came into power, and there were frequent grave disputes with the British. In 1843 Matabar Singh, the nephew of Bhimsena, returned from exile, gained favour at court, and speedily effected the destruction of his old enemies, the Kala Pandrys, who were seized and executed in May 1843. At this time a nephew of Matabar Singh, Jung Bahadur, the eldest of a band of seven brothers, rose rapidly in the army and in favour at the court, especially with one of the ranis. On May 18, 1845, he killed his uncle, obtained, with the aid of the rani, a prominent position in the government, and soon after destroyed his enemies by what is known as the Kot massacre, on Sept. 15, 1846. From that time till the day of his death Jung Bahadur was in reality the ruler of Nepal. His old friend, the rani, was ban-

ished, and all posts of any consequence in the state were filled by Jung and his relations. In 1850 Jung Bahadur paid a visit to England, and there proved himself to be a staunch friend of the British. On his return in 1851 he devoted himself to reforming the administration of the country, and it must be allowed that he eventually proved himself the greatest benefactor his country has ever possessed. In 1853 a treaty for the extradition of criminals was proposed, and ratified in Feb. 1855. In 1854 the Nepalese commenced a war against Tibet, which ended with a peace very favourable to Nepal in March 1856.

In June 1857 intelligence of the mutiny of the native troops in Hindustan reached Nepal. Jung Bahadur, in spite of great opposition, stood firm as a friend of the British. On June 26, 4,000 troops were despatched and rendered excellent service. Jung followed on Dec. 10 with a force of 8,000 men, 500 artillerymen and 24 guns, but too late to be of much use. Many of the mutineers and rebels, including the infamous Nana Sahib, took refuge in the Nepalese tarai, and it was not till the end of 1859 that they were finally swept out of the country. Jung Bahadur was knighted and decorated for his services and his troops received pay and handsome donations if wounded. Quantities of arms were presented to the Nepalese government and some territory was restored. This ground contains most valuable sal and sisu forests, and yields yearly a revenue of several lākhs of rupees.

From the termination of the mutiny Nepalese history has been uneventful. In spite of friendly relations with the British, many of the early restrictions against entering the country and trading there are still rigidly enforced. Sir Jung Bahadur died suddenly in 1877. His brother, Sir Ranadip Singh Bahadur, G.C.S.I., succeeded him as prime minister. Shortly after his accession to power a plot was formed against him, but nearly 40 of the conspirators were seized and executed, while others escaped into exile. He was, however, murdered in 1885, and was succeeded by his nephew Sir Shamsher Jung, G.C.S.I., who died in 1901 and was succeeded by his brother Deb Shamsher Jung. In June of that year a palace revolution placed another brother, Chandra Shamsher Jung, in power, whilst Deb Shamsher fled to India. Chandra Shamsher ruled Nepal with much ability. He gave effective aid to the British during the Tibet war of 1904, and the relations with the government of India became more cordial after his accession. In 1906 Chandra Shamsher was created a G.C.S.I., and in 1908 he visited England as a guest of the government, when he was invested with the G.C.B., and created major-general in the British army and honorary colonel of the 4th Gurkha Rifles.

During World War I, Sir Chandra Shamsher Jung placed the whole resources of his country at the disposal of the Allies. From 1915–18 some 10,000 men of the Nepalese army served in India and on the Indian frontier. The 20 Gurkha battalions of the Indian army were increased to 40. Exclusive of the Maharajah's personal numerous subscriptions to military hospitals and charitable war-funds, nearly £1,000,000 was contributed by the Nepalese government. Cardamoms, tea, blankets, and timber were also given. In the brief Afghan war (1919), 2,000 Nepalese troops assisted the Indian government. Chandra Shamsher Jung was also responsible for the abolition of slavery in Nepal.

Replacing the old Treaty of Segowlie (1815) a new treaty of friendship was signed on Dec. 21, 1923, an important provision of which is the recognition by the British government of the complete independence of Nepal.

The present ruler of Nepal is Maharajadhiraja Tribhubana Bir Bikram Jung Bahadur, who succeeded in 1911; the prime minister is Maharaja Sir Joodha Shum Shere Jung Bahadur Rana.

When India declared war on Germany in 1939 the Nepal government placed its resources at her disposal as in 1914–18 and as the war progressed supplied increasing numbers of men for service in the Gurkha regiments of the Indian army as well as contingents of its own, and material assistance in men and money in all branches of the war effort.

BIBLIOGRAPHY.—Dr. Daniel Wright, *History of Nepal* (1877); *Indian Antiquary*, vol. ix.; Sir C. M. Aitchison, *Treaties and Engagements;* Sir Joseph Hooker's writings; Sir Richard Temple, *Hyderabad and Nepal* (1887); Cecil Bendall, *History of Nepal and surrounding kingdoms* in Journal Asiatic Society of Bengal, vol. lxxii. (N.S. Calcutta, 1903); Landor, *Tibet and Nepal* (1905); I. Massieu, *Népal et pays himalayens* (1914).

**NEPENTHES,** an Egyptian drug spoken of by Homer in the *Odyssey* (iv. 221). Generally in the form "nepenthe" the name is given to any drug producing exhilaration and also occasionally to the herb or plant from which such a drug is produced. It is also applied to an interesting genus of plants, comprising 60 species, chiefly East Indian, known as the "pitcher-plants" on account of the formation of the leaves. Numerous varieties and artificial hybrids of several species, especially *N. ampullaria* and *N. Rafflesiana,* are grown as curiosities in hothouses.

**NEPHELINE,** a rock-forming mineral consisting of sodium, potassium and aluminium silicate, with the approximate formula $Na_6K_2Al_8Si_9O_{34}$. Its crystals belong to the hexagonal system, and usually have the form of a short six-sided prism terminated by the basal plane. The hardness is 5·5. The specific gravity (2·6), the low index of refraction and the feeble double refraction are nearly the same as in quartz; but since in nepheline the sign of the double refraction is negative, while in quartz it is positive, the two minerals can be distinguished under the microscope. An important determinative character of nepheline is the ease with which it is decomposed by hydrochloric acid, with separation of gelatinous silica (which may be readily stained by colouring matters) and cubes of salt. A clear crystal of nepheline when immersed in acid becomes for this reason cloudy; hence the name, from Gr. *νεφέλη,* a cloud.

Although in naturally occurring nepheline sodium and potassium are always present in approximately the atomic ratio 3 : 1, artificially prepared crystals have the composition $NaAlSiO_4$; the corresponding potassium compound, $KAlSiO_4$, which is the mineral kaliophilite, has also been prepared artificially. It has therefore been suggested that the orthosilicate formula, $(Na,K)AlSiO_4$, represents the true composition of nepheline, and that the excess of silica is due to the presence of albite, leucite, or silica molecules in "solid solution" in the mineral.

The mineral is specially liable to alteration, and in the laboratory various substitution products of nepheline have been prepared. In nature it is frequently altered to zeolites (especially natrolite), sodalite, kaolin, or compact muscovite. Two varieties are distinguished, differing in external appearance and mode of occurrence. "Glassy nepheline" has the form of small, colourless, transparent crystals and grains with a vitreous lustre. It is characteristic of the later volcanic rocks rich in alkalis, such as phonolite, nepheline-basalt, leucite-basalt, etc., and also of certain dike-rocks, such as tinguaite. The best crystals are those which occur with mica, sanidine, garnet, etc., in the crystal-lined cavities of the ejected blocks of Monte Somma, Vesuvius. The other variety, known as elaeolite, occurs as large, rough crystals, or more often as irregular masses, which have a greasy lustre and are opaque, or at most translucent, with a reddish, greenish, brownish or grey colour. It forms an essential constituent of certain alkaline plutonic rocks of the nepheline-syenite series, which are typically developed in southern Norway.

The colour and greasy lustre of elaeolite (Gr. *ἔλαιον,* oil, and *λίθος,* stone; Ger. *Fettstein*) are due to the presence of numerous microscopic enclosures of other minerals, possibly augite or hornblende. These enclosures sometimes give rise to a chatoyant effect like that of cat's-eye and cymophane; and elaeolite when of a good green or red colour and showing a distinct band of light is sometimes cut as a gem-stone with a convex surface.

**NEPHELINE-SYENITE** or **ELAEOLITE-SYENITE,** a holocrystalline plutonic rock which consists largely of nepheline and alkali felspar. The rocks are mostly pale coloured, grey or pink, and in general appearance they are not unlike granites, but dark green varieties are also known. They do not contain quartz, as that mineral and nepheline are mutually exclusive. From ordinary syenites they are distinguished not only by the presence of nepheline but also by the occurrence of many other minerals rich in alkalis or in rare earths. Orthoclase and albite are the principal felspars; usually they are intergrown to form perthite. In some rocks the potash felspar, in others the soda felspar predominates. Soda-lime felspar such as oligoclase and andesine are rare or entirely absent. Fresh clear microcline is very characteristic of some types of nepheline-syenite. Sodalite, colourless and transparent in the slides, but frequently pale blue in the hand specimens, is the principal felspathoid mineral in addition to nepheline. As a rule these two crystallize before felspar, but they may occur in perthitic intergrowth with it. The commonest ferro-magnesian mineral is pale green augite, which may be surrounded by rims of dark-green, pleochroic soda-augite

(aegirine). The latter forms long flat prisms or bundles of radiating needles. A dark reddish-brown biotite is very common in some of these rocks and a white mica, probably not muscovite but lepidolite, is occasionally present. The hornblende may be brown, brownish-green, blue or blue-black, belonging as a rule to the varieties which contain soda; it is often intergrown with the pyroxene or enclosed in it. The dark-brown triclinic hornblende aenigmatite occurs also in these rocks. Olivine is rare, but may be found in some basic forms of nepheline-syenite.

The commonest accessories are sphene, zircon, iron ores and apatite. Cancrinite occurs in several nepheline-syenites; in others there is fluor-spar or melanite garnet. Small amounts of primary calcite also occur in some nepheline-syenites. A great number of interesting and rare minerals have been recorded from these rocks and the pegmatite veins which intersect them. Among these we may mention eudialyte, eukolite, mosandrite, rinkite, johnstrupite, låvenite, hiortdahlite, perofskite and lamprophyllite. Many of these contain fluorine and the rare earths.

Nepheline-syenites are rare rocks; there is only one occurrence in Great Britain and one each in France and Portugal. They are known also in Bohemia and in several places in Norway, Sweden and Finland. In America these rocks have been found in Texas, Arkansas and Massachussetts, also in Ontario, British Columbia and Brazil. South Africa, Madagascar, India, New South Wales, Tasmania, Timor and Turkestan are other localities for the rocks of this series. They exhibit also a remarkable individuality, as each occurrence has its own special features; moreover a variety of types characterizes each occurrence, as these rocks are very variable. For these reasons, together with the numerous rare minerals they contain, they have attracted a great deal of attention from petrographers.

Many types of nepheline-syenite have received designations derived from the localities in which they were discovered. The laurdalites (from Laurdal in Norway) are grey or pinkish, and in many ways closely resemble the laurvikites of southern Norway, with which they occur. The foyaites include the greater number of known nepheline-syenites and are called after Foya in the Serra de Monchique (southern Portugal), from which they were first described. They are grey, green or reddish, and mostly of massive structure with preponderating potash felspar, some nepheline, and a variable (often small) amount of femic minerals. Pyroxene-, hornblende- and biotite-foyaites have been recognized according to their mineral composition. Examples of the first-named occur in southern Norway with the laurdalites; they contain aegirine and black mica. At Alnö Island in the Gulf of Bothnia (Sweden) similar rocks are found bearing enclosures of altered limestone with wollastonite and scapolite. In Transylvania there is a well-known rock of this group, very rich in microcline, blue sodalite and cancrinite. It contains also orthoclase, nepheline, biotite, aegirine, acmite, etc. To this type the name ditroite has been given from the place where it occurs (Ditro). Pyroxene-foyaite has been described also from Pouzac in the Pyrenees (S. France). Mica-foyaite is not very common, but is known at Miask in the Ural Mountains (miaskite), where it is coarse-grained, and contains black mica, sodalite and cancrinite. Hornblende-foyaites occur in Brazil (Serra de Tingua) containing sodalite and often much augite, in the western Sahara and Cape Verde Islands; also at Zwarte Koppies in the Transvaal, Madagascar, São Paulo (in Brazil), Paisano Pass (West Texas) and Montreal, Canada. The rock of Salem, Mass., U.S.A., is a mica-foyaite rich in albite and aegirine; it accompanies granite and essexite.

Litchfieldite is another well-marked type of nepheline-syenite, in which albite is the dominant felspar. It is named after Litchfield, Maine, U.S.A., where it occurs in scattered blocks. Biotite, cancrinite and sodalite are characteristic of this rock. A similar nepheline-syenite is known from Hastings Co., Ontario, and contains hardly any orthoclase, but only albite felspar. Nepheline is very abundant and there is also cancrinite, sodalite, scapolite, calcite, biotite and hornblende. The lujaurites are distinguished from the rocks above described by their dark colour, which is due to the abundance of minerals such as augite, aegirine, arfvedsonite and other kinds of amphibole. Typical examples are known near Lujaur on the White Sea, where they occur with umptekites and other very peculiar rocks. Other localities for this group are at Julianehaab in Greenland (with sodalite-syenite); at their margins they contain pseudomorphs after leucite. The lujaurites frequently have a parallel banding or gneissose structure.

Sodalite-syenites in which sodalite very largely or completely takes the place of nepheline occur in Greenland, where they contain also microcline-perthite, aegirine, arfvedsonite and eudialyte. Cancrinite-syenite, with a large percentage of cancrinite, has been described from Dalecarlia (Sweden) and from Finland.

The chemical peculiarities of the nepheline-syenites are well marked, as will be seen from the following analyses. They are exceedingly rich in alkalis and in alumina (hence the abundance of felspathoids and alkali felspars) with silica varying from 50 to 56%, while lime, magnesia and iron are never present in great quantity, though somewhat more variable than the other components. As a group, also, these rocks have a low specific gravity.

| | $SiO_2$ | $Al_2O_3$ | FeO | $Fe_2O_3$ | CaO | MgO | $K_2O$ | $Na_2O$ |
|---|---|---|---|---|---|---|---|---|
| Laurdalite | 54·55 | 19·07 | 3·12 | 2·41 | 3·15 | 1·98 | 4·84 | 7·67 |
| Ditroite | 56·30 | 24·14 | .. | 1·99 | 0·69 | 0·13 | 6·79 | 9·28 |
| Litchfieldite | 60·39 | 22·57 | 2·26 | 0·42 | 0·32 | 0·13 | 4·77 | 8·44 |
| Lujaurite | 54·14 | 20·61 | 2·08 | 3·28 | 1·85 | 0·83 | 5·25 | 9·87 |

(J. S. F.)

**NEPHELINITES.** The group of effusive rocks which contains nepheline with plagioclase felspar is subdivided into nepheline-tephrites and nepheline-basanites, while those which contain nepheline but not felspar are nephelinites and nepheline-basalts. The tephrites differ from the basanites in the absence of olivine, and the same distinction subsists between the nephelinites and nepheline-basalts.

Lavas with nepheline, plagioclase and augite=nepheline-tephrites; lavas with nepheline, plagioclase, augite and olivine=nepheline-basanites; lavas with nepheline and augite=nephelinites; lavas with nepheline, augite and olivine=nepheline-basalts.

In their essential and accessory minerals, appearance and structure, these rocks have much in common, and tend to occur in a natural association as basic rocks comparatively rich in alkalis and alumina. The nephelinites and tephrites are linked to the phonolites and pass into them by various gradations. They are usually richer in alkalis and silica and contain less iron, lime and magnesia than the basanites and nepheline-basalts, a difference which finds expression in the presence of olivine and the smaller amount of felspars and felspathoids in the latter.

Leucite appears in some tephrites; haüyne is more frequent as small dodecahedra often filled with black inclusions. The pyroxene varies a good deal, and includes green aegirine and the purple titan-augite. It has often good crystalline form, and occurs as eight-sided monoclinic prisms. Hornblende is much less common, but biotite is very characteristic of certain nephelinites. Of the felspars, labradorite is probably the most common, with more acid varieties of plagioclase. Sanidine is by no means absent, but may be considered as an accessory. The olivine presents no peculiarities. Melilite, perofskite, pseudobrookite, melanite garnet, iron oxides, apatite and chromite are occasionally met with.

All these rocks are practically confined to lavas of Tertiary and recent age, though some occur as dikes or small intrusive masses. The plutonic facies of these rocks are found among the theralites, shonkinites, essexites and ijolites. In the British Isles they are exceedingly scarce, though nepheline-basanite occurs in a dike which is presumably Tertiary, cutting the Triassic rocks at Butterton, Staffs., and nepheline-basalt has been found in a single neck at John o' Groat's and at one or two places near North Berwick. They attain a great development in the Canary Islands and in the Azores, Cape Verde Islands and Fernando Noronha. In Germany they are represented among the Tertiary eruptive rocks of the Rhine district and Thuringia, at the extinct craters of the Eifel and at the Kaiserstuhl. In central Bohemia there are many occurrences of nepheline-tephrites, basanites and basalts which though

fine grained contain all their minerals in excellent preservation. The nephelinite of Katzenbuckel in the Odenwald is well known. Contrasted with the phonolites and leucitophyres they are scarce in Italy and the Mediterranean province, but leucite-bearing nepheline-tephrites occur at Monte Vulture and nepheline-basalts in Tripoli. In America these rocks occur in Texas, in the Bearpaw mountains of Montana and at Cripple Creek, Colorado. From Argentina some members have been described: they have a great extension in East Africa (Somaliland and Masai-land) and occur also in North Nigeria. A few also have been described from New South Wales, New Zealand (Dunedin) and Tasmania.

(J. S. F.)

**NEPHRITIS:** *see* BRIGHT'S DISEASE; KIDNEY, DISEASES OF.

**NEPOMUK** or **POMUK, JOHN OF,** the national saint of Bohemia. It is necessary to distinguish between the John of Nepomuk of history and the legendary one. A John of Pomuk, son of a German called Wölfel, was vicar-general to the archbishop of Prague, John of Jengenstein, in 1393, and having thwarted King Wenceslaus IV. of Bohemia in a plan to seize the revenues of the abbey of Kladrub, was arrested and tortured, finally being carried to the bridge of Prague and thrown into the Vltava. It is difficult to connect this historical event with the legend of St. John of Nepomuk, who was canonized by Rome in 1729, mainly through the influence of the Jesuits, who hoped that this new cult would obliterate the memory of Hus. The Austrian chronicler Thomas Ebendorffer of Haselbach, who lived two generations later, first states that it was reported that King Wenceslaus had ordered that the confessor of his queen—an office that John of Pomuk never held—should be thrown into the Vltava because he would not reveal the secret of confession. The story is afterwards told in greater detail by the untrustworthy Bohemian historian Wenceslaus Hajek. It appears certain that the person canonized in 1729 was not the historical John of Pomuk or Nepomuk.

*See* A. H. Wratislaw, *Life, Legend and Canonization of St. John Nepomuk* (1873), a valuable work founded on the best Bohemian authorities; also A. Frind, *Der geschichtliche Heilige Johann von Nepomuk* (1861); O. Abel, *Die Legende vom heiligen Johann von Nepomuk* (1855); and particularly vol. iii. of W. W. Tomek's *History of the Town of Prague* (Czech) (12 vols., Prague, 1855–1901).

**NEPOS, CORNELIUS** (*c.* 99–24 B.C.), Roman historian, friend of Catullus, Cicero and Atticus, was born in Upper Italy (perhaps at Verona or Ticinum). He wrote: *Chronica,* an epitome of universal history; *Exempla,* a collection of anecdotes; letters to Cicero; lives of Cato the elder and Cicero; and *De viris illustribus,* parallel lives of distinguished Romans and foreigners, in sixteen books. One section of this work (more commonly known as *Vitae excellentium imperatorum*) and the biographies of Cato and Atticus from another (*De Latinis historicis*), have been preserved. Erotic poems and a geographical treatise are also attributed to him. The *Lives* contain many errors (especially in chronology), but supply information not found elsewhere. The language is as a rule simple and correct. The *Lives* were formerly attributed to Aemilius Probus of the 4th century A.D.; but the view maintained by Lambinus (in his famous edition, 1569)—that they are all the work of Nepos—is now generally accepted. In modern times G. F. Unger (*Der sogenannte C. N.,* 1881) has attempted to prove that the author was Hyginus, but his theory has not been favourably received.

Editions of the *Lives* (especially selections) are extremely numerous; text by E. O. Winstedt (Oxford, 1904), C. L. Roth (1881), C. G. Cobet (1881), C. Halm and A. Fleckeisen (1889), with lexicon for school use; with notes, O. Browning and W. R. Inge (1888), J. C. Rolfe (U.S. 1894), A. Weidner and J. Schmidt (1902), C. Erbe (1892), C. Nipperdey and B. Lupus (ed. maj., 1879, school ed., 1895), J. Siebelis and O. Stange (1897).

**NEPOS, JULIUS,** emperor of the West (474–475), was the nephew and successor of Marcellinus, count of Dalmatia. Being connected by marriage with Leo I., he was selected by him as emperor after the death of Olybrius. After capturing his rival Glycerius, he was recognized as emperor in Italy, Rome and Gaul. The only event of his reign was the cession of Auvergne to the Visigoths. Nepos was overthrown in 475 by the Patrician Orestes, and fled to Salona, where he was assassinated (480 or 481), possibly at the instigation of Glycerius, who had been compelled to enter the Church.

**NEPTUNE** (*Neptunus,* Etruscan *Nethuns*). An Italian god of fresh water, associated with Salacia (? from *salire,* referring to the bubbling of springs). Not later than 399 B.C. (*see* Livy, v. 13, 6), he was identified with Poseidon (*q.v.*) and henceforth was known as a sea-god.

Neptune's ancient festival (Neptunalia) was on July 23; *i.e.,* in the heat of summer, when water is most wanted and streams are drying up. He had no temple until the 3rd century B.C., so far as we know; it was near the Circus Flaminius.

In like manner Portunus, originally the god of city gates (*portae*) became god of harbours (*portus*) as Roman overseas trade became important.

*See* Wissowa, *Religion und Kultur,* 2nd ed., p. 225.

**NEPTUNE**—astronomical symbol ♆—is one of the nine planets of the solar system. Its mean distance from the sun is 30.1 times that of the earth; its period of revolution 164.8 years.

Neptune is so far from the sun and from the earth that it is invisible without optical aid, but a telescope of moderate aperture reveals it as a very small disk of greenish hue about 2.3 seconds of arc in diameter, equal in brightness to an eighth magnitude star. Although no surface markings can be seen on its apparent surface, which is the top of an extensive opaque or cloud-filled atmosphere, Neptune's rotation period, 16 hours, has been determined from spectroscopic observations of its equatorial speed of rotation. The direction of rotation is the same as that of the earth.

The mass of the planet, which can be accurately determined from the motion of its satellite, is 17.2 times that of the earth; its diameter is 31,000 miles; and its mean density 1.6 times that of water, or 0.29 that of the earth.

Although Neptune shines by reflected sunlight, its colour is quite greenish because much of the red in the incident solar light is absorbed in Neptune's atmosphere.

The spectrum shows that this absorption, like that in the atmospheres of Jupiter, Saturn and Uranus, is due primarily to strong bands of methane ($CH_4$). The bands due to methane are more intense in the spectrum of Neptune than in that of Jupiter; those due to ammonia ($NH_3$) are much weaker.

Because of Neptune's great distance from the sun, its temperature must be very low, probably not higher than −330° F.

**Neptune's Satellite.**—Neptune, like the earth, has only one satellite. It was discovered by William Lassell in 1846, less than a month after the discovery of Neptune. Although it has been called Triton, it is more generally known simply as "the satellite of Neptune." It revolves around Neptune at a distance of 220,000 miles with a period of 5 days $21^h\ 2^m$ and $38^s$ in a plane inclined 40° to Neptune's orbit. The direction of its motion is opposite to that of Neptune's rotation. The mass of Neptune's satellite, which has been accurately determined from its effect on the motion of Neptune, is 0.0013 that of Neptune.

From the motion of the plane of the satellite's orbit and the period of Neptune's rotation, the oblateness of the planet and the nature of its internal constitution can be inferred. From such deductions it is concluded that internally Neptune closely resembles Jupiter.

**The Discovery of Neptune.**—By far the most interesting thing about Neptune is the story of its discovery. The account which follows was written by the late Professor Simon Newcomb.

The detection of Neptune through its action upon Uranus before its existence had been made known by observation is a striking example of the precision reached by the theory of the celestial motions. So many agencies were concerned in the final discovery that the whole forms one of the most interesting chapters in the history of astronomy.

The planet Uranus, before its actual discovery by Sir William Herschel in the year 1781, had been observed as a fixed star on at least 17 other occasions, beginning with Flamsteed in 1690. In 1820 Alexis Bouvard of Paris constructed tables of the motion of Jupiter, Saturn and Uranus, based upon a discussion of observations up to that year. Using the mutual perturbations of these planets as developed by Laplace in the *Mé-*

*canique Céleste,* he was enabled satisfactorily to represent the observed positions of Jupiter and Saturn; but the case was entirely different with Uranus. It was found impossible to represent all the observations within admissible limits of error, the outstanding differences between theory and observation exceeding 1′. In these circumstances one of two courses had to be adopted, either to obtain the best general representation of all the observations, which would result in the tables being certainly erroneous, or to reject the older observations which might be affected with errors, and base the tables only on those made since the discovery by Herschel. A few years of observation showed that Uranus was deviating from the new tables to an extent greater than could be attributed to legitimate errors of theory of observation, and the question of the cause thus became of growing interest. Among the investigators of the question was F. W. Bessel, who tried to reconcile the difficulty by an increase of the mass of Saturn, but found that he could do so only by assigning a mass not otherwise admissible. Although the idea that the deviations were probably due to the action of an ultra-Uranian planet was entertained by Bouvard, Bessel and doubtless others, it would seem that the first clear statement of a conviction that such was the case, and that it was advisable to reach some conclusion as to the position of the disturbing body, was expressed by the Rev. T. J. Hussey, an English amateur astronomer. In a letter to Sir George B. Airy in 1834 he inquired Airy's views of the subject, and offered to search for the planet with his own equatorial if the required estimate of its position could be supplied. Airy expressed himself as not fully satisfied that the deviation might not arise from errors in the perturbations. He therefore was not certain of any extraneous action; but even if there was, he doubted the possibility of determining the place of a planet which might produce it. In 1837 Bouvard, in conjunction with his nephew Eugène, was again working on the problem; but they appear not to have gone farther than to collect observations and to compare the results with Bouvard's tables.

In 1835 F. B. G. Nicolai, director of the observatory at Mannheim, in discussing the motion of Halley's comet, considered the possibility that it was acted upon by an ultra-Uranian planet, the existence of which was made probable by the disagreement between the older and more recent observations.

In 1838 Airy showed in a letter to the *Astronomische Nachrichten* that not only the heliocentric longitude, but the tabulated radius vector of Uranus was largely in error, but made no suggestions as to the cause. In 1843 the Royal Society of Sciences of Göttingen offered a prize of 50 ducats for a satisfactory working up of the whole theory of the motions of Uranus, assigning September 1846 as the time within which competing papers should be presented. It is also recorded that Bessel, during a visit to England in 1842, in a conversation with Sir John Herschel, expressed the conviction that Uranus was disturbed by an unknown planet. He went so far as to set his assistant Fleming at the work of reducing the observations, but died before more was done.

The question had now reached a stage when it needed only a vigorous effort by an able mathematician to solve the problem. Such a man was found in John Couch Adams, then a student of St. John's College, Cambridge, who seriously attacked the problem in 1843, the year in which he took his bachelor's degree. He soon found that the observations of Uranus could be fairly well represented by the action of a planet moving in a radius of twice the mean distance of Uranus, which would closely correspond to Bode's law. During the two following years he investigated the possible eccentricity of the orbit, and in September 1845 communicated his results to Professor James Challis. In 1845, about the 1st of November, Adams also sent his completed elements to Airy, stating that according to his calculations the observed irregularities in the motion of Uranus could be accounted for by the action of an exterior planet, of which the motions and orbital elements were given. It is worthy of note that the heliocentric longitude of the unknown body as derived from these elements is only between one and two degrees in error, while the planet was within half a degree of the ecliptic. Two or three evenings assiduously devoted to the search could not therefore have failed to make the planet known. Adams's paper was accompanied by a comparison of his theory with the observations of Uranus from 1780, showing an excellent agreement. Airy in replying to this letter inquired whether the assumed perturbation would also explain the error of the radius-vector of Uranus, which he seemed to consider the crucial test of correctness.

**The Elements.**—At Arago's suggestion the investigation had been taken up by U. J. J. Leverrier, who had published some excellent work in theoretical astronomy. Leverrier's first published communication on the subject was made to the French Academy on the 10th of November 1845, a few days after Adams's results were in the hands of Airy and Challis. A second memoir was presented by Leverrier in 1846 (June 1). His investigation was more thorough than that of Adams. He first showed that the observations of Uranus could not be accounted for by the attraction of known bodies. Considering in succession various explanations, he found none admissible except that of a planet exterior to Uranus. Considering the distances to be double that of Uranus he then investigated the other elements of the orbit.

The following are the elements found by Adams and Leverrier:

| | Leverrier | Adams | |
|---|---|---|---|
| | | Hypothesis I | Hypothesis II |
| Semi-major axis | 36·154 | 38·38 | 37·27 |
| Eccentricity | 0·1076 | 0·16103 | 0·12062 |
| Long. of perihelion | 284° 45′ | 315° 57′ | 299° 11′ |
| Mean longitude | 318° 47′ | 325° 8′ | 323° 2′ |
| Epoch | 1847, Jan. 1 | 1846, Oct. 1 | 1846, Oct. 1 |
| True longitude | 326° 32′ | 328° | 329° |

The longitude of the planet was 327° 57′ on Oct. 1, 1846.

The close agreement of these elements led Airy to suggest to Challis, on the 9th of July 1846, a search for the planet with the Northumberland telescope. He proposed an examination of a part of the heavens 30° long in the direction of the ecliptic and 10° broad, and estimated the number of hours' work likely to be employed in this sweep. The proposed sweeps were commenced by Challis on the 29th of July. The plan required each region to be swept through twice, and the positions of all the known stars found to be compared, in order that the position of the planet might be detected by its motion. On the 31st of August Leverrier's concluding paper was presented to the French Academy, and on the 18th of September he wrote to John G. Galle (1812–1910), then chief assistant at the Berlin observatory, suggesting that he should search for the computed planet, with the hope of detecting it by its disk, which was probably more than 3″ in diameter. This letter, probably received on the 23rd of September, was communicated to J. F. Encke, the director of the observatory, who approved of the search. H. L. d'Arrest, a student living at the observatory, expressed a wish to assist. In the evening the search was commenced, but it was not found possible to detect any planet by its disk. Star charts were at the time being prepared at the observatory under the auspices of the Berlin Academy of Sciences. It was suggested by d'Arrest that this region might be covered by one of the charts. Referring to the chart, which was lying in a drawer, it was found that such was the case. Comparing the stars on the chart one by one with the heavens it was found that an eighth magnitude star now visible was not on the chart. This object was observed until after midnight, but no certain motion was detected. On the following evening the object was again looked for, and found to have moved. The existence of the planet was thus established. It was afterwards found that Challis had observed the planet on Aug. 4, but had failed to detect it.

The question whether Leverrier should receive the sole credit of the discovery was warmly discussed. Arago took the extreme ground that actual publication alone should be considered, rejecting Adams's communications to Airy and Challis as quite unworthy of consideration. He also suggested that the name of Leverrier should be given to the planet, but this proposal was received with so little favour outside of France that he speedily withdrew it, proposing that of Neptune instead.

The observations at the first opposition showed that the planet was moving in a nearly circular orbit, and was at a mean distance from the sun much less than that set by Leverrier as the smallest possible. The latter had in fact committed the error of determining the limits by considering the variations of the elements one at a time, assuming in the case of each that while it varied the others remained constant. But a simultaneous variation of all the elements would have shown that the representation of the observations of Uranus would be improved by a simultaneous diminution of both the eccentricity and the mean distance, the orbit becoming more nearly circular and the planet being brought nearer to the sun. But this was not at first clearly seen, and Benjamin Peirce of Harvard University went so far as to maintain that there was a discontinuity between the solution of Adams and Leverrier and the solution offered by the planet itself, and that the coincidence in direction of the actual and computed planet was an accident. But this view was not well founded, and the only explanation needed was to be found in Leverrier's faulty method of determining the limits within which the planet must be situated. As a matter of fact the actual motion of the planet during the century preceding, as derived from Leverrier's elements, was much nearer the truth than the elements themselves were. This arose from the fact that his very elliptic orbit, by its large eccentricity, brought the planet near to the sun, and therefore near to its true position, during the period from 1780 to 1845, when the action on Uranus was at its greatest.

The observations of the first opposition enabled Sears Cook Walker of the National Observatory, Washington, in February 1847 to compute the past positions of the planet, and identify it with a star observed by Lalande at Paris in May 1795. This being communicated to the Paris observatory, an examination of Lalande's manuscript showed that he had made two observations of the planet, on the 8th and 10th of May and finding them discordant had rejected one as probably in error, and marked the other as questionable. A mere re-examination of the region to see which observation was in error would have led him to the discovery of the planet more than half a century before it was actually recognized. The identity of Lalande's star with Neptune was also independently shown by Petersen of Altona.

BIBLIOGRAPHY.—The principal sources for the history of the discovery of Neptune are the *Astronomische Nachrichten,* vols. xxv., xxvi., xxviii., and Lindenau's paper in the *Ergänzungsheft* to this publication, pp. 1–31 (Altona, 1849). In the *Memoirs of the Royal Astronomical Society,* vol. xvi., Airy gave a detailed history of the circumstances connected with the discovery, so far as he was cognizant of them. Documents pertaining to the subject are found in the *Monthly Notices of the Royal Astron. Society.* B. A. Gould, *Report to the Smithsonian Institution on the History of the Discovery of Neptune,* published by the Smithsonian Institution (Washington, 1850), is the most complete and detailed history of all the circumstances connected with the discovery, and with the early investigations on the orbit of the planet, that has been published. Leverrier's investigation was published *in extenso* as an addition to the *Connaissance des temps,* and Adams's as an appendix to the *Nautical Almanac* for 1851. Peirce's discussions, so far as published at all, are found in the *Proceedings of the American Academy of Arts and Sciences.* The first computations of the orbit after the discovery were made by Sears Cook Walker, and published by the Smithsonian Institution (1848–1850). General tables of the motion of Neptune are in Kowalski's *Tables du mouvement de la planète Neptune;* Newcomb's *Investigation of the Orbit of Neptune,* Washington, Smithsonian Institution (1866); Leverrier's *Annales de l'Observatoire de Paris; Memoirs,* vol. xiv. (1877), and lastly Newcomb's "Tables" in *Astron. Papers of the American Ephemeris,* vol. vii., part iv. Tables of the satellite are found in Newcomb, *The Uranian and Neptunian Systems;* appendix to the Washington observations for 1873.

(S. N.; T. E. R. P.; S. B. N.)

**NÉRAC,** a town of France in the department of Lot-et-Garonne, 16 mi. W.S.W. of Agen by road. Pop. (1936) 3,672. Nérac in the 11th century was a possession of the monks of St. Pierre de Condom. The lords of Albret deprived them of their authority and at the beginning of the 14th century founded a castle on the Baise. Nérac, the inhabitants of which had adopted the Reformed religion, was seized by the Catholics in 1562. The conferences, held there at the end of 1578 between the Catholics and Protestants, ended in the peace of Nérac, 1579. In 1580 the town was used by Henry IV as a base for attacks on the Agenais, Armagnac and Guienne. A Chambre de l'Edit for Guienne and a Chambre des Comptes were established there by Henry IV. In 1621, however, the town took part in the Protestant rising, was taken by the troops of Louis XIII and its fortifications dismantled. Soon after it was deprived both of the Chambre de l'Edit and of the Chambre des Comptes, and its ruin was completed by the revocation of the Edict of Nantes in 1685. The town, once the capital of the dukes of Albret, is divided by the Baise into Grand-Nérac and Petit-Nérac. The river is spanned by the 16th century bridge of Pont Vieux, and by the Pont Neuf, of modern construction. From the left bank a staircase leads to the rue Henri Quatre, where stands a wing of the castle in which Henry IV lived. The former palace of the Chambre des Comptes is now occupied by the tribunal of commerce, the library and the museum. The remains of a Roman villa have been found near the promenade of La Garenne. A road leads from the south end of La Garenne to the ruins of the feudal castle of Nazareth. The Château du Tasta of the 15th century is within a short distance of Nérac. The industries include brewing and cork-working. It has a large trade in wines, brandy, corks, fruit and vegetables.

**NERBUDDA:** *see* NARBADA.

**NERCHINSK,** a town of Asiatic Russia, in the Sretensk district of the Far Eastern area, in lat. 52° 10′ N., long. 116° 32′ E., on the left bank of the Nercha, 2½ m. above its confluence with the Shilka. Pop. (1926) 6,545. It is a centre for the collection of furs, cattle and brick-tea from China and for the distribution of manufactured goods imported from industrial Russia. There are tanneries, candle factories and a fur coat factory. The town is a market for the agricultural products of the fertile river valley.

The fort dates from 1654, and the town was founded in 1658 by Pashkov, who in that year opened direct communication between the Russian settlements in Transbaikalia and those on the Amur which had been founded by Cossacks and fur-traders coming from the Yakutsk region. In 1689 was signed between Russia and China the Treaty of Nerchinsk, which stopped for two centuries the further advance of the Russians into the basin of the Amur. After that Nerchinsk became the chief centre for the trade with China. The opening of the western route through Mongolia, by Urga, and the establishment of a custom-house at Kiakhta in 1728 diverted this trade into a new channel. But Nerchinsk acquired fresh importance from the influx of immigrants into eastern Transbaikalia, the discovery of rich mines and the arrival of great numbers of convicts. In 1812 it was transferred from the banks of the Shilka to its present site.

**NERCHINSK** (in full NERCHINSKIY ZAVOD), a town and silver-mine of Asiatic Russia in the Sretensk district of the Far Eastern Area, in lat. 51° 59′ N., long. 116° 39′ E., 150 m. E.S.E. of another Nerchinsk (*q.v.*) (with which it is often confused), on a small affluent of the Argun. Pop. (1926) 3,153. It has a chemical laboratory for mining purposes, and a meteorological and magnetic observatory (51° 18′ N., 119° 37′ E., 2,200 ft. above sea-level) founded in 1842. The average yearly temperature is 25·3° F, with extremes of 97·7° and −52·6°.

NERCHINSK MINING DISTRICT (29,450 sq.m.) includes all the silver, lead and tin mines and gold-fields between the Shilka and the Argun, together with a few on the left bank of the Shilka. It is traversed by several parallel chains of mountains which rise to 4,500 ft., and are intersected by a complicated system of deep, narrow valleys, densely wooded, with a few expansions along the larger rivers, where the inhabitants with difficulty raise some rye and wheat. The Nerchinsk mountains, not yet fully surveyed, form the watershed between the streams flowing south-east into the Argun and the Onon, Unda and Shilka on the north-west. They consist of crystalline slates and limestones interspersed with granite, syenite and diorite; they contain rich ores of silver, lead, tin and iron, while the diluvial and alluvial valley formations contain auriferous sands; asbestos is found near the tin.

The Nerchinsk silver mines began to be worked in 1704, but during the first half of the 18th century their yearly production did not exceed 8,400 oz., and the total amount for the first 150 years (1704–1854) amounted to 11,540,000 ounces. Transport

and climatic difficulties have prevented the exploitation of the minerals in the region and the silver mines were closed in 1900. If the present scheme of linking the mines to the main railway is carried out, production may redevelop. The more easily reached veins of silver have been exhausted and expensive plant would be needed to work the deeper veins. Gold was first discovered in 1830, and between 1833 and 1855 260,000 oz. of gold dust were obtained. In 1864 a large number of auriferous deposits were discovered.

Until 1863 all the labour was performed by serfs and convicts, numbering usually nearly four thousand.

**NEREUS,** in Greek mythology, the eldest son of Pontus and Gē, and father of the Nereïds. He is represented as a beneficent and sage old man of the sea. The only myth concerning him is that Heracles compelled him, although, like Proteus, he assumed various forms, to tell him the way to the Hesperides (Apollodorus ii. 115).

The Nereïds are mermaids. Amphitrite (consort of Poseidon) and Thetis (*see* PELEUS) are the best known; Galatea is a Sicilian figure, loved by the Cyclops Polyphemus. The name has nothing to do with the modern Greek *νερόν* (really *νεαρόν*, "fresh" [water]).

**NERGAL,** the name of a solar deity in Babylonia, the main seat of whose cult was at Kutha or Cuthah, represented by the mound of Tell-Ibrahim. The importance of Kutha as a religious and at one time also as a political centre led to his surviving the tendency to concentrate the various sun-cults of Babylonia in Shamash (*q.v.*). He becomes, however, the representative of a certain phase only of the sun and not of the sun as a whole. Portrayed in hymns and myths as a god of war and pestilence, Nergal represents the sun of noon-time and of the summer solstice which brings destruction to mankind. Nergal is pictured also as the deity who presides over the nether-world, and stands at the head of the special pantheon assigned to the government of the dead, who are supposed to be gathered in a large subterranean cave known as Arallis or Irkalla. In this capacity there is associated with him a goddess Allatu or Ereshkigal, though there are indications that at one time Allatu was regarded as the sole mistress of Arâlu. Ordinarily the consort of Nergal is Laz. Nergal was pictured as a lion and his symbol is a griffin with panther's head, sometimes supporting his other symbol, a weapon with two panther heads.

As in the case of Nin-urta, Nergal appears to have absorbed a number of minor solar deities, which accounts for the various names or designations under which he appears, such as Lugalgira, Sharrapu ("the burner," perhaps a mere epithet), Ira or Gira, Gibil (though this name more properly belongs to Nusku, *q.v.*). A certain confusion exists in cuneiform literature between Nin-urta and Nergal, perhaps due to the traces of two different conceptions regarding these two solar deities. Nergal is called the "raging king," the "furious one," and the original Sumerian name consists of three elements, Ne-urugal, "might of the great dwelling" and thus at the head of the nether-world a pantheon is indicated. In the astral-theological system he is the planet Mars, while in ecclesiastical art the great lion-headed colossi serving as guardians to the temples and palaces seem to be a symbol of Nergal, just as the bull-headed colossi probably typify Nin-urta.

The name of his chief temple at Kutha was E-shid-lam, from which the god receives the designation of Shidlamtäea, "the one that rises up from Shidlam." The cult of Nergal does not appear to have been as widespread as that of Nin-urta. He is frequently invoked in hymns and in votive and other inscriptions of Babylonian and Assyrian rulers, but we do not learn of many temples to him outside of Kutha. Sennacherib speaks of one at Tarbisu to the north of Nineveh, but although Nebuchadrezzar II. (606–586 B.C.), the great temple-builder of the neo-Babylonian monarchy, alludes to his operations at E-shid-lam in Kutha, he makes no mention of a sanctuary to Nergal in Babylon. Local associations with his original seat—Kutha—and the conception formed of him as a god of the dead acted in making him feared rather than actively worshipped. He is often spoken of as a god who passed judgment on the souls of the dead, and in the late period arose the theory of compensation at his hands in Arallu for the righteous, and thus arose the late Hebrew belief in rewards after death to explain the problem of providence.

BIBLIOGRAPHY.—Josef Böllenrücher, *Gebete und Hymnen an Nergal* (Leipzig, 1904), where earlier monographs are mentioned; Thureau Dangin, *Revue d'Assyriologie,* xi. 103–104 on Nergal as patron of pastures (Paris, 1914). On the "Seven Gods," messengers of the god Nergal-Girra, *see* F. Jean, *ibid.,* xxi. 93–104 (Paris, 1924).

**NERI, PHILIP** (FILIPPO DE), Saint (1515–1595), Italian churchman, was born at Florence on July 21, 1515, the youngest child of Francesco Neri, a lawyer of that city, and his wife Lucrezia Soldi. He received his early teaching from the friars at San Marco, the famous Dominican monastery in Florence. At sixteen Philip was sent to his uncle, Romolo, a merchant at San Germano, to assist him in his business, and with the hope that he might inherit his possessions. But in 1533 Philip went to Rome, where he acted as a private tutor, and was able to study under the Augustinians, and to begin those labours amongst the sick and poor which gained him in later life the title of "Apostle of Rome." His nights were spent in prayer and meditation in the churches of the city and in the catacombs. In 1538 he began his missionary work; somewhat in the manner of Socrates he traversed the city, seizing opportunities of entering into conversation with persons of all ranks, and of leading them on, with playful irony, questions and counsel, to consider the topics he desired to set before them.

In 1548 he founded the confraternity of the Santissima Trinità de' Pellegrini e de' Convalescenti, to minister to the thousands of poor pilgrims to Rome, and also to relieve the patients discharged from hospitals. In 1551 he was ordained priest. He settled, with some companions, at the hospital of San Girolamo della Carità, and while there tentatively began, in 1556, the institute with which his name is more especially connected, that of the Oratory. The scheme at first was for a series of evening meetings in a hall (the Oratory), at which there were prayers, hymns, readings from Scripture, from the fathers, and from the *Martyrology,* followed by a lecture, or by discussion of some religious question proposed for consideration. The musical selections (settings of scenes from sacred history) were called *oratorios.* In 1564 the Florentines invited Philip to take charge of their church in Rome, San Giovanni dei Fiorentini, then newly built. At this time the new society included amongst its members Caesar Baronius, the ecclesiastical historian, Francesco Maria Tarugi, afterwards archbishop of Avignon, and Paravicini, all three subsequently cardinals, and also Gallonius, author of a work on the *Sufferings of the Martyrs,* Ancina, Bordoni, and other men of ability and distinction.

The Florentines, however, built in 1574 a large oratory or mission-room for the society contiguous to San Giovanni. Eventually the society took the church of Santa Maria in Vallicella, in the middle of Rome. The building was pulled down, and a splendid church erected on the site. Neri then formally organized, under permission of a bull dated July 15, 1575, a community of secular priests, entitled the Congregation of the Oratory. The new church was consecrated early in 1577, but Neri himself did not migrate from San Girolamo till 1583, and then only in virtue of an injunction of the pope that he, as the superior, should reside at the chief house of his congregation. He was at first elected for a term of three years (as is usual in modern societies), but in 1587 was nominated superior for life. He desired that all congregations formed on his model outside Rome should be autonomous, a regulation formally confirmed by a brief of Gregory XV. in 1622. Neri's only interference in political matters was in 1593, when he induced Clement VIII., to withdraw the excommunication and anathema of Henry IV. of France. Neri administered the Oratory until his death (May 26, 1595) at Rome. He was succeeded by Baronius. Neri was beatified by Paul V. in 1600, and canonized by Gregory XV. in 1622.

BIBLIOGRAPHY.—J. Marciano, *Memorie istoriche della Congregazione dell' Oratorio* (5 vols., Naples, 1693–1702); articles by F. Theiner and Hilgers in Wetzer und Welte's *Kirchenlexicon,* and by Reuchlin and Zöckler in Herzog-Hauck's *Realencyklopädie.* Neri's works include *Ricordi,* or *Advice to Youth, Letters* (Padua, 1751), and a few sonnets printed in the collection of the *Rime Oneste.* Lives by Mrs. Hope (London, 1859); Abp. Capecelatro (2 vols., 1879; 2nd ed., 1884; Eng. trans., 1882; 2nd ed. by T. A. Pope, 1894).

**NERNST, WALTER** (1864–1941), German physical chemist, was born on June 25, 1864, at Briesen, West Prussia. He studied at the universities of Zürich, Berlin, Graz and Würzburg and became an assistant at the University of Leipzig, subsequently going in this capacity to Göttingen, where he later became a professor. In 1905 he was appointed ordinary professor of physics in the University of Berlin, and later became director of the Physikal. Techn. Reichsanstalt, Charlottenburg, a position he held until 1924. In 1925 he became director of the Physical Institute in the University of Berlin. On the technical side Nernst is known for the invention of an electric glow lamp which was more efficient, although more complicated, than the old carbon lamps. In comparison with the modern metal filament lamps, however, the Nernst lamp has no general value, but in scientific work it is still used to a small extent as a concentrated source of light. In physical chemistry Nernst is responsible for a great deal of the fundamental work on reversible galvanic cells; he also made considerable contributions to the theory of solutions, more especially in connection with diffusion, hydration and dissociation of electrolytes. With H. von Wartenberg he devised a method for measuring vapour densities at very high temperatures; they investigated the dissociation of various elements and compounds. Nernst is noted for the statement of the so-called third law of thermodynamics and for initiating important measurements of specific heats at low temperatures. In 1920 he received the Nobel Prize for chemistry. He died Nov. 18, 1941, near Muskau, Germany.

He edited the *Jahrbuch der Elektrochemie* and other publications. His *Experimental and Theoretical Applications of Thermodynamics to Chemistry* has appeared in a number of German and English editions. His contribution to thermodynamics is described in *Die theoretischen und experimentellen Grundlagen des neuen Warmesatzes* (1918); an English translation has been published.

**NERO** (NERO CLAUDIUS CAESAR AUGUSTUS GERMANICUS) (A.D. 37–68), Roman emperor 54–68, was born at Antium on Dec. 15, 37. He was the son of Gnaeus Domitius Ahenobarbus and Agrippina the younger, and his name was originally L. Domitius Ahenobarbus. His father died when Nero was scarcely three years old. In the previous year (39) his mother had been banished by order of her brother Caligula (Gaius), and Nero early found shelter in the house of his aunt Domitia. The emperor Claudius recalled Agrippina, who spent the next 13 years in a struggle to obtain the succession of the throne for Nero. She married Claudius in 49, and in 50 he adopted Nero as his son. Seneca was recalled from exile to be his tutor. On his fourteenth birthday he assumed the *toga virilis*, and was introduced to the Senate by Claudius with the title of *princeps iuventutis*. This made his succession almost certain, and Agrippina subsequently got rid of the partisans of Britannicus and installed Burrus as praefect of the praetorian guard.

**Succession.**—In 52, in Claudius' absence, Nero was praefect of the city. He married Claudius' daughter Octavia. On Oct. 13, 54 Claudius died, poisoned by Agrippina's orders and Nero was presented to the soldiers on guard as their new sovereign. From the palace steps he proceeded to the praetorian camp, and thence to the senate-house, where he was made emperor.

Agrippina's bold stroke had been completely successful. Only a few voices were raised for Britannicus; nor is there any doubt that Rome was prepared to welcome the new emperor with genuine enthusiasm. His prestige and his good qualities, carefully fostered by Seneca, made him popular, while his darker passions were as yet unsuspected. His first acts confirmed this favourable impression. He modestly declined the title of *pater patriae*; the memory of Claudius, and that of his own father Domitius were duly honoured. He promised to follow the principles of Augustus, and his clemency, liberality and affability were the talk of Rome.

Much of the credit of all this is due to Seneca and Burrus. Seneca had seen from the first that the real danger with Nero lay in the savage vehemence of his passions, and he made it his chief aim to stave off by every means in his power the dreaded outbreak. The policy of indulging his tastes and helping him to enjoy the sweets of popularity without the actual burdens of government succeeded for the time. During the first five years of his reign, little occurred to damp the popular enthusiasm. Nero's promises were fulfilled, and the senate found itself free to discuss and even to decide important administrative questions. Abuses were remedied, the provincials protected from oppression, and the burdens of taxation lightened. On the frontiers no serious disaster occurred, and even the murder of Britannicus was accepted as a necessary measure of self-defence. But an essential part of Seneca's policy was to remove Nero from the influence of his mother.

**Agrippina's Eclipse.**—In 55, he found a powerful ally in Nero's passion for the beautiful freedwoman Acte, a passion which he deliberately encouraged. Agrippina's angry remonstrances served only to irritate Nero, and caresses equally failed. She then threatened to espouse the cause of Britannicus. Nero retaliated by poisoning Britannicus. Agrippina then tried to win over Nero's neglected wife Octavia, and to form a party of her own. Nero dismissed her guards, and placed her in a sort of honourable confinement (Tac. *Ann.* xiii. 12–20). During nearly three years she disappears from the history, and with her retirement things again for the time went smoothly. In 58 Nero was enslaved by Poppaea Sabina, a woman of a very different stamp from her predecessor. She was resolved to be Nero's wife, and her first object was the removal of Agrippina. By rousing Nero's jealousy and fear she induced him to seek her death, with the aid of a freedman Anicetus, praefect of the fleet of Misenum. Agrippina was invited to Baiae, and after an affectionate reception, was conducted on board a vessel so constructed as, at a given signal, to fall to pieces. But Agrippina saved herself by swimming, and wrote to her son, announcing her escape, and affecting entire ignorance of the plot. A body of soldiers under Anicetus then surrounded her villa, and murdered her in her own chamber. Nero was horrorstruck at the enormity of the crime and terrified at its possible consequences. But a six months' residence in Campania, and the congratulations which poured in upon him from the neighbouring towns, where the report had been officially spread that Agrippina had fallen a victim to her treacherous designs upon the emperor, gradually restored his courage. In Sept. 59 he re-entered Rome amid universal rejoicing. Races, exhibitions and games in the Greek fashion rapidly succeeded each other.

**Poppaea.**—The result of the death of Agrippina was the growing influence over Nero of Poppaea and her friends. In 62 Burrus died, it was said by poison, and Seneca retired from his post. Their place was filled by Poppaea, and the infamous Tigellinus, whose sympathy with Nero's sensual tastes had gained him the command of the praetorian guards in succession to Burrus. The fear of conspiracy was skilfully used by them to direct Nero's suspicions against possible opponents. Cornelius Sulla, who had been banished to Massilia in 58, was put to death on the ground that his residence in Gaul was likely to arouse disaffection in that province, and a similar charge proved fatal to Rubellius Plautus, who had for two years been living in retirement in Asia. Nero's taste for blood thus whetted, Octavia was divorced, banished to the island of Pandateria and murdered. Poppaea's triumph was now complete. She was married to Nero; her head appeared on the coins with his; and her statues were erected in the public places of Rome.

In the course of 61 occurred the rebellion of Boudicca (Boadicea) and the Iceni in Britain, resulting in the sack of Colchester and the destruction of the ninth legion before it was suppressed by Suetonius Paulinus. Further disasters were the destruction of Pompeii and the evacuation of Armenia in 63.

**The Burning of Rome.**—A far deeper and more lasting impression was produced by the great fire in Rome. The fire broke out on the night of July 18, 64, among the wooden booths at the south-east end of the Circus Maximus. Thence in one direction it rapidly spread over the Palatine and Velia up to the low cliffs of the Esquiline, and in another it laid waste the Aventine, the Forum Boarium and Velabrum till it reached the Tiber and the solid barrier of the Servian wall. After burning fiercely for six days it started afresh and desolated the regions of the Circus Flaminius and the Via Lata, and after it was finally quenched only four of the 14 *regiones* remained untouched; three had been utterly destroyed and seven reduced to ruins. The conflagration is said by all authorities later than Tacitus to have been deliberately caused by Nero himself. But Tacitus, though he mentions the rumours,

declares that its origin was uncertain, and in spite of such works as Profumo's *Le fonti ed i tempi dello incendio Neroniano* (1905), there is no proof of his guilt. By Nero's orders, the open spaces in the Campus Martius were utilized to give shelter to the homeless crowds, provisions were brought from Ostia and the price of corn lowered. In rebuilding the city every precaution was taken against the recurrence of such a calamity. Broad regular streets replaced the narrow winding alleys. The new houses were limited in height, built partly of hard stone and protected by open spaces.

This disaster undoubtedly told against Nero, being widely regarded as evidence of the wrath of the gods. The work of rebuilding included the erection of Nero's famous palace, the "golden house," and the laying-out of its wonderful grounds.

To defray the enormous cost, Italy and the provinces, says Tacitus, were ransacked, and in Asia and Achaia especially the rapacity of the imperial commissioners recalled the days of Mummius and of Sulla. It was the first occasion on which the provincials had suffered from Nero's rule, and the discontent it caused helped to weaken his hold over them at the very moment when the growing dissatisfaction in Rome was gathering to a head. Early in 65 Nero was panic-stricken by the discovery of a conspiracy involving such men as Faenius Rufus, Tigellinus's colleague in the prefecture of the praetorian guards, Plautius Lateranus, one of the consuls elect, the poet Lucan, and, lastly, not a few of the tribunes and centurions of the praetorian guard itself. Their chosen leader, whom they destined to succeed Nero, was C. Calpurnius Piso, a handsome, wealthy and popular noble, and a boon companion of Nero. The plan to murder Nero was betrayed by a freedman Milichus. Piso, Faenius Rufus, Lucan and Seneca himself were executed.

In the next few months many more fell victims to his fear and resentment. Conspicuous among them was Paetus Thrasea, whose unbending virtue had long made him distasteful to Nero, and who was now suspected, possibly with reason, of sympathy with the conspirators. Poppaea died in the autumn of 65, and the general gloom was increased by a pestilence which followed the fire. Early in the summer of 66 the Parthian prince Tiridates came to Italy to receive the crown of Armenia at Nero's hands. It represented the final triumph of the arms and policy of Corbulo in the East, and at least a temporary solution of the Parthian problem.

**Greece.**—Towards the end of 66 Nero visited Greece with a retinue of soldiers, courtiers, musicians and dancers. The spectacle presented by Nero's visit was unique. He went professedly as an enthusiastic worshipper of Greek art and a humble candidate for the suffrages of Greek judges. At each of the great festivals, which to please him were for once crowded into a single year, he entered in regular form for the various competitions, scrupulously conformed to the tradition and rules of the arena, and awaited in nervous suspense the verdict of the umpires. The dexterous Greeks humoured him to the top of his bent. He planned and commenced the cutting of a canal through the Isthmus of Corinth.

Meanwhile the general dissatisfaction was coming to a head, as we may infer from the urgency with which the imperial freedman Helius insisted upon Nero's return to Italy. Revolt started in Gaul with the insurrection of Julius Vindex, governor of Gallia Lugdunensis. It is probable that the aims of Vindex included the liberation of northern Gaul, which would explain both the enthusiasm of the Gallic chiefs, and the opposition of the legions of the Rhine. This force defeated Vindex at Vesontio (Besançon) and offered the throne to their own commander Virginius Rufus, who refused it. Meanwhile the governors of Hispania, Tarraconensis and Galba and Otho, had rebelled, and Galba had claimed the throne. Nero returned from Greece to Naples for further revels.

**Suicide.**—The revolts in Spain and Germany terrified him too late into something like energy. The senate almost openly intrigued against him, and the populace were silent or hostile. The fidelity of the praetorian sentinels even was more than doubtful. When finally the palace guards forsook their posts, Nero despairingly stole out of Rome to seek shelter in a freedman's villa some four miles off. There he heard of the senate's proclamation of Galba as emperor, and of the sentence of death passed on himself. On the approach of the horsemen sent to drag him to execution, he collected sufficient courage to save himself by suicide. Nero died on June 9, 68, in the 31st year of his age and the fourteenth of his reign, and his remains were deposited by the faithful Acte in the family tomb of the Domitii on the Pincian hill. With his death ended the line of the Caesars, and Roman imperialism entered a new phase. His statues were broken, his name everywhere erased, and his "golden house" demolished.

The Roman populace for a long time reverenced his memory as that of an open-handed patron, and in Greece the recollections of his magnificence, and his enthusiasm for art, were still fresh when the traveller Pausanias visited the country a century later. The belief that he had not really died, but would return again to confound his foes, was long prevalent, not only in the remoter provinces, but even in Rome itself; and more than one pretender was able to collect a following by assuming the name of the last of the race of Augustus. More lasting still was the implacable hatred of those who had suffered from his cruelties. Roman literature, faithfully reflecting the sentiments of the aristocratic salons of the capital, while it almost canonized those who had been his victims, fully avenged their wrongs by painting Nero as a monster of wickedness. In Christian tradition he even appears as the mystic Antichrist, who was destined to come once again to trouble the saints. Even in the middle ages, Nero was still the very incarnation of splendid iniquity, while the belief lingered that he had only disappeared for a time, and as late as the 11th century his restless spirit was supposed to haunt the slopes of the Pincian hill.

The chief ancient authorities for Nero's life and reign are Tacitus (*Annals*, xiii.–xvi., edit. Furneaux), Suetonius, Dio Cassius (*Epit.* lxi., lxii., lxiii.) and Zonaras (*Ann.* xi.). The most important modern work is that of B. W. Henderson, *The Life and Principate of the Emperor Nero* (1903; *see* an important notice in *Class. Rev.* vol. xviii. p. 57), which contains full bibliography of ancient and modern writers: *see* also H. Schiller's *Nero,* and *Geschichte d. Kaiserzeit;* Lehmann, *Claudius und Nero;* Desider Kostolanyi, *Nero* (1928).

**NERVA, MARCUS COCCEIUS** (A.D. ?35–98), Roman emperor from Sept. 18, 96 to Jan. 25, 98, was born at Narnia in Umbria on Nov. 8, probably in the year 35. He came of a senatorial family, his father and grandfather having been jurists.

He was praetor (66) and twice consul, in 71 with the emperor Vespasian for colleague and again in 90 with Domitian. Towards the close of the latter's reign (93) he is said to have been banished to Tarentum on a charge of conspiracy. On the murder of Domitian in September 96 Nerva was declared emperor by the people and the soldiers. He is described as a quiet, kindly, dignified man, honest of purpose, but unfitted by his advanced age to bear the weight of empire. Nevertheless, his selection, in spite of occasional exhibitions of weakness, justified the choice. The new emperor recalled those who had been exiled by Domitian; what remained of their confiscated property was restored to them, and a stop was put to the vexatious prosecutions which Domitian had encouraged. But the popular feeling demanded more than this. The reaction against the informers became as dangerous as the previous system. It was checked by Nerva, who was actuated by the taunt of Titus Catius Caesius Fronto that, "bad as it was to have an emperor who allowed no one to do anything, it was worse to have one who allowed everyone to do everything."

Nerva seems to have followed the custom of announcing the general lines of his future policy. He showed himself anxious to respect the traditional privileges of the senate, and such maxims of constitutional government as still survived. He pledged himself to put no senator to death. His councillors in all affairs of state were senators, and the hearing of claims against the *fiscus* was entrusted to a praetor and a court of *indices*.

The economical condition of Italy evidently excited his alarm and sympathy. The last mention of a *lex agraria* in Roman history is connected with his name. Under the provisions of this *lex,* large tracts of land were bought up and allotted to poor citizens. The cost was defrayed partly from the imperial treasury, but partly also from Nerva's private resources, and the execution of the scheme was entrusted to commissioners. He also founded or restored colonies at Verulae, Scyllacium and Sitifis in Mauretania. An entirely new departure was the main-

tenance at the public cost of the children of poor parents in the towns of Italy, which was combined ingeniously with the provision of loans for farmers. The treasury found the money, which was lent on the security of farms, and the farmers paid the interest to their municipality for the maintenance of poor children.

Private individuals were also encouraged to follow the imperial example. In the hands of Trajan, Hadrian and the Antonines, Nerva's example bore fruit in the institution of the *alimentationes,* the most genuinely charitable institution of the pagan world. These measures Nerva supplemented by others which aimed at lightening the financial burdens on the declining industry of Italy. The cost of maintaining the imperial postal system (*vehiculatio*) was transferred to the *fiscus;* from the same source apparently money was found for repairing the public roads and aqueducts; and lastly, the lucrative but unpopular tax of 5% on all legacies or inheritances (*vicesima hereditatum*), was so readjusted as to remove the grosser abuses connected with it. At the same time Nerva did his best to reduce the overgrown expenditure of the state. A commission was appointed to consider the best modes of retrenchment, and the outlay on shows and games was cut down to the lowest possible point. Early, apparently, in 97 he detected a conspiracy against his life headed by L. (or C.) Calpurnius Crassus, but he contented himself with a hint to the conspirators that their designs were known, and with banishing Crassus to Tarentum. The praetorian guards, at the instigation of one of their two prefects. Casperius Aelianus, whom Nerva had retained in office, imperiously demanded the execution of Domitian's murderers, the chamberlain Parthenius and Petronius Secundus, Aelianus's colleague. Nerva vainly strove to save, even at the risk of his own life, the men who had raised him to power, but the soldiers brutally murdered the unfortunate men, and forced him to propose a vote of thanks for the deed. This humiliation convinced Nerva of the necessity of placing the government in stronger hands than his own. He resolved to adopt as his colleague and destined successor, M. Ulpius Trajanus, a distinguished soldier, at the time in command of the legions on the Rhine. In Oct. 97, in the temple of Jupiter on the Capitol, Trajan was formally adopted as his son and declared his colleague in the government of the empire. For three months Nerva ruled jointly with Trajan, but on Jan. 25, 98, he died somewhat suddenly. He was buried in the sepulchre of Augustus, and divine honours were paid him by his successor. The verdict of history upon his reign is best expressed in his own words—"I have done nothing which should prevent me from laying down my power, and living in safety as a private man." The memory of Nerva is still preserved by the ruined temple in the Via Alessandrina (il Colonacce) which marks the site of the Forum begun by Domitian, but which Nerva completed and dedicated.

BIBLIOGRAPHY.—Dio Cass. lxviii. 1–4; Aurelius Victor 12, and *Epit.* 24; Zonaras xi. 20; compare also Pliny, *Epistolae* and *Panegyricus;* Tillemont, *Histoire des empereurs romains,* ii.; C. Merivale, *History of the Romans under the Empire,* ch. 63; H. Schiller, *Geschichte der römischen Kaiserzeit,* i. pt. 2 (1883), p. 538; J. Asbach, *Römisches Kaiserthum und Verfassung bis auf Trajan* (Cologne, 1896); A. Stein in Pauly-Wissowa's *Realencyclopädie* (*s.v.* Cocceius, 16); J. B. Bury, *The Student's Roman Empire,* ch. 23 (1893); M. I. Rostovtsev, *Social and Economic History of the Roman Empire* (1926); B. W. Henderson, *Five Roman Emperors* (1927). (H. F. P.; X.)

**NERVAL, GÉRARD DE** (1808–1855), the adopted name of Gérard Labrunie, French man of letters, born in Paris on May 22, 1808. His father was an army doctor, and the child was left with an uncle in the country, while Mme. Labrunie accompanied her husband in his campaigns. She died in Silesia. In 1811 his father returned, and beside Greek and Latin taught the boy modern languages and the elements of Arabic and Persian. Gérard found his favourite reading in old books on mysticism and the occult sciences. His first work, *La France guerrière, élégies nationales,* was published while he was still a schoolboy at the Collège Charlemagne. In 1828 he published a translation of Goethe's *Faust,* the choruses of which were afterwards used by Berlioz for his legend-symphony, *The Damnation of Faust.* A number of poetical pieces and three comedies combined to acquire for him, at the age of 21, a considerable reputation, and led to his association with Théophile Gautier in the preparation of the dramatic *feuilleton* for the *Presse.* He conceived a violent passion for the actress Jennie Colon, in whom he thought he recognized a certain Adrienne, who had fired his childish imagination. Her marriage and her death in 1842 were blows from which his nervous temperament never really recovered. He travelled in Germany with Alexandre Dumas, and alone in various parts of Europe, leading a very irregular and eccentric life. In 1843 he visited Constantinople and Syria, where, among other adventures, he nearly married the daughter of a Druse sheikh. He contributed accounts of his travels to the *Revue des Deux Mondes* and other periodicals. After his return to Paris in 1844 he resumed for a short time his *feuilleton* for the *Presse,* but his eccentricities increased and he committed suicide by hanging, on Jan. 25, 1855. The literary style of Gérard is simple and unaffected, and he has a peculiar faculty of giving to his imaginative creations an air of naturalness and reality. In a series of novelettes, afterwards published under the name of *Les Illuminés, ou les précurseurs du socialisme* (1852), containing studies on Rétif de la Bretonne, Cagliostro and others, he gave a sort of analysis of the feelings which followed his third attack of insanity. Among his other works the principal are *Les Filles du feu* (1854), which contains his masterpiece, the semi-autobiographical romance of *Sylvia; Scènes de la vie orientale* (1848–50); *Contes et facéties* (1852); *La Bohême galante* (1856); and *L'Alchimiste,* a drama in five acts, the joint composition of Gérard and Alexandre Dumas. His *Poésies complètes* were published in 1877.

*See* the notices by Théophile Gautier and Arsène Houssaye, prefixed to the posthumous *Le Rêve et la vie* (1855); Maurice Tourneux's sketch in his *Âge du romantisme* (1887); and a sympathetic study of temperament in the *Névrosés* (1898) of Mme. Arvède Barine. *See* also G. Ferrières, *Gérard de Nerval* (1906).

**NERVE,** originally a sinew or tendon (*cf.* "strain every nerve") but now used for the conducting fibres of the nervous system in anatomy and secondarily as a psychical term for courage or firmness and in "nervousness" for the opposite quality. Here the anatomy of the nerves is dealt with; *see* also NERVOUS SYSTEM, MUSCLE AND NERVE, NEUROPATHOLOGY, etc.

### CRANIAL

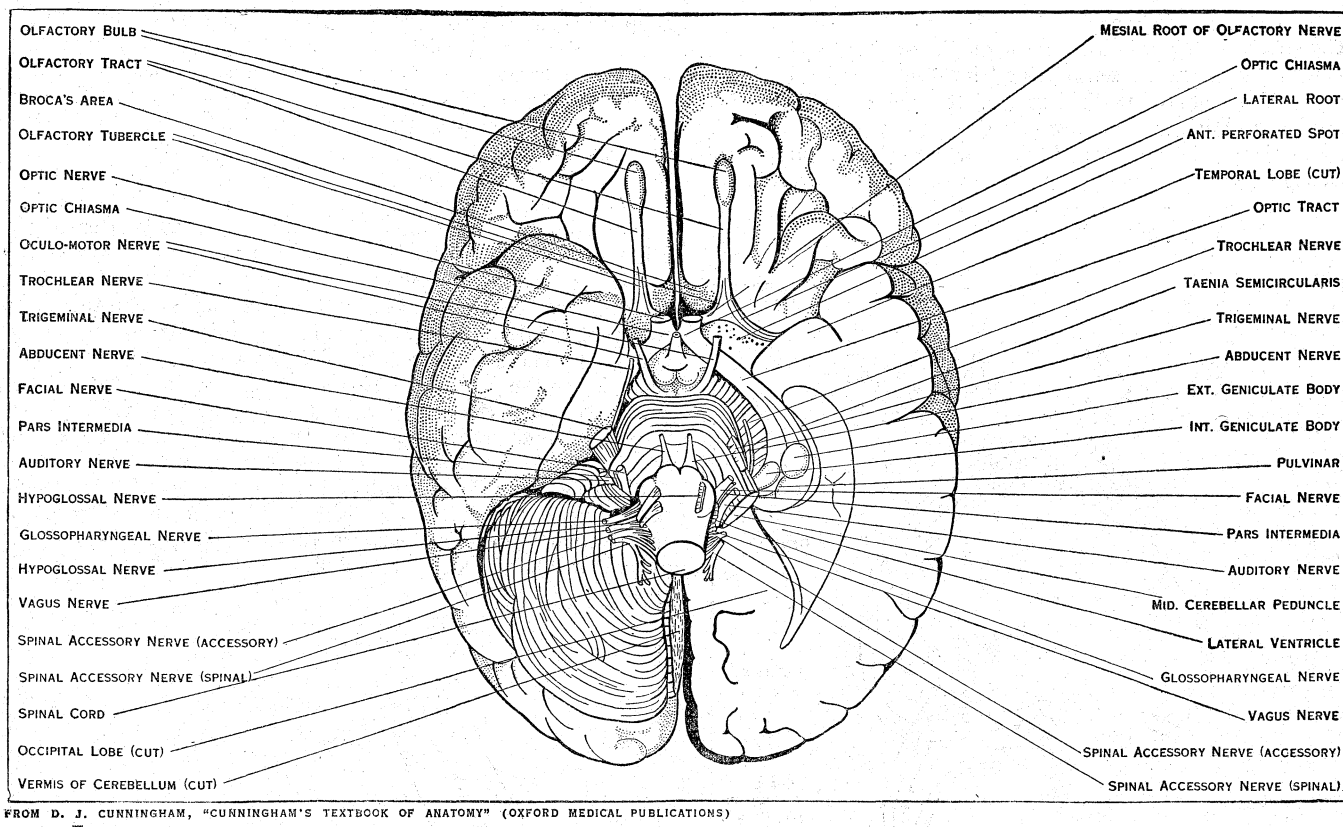
The 12 pairs of cranial nerves rise directly from the brain. With one exception they all contain medullated fibres (*see* NERVOUS SYSTEM). The following is a list:—

(1) Olfactory; (2) Optic; (3) Oculo-motor or Motor oculi; (4) Trochlearis or Patheticus; (5) Trigeminal or Trifacial; (6) Abducens; (7) Facial; (8) Auditory; (9) Glossopharyngeal; (10) Vagus or Pneumogastric; (11) Spinal accessory; (12) Hypoglossal.

**Olfactory.**—The first, or olfactory nerve, consists of the *olfactory bulb* and *tract,* which are a modified lobe of the brain and lie beneath the sulcus rectus on the frontal lobe of the brain (fig. 1). At its posterior end the tract becomes continuous with the brain; anteriorly is the bulb from which some twenty small non-medullated nerves pass through the cribriform plate of the ethmoid to supply the sensory organs in the olfactory mucous membrane (*see* OLFACTORY SYSTEM).

**Optic.**—The second or optic nerve consists of the *optic tract,* the *optic commissure* or *chiasma,* and the *optic nerve* proper. The optic tract begins at the lower visual centres or internal and external geniculate bodies, the superior quadrigeminal body and the pulvinar (fig. 1), but these again are connected with the higher visual centre in the occipital lobe by the optic radiations (fig. 2). In the chiasma some of the fibres cross and some do not, so that the right optic tract forms the right half of both the right and left optic nerves. In addition, the fibres from the internal geniculate body of one side cross in the chiasma to the same body of the opposite side, forming *Gudden's commissure.* The optic nerve passes through the optic foramen into the orbit, where it is penetrated by the central artery of the retina, and pierces the sclerotic internal to the posterior pole of the eyeball. *See* EYE.

**Oculomotor.**—The third or oculomotor nerve rises from a nucleus in the floor of the aqueduct of Sylvius and comes to the surface on the inner side of the crus cerebri (fig. 1), pierces the dura mater, and lies in the outer wall of the cavernous sinus.




FROM D. J. CUNNINGHAM, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 1.—VIEW OF INFERIOR SURFACE OF BRAIN, WITH LOWER PORTION OF THE TEMPORAL AND OCCIPITAL LOBES; THE CEREBELLUM ON THE LEFT SIDE IS REMOVED TO SHOW ORIGINS OF THE CEREBRAL NERVES

where it divides into an upper and lower branch. Both these enter the orbit through the sphenoidal fissure, the upper branch supplying the superior rectus and levator palpebrae superioris muscles, the lower the inferior and internal rectus and the inferior oblique, thus supplying five of the seven orbital muscles.

**Trochlear.**—The fourth or trochlear nerve is very small, and comes from a nucleus a little lower than that of the third nerve. It crosses to the opposite side in the fourth ventricle, winds round the outer side of the crus cerebri (fig. 1) and enters the outer wall of the cavernous sinus to reach the orbit through the sphenoidal fissure. Here it enters the superior oblique muscle on its orbital surface.

**Trigeminal.**—The fifth or trigeminal nerve consists of motor and sensory roots. The motor root rises from a nucleus in the upper lateral part of the floor of the fourth ventricle, and by a descending (mesencephalic) tract near the Sylvian aqueduct (fig. 3). The large sensory root goes to a sensory nucleus a little external to the motor one, and also, by a spinal or descending root, to the substantia gelatinosa Rolandi as low as the second spinal nerve (fig. 3). The superficial origin of the fifth nerve is from the side of the pons (fig. 1), and the two roots at once pass into a small compartment of the dura mater, where the large crescentic *Gasserian ganglion* is formed upon the sensory root, and from this the three branches, ophthalmic, maxillary, mandibular, come off. The motor root only joins the mandibular branch. The *ophthalmic division* runs in the outer wall of the cavernous sinus, where it divides into frontal, lachrymal and nasal branches. They all enter the orbit through the sphenoidal fissure. The *maxillary division* leaves the skull through the foramen rotundum, and then runs across the roof of the spheno-maxillary fossa; here the *spheno-maxillary* or *Meckel's ganglion* hangs from it by two roots. The nerve then runs in the floor of the orbit, giving off *superior dental* branches, until it emerges on to the face at the infraorbital foramen, where it divides into *palpebral, nasal* and *labial branches*. The *mandibular division* leaves the skull through the foramen ovale, and at once gives off motor branches for the muscles of mastication; these are derived from the motor root of the fifth, except that for the buccinator, which really supplies only the skin and mucous membrane in contact with the muscle. After the motor branch is given off, the nerve divides into *lingual, inferior dental* and *auriculo-temporal*. The lingual is joined by the *chorda tympani* branch of the facial nerve.

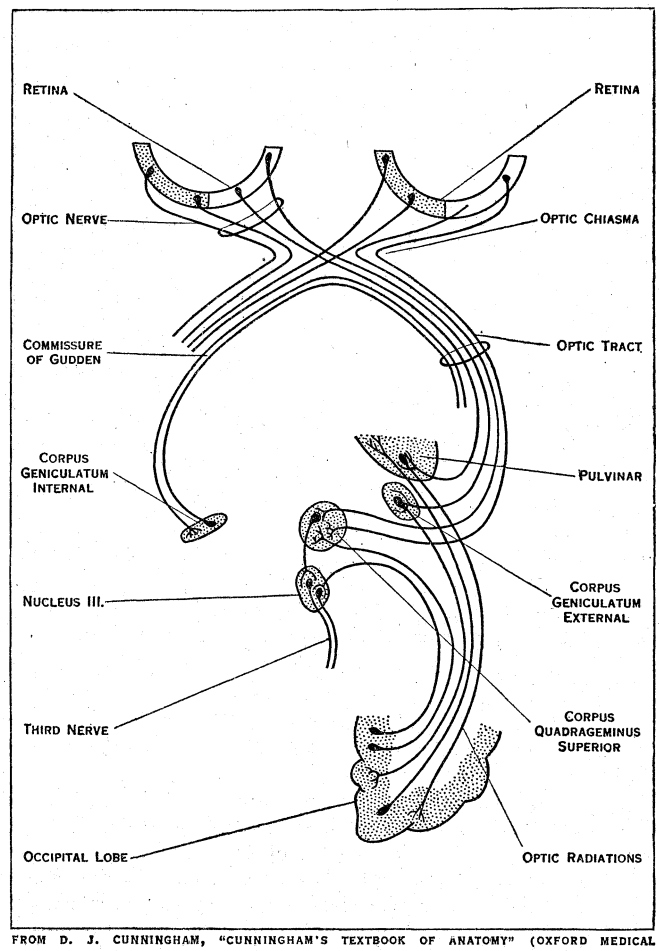
**Abducent.**—The sixth or abducent nerve rises from a nucleus in the floor of the fourth ventricle deep to the eminentia teres (fig. 3). It appears on the surface of the brain just below the pons and close to the middle line (fig. 1), pierces the dura mater and runs in the floor of the cavernous sinus to the sphenoidal fissure. Entering the orbit it supplies the external rectus muscle.

**Facial.**—The seventh or facial nerve begins in a nucleus which is about the same level as that for the sixth, but much deeper from the floor of the fourth ventricle as well as farther from the middle line (fig. 3). The fibres of the facial loop round the nucleus of the sixth, and then emerge in the triangular interval between the medulla, pons and cerebellum, close to the eighth nerve (fig. 1). Entering the internal auditory meatus the facial nerve passes into a canal in the petrous bone (*aqueductus Fallopii*), emerges at the stylo-mastoid foramen on the base of the skull, and enters the parotid gland, in which it forms a plexus called the *pes anserinus*. From this, branches pass to all the muscles of the face except those of mastication.

**Auditory.**—The eighth or auditory nerve is in two bundles, *cochlear* and *vestibular*. The former comes from the cochlear nuclei which lie deep to the acoustic tubercle in the floor of the fourth ventricle (fig. 3); the latter rises from the dorsal nucleus, nucleus of Deiters and the nucleus of the descending root, which are more deeply placed. The *nucleus of Deiters* is connected with the cerebellum, and is concerned in maintaining the equilibrium (*q.v.*) of the body; the cochlear nuclei are connected with the inferior quadrigeminal body by the lateral fillet as well as with the internal geniculate body, and thus with the higher auditory centre in the temporo-sphenoidal lobe by the auditory radiations. The vestibular root passes in front of the restiform body (fig. 3), and the cochlear behind that body. Together they enter the internal auditory meatus, pierce the lamina cribrosa, the vestibular nerve supplying the utricle and superior and external semicircular canals, the cochlear nerve, the posterior canal, the saccule

and the cochlea (*see* EAR).

**Glossopharyngeal.**—The ninth or glossopharyngeal nerve is chiefly, if not entirely, sensory, and its deep termination in the brain is the solitary bundle (fig. 3). It appears on the surface between the olive and restiform body (fig. 1), leaves the skull through the posterior lacerated foramen, runs downward and forward, between the internal and external carotid arteries, and




FROM D. J. CUNNINGHAM, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

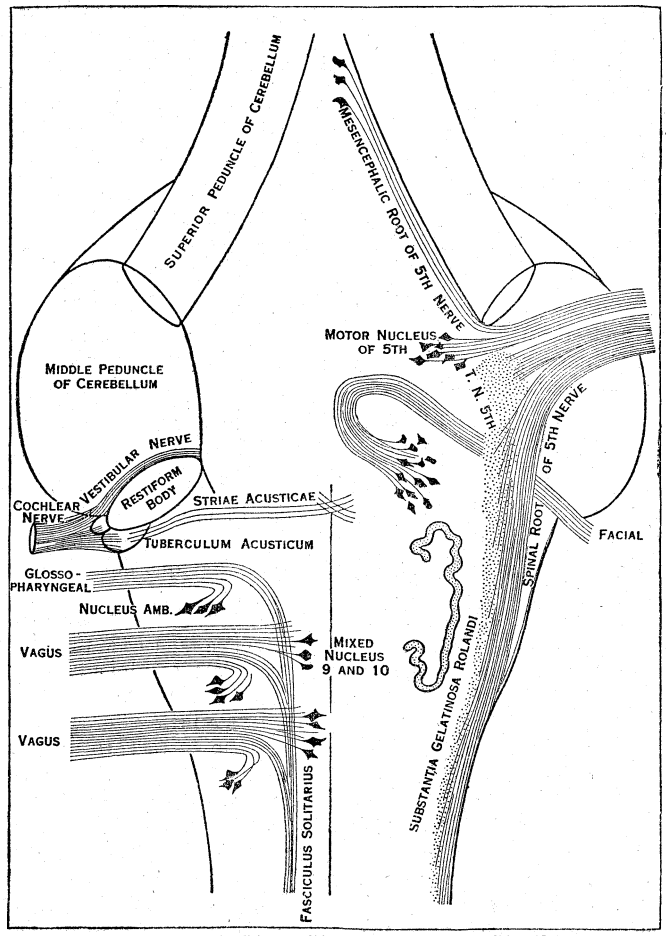
FIG. 2.—DIAGRAM OF THE CENTRAL CONNECTIONS OF THE OPTIC NERVE AND OPTIC TRACT

eventually reaches the back of the tongue (*see* TONGUE).

**Vagus.**—The tenth nerve or vagus has sensory and motor fibres; the former go to the solitary bundle mentioned in the description of the last nerve (fig. 3), while the latter come from the dorsal nucleus and nucleus ambiguus, both of which are found deep to the lower half of the fourth ventricle. The nerve appears on the surface between the olive and restiform body and just below the ninth (fig. 1). It leaves the skull through the posterior lacerated foramen, gives off *auricular* and *pharyngeal branches* and the *superior laryngeal branch* which is the sensory nerve of the larynx (fig. 4). The accessory part of the eleventh nerve joins the tenth, and from this communication motor twigs to the pharynx, larynx, alimentary and respiratory tracts are derived, as well as inhibitory fibres of the heart. In the neck the vagus accompanies the carotid artery and internal jugular vein, and gives off cardiac branches. It enters the thorax between the subclavian artery and vein. On the right side its recurrent laryngeal branch loops under the subclavian artery (fig. 4), and runs up to supply all the muscles of the larynx except one (*see* RESPIRATORY SYSTEM). In the thorax the left vagus passes in front of the arch of the aorta, under which the left recurrent laryngeal loops, and on both sides a thoracic cardiac branch is given to the deep cardiac plexus. Both vagi pass behind the root of their own lung, and break up to form the *pulmonary plexus;* they then reach the oesophagus, where they again break up into an *oesophageal plexus*. As the diaphragm is approached the two nerves become distinct again, but the left one now lies in front and the right behind the food tube, so that, when the stomach is reached, the left vagus supplies the front of the organ and communicates with the *hepatic plexus*, while the right goes to the back and communicates with the *coeliac, splenic* and *renal plexuses*.

**Spinal Accessory.**—The eleventh or spinal accessory nerve is entirely motor, and consists of a *spinal* and an *accessory* part. The former rises from the anterior horn of the grey matter of the spinal cord as low as the fifth cervical nerve. Its fibres come to the surface mid-way between the anterior and posterior nerve-roots, and run up through the foramen magnum to join the accessory part, the deep origin of which is the lower part of the nucleus ambiguus. The accessory part joins the vagus, while the spinal part pierces the sterno-mastoid muscle and runs downward and backward across the posterior triangle of the neck to enter the trapezius; both these muscles are in part supplied by the nerve.

**Hypoglossal.**—The twelfth or hypoglossal nerve is motor, and rises from a nucleus in the floor of the fourth ventricle. It emerges from the brain between the anterior pyramid and the olive (fig. 1), and leaves the skull in two bundles through the




FROM D. J. CUNNINGHAM, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

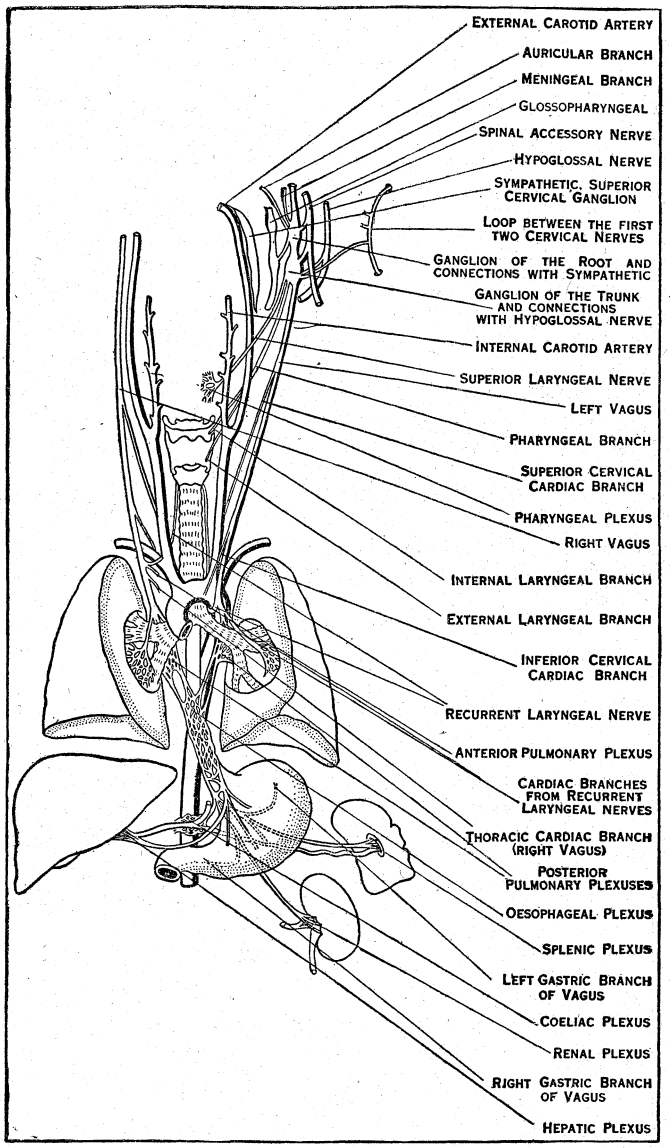
FIG. 3.—DEEP ORIGINS OF CRANIAL NERVES FROM THE FLOOR OF THE FOURTH VENTRICLE

anterior condylar foramen. Soon after it is closely bound to the vagus, and receives contributions from the loops between the first and second and the second and third cervical nerves. The nerve then passes downward and runs forward on the surface of the hyo-glossus to the muscles of the tongue. It gives off branches to many of the depressor muscles of the hyoid bone and larynx. All the true muscles of the tongue are supplied by the medullary part of the nerve.

For the embryology and comparative anatomy of the cranial nerves, *see* NERVOUS SYSTEM.

## SPINAL

The spinal nerves arise from each side of the spinal cord and are distributed to the trunk and limbs, though some of the upper ones supply the lower parts of the head and face. There are generally thirty-one pairs, eight cervical (abbreviated C.), twelve thoracic (Th.)—formerly called dorsal,—five lumbar (L.), five sacral (S.) and one coccygeal (Coc.). As the thoracic nerves are




FROM A. M. PATERSON, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

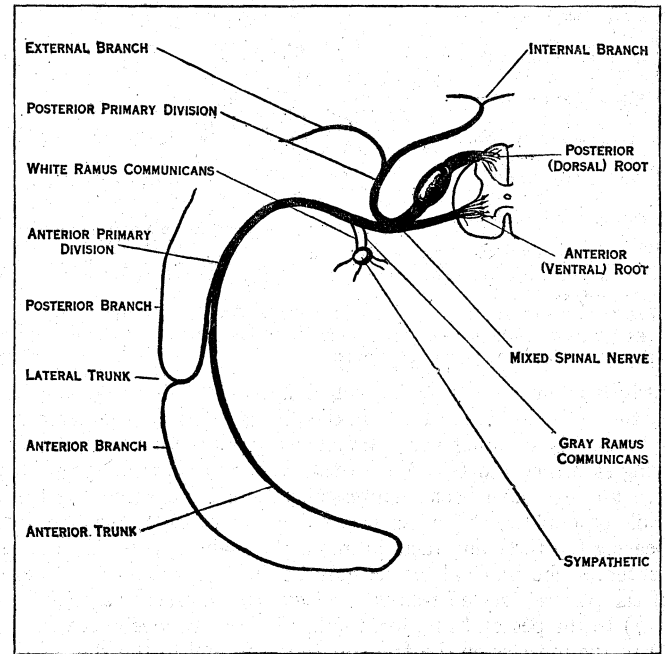
FIG. 4.—THE DISTRIBUTION OF THE 10TH (PNEUMOGASTRIC OR VAGUS) NERVE

the simplest and most generalized in their arrangement, a typical one of these, say the fourth or fifth, will be first described.

The nerve is attached to the spinal cord by two roots, of which the ventral is purely efferent or motor and the dorsal purely afferent or sensory. On the dorsal root is a fusiform ganglion which lies in the foramen between the vertebrae through which the nerve passes. The two roots then join together to form a mixed nerve (fig. 5), but very soon divide once more into anterior (ventral) and posterior (dorsal) primary divisions. These, however, each contain sensory and motor fibres. Just before it divides in this way the mixed nerve gives and receives its rami communicantes with the sympathetic (*see* NERVOUS SYSTEM).

The anterior primary division runs round the trunk, between the ribs, forming an intercostal nerve and giving off a lateral cutaneous branch, when the side of the body is reached, which divides into anterior and posterior secondary branches. The rest of the division runs forward, supplying the intercostal muscles, as far as the edge of the sternum, when it ends in an anterior cutaneous branch to the front of the chest. The dorsal primary division divides into an external (lateral) and internal (mesial) branch through which the skin and muscles of the back are supplied.

It will be seen from the foregoing that the thoracic nerves are almost completely segmental in their distribution, in other words, each supplies a slice of the body, but in the other regions this segmental character is masked by the development of the branchial skeleton and the limbs. In the cervical region the first cervical or *suboccipital nerve* comes out between the occiput and atlas and does not always have a posterior root. When it has not, it obviously can supply no skin. Its anterior primary division joins those of the second, third and fourth cervical nerves to form the *cervical plexus,* from which the skin of the side of the neck and lower part of the head and face are supplied by means of the *small occipital, great auricular, superficial cervical, suprasternal, supraclavicular* and *supraacromial* nerves (fig. 7), as well as those muscles of the neck which are not supplied by the cranial nerves. The *phrenic nerve,* which comes chiefly from the fourth cervical, runs down, through the thorax, to supply the greater part of the diaphragm. The explanation of this long course (*see* DIAPHRAGM) is that the diaphragm is formed in the neck region of the embryo. The posterior primary division of the second cervical nerve is large, and its inner (mesial) branch (*great occipital*) supplies most of the back of the scalp (fig. 7). The fifth, sixth, seventh and eighth anterior primary divisions of the cervical nerves as well as a large part of that of the first thoracic are prolonged into the arm, and in the lower part of the neck and armpit communicate with one another to form the *brachial plexus.* It will be seen from fig. 8 that each component nerve except the first thoracic divides into an anterior (ventral) and a posterior (dorsal) division which are best spoken of as secondary divisions in order to prevent confusion with the anterior and posterior



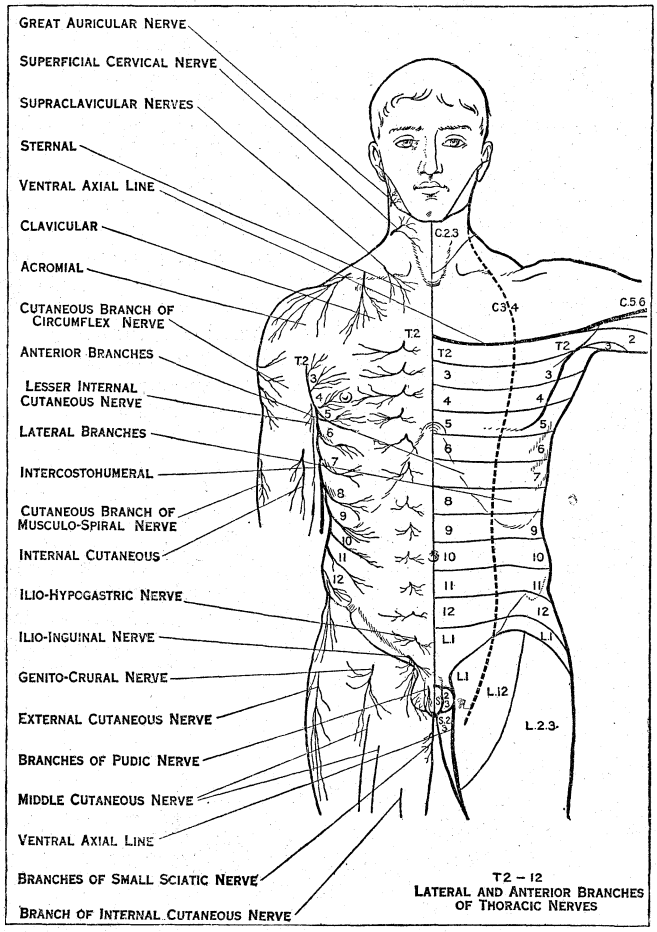

FROM A. M. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 5.—SCHEME OF THE DISTRIBUTION OF A TYPICAL SPINAL NERVE

primary divisions which all the spinal nerves undergo. In the diagram the anterior secondary divisions are white, while the posterior are shaded. Later on in the plexus three cords are formed of which the posterior is altogether made up of the posterior secondary divisions, while the anterior secondary divisions of the fifth, sixth and seventh cervical nerves form the external cord, and those of the eighth cervical and first thoracic the inner. As a general rule the nerves which rise from the ventral secondary divisions of the limb plexuses run only to that surface of the limb which was ventral in the embryo, while the

dorsal secondary divisions are confined to the original dorsal area, but, in order to apply this to the human adult, it must be realized that the limbs are at one time flattened buds coming off at right angles from the side of the body and having dorsal and ventral surfaces, one (preaxial) border toward the head of the embryo, and one (postaxial) toward the tail.

**Brachial Plexus.**—With regard to the muscular supply of a limb the general rule is that each muscle is supplied by fibres




FROM A. M. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 6.—DISTRIBUTION OF THE CUTANEOUS NERVES ON THE FRONT OF THE TRUNK, SHOWING, ON THE LEFT SIDE OF THE FIGURE, THE DISTRIBUTION OF THE SEVERAL NERVES

derived from more than one spinal nerve; this is made possible by the redistribution of fibres in the plexuses. Moreover, the muscular supply does not necessarily correspond to that of the overlying skin, because (*see* MUSCULAR SYSTEM) some of the primitive muscles have been suppressed, others have fused together, while others have shifted their position to a considerable distance. Bearing the foregoing facts in mind, the main distribution of the nerves of the brachial plexus may be surveyed. The outer cord of the plexus gives off the *external anterior thoracic nerve* (C. 5, 6, 7) to the pectoralis major, the *musculo-cutaneous* nerve (C. 5, 6) to the muscles on the front of the arm, and to the skin of the outer side of the forearm and the outer head of the *median nerve* (C. 5, 6, 7), which joins the inner head (C. 8, Th. 1) and supplies most of the flexor muscles of the front of the forearm as well as those of the ball of the thumb.

From the inner cord come the inner head of the median just mentioned, the *ulnar nerve* (C. 8, Th. 1), which passes down behind the internal condyle of the humerus, where it is popularly known as the "funny bone" and supplies the flexor carpi ulnaris, half the flexor profundus digitorum, and most of the muscles of the hand as well as the inner digit and a half on the palmar and dorsal aspects. Other branches of the inner cord are the *internal cutaneous* (C. 8, Th. 1) supplying the inner side of the forearm, the *lesser internal cutaneous* (Th. 1) which often joins the *intercosto-humeral* or lateral cutaneous branch of the second intercostal nerve to supply the skin on the inner side of the upper arm, and the *internal anterior thoracic nerve* (C. 8, Th. 1) to the pectoralis minor and major.

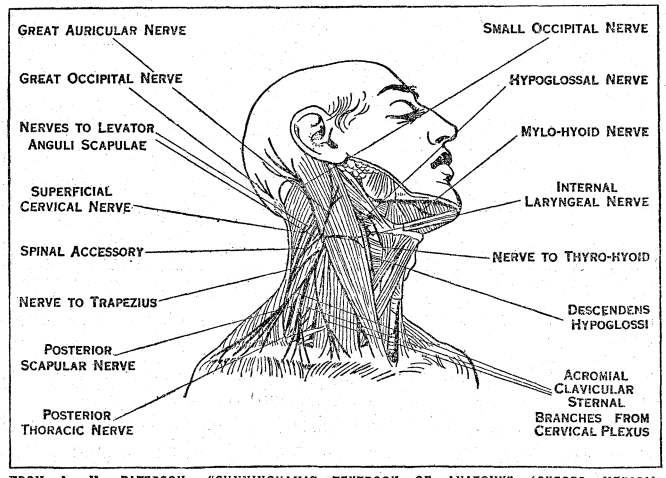
From the posterior cord are derived the three *subscapular nerves* (C. 5, 6, 7, 8) which supply the subscapularis, teres major and latissimus dorsi muscles, the *circumflex nerve* (C. 5, 6) supplying the deltoid and teres minor muscles, and the skin over the lower part of the deltoid, and the *musculo-spiral nerve* (C. 5, 6, 7, 8) which is the largest branch of the brachial plexus and gives off cutaneous twigs to the outer side and back of the arm and to the back of the forearm, as well as muscular twigs to the triceps and adjacent muscles. At the elbow this nerve divides into the *radial* and *posterior* interosseous. The radial is entirely sensory and supplies the skin of the outer side of the back of the hand, including three digits and a half, while the posterior interosseous is wholly muscular, supplying the muscles on the back of the forearm. It will be seen that the posterior cord is derived altogether from posterior secondary divisions of the plexus, but there are three other nerves derived from these which should be mentioned.

The *posterior thoracic* or respiratory nerve of Bell comes off the back of the fifth, sixth and seventh cervical nerves before the anterior and posterior secondary divisions separate, and runs down to supply the serratus magnus muscle.

The *posterior scapular* or nerve to the rhomboid muscles runs to those muscles from the fifth cervical.

The *suprascapular nerve* (C. 5, 6) passes through the suprascapular notch to supply the supraspinatus and infraspinatus muscles.

**Lumbo-Sacral Plexus.**—The spinal nerves which are distributed to the lower limbs first intercommunicate in the lumbar and sacral plexuses, which, with the perineal nerves, are sometimes spoken of together as the lumbo-sacral plexus. The *lumbar plexus* (fig. 9) is formed as a rule of the first four lumbar nerves, though the greater part of the first lumbar is segmental in its distribution and resembles one of the thoracic nerves. It early divides into an *ilio-hypogastric* and *ilio-inguinal* branch, which run round the abdominal wall in the substance of the muscles, and of which the former gives off an iliac branch, which is in

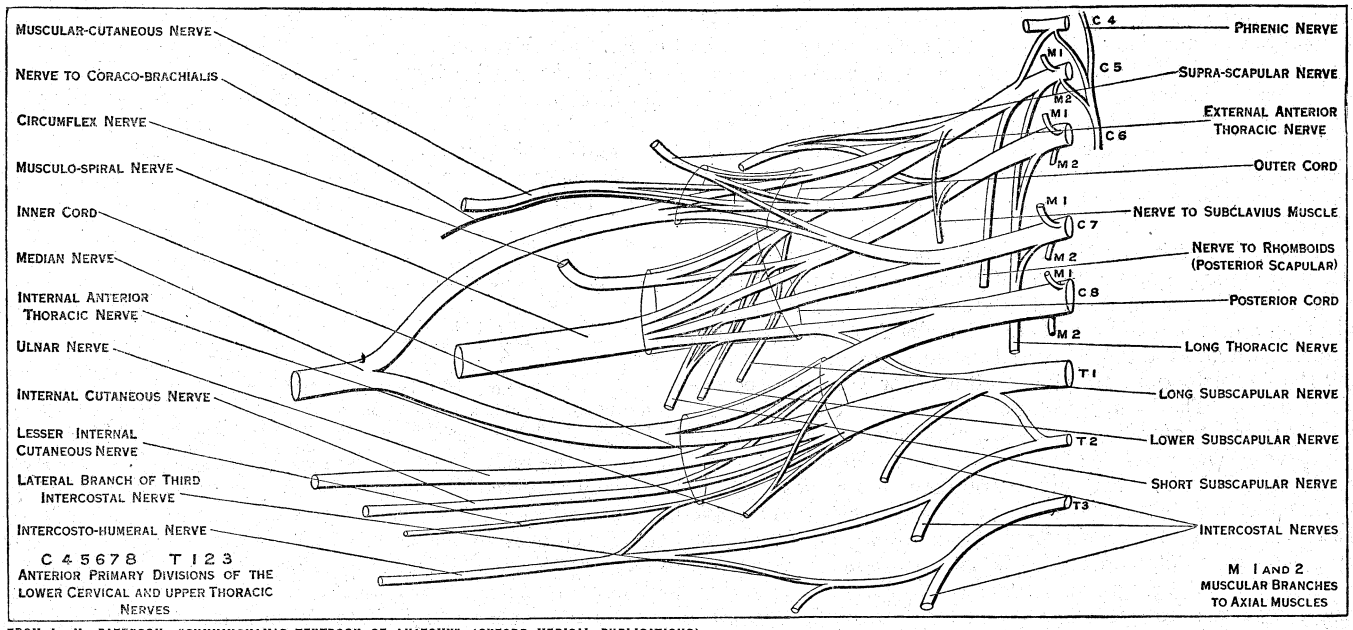



FROM A. M. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 7.—THE TRIANGLES OF THE NECK, SHOWING THE NERVES

series with the lateral cutaneous branches of the intercostal nerves and passes over the crest of the ilium to the gluteal region, while the hypogastric branch runs round to the skin of the pubic region.

The other anterior secondary division of the lumbar plexus is the obturator (fig. 9). The *obturator nerve* (L. 2, 3, 4) supplies the adductor group of muscles on the inner side of the thigh as well as the hip and knee joints; it occasionally has a cutaneous branch on the inner side of the thigh. The posterior secondary branches of the plexus are the genito-crural, the external cutaneous and the anterior crural. The genito-crural nerve (L. 1, 2)



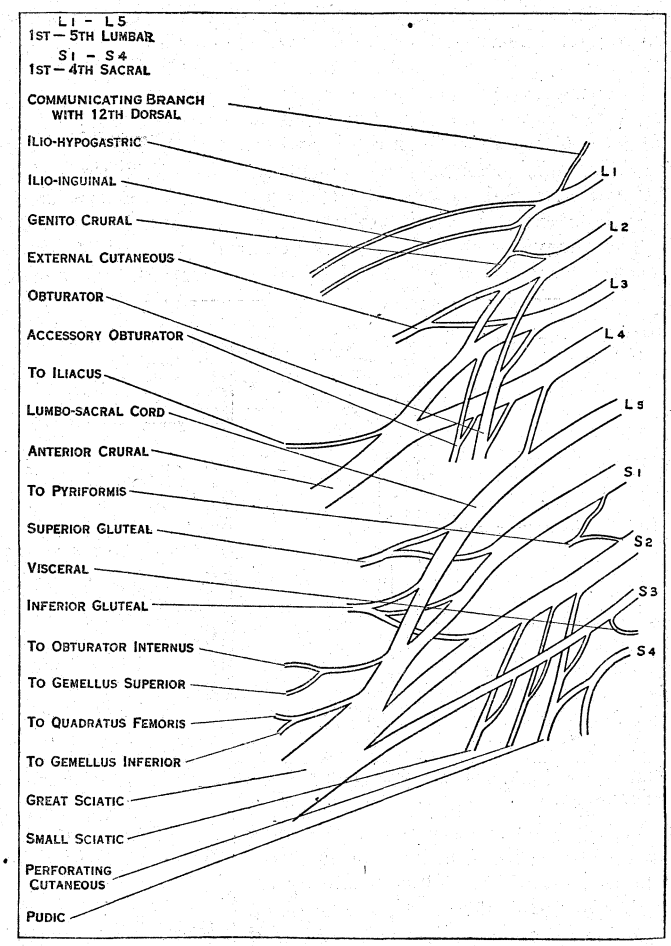

FROM A. M. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 8.—THE NERVES OF THE BRACHIAL PLEXUS

is partly anterior (ventral) and partly posterior (dorsal). It sends one anterior branch through the inguinal canal to supply the cremaster muscle, and another (posterior) to the skin of the thigh just below the groin.

The *external cutaneous nerve* (L.2, 3) supplies the skin of the outer side of the thigh, while the *anterior crural* (L.2, 3, 4) innervates the muscles on the front of the thigh, the skin on the front and inner side of the thigh, through its *middle* and *internal cutaneous* branches, and the skin of the inner side of the leg and foot through the *internal saphenous* branch. At first sight it is difficult to understand how the anterior crural nerve, which supplies the skin of the front of the thigh, is a posterior secondary division of the lumbar plexus, but the explanation is that the front of the human thigh was originally the dorsal surface of the limb bud, and the distribution of the nerve is quite easily understood if the position of the hind limb of a lizard or crocodile is glanced at. The fourth lumbar nerve is sometimes called the *nervus furcalis,* because, dividing, it partly goes to the lumbar, and partly to the sacral plexus (fig. 9), though, when the plexus is prefixed, the third lumbar may be the nervus furcalis, or, when it is postfixed, the fifth lumbar.

All the constituent nerves of the plexus run into one huge nerve, the *great sciatic,* which runs down the back of the thigh and, before reaching the knee, divides into *external* and *internal popliteal nerves.* These two nerves are sometimes separate from their first formation in the plexus, and may always be separated easily by the handle of a scalpel, since they are only bound together by loose connective tissue to form the great sciatic nerve. When they are separated in this way it is seen that the external popliteal is made up entirely of posterior (dorsal) secondary divisions (fig. 9), and is derived from the fourth and fifth lumbar and first and second sacral nerves, while the internal popliteal is formed by the anterior (ventral) secondary divisions of the fourth and fifth lumbar and first, second and third sacral nerves. The *external popliteal nerve* supplies the short head of the biceps femoris (*see* MUSCULAR SYSTEM), and, just below the knee, divides into anterior tibial and musculo-cutaneous branches, which both supply the dorsal surface of the leg and foot. The *anterior tibial nerve* is chiefly muscular, innervating the muscles in front of the tibia and fibula as well as the extensor brevis digitorum pedis on the dorsum of the foot, though it gives one small cutaneous branch to the cleft between the first and second toes. The *musculo-cutaneous nerve* supplies the peroneus longus and brevis muscles, and the rest of the skin of the dorsum of the foot and lower part of the leg, while the skin of the upper part of the dorsum of the leg, below the knee, is supplied by the external popliteal before its division. The *internal popliteal nerve,* after supplying the hamstrings, is continued into the calf of the leg as the *posterior tibial* and innervates all the muscles on this, the ventral, surface. Behind the inner ankle it divides into the *external* and *internal*




FROM "GRAY'S ANATOMY" (LONGMANS, GREEN & CO.)

FIG. 9.—PLAN OF THE LUMBAR AND SACRAL PLEXUSES

*plantar nerves,* from which the muscles and skin of the sole are supplied. A little above the knee each popliteal nerve gives off a contribution to help form the *external* or *short saphenous nerve.* These join about the middle of the back of the calf, and the, now

formed, *short saphenous nerve* runs down behind the outer ankle to supply the outer side of the foot. Sometimes it encroaches on the dorsum of the foot, replacing part of the musculo-cutaneous. To return to the sacral plexus: branches are given off from the anterior secondary divisions to the short external rotator muscles of the hip (pyriformis, quadratus femoris, etc.), while from the posterior secondary divisions come the superior gluteal (L. 5, S. 1) and the inferior gluteal (L. 5, S. 1, 2) to the muscles of the buttocks.

In modern descriptions the lower branches of the lumbo-sacral plexus are grouped into a *pudendal plexus,* and the plan, though open to criticism on morphological grounds, has such descriptive advantages that it is followed here. Contributions from the first, second, third and fourth sacral, and the coccygeal nerve, form it, and these contributions are almost all anterior (ventral) secondary divisions. The branches of this plexus are the small sciatic, pudic, visceral, perforating cutaneous, muscular and sacro-coccygeal nerves. The *small sciatic* (S.1, 2, 3) is partly dorsal and partly ventral in its origin and distribution; it supplies the skin of the perineum, buttock and the back of the thigh. The *pudic nerve* (S.2, 3, 4) helps to supply the skin and muscles of the perineum and genital organs. The *visceral branches* form the pelvic stream of white rami communicantes (*see* NERVOUS SYSTEM); they run from the second and third or third and fourth sacral nerves to the pelvic plexuses of the sympathetic system. The *perforating cutaneous nerve* (S.2, 3) pierces the great sacro-sciatic ligament and supplies the skin over the lower internal part of the buttock. The *muscular branches* (S.3, 4) supply the external sphincter, levator ani and coccygeus.

The *sacro-coccygeal nerve* (S.4, 5; Coc.1) runs down on each side of the coccyx to supply the adjacent skin, and represents the ventro-lateral nerve of the tail of lower mammals.

(F. G. P.; X.)

The function of the nerves is to transmit messages from the sense organs to the central nervous system and from the central nervous system to the muscles and gland cells. The incoming (or "afferent") messages are decoded, so to speak, in the spinal cord and brain and the outgoing ("efferent") messages are elaborated there, the nerves acting merely as the conducting mechanism between the periphery and the central controlling station. A nerve appears to the naked eye as a long cord of whitish, translucent

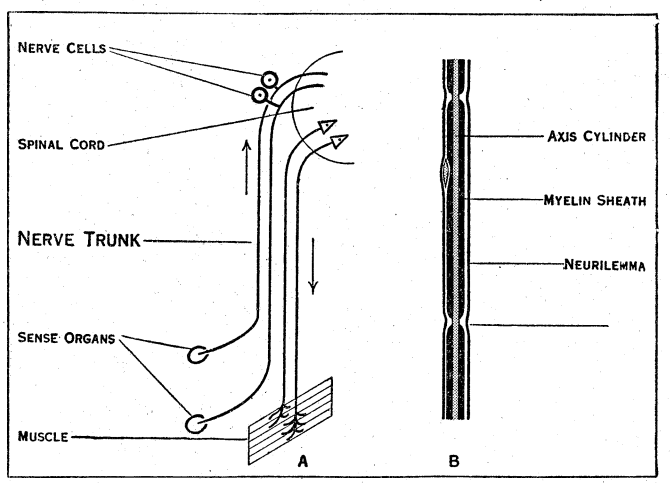



FIG. 10.—A PERIPHERAL NERVE AND ITS FIBRES. B. STRUCTURE OF NERVE FIBRE

material; the large nerve trunks like the sciatic (in man) may be half an inch in breadth, but the ultimate branches are so thin as to be scarcely visible. Microscopically the nerve is made up of a number of fibres, about $\frac{1}{100}$mm. in diameter, each of which acts as an independent conducting path: so that a nerve of medium size may contain several thousand fibres, some terminating in sense organs and some in muscles or glands.

The nerve fibre itself is made of a central core or "axis cylinder" of protoplasm arising from the body of a nerve cell which is generally stationed in or near the spinal cord: the axis cylinder runs from one end of the fibre to the other enclosed in a sheath of fatty material (myelin) interrupted by occasional constrictions or "nodes" and this in turn is enclosed in a membranous sheath called the neurilemma. Either or both sheaths may be absent in certain fibres. A diagram of the general structure of the nerve and its fibres is shown in fig. 10.

The impulse set up by an electric shock in an isolated nerve might have little connection with the normal working of the

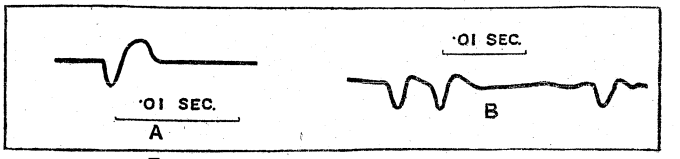



FIG. 11.—ELECTRIC RESPONSE OF NERVE

A. Record of "action current" in a frog's sciatic nerve, stimulated electrically. B. Action of currents in sensory nerve fibres, by light touch

nerve in the body, but there is now no doubt that the messages normally conveyed by the nerve fibres do consist of these impulses and of nothing else. To show this it is necessary to magnify the electric changes in the nerve trunk several thousand times by valve amplification; it is then possible to record the discharge of impulses travelling towards the central nervous system from the sense organs or away from it to the muscles. A portion of such a record is given in fig. 11. A sense organ has been stimulated by touching the skin and a series of impulses passes up the sensory fibres. Each impulse has the usual brief action current and all are of the same size whatever the strength of the stimulus. This does not prevent the nerve fibre from signalling the intensity of stimulation, for it is found that the frequency of the discharge (the number of impulses per second) depends on the stimulus, and the frequency may vary over a wide range (from 5 to 150 a second in the frog). The impulses from the different sense organs are not all exactly alike, for their rate of travel depends on the size of the fibre and the fibres from different organs are not all of the same diameter; but all impulses whether motor or sensory seem to be of the same type and up to the present we have no evidence of any other kind of nervous conduction. (E. D. A.)

**NERVI,** a coast town of Liguria, Italy, province of Genoa, $7\frac{1}{2}$ mi. S.E. of Genoa by rail (also electric tramway), 82 ft. above sea level. Pop. (1936), 4,002 (town), 8,769 (commune). It is much frequented as a winter resort. It is surrounded with groves of olives, oranges and lemons, and its villas have beautiful gardens. At Quarto, $2\frac{1}{2}$ mi. N.W., 1,000 Garibaldians embarked for Marsala in 1860.

**NERVOUS SYSTEM.** The nervous system forms an extremely complicated set of links between different parts of the body, and is divided into (A) the central nervous system, composed of (1) the brain, and (2) spinal cord; (B) the peripheral nervous system, consisting of (1) the cranial nerves, (2) the spinal nerves, (3) the various sense organs, such as the eye, ear, olfactory organ, taste organ and tactile organs, and (4) the motor end plates; (C) the sympathetic system. The anatomy and physiology of many of these parts are treated in separate articles (*see* BRAIN; SPINAL CORD; NERVE; EYE; EAR; OLFACTORY SYSTEM; TASTE; TOUCH; MUSCULAR SYSTEM, ANATOMY OF; and also SYMPATHETIC SYSTEM). The object here is to deal with anatomical points which are common to the whole system, or for which a place does not conveniently occur elsewhere.

## HISTOLOGY OF THE NERVOUS SYSTEM

Three kinds of tissue are found in the nervous system, *nerve fibres, nerve cells* and a supporting tissue called *neuroglia.*

**Nerve Fibres** may be medullated or non-medullated, but, whichever they are, they consist of the long process or *axon* of a nerve cell; in a non-medullated nerve this process is either naked or enclosed in a delicate membrane called the *primitive sheath* or *neurilemma,* but in a medullated nerve the process or *axis cylinder* is encased by a white fatty substance called myelin, and so the term "myelinated" is often used instead of "medullated" for these nerves (fig. 1). Outside this white sheath the neurilemma is present in most nerves, but is lost when they are massed to form

the white matter of the central nervous system and in the optic nerve. At regular intervals the myelin is interrupted by some substance which stains deeply with silver nitrate, and these breaks are known as *nodes of Ranvier.* They do not, however, affect the axis cylinder. In a large nerve, *e.g.,* the median, the nerve fibres are collected into small bundles (*funiculi*), enclosed in a connective tissue sheath (*perineurium*), and separated from it by a lymph space. From this sheath delicate processes penetrate among the fibres (*endoneurium*). The funiculi are collected into bundles called *fasciculi,* and the whole nerve consists of a variable number of fasciculi surrounded by a dense fibrous sheath, the *epineurium.*

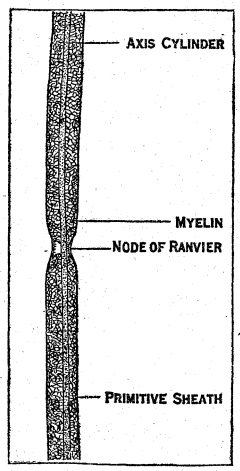
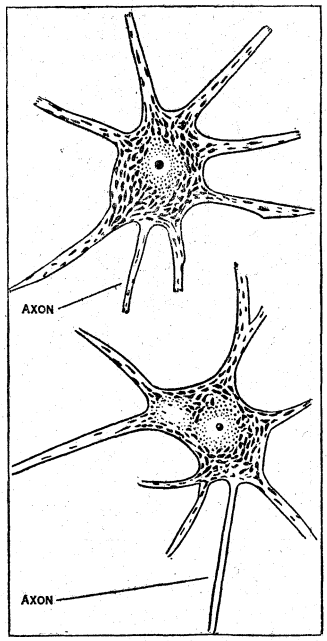



FIG. 1.—STRUCTURE OF A SINGLE NERVE FILAMENT

**Nerve Cells** are unipolar, bipolar or multipolar. *Unipolar cells* are found in the ganglia on the posterior roots of the spinal nerves, and only give off an axon or axis cylinder process; this, however, soon divides in a T-shaped manner, and all these cells were originally bipolar, though the cell has grown away from its two axons (or, as they are often regarded, axon and dendrite), leaving a stalk joining it to them at right angles. *Bipolar cells* are found as an embryonic stage of unipolar, though in fish they persist in the spinal ganglia throughout life. They are also sometimes found in the sympathetic ganglia. *Multipolar cells* are found in the brain and cord, and are best studied in the anterior horns of the grey matter of the latter, where they are nearly visible to the naked eye (fig. 2).

**Neuroglia.**—This is the delicate connective tissue which supports and binds together the nervous elements of the central nervous system. One part of it, which lines the central canal of the cord and ventricles of the brain, is formed of columnar cells (*ependyma*), while the rests consists of small cells with numerous processes which sometimes branch and sometimes do not.




FROM "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

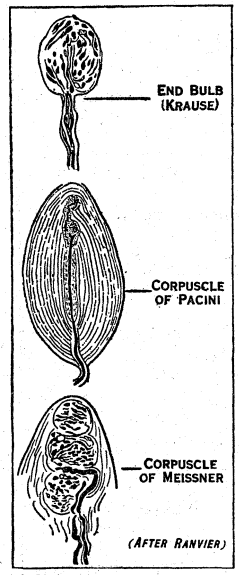
FIG. 2.—NERVE CELLS FROM THE ANTERIOR HORN OF GREY MATTER OF THE HUMAN SPINAL CORD

**Nerve Endings.**—Sensory nerves end by breaking up into fibrillae or by various tactile organs. In the former case the minute fibrils composing the axons or nerve fibres separate and end among epithelial cells of the mucous membrane or skin. In the latter case the nerve fibres lose their myelin sheath and end in one of the seven following organs:—

1. *End bulbs of Krause* (see fig. 3), oval bulbs composed of elongated cells among which the nerve fibrils end in knobs or coils; each is surrounded by a sheath of neurilemma, and the organs are found in the lips, tongue, conjunctiva, epineurium of nerves, synovial membranes of joints, and in the glans penis et clitoridis, where they have a mulberry-like appearance.

2. *Pacinian corpuscles* (fig. 3) are large enough to be seen by the naked eye, and are oval bodies made up of a series of concentric capsules of connective tissue rather resembling the structure of an onion; in the centre is a structureless core, at the distal extremity of which the nerve fibre ends in one or more knobs. These bodies are found in the palm and sole, in the mesentery, the genital organs and in joints.

3. *Tactile corpuscles of Meissner and Wagner* (fig. 3) are oval bodies found in certain of the skin papillae and mucous membrane, especially of very sensitive parts like the hand and foot, lips, tongue and nipple. They are oval and made of a connective tissue capsule from which septa enter the interior. The nerve fibre generally takes a spiral course through them, loses its myelin sheath, and ends by breaking up into its fibrils, which eventually become bulbous.




FROM R. HOWDEN, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY"

FIG. 3.—TACTILE CORPUSCLES

4. *Tactile corpuscles of Grandry* are found in the skin of those parts devoid of hair, and consist of a capsule containing two or more largish cells, between which the nerve fibre ends in the so-called tactile discs.

5. *Ruffini's endings* are flattened oval bodies with a thick connective tissue capsule, in which the nerve fibre divides into many varicose branches, form a rich plexus, and end in knobs. They are found between the true skin and subcutaneous tissues of the fingers.

6. *Organs of Golgi* occur in tendons. Nerve fibres penetrate the tendon bundles and divide in a tree-like manner to end in little disks and varicosities.

7. *Neuro-muscular spindles* are small fusiform bundles of embryonic muscle fibres, among which the nerve fibres end by encircling them and forming flattened disks. These are sensory endings, and must not be confused with the motor end plates.

Motor nerves end in striped muscle by *motor end plates.* These are formed by a nerve fibre approaching a muscle fibre and suddenly losing its myelin sheath while its neurilemma becomes continuous with the sarcolemma of the muscle fibre. The axis cylinder divides, and its ramifications are surrounded by a disk of granular matter containing many clear nuclei.

## THE SYMPATHETIC SYSTEM

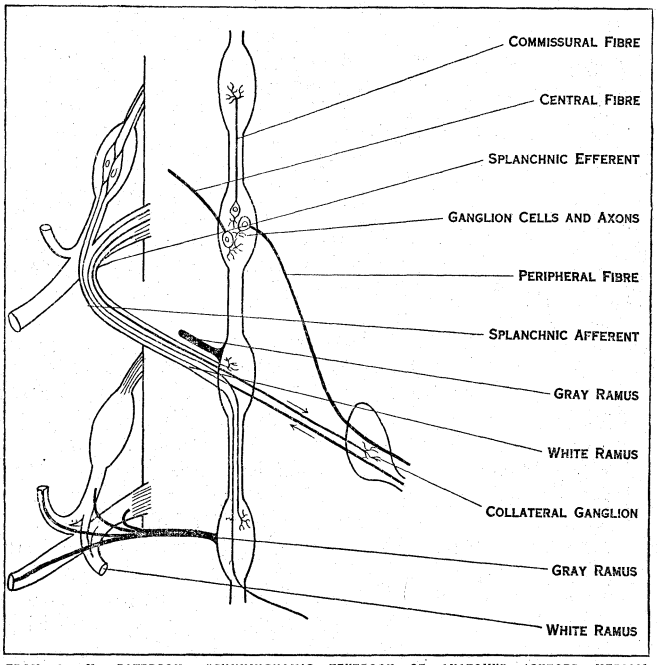
This system is made up of two gangliated cords running down one on each side of the vertebral column and ending below in the median coccygeal ganglion. In the neck the cords lie in front of the anterior tubercles of the transverse processes of the cervical vertebrae, in the thorax, in front of the heads of the ribs, while in the abdomen they lie in front of the sides of the bodies of the vertebrae. In addition to these cords there are numerous ganglia and plexuses through which the sympathetic nerves pass on their way to or from the viscera and blood-vessels.

A typical ganglion of the sympathetic chain is connected with its corresponding spinal nerve by two branches called *rami communicantes,* one of which is grey and the other white (fig. 4). The white consists of medullated fibres belonging to the central nervous system, and these are splanchnic afferent or centripetal, and efferent or centrifugal. The efferent fibres lie in the anterior roots of the spinal nerves, and, like all the fibres there, are either motor or secretory. They are the motor paths for the unstriped muscle of the vessels and viscera, and the secretory paths for the cells of the viscera. In the course of each fibre from the nerve cell in the spinal cord, of which it is an axon, to the vessel or viscus it supplies, there is always a break where it arborizes round a ganglion cell, and this may be in its own ganglion of the sympathetic chain, in a neighbouring ganglion above or below, or in one of the so-called collateral ganglia interposed between the sympathetic chain and the viscera.

The grey rami communicantes are found in connection with all the spinal nerves, though they are irregular in the paths by which they reach the sympathetic ganglia from the cells of which they spring; their fibres are mainly non-medullated, and pass into both roots of the spinal nerves and also into the anterior and posterior primary divisions of those nerves. In this way they reach the body wall and limbs, and are somatic vaso-motor, secretory and pilomotor fibres, supplying the vessels, glands and hair muscles of the

skin and its glands.

In the gangliated chain there is a ganglion corresponding to nearly each spinal nerve, except in the neck, where only three are found; of these the superior cervical ganglion is more than an inch long, and is connected with the first four spinal nerves as well as with the ninth, tenth and twelfth cranial nerves (fig. 5). Branches of distribution pass from it to the pharyngeal plexus,




FROM A. M. PATERSON, "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 4.—SCHEME OF THE CONSTITUTION AND CONNECTIONS OF THE GANGLIATED CORD OF THE SYMPATHETIC

the heart and the two carotid arteries. Of these the branch accompanying the internal carotid artery passes to the carotid and cavernous plexuses, and through these communicates with the sphenomaxillary, otic and ciliary ganglia, while the branch to the external carotid communicates with the submaxillary ganglion. The middle cervical ganglion (fig. 5), when it is present, gives rami communicantes to the fifth and sixth cervical nerves, as well as branches of distribution to the thyroid body and heart.

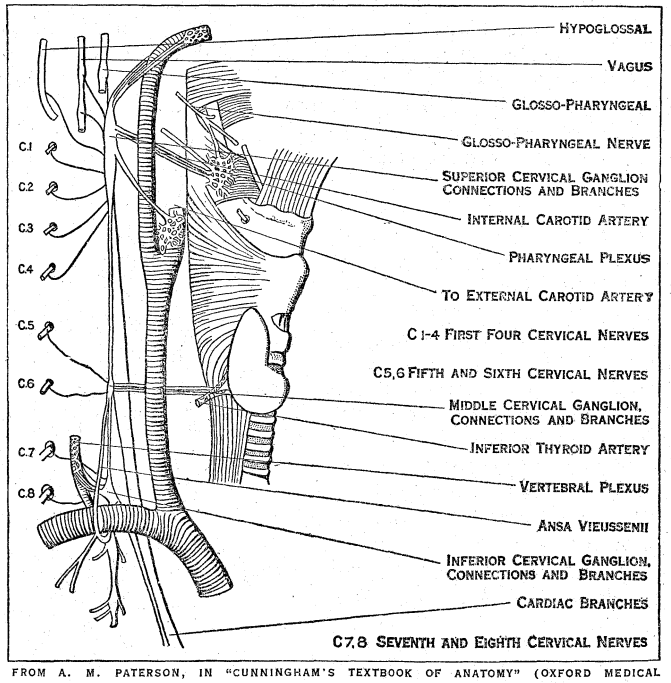
The inferior cervical ganglion (fig. 5) lies behind the subclavian artery, and, besides the main connective cord, has a loop (ansa Vieussenii) joining it to the middle cervical ganglion in front of that vessel. It communicates with the seventh and eighth spinal nerves, and gives branches of distribution to the heart and to the subclavian artery and its branches, especially the vertebral. The thoracic part of the sympathetic cord has usually eleven ganglia, which receive both white and grey rami communicantes from the spinal nerves (fig. 6); of the former the upper ones run up in the chain and come off from the cervical ganglia as already described, while the lower ones form the three abdominal splanchnics which pass through the diaphragm (*q.v.*) and join the abdominal plexuses.

The great splanchnic (fig. 6) comes from the sixth to the ninth ganglia, and ends in the semi-lunar ganglion of the solar plexus. The small splanchnic comes from the ninth and tenth, or tenth and eleventh ganglia, and ends in the aortico-renal ganglion of the solar plexus, while the smallest splanchnic comes from the last thoracic ganglion, whether it be the tenth or eleventh, and ends in the renal plexus.

In the lumbar region the gangliated cord is very irregular; there may be four or more ganglia, and these are often fused. Gray rami communicantes are given to all the lumbar spinal nerves, and white ones are received from the first two. Most of the branches of distribution pass to the aortic plexus. The sacral gangliated cord runs down just internal to the anterior sacral foramina; it usually has four small ganglia, and the two cords end by joining the coccygeal ganglion or ganglion impar, though the two-fourth sacral ganglia are united by transverse interfunicular commissures. The white rami communicantes, already mentioned as the pelvic stream, from the second to the fourth sacral spinal nerves, do not enter the ganglia but pass directly to the pelvic plexuses (fig. 6).

**Sympathetic Plexuses.**—In the thorax are the superficial and deep cardiac plexuses and the coronary plexuses; the former receives the left superior cervical cardiac of the vagus, and lies in the concavity of the arch of the aorta. The deep cardiac plexus is larger, and lies in front of the bifurcation of the trachea; it receives all the other cardiac nerves, and communicates with the anterior pulmonary plexuses of the vagus (*see* NERVE: *Cranial*).

In the abdomen the solar plexus is by far the most important. It lies behind the stomach and surrounds the coeliac axis; in it are situated the semilunar, aortico-renal and superior mesenteric ganglia, and from it are prolonged subsidiary plexuses along the main arteries, so that diaphragmatic, suprarenal, renal, spermatic, coeliac, superior mesenteric, aortic and inferior mesenteric plexuses, are recognized. The hypogastric plexus is the continuation downward of the aortic, and lies just below the bifurcation of the aorta (fig. 6); it divides into two branches, which accompany the internal iliac arteries and are joined by the pelvic stream of white rami communicantes from the sacral spinal nerves and some twigs from the ganglia of the sacral sympathetic to form the pelvic plexuses. These are prolonged to the viscera along the branches of the internal iliac artery, so that haemorrhoidal, vesical, prostatic, vaginal and uterine plexuses are found. By the side of the neck of the uterus in the last-named plexus several




FROM A. M. PATERSON, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

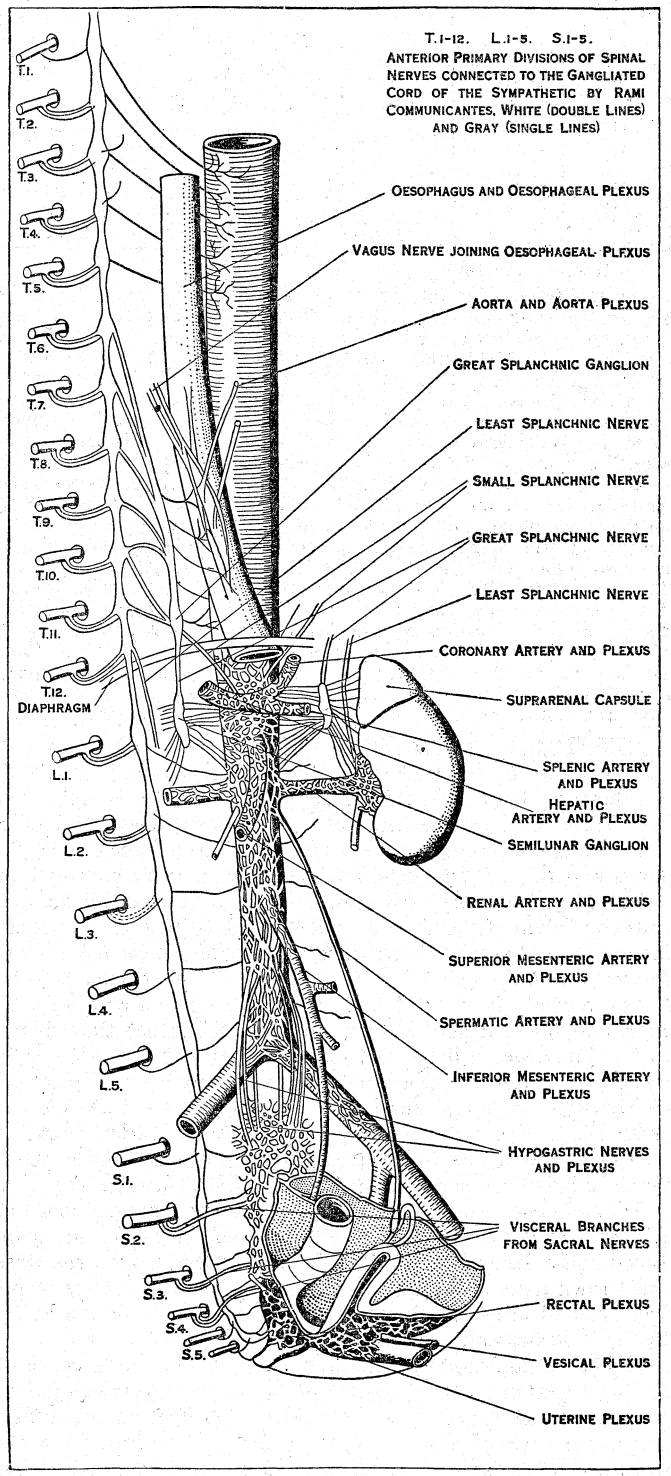
FIG. 5.—THE DISTRIBUTION OF THE SYMPATHETIC GANGLIATED CORD IN THE NECK

small ganglia are seen. (For the literature of the sympathetic system, *see* Quain, *Anatomy,* London.)

## EMBRYOLOGY OF NERVOUS SYSTEM

The development of the brain, spinal cord and organs of special sense (eye, ear, tongue), will be found in separate articles. Here that of the cranial and spinal nerves and the sympathetic system is dealt with. The thoracic spinal nerves are the most typical, and one of them is the best to begin with. In fig. 7 the ganglion on the dorsal root is seen growing out from the neural crest, and the cells or neuroblasts of which it is composed become fusiform and grow in two directions as the ganglion recedes from the cord. Those which run toward the spinal cord are the axons, while those growing into the mesoderm are probably enlarged dendrites. The ventral roots rise as the axons of the large cells in the ventral

horn of the grey matter, and meet the fibres of the dorsal root on the distal side of the ganglion. As the two roots join each divides into an anterior (ventral) and a posterior (dorsal) primary division, the latter growing into the dorsal segment of its muscle plate and the skin of the back. The anterior primary division grows till it reaches the cardinal vein and dorsal limit of the coelom, and there forks into a somatic branch to the body

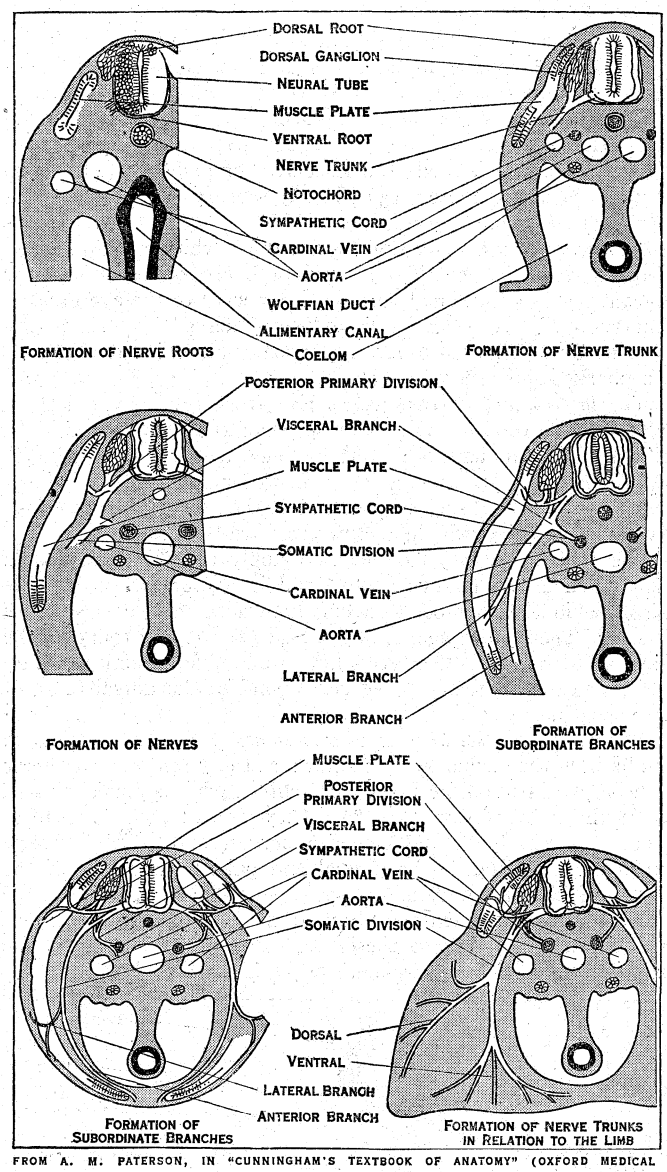



FROM A. M. PATERSON, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 6.—THE ARRANGEMENT OF THE SYMPATHETIC SYSTEM IN THE THORAX, ABDOMEN AND PELVIS

wall, and a splanchnic or visceral branch which joins the sympathetic and forms the white ramus communicans. The somatic branch grows round the body wall and gives off lateral and anterior branches.

The cranial nerves are developed in the same way as the spinal, so far as concerns the facts that the motor fibres are the axons of cells situated in the basal lamina of the mesencephalon and




FROM A. M. PATERSON, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 7.—DEVELOPMENT OF THE SPINAL NERVES

rhombencephalon (*see* BRAIN), and the sensory are the axons and dendrites of cells situated in ganglia which have budded off from the brain. The evidence of comparative anatomy, however, shows that the cranial nerves cannot be directly homologized with the spinal, nor can the fact of there being twelve of them justify us in assuming that the head contains the rudiments of twelve fused or unsegmented somites.

The sympathetic system is developed from the posterior root ganglia of the spinal nerves, by cells which in man migrate a few at a time. A. M. Paterson, however, believes that the sympathetic is developed, independently of the cerebro-spinal system, in the mesoderm (*Phil. Trans.*, B. clxxxi.).

## COMPARATIVE ANATOMY

The comparative anatomy of the brain and spinal cord is dealt with in the separate articles devoted to them.

In *Amphioxus* the dorsal and ventral roots of the spinal nerves do not unite with one another but alternate, a dorsal root on one side being opposite a ventral on the other. The dorsal roots are both sensory and motor, the ventral only motor. In the Cyclostomata (*Petromyzon*) the arrangement is nearly the same, but in some regions there are two ventral roots to one dorsal. In the

fishes and higher vertebrates the dorsal and ventral roots unite, though in selachian (shark) embryos the dorsal and ventral roots alternate (F. M. Balfour, *The Development of Elasmobranch Fishes,* London, 1878).

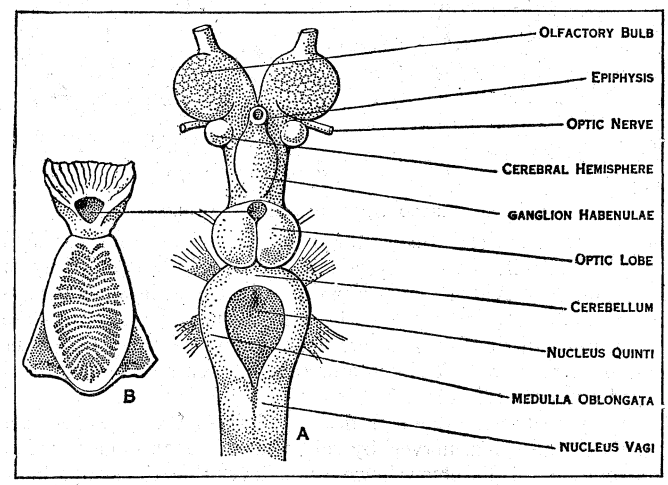
The cranial nerves are only represented by two pairs in *Amphioxus.* In the Cyclostomata, fishes and Amphibia, ten pairs of nerves are found, which in their distribution do not always agree with those of man. In the Amniota or reptiles, birds and mammals, the eleventh and twelfth nerves have been added. The cranial nerves are formed of at least five components: (1) ventral motor, (2) lateral motor, (3) somatic sensory, (4) visceral sensory, (5) lateral line nerves.

The *ventral motor components* are those which rise from cells situated close to the mid line, and probably correspond to the ventral roots of the spinal nerves. The nerves to the eye muscles (motor oculi, trochlearis and abducens) have this origin (*see* NERVE: *Cranial*), as also has the hypoglossal, which doubtless is a cephalized spinal nerve.

The *lateral motor components* rise from cells situated more laterally, and comprise the motor roots of the fifth (trigeminal), seventh (facial), and ninth, tenth and eleventh (glossopharyngeal, vagus and spinal accessory). These nerves supply muscles belonging to the branchial skeleton, instead of the muscles of the primitive cranium, of which the eye muscles are the remnants.

The *somatic sensory components* supply the skin, and end in cells which, among the cyclostomes and fishes, form a considerable elevation in the rhombencephalon, known as the nucleus quinti (fig. 8). These components, in the lower forms, are found in the fifth, seventh and tenth nerves, but in mammals practically only the fifth contains them. They correspond to the dorsal roots of the spinal nerves.

The *splanchnic sensory* or *viscero sensory components* end in the brain in the medullary cells known as the *fasciculus communis* in fishes, and named the *fasciculus solitarius* in mammals, as well as in the nucleus vagi (fig. 8). They are found in the fifth, seventh, ninth, tenth and eleventh nerves, and supply visceral surfaces. In mammals the lingual and palatine branches of the fifth, the chorda tympani and great superficial petrosal of the seventh, and all the sensory fibres of the ninth and tenth except Arnold's nerve, represent these. In fishes and Amphibians the palate is supplied by the seventh nerve instead of the fifth.




BY COURTESY OF THE MUSEUM OF THE ROYAL COLLEGE OF SURGEONS, ENGLAND

FIG. 8.—A. BRAIN. B. CHOROID PLEXUSES OF LAMPREY

The system of the lateral line or acustico-lateralis component is sometimes regarded merely as a subdivision of the somatic sensory. It is best developed in the fish, and may be divided into pre- and post-auditory and auditory. The pre-auditory part comprises the pit and canal end organs supplied by the seventh, and also probably the olfactory organ supplied by the first nerve. The auditory apparatus, supplied by the eighth nerve, is, according to modern opinion, undoubtedly a part of this system, while the tenth nerve sends a large branch along the lateral line supplying the special end organs of the post-auditory part.

The following table, slightly modified from the one drawn up by J. McMurrich, gives a fair idea of the present state of our knowledge of the nerve components in the Mammalia.

| Nerve | Ventral motor | Lateral motor | Somatic sensory | Splanchnic sensory | Lateral line |
|---|---|---|---|---|---|
| I. | .. | .. | .. | .. | +(?) |
| II.* | .. | .. | .. | .. | .. |
| III. | + | .. | .. | .. | .. |
| IV. | + | .. | .. | .. | .. |
| V. | .. | + | + | + | .. |
| VI. | + | .. | .. | .. | .. |
| VII. | .. | + | .. | + | .. |
| VIII. | .. | .. | .. | .. | + |
| IX., X., XI. | .. | + | + | + | + |
| XII. | + | .. | .. | .. | .. |
| Spinal | + | (?) | + | + | .. |

*A tract of the brain.

BIBLIOGRAPHY.—For further details and literature of the nervous system *see* Quain, *Anatomy* (latest edition); R. Wiedersheims, *Comp. Anat. of Vertebrates* (London, 1907); Bronn, *Classen und Ordnungen des Thierreichs,* McMurrich, *Development of the Human Body* (London, 1923). For the theory of nerve components *see* Onèra Merritt, *Journ. Anat. and Phys.,* vol. xxxix. A general discussion on the comparative anatomy and morphology of limb plexuses will be found in Miss C. W. Saberton's paper (1906), "Nerve Plexuses of *Troglodytes niger,*" *Studies in Anatomy* (Manchester, 1906). She refers to most of the literature on the subject, but the papers of H. Braus, *Jena Zeitschr.* (1898), on fish, of M. Davidoff, *Morph. Jahrb.* (1879), on the pelvic plexuses of fish, and of M. Fürbringer, *Gegenb. Festschr.* (1897), on the spino-occipital nerves and brachial plexus of fish, are also important. *See* also S. W. Ransom, *The Anatomy of the Nervous System* (Philadelphia, 1927; bibl.); A. Pitres and L. Testut, *Les nerfs en schémas* (Paris, 1925); L. Bianchi, *The Mechanism of the Brain and the Function of the Frontal Lobes* (Edinburgh, 1922; bibl.); J. R. Whitaker, *Anatomy of the Brain and Spinal Cord* (Edinburgh, 1921); C. U. A. Kappers, *Die Vergleichende Anatomie des Nervensystems der Wirbelthiere und des Menschen* (Haarlem, 1920–21; bibl.). (F. G. P.)

**NESFIELD, WILLIAM EDEN** (1835–1888), British architect, one of the leaders of the Gothic revival in England, was born in Bath on April 2, 1835, and died in Brighton on March 25, 1888. His father, Maj. William Andrews Nesfield, a well-known landscape gardener, laid out Regent's park and St. James's park and remodelled Kew. Nesfield was educated at Eton and articled successively to William Burn, a classicist, and Anthony Salvin of the Gothic school. He then travelled for study in France, Italy and Greece. The volume of his *Sketches from France and Italy* (1862) became one of the text-books of the Gothic revival. In 1859 Nesfield settled in London and began in 1862 a nominal partnership with Norman Shaw, when they shared rooms, but never collaborated. Nesfield's principal work was in domestic architecture, wherein he showed a mastery of planning and construction and a conscientious regard for detail. As he progressed he forsook the early French style of his earlier work, as seen in Combe abbey and Cloverly hall (1864) and developed a purely English manner, coming at last to English renaissance, as at Kinmel park. Among his other notable works are the lodge at Regent's park (1864) and at Kew gardens (1866); Farnham Royal house, Leawood, Loughton hall, Westcombe park, the Rose and Crown hotel and the bank at Saffron Walden. Many of his sketches and measured drawings are in the library of the Royal Institute of British Architects.

**NEST.** Nidification or the practice of making nests concerns all that appertains to the preparation for the reception of eggs, or newly-born young, and the subsequent care thereof on emergence. Our conceptions of nidification are commonly derived from observations on birds; but mammals, reptiles, amphibia and fishes, as well as invertebrates, include species which make more or less elaborate preparation in advance for the reception of their young.

The first stage in this sequence commonly consists in the selection of a definite site whereon, with a few exceptions, a nest is built in, or on which the eggs, or young, are deposited. Two factors govern this preparation,—the conditions of the environment, and the state of the young on emergence.

BY COURTESY OF (1, 4, 11) CAPT. C. W. R. KNIGHT, OWNER OF COPYRIGHT, (3, 5, 7-10, 12, 14) THE AMERICAN MUSEUM OF NATURAL HISTORY, (6) THE NATIONAL ASSOCIATION OF AUDUBON SOCIETIES, FROM A PHOTOGRAPH BY O. E. BAYNARD, (13) THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, (2) EWING GALLOWAY

## NESTS AND NESTING SITES OF VARIOUS BIRDS

1. Sparrow hawk in a nest of sticks, England. 2. Storks on a chimney top, France; the nest of sticks and reeds is added to year by year. 3. Nest of the golden eagle, built on a high mountain ledge. 4. Female kestrel about to feed her young in an abandoned crow's nest, England. 5. Community of brown pelicans showing nests, Florida. 6. Nest of American egret, Florida. 7. Community of flamingoes, Bahamas, showing mud nests 8. Neighbouring nests of an ibis and a little blue heron, Florida. 9. Sandhill crane approaching its nest built in a marsh, Florida. 10. Derby flycatchers in a loosely made nest, Texas. 11. Blackcap feeding her young, England. 12. American crow on a bulky nest of sticks placed high in a tree. 13. Edible nests of an East Indian swift, made of solidified saliva. 14. Nest of the North American hermit thrush, placed on the ground

# NEST

BY COURTESY OF (1, 2, 4, 6, 8, 9, 13, 14, 18) THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY), (3, 5, 7, 10-12, 16, 17) THE AMERICAN MUSEUM OF NATURAL HISTORY; PHOTOGRAPH, (15) JAMES'S PRESS AGENCY

## NESTING HABITS OF BIRDS, MAMMALS, INVERTEBRATES AND FISHES

1. Nest of the humming bird (*Panterpe insignis*), Costa Rica, made of moss and spiders' webs. 2. Japim Hang-nests (*Cassicus persicus*), Amazon, with their nest of woven grass suspended from a tree branch. 3. Nest of the black and yellow crested cacique, Mexico, sometimes several feet in length, made of grass and strips of palm leaf. 4. Reed warbler, England, and its cup-shaped nest of reed stems supported by several upright reeds. 5. The feathered nest of the palm swift, usually agglutinated to the under surfaces of palm leaves or grass roofs of huts. 6. Hanging nest of the Turkistan *Remera*, formed of dried grasses and feathers. The bottle-neck entrance affords protection against intruders. 7. Nest of the social weaver bird, Africa. It consists of an umbrella-shaped roof of grass sheltering an under surface honeycombed with numerous feather lined cavities. 8. Hanging nest of the *Remera* of Rumania, constructed of lichens, mosses and grass, lined with feathers. 9. Clay nest of the red oven-bird (*Furnarius rufus*), South America, usually about a foot in diameter. 10. Nest of twigs lined with dry leaves built by a group of Anis, Mexico. It is large enough to accommodate all the females of the company who deposit their eggs in layers separated by leaves. 11. Nest of the woodcock, a hollow scratched in the ground. 12. View of a gopher turtle habitat (*Gopherus polyphemus*) (Daudin) in a sand dune showing the pile in front of the burrow where the turtle deposits its eggs. 13. Nest of the cape (African) weaver birds, constructed of grass stems and vegetable fibers suspended by long "arms" from trees, bushes or eaves. 14. Underground burrow of the mole, lined with grass. 15. Nest of the harvest mouse, woven of grass and leaves of corn and attached to cornstalks. 16. Butterfish (*Pholis gunnellis*) coiled around an egg mass in the reversed upper valve of a dead oyster shell. 17. Red backed salamander (*Plethodon cinereus*) guarding its eggs in the moist shadow of a cave nest. 18. Grass spider (*Agalena*)

**Birds.**—With the birds a nest is not invariably made, as for example with the guillemot whose single egg is deposited on a bare ledge of rock projecting from the face of a cliff rising steeply from the sea. Species which haunt sandy wastes make little or no preparation by way of a nest. This receptable seems originally to have been made for the purpose of keeping the incubating bird, and the eggs, from contact with cold, damp earth.

Much more elaborate are the nests of the smaller species. These placed in hedgerows, or bushes, or even on the ground, are bowl-shaped structures made of fine grass-stems interwoven with horse-hair, and cunningly masked by moss or lichen, as in the case of the long-tailed titmouse. Some, like the thrush, use a foundation of clay, and line the interior of the nest with a mixture of decayed wood and cow-dung. Some of the African weaver-birds, and of the American hang-nests, suspend the nest, which is made of long grass-stems, and vegetable fibres, by a long "rope" attached to the bough of a tree. Towards the end this rope is enlarged to form a spherical chamber, with an entrance at the side in the hang-nests; and at the end of a further extension of the rope beneath the nest in the weavers.

Some of the flower-peckers of Africa build a nest of felted cotton-down. A few species make a more or less extensive use of saliva as a cement for mud-built nests, as with the swallow-tribe, the oven-bird, and the flamingo. The use of salivary glands in nest-building attains to its maximum with the edible swifts which use saliva alone. Such nests are used by the Chinese in making bird's nest soup.

Hollow trees are used by many birds, such as the parrots and the woodpeckers, the eggs being deposited on the rotten wood at the bottom of the hole. Others, like the sand-martin and the kingfisher drive long tunnels into the face of a sand-bank, enlarging the end of the tunnel to form a nest-chamber. The greatness of this achievement is commonly overlooked; for it would be difficult to find birds more apparently unsuited for such a task, since the sand-martin has the feeblest of feet and an extremely short beak, while the short legs, and syndactyle toes of the kingfisher, coupled with its long, pointed beak, seem still less fitted for burrowing.

While there is general conformity of type characteristic of the nests of the different groups of birds, there are striking exceptions to the rule. Thus the stork-tribe are content with a simple platform of sticks; but the hammer-head (*Scopus umbretta*) builds a huge nest of mud and sticks, covered in by a roof so substantial as to bear easily the weight of a man. This roof may be as much as 6ft. across. The flamingo, again, builds a steep pedestal of mud, the top of which is scooped out to receive the eggs. Parrots nest in hollow trees, but the quaker-parrot (*Myopsittacus*) of South America builds a large domed nest of sticks.

The Gallinaceous birds make little more than an apology for a nest, fashioned in a depression in the ground. But the megapodes of Celebes, New Guinea and Australia build a huge mound of decaying vegetable matter, and laying their eggs deep down in the fermenting mass leave them to hatch by the heat thus engendered.

One of the most remarkable cases of nidification among birds is furnished by the horn-bills. The eggs are laid at the bottom of a cavity in a tree, and as soon as the female has started incubation, the entrance-hole is closed by the male by means of clay; but a space is left open wide enough for his mate to push her beak through to receive food.

### NON-AVIAN NEST-MAKERS

**Mammals.**—Few other animals have attained to the skill in weaving displayed by birds. The harvest-mouse among the mammals is, however, the rival of most birds. The rabbit builds a nest in her burrow, and lines it with the under-fur plucked from her body, forming a parallel to the case of the ducks, geese and swans, which line the nest with down similarly plucked from the breast for this purpose.

The only nest-building mammals which produce eggs are the *Echidna,* or spiny ant-eater, and the duck-billed platypus or *Ornithorhynchus*. The nest is of the simplest character, placed in a chamber at the end of a long tunnel dug by the animal.

**Reptiles.**—Among the reptiles nest-building goes little or no further than digging a hole in the ground, and depositing the eggs within it, leaving them to their fate as in the case of the megapodes among the birds. The European pond-tortoise, however, takes a little more trouble. She first prepares the ground by watering it from the bladder, and from special anal water-sacs. Then, boring a hole with the tail, as one would use a stick, the feet are used to enlarge it. When about five inches deep the eggs are laid at the bottom, and the soil is put back again and beaten down flat.

The crocodile digs a hole in the sand nearly two feet deep, laying her eggs therein and covering them up. But she returns periodically to sleep above her treasures. She is thus at hand to assist the young to escape at the time of hatching. She is warned of this by the noise they make in endeavouring to break through the shell; just as young birds announce their advent by cheeping before the shell is actually broken. When they have all emerged the mother escorts them to the water. The alligator, on the other hand, builds a great mound of decaying leaves, mixed with fine earth, to a height of about three feet, and as much as eight feet in diameter. Some eight inches from the surface the eggs, twenty to thirty, white and hard-shelled, are laid.

The python, among the snakes, like *Ichthyophis* among the Amphibia coils her body around the eggs until they hatch, and guards her young for some time after.

**Amphibia.**—The Amphibia furnish instances of nidification of a very remarkable character, and at the same time, provide valuable material for the study of behaviour in regard to the parental instincts to serve as a standard of comparison with the higher vertebrates on the one hand, and the lower on the other.

The frogs of the genus *Phyllomedusa* build nests recalling that of the tailor-bird. The process of this nest-making has been watched in *Phyllomedusa hypochondria,* the *Wollenkukk* of the Paraguayan Chaco. The female carries the male upon her back while searching for a suitable leaf—which must be of some tree overhanging the water. This found, both then seize it and hold the edges together with their hind-feet, while the female pours her eggs into the funnel thus formed, the male fertilizing them as they pass in. The gelatinous envelope of the eggs suffices to hold the leaf-edges in position as they are brought together in the filling process which goes on until about 100 eggs are laid.

**Fishes.**—Among the fishes the fresh-water sticklebacks (*Gastrosteus*) and the marine fifteen-spine stickleback (*Spinachia*) build nests of weeds, the task being undertaken by the male, who uses, as a binding material, a secretion formed by the kidneys. He undertakes the sole charge of the eggs and young. The gourami (*Osphromenus*) of the Malay Archipelago fashions a nest of air-bubbles toughened by a kind of saliva, and mounts guard over both eggs and young. The Cichlid fishes both of America and the Old World, as well as some of the Siluroid fishes, carry the young in the mouth; in some species both sexes do this, in others the male alone. The male pipe-fish carries the eggs and young in a pouch running along the belly. The Aspredo of the Guianas carries her eggs attached to the under surface of the head, belly and paired-fins. For their accommodation the skin assumes a spongy condition so that each comes to lie within a deep depression, recalling the egg-pits of the Surinam toad, but in the case of Aspredo the pits are shallow and the larvae are not retained there.

**Invertebrates.**—Among the insects the elaborate care for the eggs and young displayed by the ants, bees and wasps is too well known to need further mention. The scorpions and the wolf-spiders carry their young about on their backs until they can fend for themselves; and some of the scorpions, again, like the wolf-spiders, bear their eggs about closely packed within a spherical silken bag.

Among the Echinoderms we find an Antarctic sea-slug (*Cucumaria crocea*) carrying the young on its back. One of the sea-urchins (*Hemiaster philippi*), and a starfish (*Asterias spirabilis*) carry the young in brood-pouches on the back in the case of the sea-urchin, and around the mouth in the starfish. It would seem that only Arctic and Antarctic species behave after this fashion.

In all other cases the young leave the parent as minute, free-swimming larvae, undergoing a complicated metamorphosis before attaining to the adult form. Here, then, we must regard the care of the young as an entirely impersonal, unconscious act, determined by the physical peculiarities of the external environment. This is a factor to be borne in mind in considering the origin, and evolution, of nidification in animals of all grades. (W. P. P.)

**NESTOR** (*c.* 1056–*c.* 1114), the reputed author of the earliest Russian chronicle, was a monk of the Pecherskiy cloister of Kiev from 1073. The only other known fact of his life is that he was commissioned with two other monks to find the relics of St. Theodosius, a mission which he succeeded in fulfilling. The chronicle begins with the deluge, as those of most chroniclers of the time did. The compiler appears to have been acquainted with the Byzantine historians; he makes use especially of John Malalas and George Hamartolus. He also had in all probability other Slavonic chronicles to compile from, which are now lost. Many legends are mixed up with Nestor's *Chronicle;* the style is occasionally so poetical that perhaps he incorporated *byliny* which are now lost. The early part is rich in these stories, among which are the arrival of the three Varangian brothers, the founding of Kiev, the murder of Askold and Dir, the death of Oleg, who was killed by a serpent concealed in the skeleton of his horse, and the vengeance taken by Olga, the wife of Igor, on the Drevlians, who had murdered her husband. The account of the labours of Cyril and Methodius among the Slavs is also very interesting, and to Nestor we owe the tale of the summary way in which Vladimir suppressed the worship of Perun and other idols at Kiev. As an eyewitness he could only describe the reigns of Vsevolod and Sviatopolk (1078–1112), but he gathered many interesting details from the lips of old men, two of whom were Giurata Rogovich of Novgorod, who gave him information concerning the north of Russia, Petchora, and other places, and Jan, a man ninety years of age, who died in 1106, and was son of Vishata the voivode of Yaroslavl and grandson of Ostromir the Posadnik, for whom the *Codex* was written. Many of the ethnological details given by Nestor of the various races of the Slavs are of the highest value.

The latest theory about Nestor is that the *Chronicle* is a patchwork of many fragments of chronicles, and that the name of Nestor was attached to it because he wrote the greater part or perhaps because he put the fragments together.

*The Chronicle* has come down to us in several manuscripts, but unfortunately no contemporary ones, the oldest being the so-called Lavrentievski of the 14th century (1377). It was named after the monk Lavrentii, who copied it out for Dimitri Constantinovich, the prince of Souzdal. The work, as contained in this manuscript, has had many additions made to it from previous and contemporary chronicles, such as those of Volinia and Novgorod. Soloviev, the Russian historian, remarks that Nestor cannot be called the earliest Russian chronicler, but he is the first writer who took a national point of view in his history, the others being merely local writers. The language of his work, as shown in the earliest manuscripts just mentioned, is Palaeo-Slavonic with many Russisms.

The *Chronicle* has been translated into Polish, Bohemian, German and French. The compiler cannot very well be the author of the lives of Boris and Gleb, the martyrs, and of the life of St. Theodosius, because they contradict many passages in the *Chronicle.* The work is of primary importance for early Russian history, and has amusing episodes of an Herodotean character. The reputed body of the ancient chronicler may be seen among the relics preserved in the Pecherskiy monastery at Kiev.

*See* Louis Leger, *Chronique dite de Nestor* (Paris, 1884); Bestuzhev Riumin, *On the Composition of the Russian Chronicles till the end of the 14th century* (in Russian) (St. Petersburg, 1869). (W. R. Mo.)

**NESTOR,** in Greek legend, son of Neleus and Chloris, king of Pylos (Kakovátos) in Elis. When all his brothers were slain by Heracles, in consequence of the refusal of Neleus to purify him for the murder of Iphitus, Nestor alone escaped. In the *Iliad,* he is about 70 years old, full of good advice and of stories of his early exploits. In the *Odyssey,* he is seen by Telemachus at Pylos. The name is used in modern times for any old man of ripe experience, or the oldest member of a class or corporation.

**NESTOR,** the name of a small group of parrots peculiar to New Zealand. The type is *Nestor meridionalis,* the kaka, an olive-brown bird about as big as a crow. The larger *N. notabilis,* the kea (*q.v.*) has developed the habit of attacking sheep to obtain the kidneys. It also eats carrion, grubs, fruits and seeds. A third, more brightly coloured species is said to have inhabited Norfolk Island and a fourth Phillip Island; both of these are now extinct and no specimens of the former are known to exist.

**NESTORIANS.** The present article deals not with the life and doctrine of Nestorius (*q.v.*) but with the Eastern Churches called by his name.

A christology of the kind usually called Nestorian was eagerly and successfully propagated in Syria and Persia by Ibas, bishop of Edessa (435) and Barsumas, bishop of Nisibis. In Persia the old churches were stimulated into vigour and new ones founded. Their centre was at Ctesiphon on the Tigris, a busy trading city. The church traced its doctrines to Theodore of Mopsuestia rather than to Nestorius, whose name at first they repudiated, not regarding themselves as having been proselytized to any new teaching. After the Mohammedan invasion of Persia early in the 7th century the Nestorians were able to come to terms with the invaders; and for five centuries the Nestorians were a recognized institution within the territory of Islam, though their treatment varied from kindly to harsh. But the barbaric invasions of the 13th and 14th centuries fell with crushing force on the Nestorians. In 1258 Hulagu Khan took Baghdad, and about 1400 Timur again seized and sacked the city. Though the Nestorians were numerous, their moral influence and their church life had greatly deteriorated. Those who escaped capture by Timur fled to the mountains of Kurdistan, and the community that had played so large a part in Mesopotamian history for a thousand years was thus shattered. Various attempts during the 16th century to promote union between the Nestorians and Rome proved fruitless, but the Roman Church has never ceased in its efforts to absorb this ancient community.

The Nestorians showed a zeal for evangelization which resulted in the establishment of their influence throughout Asia, as is seen from the bishoprics founded not only in Syria, Armenia, Arabia and Persia, but at Halavan in Media, Merv in Khurasan, Herat, Tashkent, Samarkand, Baluk, Kashgar, and even at Kambaluk (Pekin) and Singan fu (Hsi'en fu) in China, and Kaljana and Kranganore in India. Mongolian invasions and Mohammedan tyranny have, of course, long since swept away all traces of many of these. The 400,000 Syrian Christians ("Christians of St. Thomas," *see* THOMAS, ST.) who lived in Malabar no doubt owed their origin to Nestorian missionaries, the stories of the evangelization of India by the Apostles Thomas and Bartholomew having no real historical foundation, and the Indian activity of Pantaenus of Alexandria having proved fruitless, in whatever part of India it may have been exercised. The theology of the Indian Syrian Christians is of a Nestorian type, and Cosmas Indicopleustes (6th century) puts us on the right track when he says that the Christians whom he found in Ceylon and Malabar had come from Persia (probably as refugees from persecution, like the Huguenots in England and the Pilgrim Fathers in America). Pehlevi inscriptions found on crosses at St. Thomas's Mount near Madras and at Kottayam in Travancore, are evidence both of the antiquity of Christianity in these places (7th or 8th century), and for the semi-patri-passianism (the apparent identification of all three persons of the Trinity in the sufferer on the cross) which marked the Nestorian teaching. In 745 Thomas of Kana brought a new band of emigrants from Baghdad and Nineveh, and possibly the name "Christians of St. Thomas" arose from confusion between this man and the apostle. Other reinforcements came from Persia in 822, but the Malabar church never developed any intellectual vigour or missionary zeal. They had their own kings, lived as a close caste, and even imitated the Hindus in caste regulations of food and avoidance of pollution. In 1330 Pope John XXII. issued a bull appointing Jordanus, a French Dominican, bishop of Quilon, and inviting the Nestorians to enter "the Christian Church." The

invitation was declined, but in the 16th century the Syrian Christians sought the help of the Portuguese settlers against Mussulman oppression, only to find that before long they were subjected to the fiercer perils of Jesuit antagonism and the Inquisition. The Syrians submitted to Rome at the synod of Dampier in 1599, but it was a forced submission, and in 1653 when the Portuguese arrested the Syrian bishop just sent out by the catholicus of Babylon, the rebellion broke out. The renunciation was not quite thorough, one party adhering to the Roman Church as Romo-Syrians, the others reverting wholly to Syrian usages and forming to-day about three-fourths of the whole community.

### WIDESPREAD MISSIONS

Early evidence of Nestorian missions in China is extant in the tablet found in 1625 at Chang'an in the district of Hsi'en-fu, province of Shensi. It commemorates "the introduction and propagation of the noble law of Ta t'sin in the Middle Kingdom," and beneath an incised cross sets out in Chinese and Syriac an abstract of Christian doctrine and the course of a Syrian mission in China beginning with the favourable reception of Olopan, who came from Judaea in 636. For two generations the little cause prospered, and again after persecutions in 699 and 813. Later on a second mission arrived, many churches were built and several emperors patronized the faith.

In the 10th century the Nestorians introduced Christianity into Tartary proper; in 1274 Marco Polo saw two of their churches. The legend of Prester John is based on the idea of the conversion of a Mongol tribe, the Karith, whose chieftain Ung Khan at baptism received the title Malek Juchana (King John). Their activity may well be said to have covered the continent. Their campaign was one of deliberate conquest, one of the greatest ever planned by Christian missionaries. Marco Polo is witness that there were Nestorian churches all along the trade routes from Baghdad to Pekin.

**The Modern Nestorians.**—The Nestorians or East Syrians (*Surayi*) of Turkey and Persia now inhabit a district bounded by Lake Urmia, or Urumia, on the east, stretching westwards into Kurdistan, to Mosul on the south, and nearly as far as Van on the north. It is only of late years, under the influence of the different missions, that education, ruined by centuries of persecution, has revived amongst the Nestorians; and even now the mountaineers, cut off from the outer world, are as a rule destitute of learning, and greatly resemble their neighbours, the wild and uncivilized Kurds. They are, however, extraordinarily tenacious of their ancient customs, and, almost totally isolated from the rest of Christendom since the 5th century, they afford an interesting study to the ecclesiastical student. Their churches are rude buildings, dimly lighted and destitute of pictures or images, save that of the Cross, which is treated with the deepest veneration. There are three liturgies—of the Holy Apostles, of Theodore and of Nestorius. The first is quite free from Nestorian influence, dates from some remote period, perhaps prior to 431, and is certainly the most ancient of those now in use in Christendom; the other two, though early, are undoubtedly of later date. The Nestorian canon of Scripture seems never to have been fully determined, nor is the sacramental system rigidly defined. Nestorian writers, however, generally reckon as sacraments the Priesthood, the Oil of Unction, the Offering of the Body and Blood of Christ, Absolution, the Holy Leaven and the Signation of the life-giving Cross. The "Holy Leaven" is reputed to be a part of the original bread of the first Eucharist, brought by Addai and Mari and maintained ever since in the Church; it is used in the confection of the Eucharistic wafers, which are rather thicker than those used in the Western Church. Communion is given in both kinds, as throughout the East; likewise, confirmation is administered directly after baptism. Sacramental confession is enjoined, but has recently become obsolete; prayers for the departed and invocation of saints form part of the services. The bishops are always celibates and are chosen from episcopal families. The service-books were wholly in ms. until the press of the archbishop of Canterbury's mission at Urmia issued the *Takhsa* (containing the liturgies, baptismal office, etc.) and several other liturgical texts.

The Nestorians commemorate Nestorius as a saint, and invoke his aid and that of his companions. They reject the Third Oecumenical Council, and though showing the greatest devotion to the Blessed Virgin, deny her the title of *Theotokos, i.e.*, the mother or bearer of God. Their theological teaching is misty and perplexing; but systematic or even consistent theological thinking is not their primary interest (*see* J. F. Bethune-Baker, *Nestorius and his Teaching*). The peculiar circumstances, both ecclesiastical and temporal, of the Nestorians have attracted much attention in western Christendom, and various missionary enterprises amongst them have resulted (*see* authorities named below).

BIBLIOGRAPHY.—J. S. Assemani, *Bibliotheca Orientalis,* ii. and iv.; A. J. Maclean and G. F. Browne, *The Catholicus of the East and his People* (1892); G. P. Badger, *Nestorians and their Rituals* (1852); M. Labourt, *Le Christianisme dans l'empire perse* (Paris, 1904); W. F. Adeney, *The Greek and Eastern Churches,* pp. 477-538 (Edinburgh, 1908); J. Rendel Harris, *Sidelights on New Testament Research,* Lect. iv. (1908); G. Milne Rae, *The Syrian Church in India* (1892); K. Heussi und H. Mulert, *Atlas zur Kirchengeschichte,* Map III. (Tübingen, 1905); J. W. Etheridge, *Syrian Churches* (1846); *The Liturgy of the Holy Apostles Adai and Mari,* etc. (1893); Piolet, *Les Missions catholiques au XIX^me^ siècle* (vol. i.); *Quarterly Papers* and *Annual Reports* of the Archbishop of Canterbury's Assyrian Mission.

**NESTORIUS** (d. *c.* 451), Syrian ecclesiastic, patriarch of Constantinople from 428 to 431, was a native of Germanicia at the foot of Mount Taurus, in Syria. The year of his birth is unknown. He received his education at Antioch, probably under Theodore of Mopsuestia. As monk in the neighbouring monastery of Euprepius, and afterwards as presbyter, he became famous in the diocese for his asceticism, his orthodoxy and his eloquence. He was nominated by Theodosius II. patriarch of Constantinople, and was consecrated on April 10, 428. He immediately set to work to extirpate heresy in his diocese, beginning by the suppression of the assemblies of the Arians. These, by a bold stroke of policy, anticipated his action by themselves setting fire to their meeting-house, Nestorius being forthwith nicknamed "the incendiary." His repression of the Novatians and the Quartodecimans led to serious disturbances at Sardis and Miletus. The toleration the followers of Macedonius had long enjoyed was also broken, the recently settled Pelagians alone finding any respite. One of the practices assailed by Nestorius was the custom, which had become almost universal in Constantinople, of bestowing the epithet Θεοτόκος "Mother of God," upon Mary the mother of Jesus. From Antioch Nestorius had brought along with him to Constantinople a co-presbyter named Anastasius, who enjoyed his confidence and is called by Theophanes his "syncellus." This Anastasius, in a pulpit oration which the patriarch himself is said to have prepared for him, caused great scandal to the partisans of the cult of Mary by saying, "Let no one call Mary the mother of God, for Mary was a human being; and that God should be born of a human being is impossible."

Cyril (*q.v.*) of Alexandria seized his opportunity. He stirred up his own clergy, he encouraged the dissidents at Constantinople, he addressed himself to the sister and wife of the emperor, and he bribed the officials of the court. He also sent to Rome a careful selection of Nestorius's sayings and sermons. Nestorius himself, on the other hand, having occasion to write to Pope Celestine I. about the Pelagians (whom he was not inclined to regard as heretical), gave from his own point of view an account of the disputes which had recently arisen within his patriarchate. Celestine naturally resented any questioning of the Roman decision concerning the Pelagians, and was jealous of the growing power of the Constantinople see. In a synod which met in 430, he decided in favour of the title Θεοτόκος, bade Nestorius retract his erroneous teaching, on pain of instant excommunication, and entrusted the execution of this decision to the patriarch of Alexandria.

In this situation of affairs the demand for a general council became irresistible, and accordingly Theodosius and Valentinian III. issued letters summoning the metropolitans of the Catholic church to meet at Ephesus at Whitsuntide 431, each bringing with him some able suffragans. Nestorius, with sixteen bishops and an armed following, Cyril with fifty bishops, Juvenal of Jerusalem, and Flavian of Thessalonica arrived. John of Antioch was delayed on his journey, and wrote requesting that the opening of the

synod should not be delayed on his account. Cyril and his friends assembled in the church of the Theotokos on June 22, and summoned Nestorius to give an account of his doctrines. He replied that he would appear when all the bishops were assembled; and the imperial commissioner, Candidian, formally protested against the opening of the synod. Cyril and the 159 bishops who were with him nevertheless proceeded to read the imperial letter of convocation, and afterwards the letters which had passed between Nestorius and Cyril. The entire assembly then cried anathema on Nestorius and his doctrines, and the decree of his exclusion from the episcopate and from all priestly communion was solemnly read and signed by all present. The accused and his friends never had a hearing.

The populace accompanied the members with torches and censers to their lodgings, and there was a general illumination of the city. A few days afterwards (June 26th or 27th) John of Antioch arrived; whether inclined or not to the cause of his former co-presbyter, he disapproved the precipitancy with which Cyril had acted, and at a *conciliabulum* of forty-three bishops held in his lodgings he was induced by Candidian, the friend of Nestorius, to depose the bishops of Alexandria and Ephesus on the spot. The Ephesians intervened to prevent the execution of this decision on the next Sunday. Meanwhile a letter from the emperor declared invalid the session at which Nestorius had been deposed unheard; numerous sessions and counter-sessions were afterwards held, the conflicting parties both seeking the imperial support. In the end Theodosius decided to confirm the depositions which had been pronounced on both sides, and Cyril and Memnon as well as Nestorius were by his orders laid under arrest. Representatives from each side were now summoned before him to Chalcedon, and at last, yielding to the sense of the evident majority, he gave a decision in favour of the "orthodox," and the council of Ephesus was dissolved. Maximian, one of the Constantinopolitan clergy, a native of Rome, was promoted to the vacant see, and Nestorius was henceforward represented in the capital only by one congregation, which presently became extinct.

But the Antiochenes maintained for some time an attitude of antagonism towards Cyril and his creed, and were not pacified until an understanding was reached in 433 on the basis of a new formula involving some concessions by him. The union even then was opposed by certain bishops, who were deposed from their sees. Their school at Edessa was closed by Zeno in 489. Immediately after his deposition Nestorius withdrew into private life in his old monastery of Euprepius, Antioch, until 435, when the emperor ordered his banishment to Petra in Arabia. A second decree, it would seem, sent him to Oasis, probably the city of the Great Oasis, in Upper Egypt, where he was still living in 439, at the time when Socrates wrote his *Church History*. He was taken prisoner by the Blemmyes, a nomad tribe that gave much trouble to the empire in Africa, and when they set him free in the Thebaid near Panopolis (Akhmim) *c.* 450, they exposed him to further persecution from Schenute, the hero of the Egyptian monks. There is some evidence that he was summoned to the Council of Chalcedon, though he could not attend it, and in the concluding portion of his book known as *The Bazaar of Heraclides* he not only gives a full account of the "Robber Synod" of Ephesus 449, but knows that Theodosius is dead (July 450) and seems aware of the proceedings of Chalcedon and the flight of Dioscurus, the unscrupulous successor of Cyril at Alexandria. Nestorius was already old and ailing and must have died very soon after. There are still Nestorians in Kurdistan, and the Syriac Church is Nestorian in theology, as are the churches in Asia founded by Nestorian missionaries in the middle ages.

**Modern View.**—Only recently has an attempt been made to judge Nestorius from some other evidence than that afforded by the accusations of Cyril and the inferences drawn therefrom. This other evidence consists partly of letters from Nestorius, preserved among the works of those to whom they were written, some sermons collected in a Latin translation by Marius Mercator, an African merchant who was doing business in Constantinople at the time of the dispute, and other material gathered from Syriac manuscripts. Since the helpful collection of *Nestoriana* published by Dr. F. Loofs in 1905 there has also come to our knowledge the most valuable evidence of all, Nestorius's own account of the whole difficulty, viz., *The Bazaar*[1] *of Heraclides of Damascus*. This pseudonym served to protect the book against the fate that overtook the writings of heretics, and in a Syriac version it was preserved in the Euphrates valley where the followers of Nestorius settled. Ebed Jesu in the 14th century mentions it together with *Letters* and *Homilies*, as well as the *Tragedy*, or a *Letter to Cosmas*, the *Theopaschites* (of which some fragments are still extant) and the *Liturgy*, which is still used by the Nestorian Church. The discovery of *The Bazaar*, which is the *Apologia* of Nestorius, was made public by Dr. H. Goussen (though members of the Archbishop of Canterbury's Mission to the Assyrian Christians had previously been acquainted with the book). The text has been edited by P. Paul Bedjan (Leipzig, 1910) and a French translation has been made by M. l'abbé F. Nau. A representative selection of extracts has been given to English readers in J. F. Bethune-Baker's *Nestorius and his Teaching* (Cambridge, 1908), chapter ii. of which describes the ms. and its accounts.

BIBLIOGRAPHY.—On Nestorius, in addition to the modern literature cited in the article, and the standard histories of dogma (A. Harnack, F. Loofs, R. L. Ottley's *Doctrine of the Incarnation*, etc.), *see* R. Seeberg, *Lehrbuch der Dogmengeschichte*, Bd. ii. § 27 (Leipzig, 1910), L. Duchesne, *Histoire ancienne de l'église*, vol. iii. chs. x. xi. (1910); J. F. Bethune-Baker, *Nestorius and his teaching* (1908); F. Nau, *Nestorius, d'après des sources orientales* (1911); *Hist. de N. d'après la Lettre à Cosme et l'Hymne de Sliba, etc.*, textes syrienne ed. et trans. by F. Nau (1919); F. Loofs, *Nestorius and his Place in History* (1914); C. Pech, *Nestorius als Irrlehrer* (1921). *See* also *Catholic Encyclopaedia*.

**NET.** A fabric of thread, cord or wire, the intersections of which are knotted so as to form a mesh. The art of netting is intimately related to weaving, knitting, plaiting and lace-making, from all of which, however, it is distinguished by the knotting of the intersections of the cord. It is one of the most ancient and universal of arts, having been practised among the most primitive tribes, to whom the net is of great importance in hunting and fishing. Net is a common Teut. word, of which the origin is unknown; it is not to be connected with "knit" or "knot." The term "net," *i.e.*, remaining after all deductions, charges, etc., have been made, as in "net profit," is a variant of "neat," tidy, clean, Lat. *nitidus*, shining. Net-making, as a modern industry, is principally concerned with the manufacture of the numerous forms of net used in fisheries, but netting is also largely employed for many other purposes, as for the temporary division of fields, for protecting fruit in gardens, for screens and other furniture purposes, for bags, appliances used in various games, etc. Since the early part of the 19th century numerous machines have been invented for netting, and several of these have attained commercial success. Fishing nets were formerly made principally from hemp fibre —technically called "twine."

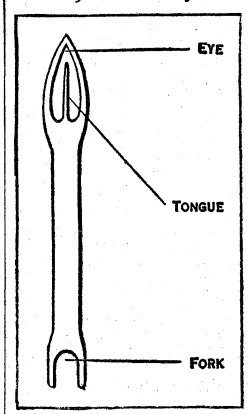


FIG. 1.—NEEDLE USED IN NET-MAKING

The forms of fishing nets vary according to the manner in which they are intended to act. This is either by entangling the fish in their complicated folds, as in the trammel; receiving them into pockets, as in the trawl; suspending them by the body in the meshes, as in the mackerel-net; imprisoning them within their labyrinth-like chambers, as in the stake-net; or drawing them to shore, as in the seine. The parts of a net are the head or upper margin, along which the corks are strung upon a rope called the head-rope; the foot is the opposite or lower margin, which carries the foot-rope, on which in many cases leaden plummets are made fast. The meshes are the squares composing the net. The width of a net is expressed by the term "over"; *e.g.*, a day-net is three fathoms long and one over or wide. The lever is the first row of a net. There are also accrues, false meshes or quarterings, which are loops inserted in any given row, by which the number of meshes is increased. To bread or breathe a net is to make a net.

[1]Syriac, *tēgūrtā*, lit. "merchandise." The Greek word may have been ἐμποριόν. Nothing is certainly known of any such Heraclides.

**Hand-Netting.**—The tools used in hand-netting are the needle, an instrument for holding and netting the material; it is made with an eye E, a tongue T, and a fork F (fig. 1). The twine is wound on it by being passed alternately between the fork and round the tongue, so that the turns of the string lie parallel to the length of the needle, and are kept on by the tongue and fork. A spool or mesh-pin is a piece of round or flat wood on which the loops are formed, the perimeter of the spool determining the size of the loops. Each loop contains two sides of the square mesh; therefore, supposing that it be required to make a mesh 1in. square—that is,

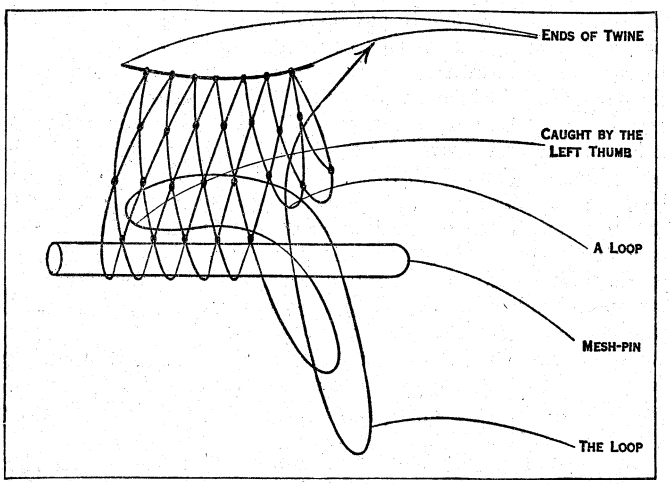



FIG. 2.—DIAGRAM SHOWING COURSE OF TWINE IN FORMING A FISHERMAN'S KNOT IN NET-MAKING

measuring 1in. from knot to knot—a spool 2in. in circumference must be used. Large meshes may be formed by giving the twine two or more turns round the spool, as occasion may require; or the spool may be made flat, and of a sufficient width. The method of making the hand-knot, known as the fisherman's knot, is more easily acquired by example than described in writing. Fig. 2 shows the course of the twine in forming a single knot. From the last-formed knot the twine passes over the front of the mesh-pin, and is caught behind by the little finger of the left hand, forming the loop, thence it passes to the front and is caught by the left thumb, then through the loops as sketch indicates, after which the twine is released by the thumb and the knot is drawn taut. Fig. 3 is a bend knot used for uniting two ends of twine.

**Machine-Netting.**—In 1778 a netting-machine was patented by William Horton, William Ross, Thomas Davies and John Golby. In 1802 the French Government offered a reward of 10,000 francs to the person who would invent an automatic machine for net-making. Jacquard submitted a model of a machine which was brought under the notice of Napoleon I. and Carnot, and he was summoned to Paris by the emperor who asked—"Are you the man who pretends to do what God Almighty cannot—tie a knot in a stretched string?" Jacquard's model, which is incomplete, was deposited in the Conservatoire des Arts et Métiers; it was awarded a prize, and he himself received an appointment in the conservatoire, where he perfected his famous attachment to the common loom. In the United Kingdom, the first to succeed in inventing an efficient machine and in establishing the industry of machine net-making was James Paterson of Musselburgh. Paterson, originally a cooper, served in the army through the Peninsular War, and was discharged after the battle of Waterloo. He established a net factory in Musselburgh about 1820; but the early form of machine was imperfect, the knots it formed slipped readily and, there being much prejudice against machine nets, the demand was small. Walter Ritchie, native of Musselburgh, devised a method for

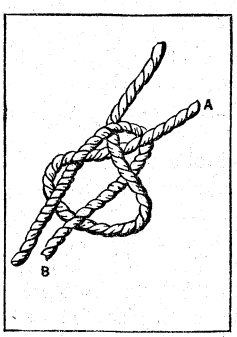



FIG. 3.—A BEND KNOT USED TO JOIN TWO ENDS, A AND B

forming the ordinary hand-knot on the machine nets, and the machine, patented in July 1835, became the foundation of an extensive and flourishing industry. The Paterson machine is very complex. It consists of an arrangement of hooks, needles and sinkers, one of each being required for every mesh in the breadth being made. The needles hold the meshes, while the hooks seize the lower part of each and twist it into a loop. Through the series of loops so formed a steel wire is shot, carrying with it twine for the next range of loops. This twine the sinkers successively catch and depress sufficiently to form the two sides and loop of the next mesh to be formed. The knot formed by threading the loops is now tightened up, the last formed mesh is freed from the sinkers and transferred to the hooks, and the process of looping, threading and knotting thus continues.

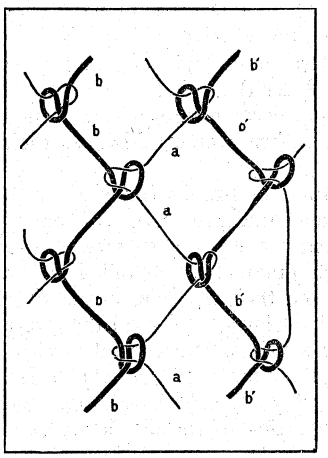



FIG. 4.—BAUDOUIN AND JOUANNIN'S NET LOOM, WHERE THE "A" SERIES IS DRAWN INTO LOOPS, OVER AND THROUGH WHICH THE "B" SERIES PASSES

Another form of net-loom, working on a principle distinct from that of Paterson, was invented and patented in France by Onésiphore Pecqueur in 1840, and again in France and in Great Britain in 1849. This was improved by many subsequent inventors; especially by Baudouin and Jouannin.

**Net Manufacture in the United States.**—The manufacture of nets for the fisheries in the United States dates back to about 1844, being initiated by a manufacturer of cotton yarns at Canton, Massachusetts. The popularity with which the first experimental cotton twines were received led the manufacturer to devote his whole time to their manufacture and improvement. In 1858 the first netting-machine in the United States was seen. The limitations of this machine led to the development of new inventions, particularly those designed for handling heavy twines.

In 1937 there were nine establishments manufacturing nettings, nets, scrape bags, and seines. These establishments employed 502 wage earners, and paid $463,063 in wages. The total value of products manufactured was $3,363,435. The fibre materials used are flax, cotton, and manila.

In view of the wholly inadequate supply of domestic flax and as but little of it is suitable for the manufacture of netting, domestic manufacturers are dependent upon imports for their raw materials. The use of cotton in the making of nets has increased until the quantities used in 1920 exceeded those for linen. Manila is used by the domestic manufacturers in the making of trawls or other bag-nets.

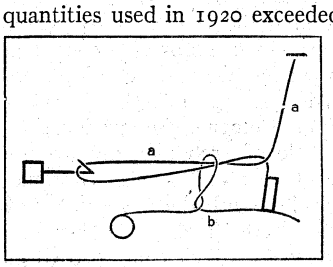



FIG. 5.—DIAGRAM SHOWING THE CONTINUATION OF THE PROCESS

Fishery apparatus employed in the fisheries of the United States and Alaska is valued at approximately $16,000,000, a large part of which is invested in nets, nettings and lines chiefly cotton, flax and hemp. Much of this material lasts but two years at best, so that the annual investment in new netting each year is an important factor in the fisheries.

**NETHERLANDS.** The Netherlands first became known to the Romans through the campaigns of Julius Caesar. He found the country peopled partly by tribes of Gallo-Celtic, partly by tribes of Germanic stock, the river Rhine forming roughly the line of demarcation between the races. The Gallo-Celtic tribes bore the general appellation of Belgae, and among these the Nervii, inhabiting the district between the Scheldt and the Sambre were at the date of Caesar's invasion, 57 B.C., the most warlike and important. To the north of the Meuse, and more especially in the low-lying ground enclosed between the Waal and the Rhine

(*insula Batavorum*) lived the Batavi. Beyond these were found the Frisians (*q.v.*), who gave their name to the territory between the Rhine and the Ems.

Julius Caesar, after a severe struggle with the Nervii and their confederates, was successful in bringing the Belgic tribes into subjection to Rome. Under Augustus, 15 B.C., the conquered territory was formed into an imperial province, *Gallia Belgica,* and the frontier was strongly fortified. The Batavians were first brought under Roman rule in the governorship of Drusus, 13 B.C. They were not incorporated in the empire, but were ranked as allies. In 69 they revolted under a native leader, known only under his Roman name of Claudius Civilis. After the rising, they returned to their position of *socii.* Their land became a recruiting ground for the Roman armies and they were henceforth faithful in their steady allegiance to Rome.

When at the end of the 3rd century the Franks (*q.v.*) began to swarm over the Rhine into the Roman lands, the names of the old tribes had disappeared. The branch of the Franks—who were a confederacy, not a people—which gradually overspread Gallia Belgica, bore the name of Salii, from their position on the river Saale. In the days of their great king Clovis (481–511) they were in possession of the whole of the southern and central Netherlands. The strip of coast between the mouths of the Scheldt and Ems remained, however, in the hands of the Frisians (*q.v.*), and the Saxons (*q.v.*) had occupied a portion of the districts known later as Gelderland, Overyssel and Drente.

The conversion of the Franks tended to facilitate fusion between them and the Gallo-Roman population, and to accentuate the enmity between the Franks and the heathen Frisians and Saxons. In the south of the Netherlands bishoprics were set up at Cambrai, Tournai, Arras, Thérouanne and Liége. In the north progress was much slower and success was due rather to the arms of the Carolingian kings than to missionary efforts. Towards the end of the century, Charlemagne, himself a Netherlander by descent and ancestral possessions, after a severe struggle thoroughly subdued the Frisians and Saxons, and compelled them to embrace Christianity.

**The Duchy of Lower Lorraine.**—The Verdun treaty (843) assigned the central part of the Empire to the Emperor Lothaire, separating the kingdom of East Francia (the later Germany) from West Francia (the later France). This middle kingdom included the whole of the later Netherlands with the exception of the portion on the left bank of the Scheldt, which river was made the boundary of West Francia. On the death of the emperor, his son Lothaire II. received the northern part of his father's domain, known as *Lotharii Regnum,* corrupted later into Lotharingia and Lorraine. Lothaire had no heir, and in 870 by the Treaty of Mersen his territory was divided between the kings of East and West Francia. In 879 East Francia acquired the whole; from 912 to 924 it formed part of West Francia. In 924 Lorraine passed in the reign of Henry the Fowler under German overlordship. Henry's son, Otto the Great, placed it in 953 in the hands of his able brother, Bruno, archbishop of Cologne, for pacification. Bruno, who kept for himself the title of archduke, divided the territory into the two duchies of Upper and Lower Lorraine. Godfrey of Verdun was invested by him with the government of Lower Lorraine. The history of the Netherlands from this time forward—with the exception of Flanders, which continued to be a fief of the French kings—is the history of the various feudal States into which the duchy of Lower Lorraine was gradually broken up. (*See* FLANDERS; HOLLAND; BRABANT; GELDERLAND; LIMBURG; UTRECHT; LIÉGE.)

The development of feudalism in the Netherlands was largely due to the necessity of protecting the land against the Scandinavian attacks of the 9th and 10th centuries. For a time near the middle of the 9th century the Northmen were masters of all Holland and Friesland, though they never established permanent settlements there. On one occasion, in 880, the emperor, Charles the Fat, led an army against the Northmen, then encamped at Elsloo, but the remoteness of the Netherlands from the centres of either French or imperial power threw the burden of defence upon local magnates, and a great increase in their authority was the inevitable consequence. Long before the end of the 11th century the system of feudal States had been firmly established in the Netherlands. The part which their rulers played in the Crusades is a proof of their order and prosperity.

## EARLIEST CHARTERS

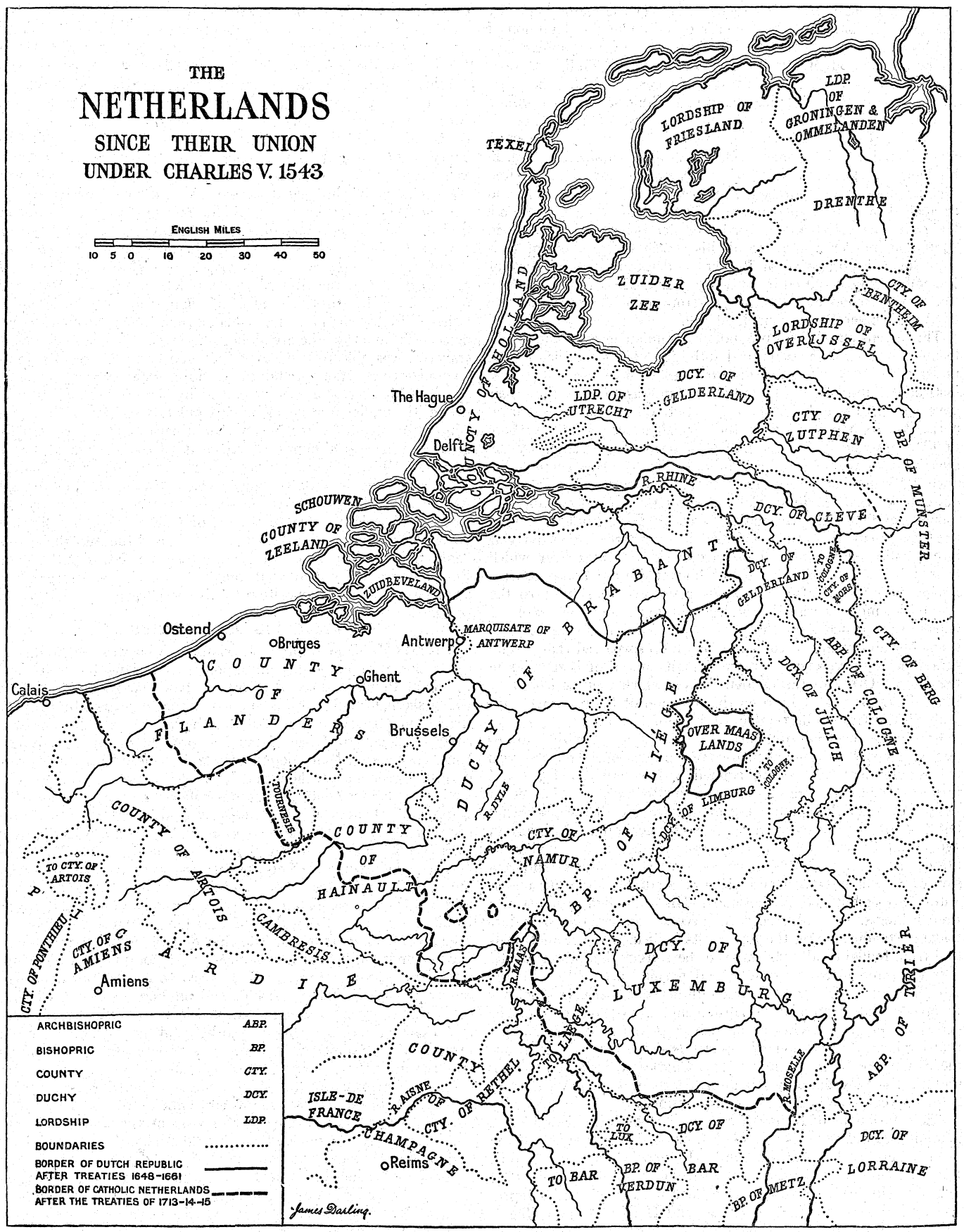
**Rise of the Cities in the Netherlands.**—Little is known about the Netherlands towns before the 12th century. The earliest charters date from that period. The charters were of the nature of a treaty between the city and its feudal lord, and they differed much in character according to the importance of the place and the pressure it was able to put upon its sovereign. The extent of the rights which the charter conceded determined whether the town was a free town or a commune. In the case of a commune the concessions included generally the right of inheritance, justice, taxation, use of wood, water, etc. The lord's representative, entitled "justiciary" (*schout*) or "bailiff" (*baljuw*), presided over the administration of justice and took command of the town levies in war. The *gemeente*—consisting only of those bound by the communal oath for mutual help and defence—elected their own magistrates. These electors were often a small proportion of the whole body of inhabitants: sometimes a few influential families alone had the right, and it became hereditary. The magistrates bore the name of *scabini,* and at their head was the seigneurial official—the *schout* or *baljuw.* These *scabini* appointed from the citizens a body of sworn councillors to assist them whose presidents, styled "burgomasters," had the supervision of the communal finances.

The most powerful and flourishing of all were those of Flanders —Ghent, Bruges and Ypres. In the 13th century these towns had become the seat of large industrial populations employed upon the weaving of cloth with its dependent industries, and closely bound up by trade interests with England, whence they obtained the wool for their looms. Bruges, at that time connected with the sea by the river Zwijn and with Sluis as its port, was the central mart and exchange of the world's commerce. In these Flemish cities the early oligarchic form of municipal government speedily gave way to a democratic. The great mass of the townsmen organized in trade gilds—weavers, fullers, dyers, smiths, leatherworkers, brewers, butchers, bakers and others, of which by far the most powerful was that of the weavers—as soon as they became conscious of their strength rebelled against the exclusive privileges of the patricians and succeeded in ousting them from power. The patricians relied upon the support of the French Crown, but the fatal battle of Courtrai (1302), in which the handicraftsmen laid low the chivalry of France, secured the triumph of the democracy. The power of the Flemish cities rose to its height during the ascendancy of Jacob van Artevelde (*c.* 1290–1345), the famous citizen-statesman of Ghent, but after his downfall the mutual jealousies of the cities undermined their strength, and with the crushing defeat of Roosebeke (1382) in which Philip van Artevelde perished, the political greatness of the municipalities entered upon its decline.

In Brabant—Antwerp, Louvain, Brussels, Malines (Mechlin)—and in the episcopal territory of Liége—Liége, Huy, Dinant—there was a more feeble repetition of the Flemish conditions. Flourishing communities were likewise to be found in Hainault, Namur, Cambrai and the other southern districts of the Netherlands, but nowhere else the vigorous independence of Ghent, Bruges and Yprès, nor the splendour of their civic life. In the north also the 13th century was rich in municipal charters. Dordrecht, Leyden, Haarlem, Delft, Vlaardigen, Rotterdam in Holland and Middelburg and Zierikzee in Zeeland, repeated with modifications the characteristics of the communes of Flanders and Brabant. But the growth and development of the northern communal movement, though strong and instinct with life, was slower and less tempestuous than the Flemish. In the bishopric of Utrecht, in Gelderland and Friesland, the privileges accorded Utrecht, Groningen, Zutphen, Stavoren, Leeuwarden followed rather on the model of those of the Rhenish "free cities" than of the Franco-Flemish commune.

## THE BURGUNDIAN DOMINION

**Consolidation of Power.**—It was at this time that Flan-




FROM POOLE, "HISTORICAL ATLAS" (CLARENDON PRESS, OXFORD)

ders, and gradually the other feudal States of the Netherlands, by marriage, purchase, treachery or force, fell under the dominion of the house of Burgundy. The foundation of the Burgundian rule in the Netherlands was laid by the succession of Philip the Bold to the counties of Flanders and Artois in 1384 in right of his wife, Margaret de Mâle. In 1404 Antony, Philip's second son (killed at Agincourt, 1415), became duke of Brabant by bequest of his great-aunt Joan. The consolidation of the Burgundian power was effected by Philip the Good, grandson of Philip the Bold, in his long and successful reign of 48 years, 1419–67. He inherited Flanders and Artois, purchased the county of Namur (1427) and compelled his cousin Jacqueline, the heiress of Holland, Zeeland, Hainault and Friesland, to surrender her possessions to him in 1428. On the death, in 1430, of his cousin Philip, duke of Brabant, he took possession of Brabant and Limburg; the duchy of Luxembourg he acquired by purchase, 1443. He made his bastard son David bishop of Utrecht, and from 1456 onwards that see continued under Burgundian influence.

This extension of the Burgundian dominion implied the establishment of a strong monarchical authority. The dukes had united under their sway a number of provinces with different histories, institutions and languages, and their aim was to centralize their government. The nobility and clergy were on the side of the ducal authority; its opponents were the municipalities, especially those of Flanders. Their strength had been seriously weakened by the overthrow of Roosebeke, but Philip on his accession found them once more advancing rapidly in power and prosperity. He was quite aware that the industrial wealth of the great Flemish communes was financially the mainstay of his power, but their very prosperity made them the chief obstacle of his schemes of unifying into a solid dominion the loose aggregate of States over which he was the ruler. On this matter Philip would brook no opposition. Bruges was forced after strenuous resistance to submit to the loss of its most cherished privileges in 1438, and the revolt of Ghent was quenched in the "red sea" of Gavre in 1453. The splendour and luxury of the court of Philip surpassed that of any contemporary sovereign. A permanent memorial of it remains in the famous Order of the Golden Fleece, which was instituted by the duke at Bruges in 1430 on the occasion of his marriage with Isabel of Portugal, a descendant of John of Gaunt.

Before the accession of Charles, the only son of Philip, two important steps had been taken towards unification. The first was the appointment of a grand council with supreme judicial and financial functions, whose seat was finally fixed at Malines in 1473; the other the summoning of deputies of all the provincial "States" of the Netherlands to a States-general at Brussels in 1465. But Charles did not possess the qualities of a builder of States. At first all went well with him. By his ruthless suppression of revolts at Dinant and Liége he made his authority undisputed throughout the Netherlands. His campaigns against the French king were conducted with success. His creation of a formidable standing army, the first of its kind in that age of transition from feudal conditions, gave to the Burgundian power all the outward semblance of stability and permanence. But Charles, though a brave soldier and good military organizer, was neither a capable statesman nor a skilful general. At the very height of his power all his schemes of aggrandisement came to sudden ruin through a succession of disastrous defeats at the hands of the Swiss. At Nancy, Jan. 5, 1477, Charles was himself among the slain, leaving his only daughter, Mary of Burgundy, then in her 20th year, sole heiress to his possessions.

The catastrophe of Nancy threatened the loosely knit Burgundian dominion with dissolution. Louis XI. claimed the reversion of the French fiefs, and seized Burgundy, Franche Comté and Artois. But the Netherland provinces, though not loving the Burgundian dynasty, had no desire to have a French master. Deputies representing Flanders, Brabant, Hainault and Holland met at Ghent, where Mary was detained almost as a prisoner, and compelled her (Feb. 10, 1477) to sign the "Great Privilege." This charter provided that no war could be declared nor marriage concluded by the sovereign, nor taxes raised without the assent of the States, that natives were alone eligible for high office and that the national language should be used in public documents. The central court of justice at Malines was abolished, but the Grand Council was reorganized and made thoroughly representative. The Great Privilege was supplemented by provincial charters, the Flemish Privilege (Feb. 10), the Great Privilege of Holland and Zeeland (Feb. 17), the Great Privilege of Namur and the *Joyeuse Entrée* of Brabant, both in May, thus curtailing the sovereign's power of interference with local liberties. On these conditions Mary obtained the hearty support of the States against France. Her marriage four months later to Maximilian of Austria was the beginning of the long domination of the house of Habsburg. The next 15 years were for Maximilian a stormy and difficult period. The duchess Mary died from the effects of a fall from her horse (March 1482), and Maximilian became regent (*mambourg*) for his son. The peace of Arras with France (March 1483) freed him to deal with the discords in the Netherland provinces, and more especially with the turbulent opposition in the Flemish cities. With the submission of Ghent (June 1485) the contest was decided in favour of the archduke, who in 1494, on his election as emperor, was able to hand over the country to his son Philip in a comparatively tranquil and secure state. Philip was 15 years of age, and his accession was welcomed by the Netherlanders with whom Maximilian had never been popular. Gelderland, however, which had revolted after Nancy, had Charles of Egmont for its duke, and the two bishoprics of Liége and Utrecht were no longer subject to Burgundian authority. In 1496 Philip married Joanna of Aragon, who in 1500 became heiress apparent to Castile and Aragon, and she gave birth at Ghent to a son, afterwards the Emperor Charles V. On the death of Queen Isabel, Philip and Joanna succeeded to the crown of Castile and took up their residence in their new kingdom (Jan. 1506). A few months later Philip unexpectedly died at Burgos (Sept. 25). His Burgundian lands passed without opposition to his son Charles, then six years of age. (X.)

### RELIGIOUS DIFFICULTIES

**Charles V.**—The emperor Maximilian, who was regent during the minority of his grandson, appointed his daughter Margaret, widow of Philibert duke of Savoy, as governor-general, an office which she held with varying success for eight years. In 1515, at the instance of the States-General, the 15-year-old Charles was suddenly declared of age. Born and brought up in the Netherlands he was personally popular there and the country was prosperous. Unfortunately, however, his accession brought the Netherlands into the huge and incongruous collection of states which the wars and marriages of the Habsburgs had heaped together. By the time he was 20 Charles was king of Aragon and Castile, with their Italian and American possessions, head of the house of Austria, and emperor. This meant first that he had to spend most of his life in his other dominions, leaving the Netherlands again to his aunt Margaret, and after her death (Nov. 27, 1530) to his sister Mary, the widow of that king of Hungary who had fallen at Mohacz. It meant also that he had to make large financial demands on these rich provinces for the purposes of his many wars. Opposition to the taxes led at last to one serious collision: the great city of Ghent resisted, and on Feb. 14, 1540, Charles entered it as a conqueror and humbled it by annulling its liberties and exacting a heavy fine. Another difficulty was the rapid growth of Protestantism. A series of severe edicts against heresy was issued and enforced; but though many heretics were executed, every form of Protestant belief continued to make converts. None of these dangers however, came as yet to a head. The rule of Charles and the "governesses" was on the whole moderate and successful. He rounded off the dominions by the purchase and subjugation of Friesland (1524), the annexations of the lands of the bishops of Utrecht (1528) and the defeat of an opponent who tried to establish himself in the duchy of Gelderland (1538). By 1543 he ruled over the 17 provinces which are usually meant by the name "Netherlands," though oddly enough there are several different ways of enumerating them. It is due not to any geographical or racial factors, but simply to the subsequent course of political history that there was no further expansion of the frontiers to the east or south. In the task of welding these

provinces together by constitutional links Charles made some headway, but not much. He made the rules of hereditary succession the same for all of them, so that they should never be divided among different heirs. He carried out a nominal, but in the result quite ineffective, incorporation of the provinces in the Holy Roman empire. He governed the provinces by executive councils of the type usual in the monarchies of the period, and, in addition to the provincial estates, he liked to summon, when he needed grants of money, States-General such as his predecessors had sometimes used. These stood, however feebly, for the principle of the unity of the Netherlands.

**Philip II.**—Conflict was precipitated in the Netherlands under Philip II., who succeeded his father on his abdication in 1555. In the first 12 years of his reign all the latent quarrels burst out. In 1559 the Peace of Cateau Cambrésis (a town better known now as Le Cateau) removed the pressure of war with France, and so cleared the way for the Dutch revolt and for the French wars of religion. As Philip was not emperor and ceased to be king of England on the death of his wife Queen Mary in 1558, the Netherlands now belonged to a combination of states, in which no other part was infected with Protestantism: the religious struggle there was consequently more uncompromising than in Germany. Philip was determined to crush heresy. His policy was in a sense no more harsh than that of Charles; but as Protestantism grew its repression caused greater discontent. Philip began, but never completed, the carrying out of a scheme which had been for some time in contemplation for rectifying the anomalies of the boundaries of the episcopal sees, and for making smaller dioceses with a more efficient episcopate. This not only intensified the fear of persecution, but alienated the greater nobles.

**Prelude to the Revolt.**—These religious questions would not by themselves have led to a revolution. The most powerful class in the Netherlands were the great nobles, from whom the "stadholders" or lieutenants of the provinces were chosen, and on whom the privileged order of the Golden Fleece was often conferred. Among these there was a widespread feeling against Spanish rule, and a desire to subordinate the power of the king's ministers to their own and that of the estates. The period from 1559 (when Philip departed to Spain) to 1567, during which the governor-general was the king's illegitimate half-sister Margaret duchess of Parma, is known as the prelude to the revolt. Its first stage lasted till 1564. By this time the magnates, led by William of Orange (*see* WILLIAM I., PRINCE OF ORANGE), Egmont and Hoorn had succeeded in two things. They had brought about the withdrawal of the Spanish troops, and they had got rid of the minister Cardinal Granvelle, archbishop of the new see of Mechlin, whom they somewhat mistakenly blamed for most of their grievances. Margaret's decision to rely on co-operation with the magnates did not, however, promote real harmony. The religious troubles increased and led to a conflict between the Government and the chartered privileges of the towns and estates, in the course of which the magnates formulated demands for the summoning of the States-General and for government by councils of aristocratic composition. In the summer of 1565 a new element came forward. More than 300 of the lesser nobles or gentry signed the Compromise by which they undertook to help and protect one another against persecution and to put an end to the inquisition. They were actuated by religious conviction, not, like the magnates, by the tolerance of the man of the world, and there were many among the rich burghers who were prepared to back up this determined party. On April 5, 1566, the signatories presented to Margaret a petition called the Request. On this occasion a nobleman contemptuously referred to them as beggars (*gueux*). They adopted this nickname and wore as badges the curious medals with a beggar's wallet which may still be seen in museums. Margaret made an ambiguous concession to their demands; but the result was only to precipitate the conflict (*see* GUEUX, LES). Extreme Calvinists and religious fanatics of all sects redoubled their activity. Field-preaching spread like wildfire and became something very little different from rebellion. In August many places, especially Antwerp, were alarmed by formidable riots for the smashing of the images, altars, pictures and painted windows of the churches. The Calvinist burghers and gentry were forming armies and preparing to defend the towns where they were most influential. The general confusion, however, caused many of their adherents to fall away and most of the magnates to rally to the Government. William of Orange, by attempting to mediate, lost the confidence of both sides. Margaret raised a considerable force of German mercenary troops, which took possession of Valenciennes and Tournay and destroyed the ill-organized rabble of Calvinists in West Flanders and before Antwerp.

The troubles had reached a stage in which there was to be no more mercy or hesitation on the side of the Government; but the only one of the discontented magnates who grasped this was William of Orange, who departed to his German estates in April 1567. The veteran Spanish general the duke of Alva was already on the march from Italy with a model force of about 10,000 men.

### THE REVOLT OF THE NETHERLANDS

Alva's rule, from 1568 to 1573, is the classical example of military despotism. Margaret resigned soon after his arrival: Egmont and Hoorn had already been arrested. An illegal tribunal, the Council of Troubles, nicknamed the Council of Blood, was set up to try those who had taken part in the disturbances. There were wholesale executions. Crowds of refugees fled by sea and land. Orange was outlawed (Jan. 24, 1568) and his estates confiscated; his eldest son and heir, a student at Louvain, was kidnapped and carried away to Spain. The father meanwhile, acting in his capacity as a sovereign prince and making war nominally only on Alva, not on his master Philip, had raised an army in Germany which was led by his brother Louis of Nassau into Friesland. Here it won a fight at Heiligerlee (May 23); but at Jemgum or Jemmingen it was completely defeated on July 21 by Alva in person. Before setting out from Brussels he had struck a characteristic blow. Egmont and Hoorn and 20 other nobles had been beheaded. In September Orange appeared with another army; but Alva, avoiding battle, starved him back into Germany. He was now undisputed master in the Netherlands and settled down to the military, ecclesiastical, judicial and other measures which were needed to consolidate his success. These measures caused subterranean discontent and was growing opposition.

**Campaigns of 1572–73.**—In 1572 affairs took a new turn. William had been in the habit of granting to some of his followers commissions to act as privateers. These fierce sea-rovers, the Sea-Beggars (*gueux de mer*) had committed many depredations on commerce and had not abstained from cruelties, especially against priests, but they had had to operate from foreign parts, such as England or East Friesland. Now, on April 1, 1572, they seized the port of Brill, at the mouth of the Maas. Soon after this they took Flushing, which commands the other great waterway, the Scheldt. Henceforth the rebels had a foothold of their own in the Netherlands. In comparison with this great fact it was of minor importance, though few saw it at the time, that an almost simultaneous movement of rebellion in the southern provinces was overpowered. William's brother Louis met with disaster in his seizure of Mons, from which the promised help of the French Huguenots was cut off by the massacre of St. Bartholomew. The co-operating army of William failed as his other armies had failed. Within three months of the capture of Brill Amsterdam was the only town still remaining to the Spaniards in the province of Holland. The States of Holland assembled and put the finances and administration of the rebels on a sound footing. When the south fell away after his and Louis's failure, William took up his residence at Delft. He had been converted to Lutheranism at an earlier stage, but was soon to throw in his lot with the Calvinists of Holland. Alva moved northwards to stamp out the rebellion. At Mechlin there were three days of butchery. The duke's son Don Frederick de Toledo sacked Zutphen and massacred the whole population of Naarden. But a new element was making its appearance in history: the burghers began to show a heroism with which the Spaniards could not cope. Haarlem held out all through the winter. On July 12, 1573, it surrendered: the townsfolk were spared, but the garrison, except the German merce-

naries, were killed to a man. At Alkmaar victory began: the dikes were cut and Don Frederick withdrew his army before the advancing inundations. In October Alva's fleet was defeated on the Zuider Zee and the admiral captured. On land his troops were unpaid and mutinous; he had lost the confidence of the king; on Dec. 18 he left Brussels, having served the master as badly as he had served the subjects.

**Requesens.**—His successor, Don Luis de Requesens, grand commander of Castile, arrived in Nov. 1573. Both sides were now ready for compromise. The south was suffering from the maritime war, but the north insisted on freedom of religious belief and the negotiations which were begun broke down in July 1574. Meanwhile the war had gone on, with serious reverses for the rebels but on the whole in their favour. In Feb. 1574 the fall of Middelburg ended the hold of the Spaniards on Zeeland; but on March 14 Louis of Nassau was defeated and killed at Mook Heath near Nijmwegen. The siege of Leyden was a turning-point. After enduring every extremity the town was at last relieved on Oct. 3 by ships which crossed the flooded countryside. This triumph was commemorated by the foundation of the university which soon made Leyden one of the famous places of the world. During the summer support had been falling away from the inefficient Requesens: only Hainault, Artois and Namur appeared at a meeting of the States-General. On the other hand the north set about strengthening its organization. Holland and Zeeland made an agreement for union, and entrusted William of Orange, their stadholder, with the command of the naval and military forces and the final appointment to all political and judicial offices and to vacant city magistracies.

The fighting was still not uniformly favourable to the north. In October the Spaniards Mondragon and Ulloa began the reconquest of the islands of Duiveland and Schouwen in Zeeland. But this availed little. On March 5, 1576, Requesens died and the council of state took over the Government. The fighting in Zeeland had used up all the money, so in July the troops there mutinied and marched into Brabant where they established themselves at Alost. Popular opinion turned against the council of state. The States of Brabant had troops in their service, and on Sept. 5 these arrested the members of the council in the name of the States, though not by their order.

**The Pacification of Ghent and Its Failure.**—William of Orange saw the chances of the moment and, with a picked body of troops, advanced into Flanders, occupied Ghent and entered into negotiations with the States-General. His overtures were favourably received, the council at Brussels was dissolved, and a conference was opened at Ghent on Oct. 19. While it was at work the news came of the Spanish Fury at Antwerp. On Oct. 3 the mutinous troops had marched thither from Alost, had overpowered the garrison and had sacked the greatest city of the Netherlands with barbarous ferocity. This news silenced all differences among the Netherlanders and on Nov. 8 there was signed the Pacification of Ghent.

This marked in a sense the zenith of the revolt; but the nobles of Brabant and Hainault were not under William's leadership, and the religious articles left the way open for a later split. The first problem was that of Don John of Austria. This famous man, bastard brother of the king and victor of Lepanto, had been appointed governor and had arrived at Luxembourg on the day of the Spanish Fury. Orange opposed his recognition as governor and persuaded the States-General to recognize him only on condition that he should accept the Pacification. Negotiations led to a deadlock. At this crisis the hands of Orange and the patriotic party were greatly strengthened by a new compact, the Union of Brussels (Jan. 1577), which was signed by all the provinces represented in the States-General. This engaged its signatories to unite in ejecting the foreign soldiery, in carrying out the Pacification, in recognizing Philip's sovereignty, and at the same time in maintaining the charters and constitutions which the king on his accession had sworn to observe. It added the north-east to the area which had accepted the Pacification; many signatories were Catholics. Luxembourg was left outside it. Faced by this opposition, Don John had to yield, and on Feb. 12 he signed the Perpetual Edict (ratified soon after by Philip) in which he accepted the programme of William of Orange, except that Catholicism was to be maintained.

On May 1 Don John made his state entry into Brussels, but only to find that he had no real authority. He wrote to Philip: "The prince of Orange has bewitched the minds of all men. They keep him informed of everything and take no resolution without consulting him." In July with some Walloon troops Don John suddenly left Brussels for Namur. This was practically a renewal of civil war. It alienated the States-General and the southern aristocrats, and on Sept. 23 William of Orange triumphantly returned to Brussels after an absence of ten years.

The unanimity on which this triumph was based did not last long: in October the States-General repudiated him as their leader. The prospect of success ended unity. The growth of Calvinism alarmed the Catholics. At the secret invitation of the Catholic nobles of the south headed by the duke of Aerschot there arrived in Brussels the archduke Matthias, brother of the emperor, and afterwards emperor himself. He was 20 years of age. On Jan. 18, 1578, he assumed the title of governor, which he nominally held till 1581.

**Alienation of the South.**—Philip, now thoroughly alarmed, sent Alexander Farnese with a veteran force of 20,000. With these Don John at Gemblours near Namur routed the rebel army. He became master of Louvain, Judoigne, Tirlemont, Aerschot, Bouvignes, Sichem, Nivelles, Roeux, Soignies, Binch, Beaumont, Walcourt, Maubeuge and Chimay. The malcontent Catholics now turned from Matthias to the duke of Anjou, formerly Alençon, who had invaded the Netherlands with a French force and seized Mons. At the same time John Casimir, brother of the elector palatine, at the invitation of the Calvinist party and with the secret financial aid of Queen Elizabeth, entered the country at the head of a body of German mercenaries from the east. In Ghent under his protection there were Calvinist excesses which alienated the southern Catholic nobles, the States-General and the town patriciates. Orange prevailed on Anjou to accept the title of "Defender of the liberties of the Netherlands," and Anjou promised, if the provinces would raise an army of 10,000 foot and 2,000 horse, to come to their aid with a like force. John Casimir and Anjou both left the Netherlands in the winter of 1578–79, the latter to return at a later stage of events. Meanwhile Don John had aroused the distrust of Philip by his dreams of invading England and marrying Mary Queen of Scots, and Philip cut off supplies. Don John died on Oct. 1, 1578.

On Jan. 5, 1579, the deputies of Hainault, Artois, Douai, formed themselves into a league for the defence of the Catholic religion, and, subject to his observance of the political stipulations of the Union of Brussels, professed loyal allegiance to the king. This league of Arras called forth the answering Protestant Union of Utrecht, the work of John of Nassau. Both were nominally under the Pacification of Ghent, but the signatories were cleanly divided by religion. At this point it is convenient to end the narrative of the history of the Netherlands, treating henceforth as separate political units the obedient provinces of the south and the seven northern provinces which had already as good as won their independence and were to maintain it as a republic. (*See* BELGIUM: *History,* and HOLLAND: *History.*)

BIBLIOGRAPHY.—The best short general accounts in English are G. Edmundson, *History of Holland* (1922) and the same writer's chapters in *Cambridge Modern History,* vol. i. c. xiii. (1902), vol. iii. c. vi. and vii. (1904): both works have bibliographies. For original authorities and books in the Dutch language *see* the excellent lists in I. H. Gosses and N. Japikse, *Handboek tot de staatkundige geschiedenis van Nederland* (The Hague, 1920), which is the best handbook, and P. J. Blok, *History of the People of the Netherlands,* 5 vols. (1898–1912), the standard work for the northern provinces; that for the southern is H. Pirenne, *Histoire de Belgique,* vols. i.–vii. (3rd ed., 1909–26) to which the same author's *Bibliographie de l'histoire de Belgique* is a companion. For the earlier part of the period E. Armstrong, *The Emperor Charles V.,* 2 vols. (2nd ed., London, 1910), is valuable. J. L. Motley, *The Rise of the Dutch Republic,* 3 vols. (1856 and many subsequent editions) is a classical work and still a popular favourite. Ruth Putnam, *William the Silent* (1911) is a brief modern biography; F. Rachfahl, *Margaretha von Parma* (Munich, 1898), an excellent work of the same class; the

same author's *Wilhelm von Oranien und der niederländische Aufstand,* 3 vols. (The Hague, 1906–24) is a minute study of the period down to 1569. (G. N. C.)

**NETHERSOLE, OLGA** (1870– ), English actress, of Spanish descent, was born in London, and made her stage début at Brighton in 1887. In 1888 she played with John Hare at the Garrick, London, and, after other engagements, in 1894 took the Court Theatre on her own account. She was manager at His Majesty's (1898), at the Adelphi (1902) and at the Shaftesbury (1904). She took the Théâtre Bernhardt, Paris, in 1907, appearing herself in leading rôles. She toured Australia and America, playing leading parts in modern plays, notably Clyde Fitch's *Sapho* (produced in London in 1902). Miss Nethersole worked during the World War on various Red Cross organizations. She was the founder in 1917 of the People's League of Health. In 1936 she was created C.B.E.

**NETHINIM,** the name given to the members of a class of assistants in the service of the temple of Jerusalem. In the Old Testament they are specially mentioned, and thus designated, only by the compiler of Chronicles-Ezra-Nehemiah (3rd century B.C.). The name means "given" or "dedicated," *i.e.,* to the temple; *cf.* Num. iii. 9, viii. 19, where the same term is applied to the Levites. In 1 Esdras and Josephus they are called ἱερόδουλοι, as are also the Levites in 1 Esdras i. 3. In the census lists compiled by the Chronicler, where a complete classification is desired, we find the order: Levites, singers, porters, Nethinim, *e.g.,* in Ezra ii. Of these classes, the first three are of equal rank; the singers and porters are Levites (1 Chr. ix. 2, Neh. xi. 3, 15–18, xiii. 22, etc.), though sometimes expressly distinguished from them, when the special duties of the several orders are thought of (2 Chr. xxxv. 15, Ezra ii. 70, etc.). In the time of the Chronicler the Nethinim were free men and members of the Israelite community. They were registered by families and were exempt from taxation. Like the priests and Levites they served in rotation, being assigned to a certain portion of Jerusalem (Ophel), and also to neighbouring Levitical cities or villages. In Neh. x. 29 *seq.* they join in the solemn covenant, promising among other things not to intermarry with "the peoples of the land."

It is generally supposed, and not without good reason, that the Nethinim had their origin in a class of foreign menials (slaves) employed in the temple. In the time of the Chronicler it was customary to describe the Nethinim as "those given by David for the Levitical service" (Ezra viii. 20), and similar to this is the designation of one portion of them as the "children of Solomon's servants" (Ezra ii. 55, Neh. vii. 57, xi. 3). (C. C. T.)

**NETLEY,** a village in Hampshire, England, 3 mi. S.E. of Southampton, and on a branch of the S.Ry. Pop. of ecclesiastical parish (1931) 2,074. A Cistercian abbey was founded in 1237 by Henry III; its ruins include a great part of the cruciform church, abbot's house, chapter house and domestic buildings. The style is Early English and Decorated. The gatehouse was transformed into a fort in the time of Henry VIII. Netley Hospital for wounded soldiers, built after the Crimean War, is one of the principal military hospitals in Great Britain.

**NETSCHER, GASPAR** (1639–1684), German portrait and genre painter, was born at Heidelberg in 1639. As a boy he was adopted by a physician named Tullekens, who placed him under an artist named de Koster, and afterwards under Ter Borch. He then went to Italy, but finally settled at Bordeaux, where he made a living by painting the small cabinet pictures which are now so highly valued on account of their exquisite finish. After removing to The Hague, he turned his attention to portrait-painting, which proved more lucrative and he was soon able to gratify his own taste by depicting the musical and conversational pieces which fully displayed his genius. These possess easy yet delicate pencilling, brilliant and correct colouring and pleasing light and shade although frequently their refinement passes into weakness. His sons, Constantyn (1668–1722) and Theodorus (1661–1732), were also painters, after their father's style but inferior in merit.

**NETTLE,** the common name for the plants of the botanical genus *Urtica,* which gives its name to the family Urticaceae. It contains about 30 species found in the temperate parts of both hemispheres. They are herbs covered with stinging hairs, and with very small, greenish, unisexual flowers on the same or on different plants. The stinging hairs consist of an elongated tubular cell the extremity of which is finely pointed. By this point the hair penetrates the skin, breaks off and its contents pass out. The fluid contains formic acid and has a temporary irritant effect. Nettle tops, or the very young shoots of the nettle, may be used as a vegetable like spinach; but from the abundance of crystals (*cystoliths*) they contain they are apt to be gritty. The fibre furnished by the stems of several species is used for cordage or paper-making. Three species of nettle are wild in the British Isles: the common or great nettle (*U. dioica*), which is a hairy perennial with staminate and pistillate flowers in distinct plants; the small nettle (*U. urens*), which is annual and, except for the stinging hairs, glabrous, and has staminate and pistillate flowers in the same panicle; and the Roman nettle (*U. pilulifera*), an annual with the pistillate flowers in rounded heads, which occurs in waste places in the east of England, chiefly near the sea—the most virulent British species.

In North America, where the small nettle has become naturalized locally and the great nettle, from Newfoundland to Colorado and southward, there are several native nettles. Among these are the tall nettle (*U. gracilis*), found across the continent northward; the weak nettle (*U. chamaedrioides*), of the south-eastern States; the hoary nettle (*U. holosericea*), found from Idaho and Washington to Lower California. Closely allied are the wood nettle (*Laportea canadensis*), of the eastern United States, and the western nettle (*Hesperocnide tenella*), of California, both of which also produce stinging hairs.

**NETTLERASH:** *see* URTICARIA.

**NETTLESHIP, HENRY** (1839–1893), English classical scholar, was born at Kettering on May 5, 1839. He was educated at Lancing, Durham and Charterhouse schools, and Corpus Christi college, Oxford. He was a master at Harrow and later professor of Latin at Oxford, where he died on July 10, 1893. He specialized in the study of Virgil. After Conington's death in 1869, he saw his edition of Virgil through the press, and revised and corrected subsequent editions. In 1887 he published some of the results of 12 years' labour on a Latin lexicon (never completed) in a volume entitled *Contributions to Latin Lexicography.* The second series of his *Lectures and Essays,* published in 1895, and edited by F. Haverfield, contains a memoir by Mrs. M. Nettleship, with full bibliography.

**NETTLESHIP, RICHARD LEWIS** (1846–1892), English philosopher, was born on Dec. 17, 1846, and educated at Uppingham and Balliol college, Oxford. He won the Hertford scholarship, the Ireland, the Gaisford Greek verse prize, a Craven scholarship and the Arnold prize, but took only a second class in Litterae Humaniores. He became fellow and tutor of his college and succeeded to the work of T. H. Green, whose writings he edited with a memoir (1880). His philosophy was idealistic and Hegelian. He died on Aug. 25, 1892, from the effects of exposure on Mont Blanc, and was buried at Chamonix.

Besides his edition of Green's works, Nettleship published *The Theory of Education in Plato's Republic* (1880). His *Philosophical Lectures and Remains* were edited by A. C. Bradley (1897, 2nd ed., 1901), the *Lectures on the Republic of Plato* being printed separately in 1898 (2nd ed., 1901).

**NETTLE-TREE,** the name applied to certain trees of the genus *Celtis,* belonging to the elm family (Ulmaceae). The best-known species have usually obliquely ovate, or lanceolate leaves, serrate at the edge, and marked by three prominent nerves. The flowers are inconspicuous, with a 4- or 5-parted perianth, as many stamens, a hairy disk and a 1-celled ovary with a 2-parted style. The fruit is succulent, drupe-like, a character which serves to separate the genus alike from the nettles and the elms, to both of which it is allied. *C. australis* is a common tree, both wild and planted, throughout the Mediterranean region extending to Afghanistan and the Himalayas; it is also cultivated in Great Britain. It is a rapidly growing tree, from 30 to 40 ft. high, with a remarkably sweet fruit, recalling a small black cherry, and was one of the plants to which the term "lotus" was applied

by Dioscorides and the older authors. The wood, which is compact and hard, is used for a variety of purposes. *C. occidentalis,* a North American species, is the hackberry (*q.v.*).

**NEU-BRANDENBURG,** a town of Germany, in Mecklenburg, on the Tollense See at the mouth of the Tollense, 58 m. W.N.W. of Stettin by rail. Pop. (1939) 22,275. Neu-Brandenburg was founded in 1248, and has belonged to Mecklenburg since 1292. It is partly surrounded with walls, and possesses four old Gothic gates, dating from about 1300. The principal buildings are the Marienkirche, a 13th century Gothic building, the former grand ducal palace, and the palace of Belvedere.

**NEUBREISACH:** *see* NEUF-BRISACH.

**NEUBURG,** a town in the *Land* of Bavaria, situated on the Danube 12 m. W. of Ingolstadt by rail. Pop. (1933) 7,670. Neuburg was originally an episcopal see. In the 10th century it passed to the counts of Scheyern, and through them to Bavaria, being ceded to the Rhenish Palatinate in 1507. From 1557 to 1742 it was the capital of a small principality ruled by a cadet branch of the family of the elector palatine of the Rhine. In 1742 it was united again with the Rhenish Palatinate, with which it passed in 1777 to Bavaria. Its most important building is the old residence of its princes, in 16th century Renaissance style.

**NEUCHÂTEL** (Ger. *Neuenburg*), one of the cantons of western Switzerland, on the frontier towards France. It is the only Swiss canton that is situated entirely in the Jura, of which it occupies the central portion (its loftiest summit is the Mont Racine, 4,731 ft. in the Tête de Rang range). The canton has a total area of 305 sq.m., of which more than three quarters are reckoned "productive." It consists, for the most part, of the longitudinal ridges and valleys characteristic of the Jura, while its drainage is very unequally divided between the Thièle or Zihl, and the Doubs, which forms part of the north-west boundary of the canton, and receives only the streams flowing from the Le Locle and La Chaux de Fonds valley. Three regions make up the territory. That stretching along the shore of the lake is called *Le Vignoble* (from its vineyards) and extends from about 1,500 ft. to 2,300 ft. above the sea-level. An intermediate region is named *Les Vallées,* for it consists of the two principal valleys of the canton (the Val de Ruz, watered by the Seyon, and the Val de Travers, watered by the Areuse) which lie to a height of about 2,300 ft. to 3,000 ft. above the sea-level. The highest region is known as *Les Montagnes,* and is mainly composed of the long valley in which stand the industrial centres of La Chaux de Fonds (*q.v.*), and Le Locle (*q.v.*) to which must be added those of La Sagne, Les Ponts and Les Verrières, the elevation of these upland valleys varying from 3,000 ft. to 3,445 ft. The canton is well supplied with railways, the direct line from Berne past Kerzers (Chiètres), Neuchâtel, the Val de Travers and Les Verrières to Pontarlier for Paris passing through it, while La Chaux de Fonds is connected by a line past Le Locle with Morteau in France. Other lines join the capital, Neuchâtel, to La Chaux de Fonds, as well as to Yverdon at the south-west extremity of the lake, and to St. Blaise at its north-east end.

The population declined in the 20th century: (1920) 131,349; (1930) 124,324; (1941) 117,994. In 1930 105,516 were French-speaking, 15,248 German-speaking and 2,888 Italian-speaking, while 100,548 were Protestants, 13,720 Roman Catholics and 436 Jews. There are three "established and state-endowed" churches, the National Evangelical, the Roman Catholic and the Old Catholic (this sect in La Chaux de Fonds only), while the pastors of the Free Evangelical church and of the Jews (mostly in La Chaux de Fonds) receive special privileges.

Besides the capital, Neuchâtel (*q.v.*), the chief towns are La Chaux de Fonds, Le Locle and Fleurier, the principal village in the Val de Travers.

The most valuable mineral product is asphalt, of which there is a large and rich deposit in the Val de Travers. The wine of the Vignoble region is plentiful. Absinthe is manufactured in the Val de Travers.

The most characteristic industry is that of watch-making, which is chiefly carried on (since the early 18th century) in the highland valleys of La Chaux de Fonds and of Le Locle, as well as at Fleurier in the Val de Travers.

The canton is divided into 6 administrative districts, which comprise 63 communes.

The legislature or *Grand Conseil* consists of members elected in the proportion of population and holds office for three years.

The canton in 1941 sent six representatives (elected for a term of four years) to the *Nationalrat,* lower chamber of the national parliament. It sends two members to the upper chamber.

**History.**—We first hear of the *novum castellum* (Neuchâtel) in the will (1011) of Rudolf III., the last king of Burgundy, on whose death (1032) that kingdom reverted to the empire. About 1034 the emperor Conrad II. gave this castle to the lord of several neighbouring fiefs, his successors establishing themselves permanently there in the 12th century and taking the title of "count." In 1288 the reigning count resigned his domains to the emperor Rudolf, who gave them to the lord of Châlon-sur-Saône, by whom they were restored to the count of Neuchâtel on his doing homage for them. This act decided the future history of Neuchâtel, for in 1393 the house of Châlon succeeded to the principality of Orange by virtue of a marriage contracted in 1388. The counts gradually increased their dominions, so that by 1373 they held practically all of the present canton, with the exception of the lordship of Valangin which was held by a cadet line of the house till bought in 1592. In 1532 the title of "prince" was taken by the reigning count, while by the treaty of Westphalia (1648) the principality became sovereign and independent of the empire. In 1707 the Longueville house of Neuchâtel also became extinct, and a great struggle arose as to the succession. Finally the parliament (states) of Neuchâtel decided in favour of Frederic I., the first king of Prussia. The nominal rule of the Prussian king (for the country enjoyed practical independence) lasted till 1857, with a brief interval from 1806 to 1814, when the principality was held by Marshal Berthier, by virtue of a grant from Napoleon. In 1814 its admission into the Swiss confederation was proposed and was effected in 1815, the new canton being the only non-republican member, just as the hereditary rulers of Neuchâtel were the last to maintain their position in Switzerland. This anomaly led in 1848 to the establishment (attempted in 1831) of a republican form of government, brought about by a peaceful revolution led by A. M. Piaget. A royalist attempt to regain power in 1856 was defeated, and finally, after long negotiations, the king of Prussia renounced his claims to sovereignty, though retaining the right to bear the title of "prince of Neuchâtel." Thus in 1857 Neuchâtel became a full republican member of the Swiss confederation.

BIBLIOGRAPHY.—F. de Chambrier, *Histoire de Neuchâtel et de Valangin jusqu'à l'avènement de la maison de Prusse, 1707* (Neuchâtel, 1840); A. Piaget, *Documents inédits sur la Reformation dans le pays de Neuchâtel* (Neuchâtel, 1909); P. de Vargas, *L'Affaire de Neuchâtel 1856–57* (Lausanne, 1913); A. Chapuis, *Histoire de la Pendulerie neuchâteloise* (1917); A. Piaget, *Histoire de la Révolution neuchâteloise* vol. i. (Neuchâtel, 1919). *See* also *Musée Neuchâteloise* published by the Neuchâtel Société Cantonale d'Histoire 1864 etc.; and the second series of publications, 1923.

**NEUCHÂTEL,** capital of the above Swiss canton, situated near the north-east corner of the lake of Neuchâtel. In 1930 it had 22,668 inhabitants, the greater portion of whom were French-speaking and Protestant, with a minority of German-speaking inhabitants and Roman Catholics, and a small number of Jews. It is the meeting-point of several important railway lines. The older portion of the town is built on the steep slope of the Chaumont (3,855 ft.), and originally the waters of the lake bathed the foot of the slope. But the gradual growth of alluvial deposits, and more recently the artificial embankment of the shore of the lake, have added much dry ground, and on this site the finest modern buildings have been erected. The 16th century castle and the 13th century collegiate church of Notre Dame (now Protestant) stand close together, and were founded in the 12th century when the counts took up their permanent residence in the town, to which they granted a charter of liberties in 1214. Among the buildings on the quays are the Musée des Beaux Arts (modern Swiss paintings and various historical collections, including that

of Desor relating to the Lake Dwellings), the Gymnase (in which are also the museum of natural history, with the fine collections of Agassiz, and the town library), the university and the École de Commerce. The town owes much to the gifts of citizens.

**NEUCHÂTEL, LAKE OF.** The lakes of Neuchâtel, Bienne and Morat, connected by canals, are survivors of a former great lake of the lower Aar valley. It is the largest lake wholly in Switzerland. Its total area is 92½ sq.m. (36½ sq.m. are in the Canton of Neuchâtel over 33 sq.m. in Vaud, 20¾ sq.m. in Fribourg and in Berne 2 sq.m.). It is about 23½ m. long, from 3¾ to 5 m. wide, its greatest depth is 502 ft., while its surface is 1,427 ft. above sea level. The Thièle or Zihl river enters at its south-western end and issues from it at its north-eastern end, but it also receives the Areuse (N.W.), Seyon (N.W.) and the Broye (N.E.). On the south-eastern shore the picturesque and historic little town of Estavayer is the chief place. At the south-western extremity of the lake is Yverdon (the *Eburodunum* of the Romans and the residence of Pestalozzi, 1806–1825). Far more populated is the northwestern shore, where from southwest to northeast, we find Grandson, Cortaillod, Serrières and Neuchâtel itself. On the north shore is La Tène.

**NEUENDORF:** *see* NOWAWES.

**NEUF-BRISACH** or **NEUBREISACH,** a town of France in the department of Haut-Rhin on the Rhine-Rhone canal, 12 mi. E. from Colmar by the railway to Freiburg. Pop. (1936) 2,150. Neuf-Brisach is a garrisoned fortress town founded by Louis XIV in 1699 and fortified by Vauban. It was taken by the Germans on Nov. 10, 1870, and became French once more in 1918.

**NEUFCHÂTEAU,** a town of eastern France, in the department of Vosges at the confluence of the Meuse and the Mouzon, 49 mi. W.N.W. of Épinal by rail. Pop. (1936) 4,083. The town, which is said to occupy the site of the Roman *Neomagus,* belonged in the middle ages to the dukes of Lorraine, ruins of whose château are still to be seen. In 1641 it passed to France. The churches are those of St. Christopher (13th and 15th centuries) and St. Nicholas, the latter combining the Romanesque and Gothic styles and built above a Romanesque crypt.

**NEUHOF, THEODORE STEPHEN,** BARON VON (*c.* 1690–1756), German adventurer and for a short time nominal king of Corsica, was the son of a Westphalian nobleman and was born at Cologne. Educated at the court of France, he served first in the French army, and then in that of Sweden. Baron de Goertz, minister to Charles XII, realizing Neuhof's capacity for intrigue, sent him to England and Spain to negotiate with Cardinal Alberoni. He returned to Sweden and then went to Spain, where he was made colonel and married one of the queen's ladies-in-waiting. Deserting his wife soon afterwards he repaired to France and became mixed up in Law's financial affairs; then he wandered about Portugal, Holland and Italy, and at Genoa he made the acquaintance of some Corsican prisoners and exiles, whom he persuaded that he could free their country from Genoese tyranny if they made him king of the island. With their help and that of the bey of Tunis he landed in Corsica in March 1736, where the islanders, believing that he had the support of several of the powers, proclaimed him king. He assumed the style of Theodore I, issued edicts, instituted an order of knighthood and waged war on the Genoese, at first with some success. But he was eventually defeated, and civil broils soon broke out in the island; the Genoese having put a price on his head and published an account of his antecedents, he left Corsica in Nov. 1736, ostensibly for foreign assistance. He returned to the island in 1738, 1739 and 1743, but the combined Genoese and French forces drove him out. Arrested for debt in London he regained his freedom by mortgaging his "kingdom" of Corsica and subsisted on the charity of Horace Walpole and other friends until his death in London on Dec. 11, 1756.

See *Mémoires pour servir à l'histoire de la Corse,* by his son, Frederick, also an English translation, both published in London in 1768. In 1795 he published a new edition on *Description of Corsica with an account of its union to the crown of Great Britain. See* also Fitzgerald, *King Theodore of Corsica* (1890) and Le Glay, *Théodore de Corse* (1907).

**NEUILLY, TREATY OF.** The Bulgarian treaty was signed at Neuilly on Nov. 27 1919, and came into force on Aug. 9 1920. In the main it is the same as the Austrian treaty. But there were important differences in the military and naval clauses, and also in reference to reparation and finance.

The only serious territorial changes were to the west and south. The Serb-Croat-Slovene kingdom obtained several strategic ratifications. The two most important are that the Strumitsa salient in the extreme south-west has been flattened out, the western half being ceded to the Serbs; also, and more important, in the Nish-Pirot area the town of Tsaribrod has been taken from Bulgaria and a line drawn whereby an advance on Nish would be rendered more difficult. The frontier, however, confers no offensive advantage on the Serbs. A loss more serious in another sense is that to Greece of the district of Western Thrace, lying between Xanthi and the Maritsa river. This was ceded to Greece on her obtaining Eastern Thrace and Adrianople. Bulgaria, for ethnic reasons, received a slight extension of territory west of Adrianople. The expulsion of Greeks from Adrianople and East Thrace by the Turks did not, however, cause the Allies to change their minds about Western Thrace, which remains annexed to Greece and is denied to Bulgaria.

Bulgaria had always asserted claims to that part of Macedonia now in Serbian hands, and also to Eastern and Western Thrace. In the former area her ethnic pretensions are better founded than in the latter. But Serbian Macedonia is in the hands of a formidably armed and militarily strong nation. Greek Macedonia and Thrace are now populated by hundreds of thousands of Greek refugees from Asia, and contain over 80% of a purely Greek population. In population Bulgaria lost some 300,000 persons, of whom some are not Bulgars.

*Part IV.* The military, naval and air clauses have some special points. Bulgaria is allowed 20,000 regulars, 10,000 gendarmes and 3,000 frontier guards, or 33,000 in all. This number is insufficient to maintain order in a turbulent Balkan State, and the subsequent serious disturbances in Bulgaria are due directly to this fact. It is increased by the difficulty of applying the voluntary long-service system of 12 consecutive years to a nation of peasants. In an agricultural country it is practically impossible to get men to leave their farms for 12 years, and the army is always likely to be dangerously below strength, and the less regular formations dangerously above it. The naval clauses do not differ from those of the German or Austrian treaties. All Bulgaria's navy has now been destroyed, and she was left with four torpedo-boats, of which three were damaged, and six motor-boats, of which four were damaged.

*Part V.* (*Prisoners of War and Graves*) and

*Part VI.* (*Penalties*) are the same as in the Austrian treaty (*see* ST. GERMAIN, TREATY OF).

*Part VII.* (*Reparation.*) This contains the most novel and interesting feature of the treaty, and is, in fact, the only serious attempt to get reparation on to a business basis. It contained three features of great interest.

(*a*) Contrary to the practice in the German, Austrian and Hungarian treaties, there was no attempt made to seize or distribute the Bulgarian commercial fleet on the "ton-for-ton" or "class-for-class" principle.

(*b*) It fixed the amount to be paid at the lump sum of £90,000,000.

(*c*) It created a Reparation Commission consisting of French, British and Italian representatives with power to reduce this amount by a simple majority vote (not by unanimity as is the systematic rule), on the suggestion of the inter-allied Commission.

The general scope and powers of the Reparation Commission are drawn in such a manner as to control the finances of the country sufficiently to obtain reparation, without offensive interference. In the end, the Reparation Commission, after examining the question on the spot, has practically remitted three-quarters of the total of £90,000,000. The annual sum now required to meet the charges on the 550,000,000 gold francs of the debt is well within the capacity of the new Bulgarian State, and is being punctually paid. None of the remaining clauses of the Bulgarian treaty have any special features of interest or importance.

(*See* BULGARIA; PARIS, CONFERENCE OF; REPARATION, etc.).

BIBLIOGRAPHY.—H. W. V. Temperley, ed., *History of Peace Conference,* vol. iv. and v. (1921); *Text of Treaty, Parliamentary Papers* (Treaty Series, 1920), No. 5 Cmd. 522.

**NEUILLY-SUR-SEINE,** a suburb of Paris 8 kilometres northwest from Notre Dame, in the department of Seine. It is situated between the fortifications and the Seine. Pop. (1936) 56,938. A castle at Neuilly, built by the count of Argenson in the 18th century, ultimately became the property and favourite residence of the duke of Orléans (Louis Philippe), the birthplace

of nearly all his children and the scene of the offer of the crown in 1830. The buildings were pillaged and burned by the mob in 1848. The park, which extended from the fortifications to the river, as well as the neighbouring park of Villiers (also belonging to the princes of Orleans), was broken up into building lots, and is occupied by many small middle-class houses and a few fine villas. The fine bridge, designed in the 18th century by Perronet, is noteworthy as the first level bridge constructed in France. The Galignani institution, founded by the brothers Galignani for aged book-sellers, printers and others, has accommodation for 100 residents. The manufactures include perfumery, chocolate, colours, varnish, automobiles, carpets; Neuilly is an engineering centre.

**NEUMANN, FRANZ ERNST** (1798–1895), German mineralogist, physicist and mathematician, was born at Joachimstal on Sept. 11, 1798. Neumann's earlier papers on crystallography led to his appointment as Privatdozent at Königsberg, where in 1828 he became extraordinary, and in 1829 ordinary professor of mineralogy and physics. In 1831, from a study of the specific heats of compounds, he formulated "Neumann's law" (that "the molecular heat of a compound is equal to the sum of the atomic heats of its constituents"). Devoting himself next to optics, he produced memoirs which entitle him to a high place among the early searchers after a dynamical theory of light. In 1832, by the aid of a particular hypothesis as to the constitution of the ether, he reached results agreeing with those obtained by A. L. Cauchy, and succeeded in deducing laws of double refraction resembling those of A. J. Fresnel. He made contributions to the mathematical theory of electrodynamics, and in papers published in 1845 and 1847 established mathematically the laws of the induction of electric currents. His last publication was on spherical harmonics (*Beiträge zur Theorie der Kugelfunctionen*, 1878). He died at Königsberg on May 23, 1895.

**NEUMANN** (originally BAMBERGER), **KARL FRIEDRICH** (1793–1870), German orientalist, was born at Reichsmannsdorf, near Bamberg, on Dec. 28, 1793. He studied philosophy and philology at Heidelberg, Munich and Göttingen. From 1822 to 1825 he was a teacher at Spires; then he learned Armenian in Venice and visited Paris and London. In 1829 he went to China, where he amassed a library of about 12,000 valuable books and manuscripts, which he presented to the royal library at Munich. In 1831 Neumann became professor of Armenian and Chinese at Munich. In 1852 he was removed from his chair on account of his revolutionary views. He died in Berlin on March 17, 1870.

Neumann wrote *Geschichte des englischen Reichs in Asien* (Leipzig, 1851); *Geschichte der Vereinigten Staaten von Amerika* (Berlin, 1863–1866); *Versuch einer Geschichte der armenischen Literatur* (Leipzig, 1836); *Die Völker des südlichen Russland* (1846, and again 1855); and several translations from the Chinese. The journal of the Royal Asiatic Society (London, 1871) contains a full list of his works.

**NEUMES,** the signs employed in Western musical notation before the introduction of the staff. (Gr. *νεῦμα*, a sign). They were, in the first instance, merely rough expression marks placed over the words, to guide the singers of the plainsong melodies, the melodies themselves being learned by ear, and hence they gave no indication as to the pitch or time-relations of the notes. Gradually, however, they became more and more elaborate and precise, then their positions on the paper were varied to indicate pitch, though at first without the employment of lines; subsequently lines were introduced, and so, step by step, the whole present-day system was evolved. (*See* MUSICAL NOTATION.)

**NEUMÜNSTER,** a town in the Prussian province of Schleswig-Holstein, Germany, lies on the Schwale, 40 mi. N. of Altona-Hamburg by rail, and at the junction of lines to Kiel, Vamdrup (Denmark) and Tönning. Pop. (1939) 52,719. The name, which was originally Wipendorp, is derived from an Augustine monastery, founded in 1130, and is mentioned as *novum monasterium* in a document of 1136. Its industrial importance began in the 17th century, when the cloth-workers of Segeberg, a town to the south-east, migrated to it. It became a town in 1870. It is, after Altona, the most important industrial town in the province.

**NEUNKIRCHEN** or OBER-NEUNKIRCHEN, a town in the Saarland territory, Germany, on the Blies, 12 mi. N.E. of Saarbrücken. Pop. (1939) 39,866, consisting almost equally of Protestants and Roman Catholics. The town is first mentioned in 1280, and became important industrially during the 18th century. The principal industrial establishment is an iron-foundry. Around the town are important coal mines. The castle built in 1570 was destroyed in 1797.

**NEUQUÉN,** an inland territory of Argentina on the Chilean frontier, between the Colorado and Limay rivers, with the province of Mendoza on the north and the territory of Río Negro on the east and south. Area, 36,324 sq.mi. Pop. (1942 est.) 78,500. The greater part of the territory is mountainous, with fertile, well-watered valleys and valuable forests. The eastern part, however, contains large plains, showing only stunted vegetation, and having numerous saline deposits. The long droughts that prevail in this region have deterred agricultural settlement. Nevertheless agriculture and stock raising provide the chief sources of wealth, Neuquén ranking third among the states in the production of goats in 1937. The Neuquén, which unites with the Limay near the 68th meridian to form the Río Negro, is the principal river of the territory. The largest of a group of beautiful lakes in the higher Andean valleys is the celebrated Nahuel Huapí (Lion Grass), which has an area of 216 sq.mi., and which lies partly in the southwest angle of the territory, partly in Río Negro, and partly in the republic of Chile. It is the source of the Río Limay and receives the overflow from two smaller neighbouring lakes.

The temperature of the Andean region is cold even in summer, but on the lower plains it is hot in summer. The territory is reached by a light-draught river steamer which ascends the Río Negro to Neuquén, the capital, at the confluence of the Limay and Neuquén, and by a branch of the Great Southern railway from Bahía Blanca to Zapala, via Neuquén. The population is concentrated in a few small towns on the rivers and in some colonies, in the fertile districts of the Andes. The capital, founded Sept. 12, 1904, has a population (1940 est.) of about 7,500.

**NEURALGIA,** a term generally used to indicate pain affecting a particular nerve or its branches from any cause. The existence of neuralgia usually betokens a depressed or enfeebled state of health. It is often found to affect the hereditarily rheumatic or gouty. In weakened conditions from improper or insufficient food, in anaemia from any cause, and in syphilis or malaria, neuralgia is a frequent concomitant. The pain is often localized, but may come to extend beyond the area of its first occurrence. It is usually paroxysmal, not unfrequently periodic; occurring at a certain time of the day or night, varies in intensity, and may be agonizing or less severe and tingling. Perverted nerve function may co-exist with or following neuralgia. Thus there may be hyperaesthesia, anaesthesia, paralysis or alterations of nutrition, such as wasting of muscles, whitening of the hair, etc.

The commonest forms of neuralgia are facial neuralgia or tic douloureux, intercostal neuralgia and sciatica.

**Facial Neuralgia** (or *tic douloureux*) affects the great nerve of sensation of the face (fifth nerve), and may occur in one or more of its three divisions. It is usually confined to one side. When the ophthalmic division of the nerve is involved the pain is mostly felt in the forehead and side of the head. It is often intensely sharp, cutting or burning, either constant or with exacerbations, and often periodic. The skin over the affected part is often red and swollen, and, even after the attack has abated, feels stiff and tender to the touch. In this, as in all forms of neuralgia, at certain localities the pain is more intense, these "painful points" usually being where the branches of the nerves emerge from bony canals or pierce the fascia to ramify in the skin. Hence, in this form, the greater severity of the pain above the eyebrow and along the side of the nose. There is also pain in the eyelid, redness of the eye, and flow of tears. When the maxillary division of the nerve is affected the pain is chiefly in the cheek and upper jaw, the painful points being immediately below the lower eyelid, over the cheek bone and about the upper lip. When the mandibular division of the nerve suffers the pain affects the lower jaw, and the chief painful points are in front of the ear and about the chin.

**Intercostal neuralgia** is pain affecting the nerves which emerge from the spinal cord and run along the spaces between the ribs to the front of the body. It affects the left side more than the right, is much more common in women than in men, and occurs generally in enfeebled states of health. It might be mistaken for pleurisy or some inflammatory affection of the lungs; but the absence of chest symptoms, its occurrence independently of respiration and other considerations establish the distinction. The specially painful points are chiefly at the commencement of the nerve as it issues from the spinal canal, and at the extremities towards the front of the body, where it breaks up into filaments which ramify in the skin. This form of neuralgia occasionally precedes or follows an attack of shingles (*Herpes zoster*).

**Sciatica** is another common form of neuralgia. It affects the great sciatic nerve which emerges from the pelvis and runs down the leg to the foot. It is often traceable to cold or damp, to overuse of the limbs in walking, etc. Any source of pressure upon the nerve within the pelvis, *e.g.*, pregnancy, a tumour or even constipation, may excite an attack of sciatica. It is often connected with a rheumatic or gouty constitution. In general the nerve of one side only is affected. The pain which is felt at first a little behind the hip-joint steadily increases in severity and extends along the course of the nerve and its branches, perhaps, down to the toes. The specially painful points are about the knee and ankle joints; besides which a feeling of numbness is experienced throughout the whole limb. In severe cases all movement of the limb aggravates the pain, and the patient is obliged to remain in bed. In prolonged attacks the limb may waste and be drawn up and fixed in one position. Attacks of sciatica are often attended with great suffering, and are apt to be very intractable to treatment.

**Treatment.**—In the treatment of all forms of neuralgia it is of first importance to determine if possible any underlying cause. When the attack is periodic the administration of a large dose of quinine two or three hours previous to the usual time of the seizure will often mitigate, and may even prevent the paroxysm. Many topical applications are of great efficacy. Liniments containing opium, belladonna or aconite rubbed into the affected part will often soothe the most severe local pain. And antipyrin, phenacetin, aspirin and similar analgesics are commonly taken. The plan at one time resorted to of dividing or excising a portion of the affected nerve is now seldom employed, but the operation of nerve-stretching in some forms of neuralgia, notably sciatica, is sometimes successful. Such an operation is justifiable only in cases where other less severe measures have failed to give relief. Electricity proves serviceable in many instances. In the severest forms of tic douloureux complete relief has followed extirpation of the Gasserian ganglion. (F. W. Mo.)

**NEURASTHENIA,** a medical term for weakness of the nervous system. The symptoms may present themselves as follows: (1) general feeling of malaise, combined with a mixed state of excitement and depression; (2) headache, sometimes with the addition of vertigo, deafness and a transitory clouding of consciousness simulating *petit mal* or *migraine;* (3) disturbed and restless, unrefreshing sleep, often troubled with dreams; (4) weakness of memory, especially for recent events; (5) blurring of sight, noises or ringing in the ears; (6) variable disturbances of sensibility, especially scattered analgesia (partial and symmetrical) affecting the backs of the hands especially, and in women the breasts; (7) various troubles of sympathetic origin, notably localized coldness, particularly in the extremities, morbid heats, flushings and sweats; (8) various phenomena of nervous depression associated with functional disturbances of organs.

According to the complexity of symptoms, the neurasthenia is more particularly defined as cerebral, spinal, gastric and sexual. The cerebral form is sometimes termed *psychasthenia,* and is liable to present morbid fears or phobias, *e.g.*, agoraphobia (fright in crowds), monophobia (fright of being alone), claustrophobia (fright of being in a confined place), anthropophobia (fright of society), batophobia (fright of things falling), siderodromophobia (fright of railway travelling). There may also be mental ruminations, in which there is a continuous flow of connected ideas from which there is no breaking away, often most insistent at night and leading to insomnia. Sometimes there is arithmomania (an imperative idea to count). Such cases often exhibit a marked emotionalism and readily manifest joy or sorrow; they may be cynical, pessimistic, introspective and self-centred, only able to talk about themselves or matters of personal interest, yet they frequently possess great intellectual ability, and there is an absence of the insane ideas characteristic of melancholia.

*Traumatic neurasthenia* is the neurasthenia following shock from injury; it is sometimes termed "railway spine," "railway brain," from the frequency with which it occurs after railway accidents, especially in people of a nervous temperament. The physical injury at the time may be slight, so that the patient is able to resume work, but symptoms develop later which may simulate serious organic disease. As in all forms of neurasthenia, the subjective symptoms may be numerous and varied, whereas the objective signs are but few and slight. Many difficulties, therefore, present themselves in arriving at a sound opinion as to the future in such cases. "Shell-shock" (*q.v.*) is a modern variant of neurasthenia occasioned by war conditions. The treatment of neurasthenia is largely psychical and if carried out systematically is often very successful (*see* PSYCHOTHERAPY). (F. W. Mo.)

BIBLIOGRAPHY.—T. A. Ross, *The Common Neuroses* (1923); I. G. Cobb, *A Manual of Neurasthenia,* bibl. (1920); Sir M. Craig, *Nerve Exhaustion* (1922); H. S. Stannas, "Tropical Neurasthenia," *Med. Press,* cxxiii., 381 (1927); E. F. Buzzard, "Traumatic Neurasthenia," *Ment. Hyg.,* viii., 425 (1924); E. S. Reynolds, "Hysteria and Neurasthenia," *Brit. Med. Journ.,* ii., 1,193 (1923). For U.S. Bibliography.—Peterson, Frederick *Cecil's Textbook* W. B. Saunders Co., 1927, pp. 1419–1426.

**NEURITIS,** a term denoting inflammation of nerve fibres. Two varieties are known, the localized and the multiple. The localized form frequently follows exposure to cold and may attack a single nerve. Facial paralysis (Bell's palsy) is commonly seen following a neuritis of the facial nerve. Neuritis may follow blows and wounds, stretching or long-continued pressure, as in a dislocation of the elbow joint, or the nerve may be involved in a neighbouring inflammation. The first symptom of a localized neuritis is boring pain along the course of a nerve and its distribution, the part being sensitive to pressure.

Multiple neuritis or polyneuritis may affect many of the peripheral nerves symmetrically and at the same time. For the pathological changes *see* NEUROPATHOLOGY. The causes may be divided as follows: (1) The toxins of acute infective diseases, such as diphtheria, influenza, typhoid fever, malaria, scarlet fever and septicaemia. (2) Acute or chronic poisoning by lead, arsenic, mercury, copper and phosphorus. (3) General disorders: gout, rheumatism, tubercle, carcinoma. (4) The local action of leprosy and syphilis. (5) Endemic disease: beri-beri (*q.v.*). (6) Alcohol, the most common. Alcoholic neuritis is a result of constant steady drinking, particularly of beer. It begins with numbness of the feet and later of the hands, then painful cramps in the legs appear and there is pain on moving the limbs, and superficial tenderness is occasionally present. In other cases the earliest symptoms are weakness of the legs and extreme fatigue, leading to a characteristic "steppage gait," or marked inco-ordination of movement may occur and the gait become ataxic. Trophic changes soon appear, early and rapid muscular wasting occurs, the skin becomes dry and glossy, the nails brittle and the hair thin. In time contractures take place, the hip and knee-joints become flexed and the foot dropped at the ankle. Should the case progress the patient may become bedridden and powerless, and degenerative mental changes may take place, loss of memory, irritability of temper and emotional instability. Early cases may recover completely under treatment. The galvanic and faradaic currents combined with massage are useful in helping to restore the wasted muscles, and hot-air baths and warm applications are appreciated.

Arsenical neuritis mostly affects the lower extremities, as contrasted with lead, which mainly paralyses the fingers and wrists; recovery is even slower than in alcoholic neuritis, the treatment being on the same lines, with the removal of the cause of the disease. In the neuritis of chronic lead poisoning a fine tremor of the hands in an early symptom and sensory symptoms are usually

absent; the muscles affected are the extensors of the wrists, thumb and fingers (*see* LEAD POISONING). The course of the disease is long, and an attempt should be made to eliminate the lead from the system by purgatives and the administration of potassium iodide.

In diabetic neuritis paraesthesia is slight, and the legs are chiefly affected; weakness and ataxia may be present. Trophic sores on the feet are of frequent occurrence in this variety. The treatment is that of the disease.

Post-diphtheric neuritis occurs in about 10% of all cases of diphtheria. Paralysis of the soft palate is the earliest, and may be the only, symptom. The limbs are affected much later, usually about the fifth or sixth week. Atrophy of the muscles is frequently rapid. If the respiratory muscles are unaffected the prognosis is good, but the paralysis of the limbs may last for several months. The treatment is complete rest, good food and the administration of strychnine.

Acute polyneuritis with numbness and motor weakness has been noted after influenza, together with slight muscular wasting and electrical degeneration. Later, there is loss of sensation in the peripheral portion of the limbs, and the motor weakness may affect the muscles of the trunk and face. Such cases tend towards complete recovery.

BIBLIOGRAPHY.—W. Harris, *Neuritis and Neuralgia* (1926); H. Higier, "Zur Klinik d. rezidivierenden Formen d. Polyneuritis, Myelitis u. Meningoencephalitis (Meningitis serosa, Pseudotumor cerebri)" in *Ztschr. f. d. ges. Neurol. u. Psychiat.*, civ., 453, bibl. (1926); W. Martin, "Some types of neuritic reflex pains not generally recognized; treatment by physical measures" in *Med. Jn. and Rec.*, cxxiv., 782 (1926); T. G. Stewart and W. Harris, "Discussion on causation and symptomatology of multiple neuritis" in *Brit. Med. Jn.*, ii., 461 (1925); Stauck, "Ueber progressive hypertrophische Neuritis (Hoffmannsche Krankheit)" in *Ztschr. f. d. ges. Neurol. u. Psychiat.*, xcii., 34, bibl. (1924).

**NEUROPATHOLOGY,** the general name for the science concerned with diseases of the nervous system. For the anatomy and physiology, *see* NERVE, NERVOUS SYSTEM, BRAIN, SPINAL CORD and SYMPATHETIC SYSTEM. The morbid processes affecting the nervous system are usually clinically divided into two great groups of (1) organic disease, (2) functional disturbance, depending on whether or not symptoms observed during life can be associated with recognizable changes after death. Knowledge of the first group is much more advanced than of the latter, for, given certain symptoms during life, we can, as a rule, predict not only the nature of the morbid process, but its particular locality.

The histological elements which make up the nervous system may also be divided into two groups: (1) the nervous units or neurones, (2) the supporting, protecting and nutrient tissues. Nervous diseases may start primarily in the neurones and cause their degeneration; such may bring about "diseases," or "syndromes" within the nervous system. The nervous units, however, may be affected secondarily by disease processes starting in the supporting, protecting and nutrient tissues within the nervous system; such include changes of the blood-vessels, lymphatics, membranes and the special nervous connective tissue, neuroglia (a residue of the embryonal structure from which the nervous system was developed). Tumours and new growths must also be included.

The causes of pathological processes occurring in the nervous units (neurones) may be divided into internal and external; in all cases except direct injury the two groups are generally more or less combined.

**Internal Causes.**—Of the factors involved in nervous disease *hereditary predisposition* may first be accented. In 70% of 150 cases of idiocy or imbecility in the London county asylums, Dr. Tredgold found a family history of insanity in some form or another. This predisposition may be convergent, paternal, maternal; from grandparents or even more remote ancestors. Moreover, no study of heredity is complete that does not take into consideration collaterals. Especially does this apply to functional neuroses, *e.g.*, epilepsy, migraine, hysteria and neurasthenia; and to psychoses, *e.g.*, delusional insanity, mania and melancholia, manic-depressive, recurrent or periodic insanity and dementia-praecox or adolescent insanity. Strictly speaking, it is the tendency to nervous disease rather than the disease itself that is inherited, and this is frequently spoken of as a neuropathic or psychopathic taint.

## EXTERNAL CAUSES

The external causes producing morbid changes in the nervous elements are: I. Abnormal conditions of the blood and lymph. II. Excess or deficiency of normal stimulation, or existence of abnormal stimulation. III. Injury or diseases of supporting, enclosing or vascular tissues.

**Abnormal Conditions of the Blood and Lymph.**—The essential causes of change in environment of the nervous elements (neurones) are: (1) Deficiency or absence of blood-supply to the nervous system in general (as after severe haemorrhage), or to some particular portion, owing to local vascular disturbance or occlusion. (2) Alterations in the normal condition of the blood, due to (*a*) deficiency or absence of certain essential constituents, (*b*) excess of certain normal constituents, (*c*) the presence of certain abnormal constituents produced within the body, or entering it from without. All these act through the cerebro-spinal fluid, a special lymph secreted by the choroid plexus in the ventricles of the brain by which the neurones are bathed.

(1) *Quantity of Blood Supply.*—Syncope or fainting occurs when the blood supply suddenly fails to reach the higher centres of the brain; such may arise from sudden reflex arrest of the heart's action, or from localized spasms of the cerebral vessels. The effects of embolism and thrombosis are considered later.

(2) *Quality of Blood Supply.*—(*a*) Insufficiency of oxygen, as in anaemia, leads to functional depression, lassitude and mental fatigue. Impoverishment of the blood in women by frequent pregnancies and excessive lactation causes neuralgia, nervous exhaustion and may aid in the development of neurasthenic or hysterical reactions. The tendency of psychoneuroses and psychoses to occur and recur at menstrual and climacteric periods in women, indicates that these factors themselves are of periodic significance. These are connected with the reproduction function, rather than with the blood however. The most striking examples of the effect of absence or "sub-minimal" deficiency of a normal constituent of the blood upon the development and functions of the nervous system are afforded by cretinous idiots, who are born without thyroid glands, and whose brains never develop in consequence; and by those people who suffer from myxoedema (*q.v.*) occasioned by the absence of thyroxin or other products of the internal secretion of the thyroid gland. The proof of this is shown by the disappearance of the nervous phenomena, slowness of thought, slowness of speech, etc., after thyroxin or a preparation of the gland has been continuously administered. This is an excellent example of a reversible process.

(*b*) Excess of certain Normal Constituents in the Blood.—Excess of carbonic acid causes drowsiness, and probably in asphyxia is one of the causes of the convulsions. All the nitrogenous waste products are normal constituents of the blood; but should oxidation be incomplete, from disease of the liver, or should these substances accumulate in the blood, owing to inadequate function of the kidneys, uraemia may supervene, the manifestations of which are headache, drowsiness, unconsciousness or coma, epileptiform convulsions and sometimes symptoms of polyneuritis. Again, in Graves's disease (hyperthyroidism), nervous phenomena, in the form of exophthalmos, fine tremors, palpitation and mental excitement have by some authorities been explained by the excess of thyroid internal secretion, due to the enlargement and increased functional activity of the gland.

(*c*). The presence of abnormal constituents in the blood is a most important cause of disease of the nervous elements. These are: Poisons produced within the body ($\alpha$) by perverted function of organs or tissues, auto-intoxication; ($\beta$) by the action of micro-organisms, protozoa and bacteria, upon the living fluids and tissues of the body; ($\gamma$) poisons introduced into the body from without.

($\alpha$) Poisons resulting from perverted Function of the Organs.—Nervous symptoms follow auto-intoxication by products of disordered digestion, fatigue products (*e.g.*, sarcolactic acid in prolonged muscular spasm), excess of uric acid, phosphates, oxalates, sugar, bile, hepatic products as in acute yellow atrophy. In pernicious and certain grave anaemias, the degenerative changes in

the spinal cord found in some cases is due, chiefly, to some neuro-toxin, which probably arises from imperfect metabolism or absorption from the alimentary canal. In auto-intoxication, disease of one organ or tissue is apt to establish a vicious circle which is constantly enlarging; therefore nervous symptoms manifesting themselves in the course of a disease add much to the gravity of the complaint.

(β). Poisons produced by infective Micro-organisms.—Some of these have a general devitalizing influence by altering the blood and producing fever. In acute infectious diseases, delirium is a frequent complication; in severe cases, stupor and coma may occur, and in this extreme stage the nerve cells undergo an acute morbid bio-chemical change. These particular poisons may have marked selective toxic action upon particular parts of the nervous system.

Poisons may have a *selective influence* upon some part of the nervous system. The syphilitic organism and its poisons are most important factors in the production of two progressive degenerations of the nervous system—one affecting especially the afferent conducting tracts of the spinal cord, namely, tabes dorsalis (locomotor ataxia), and the other affecting especially the frontal and central convolutions of the cerebral hemispheres, namely, general paresis (general paralysis of the insane). When syphilis attacks the supporting, enclosing and nutrient vascular tissues, a predilection to affect structures about the base of the brain occurs, and paralyses of the third nerve are frequent in this disease. Other examples occur in rabies, tetanus, diphtheria (*q.v.*).

**Protozoa and Diseases of the Nervous System.**—The relation of protozoa to the existence of widespread diseases affecting men and animals is becoming yearly of greater importance. Certain diseases in which the nervous system is profoundly affected are now explained by the invasion of the tissues of the body by these lowly organisms, for example, African sleeping sickness due to a special protozoan; Syphilis due to *Spirochaeta* or *Treponema pallida;* Malaria due to *Haematozoon malariae.*

The bacterial invasion of tissues is generally characterized by a migration of polymorpho-nuclear leucocytes, but protozoal invasion is characterized by a formative hyperplasia of the fixed cell tissues, endothelial, epithelial and conjunctival, and there is a close similarity in the defensive reaction of the tissues to all forms of protozoal invasion.

When the nervous system is affected a local or general chronic meningo-encephalitis is set up, characterized by a meningeal and perivascular infiltration with lymphocytes and plasma cells, occasioned by a chronic irritative process, presumably caused in the case of sleeping sickness for example by the presence of trypanosomes in the actual cerebro-spinal fluid. The same perivascular and meningeal infiltration with plasma cells and lymphocytes is found in syphilitic diseases of the nervous system.

**Pathology of the Cerebro-spinal Fluid.**—Pathological changes in the cerebro-spinal fluid are important in the diagnosis of nervous diseases. Normal cerebro-spinal fluid is clear like water; it has a specific gravity of 1·006 and resembles in its composition the blood *minus* its corpuscular and albuminous constituents. Being secreted by the choroid plexus, if any cause, such as tumour or meningitis, should interfere with its escape from the ventricles it gives rise by pressure to *internal hydrocephalus* and cerebral anaemia which may occasion epileptic convulsions and various degrees of drowsy stupor, lethargy, unconsciousness and even coma. Lumbar puncture has proved of some use in treatment, but is invaluable in the diagnosis of various diseases of the central nervous system. The fluid withdrawn should be centrifuged and the deposit examined microscopically if necessary after staining by suitable methods; the existence of cells indicates disease of the central nervous system. In general paresis, cerebro-spinal syphilis and tabes dorsalis even in early stages, the deposit consists almost entirely of lymphocytes. Some evidence of the progress of the disease and the effect of treatment may be obtained by counting the number of cells at different periods. In tuberculous meningitis there are also lymphocytes in abundance; tubercle bacilli cannot readily be found, but if the fluid be injected into a guinea pig, the animal will develop tubercle. In epidemic cerebro-spinal meningitis the cells in the deposit are polymorpho-nuclear leucocytes and in the leucocytes can be seen *Diplococcus intracellularis.* Septic, pneumonic and pyogenic organisms may also invade the central nervous system giving rise to meningitis, and in these cases the deposit will be polymorpho-nuclear leucocytes, and perhaps the specific organisms may be seen in stained preparations; but if not, they can be obtained by cultural methods.

Other formed elements which may be found are large cells, macrophages containing blood pigment; these cells indicate that haemorrhage has occurred. One of the most important uses of lumbar puncture has been the discovery of the cause of African sleeping sickness. The fluid withdrawn and centrifuged is found to contain large numbers of lymphocytes and plasma cells in addition to specimens of the actively moving organism *Trypanosoma gambiense,* a flagellate. In the forms of disease here described as containing cells in the centrifuged deposit, there is also in the fluid an appreciable amount of proteins. If pathological cerebro-spinal fluid be added to an equal quantity of saturated solution of sodium sulphate there will be a distinct turbidity indicating the presence of proteins in appreciable quantity. This appreciable quantity of proteins is especially significant in the case of fluid withdrawn from cases of general paralysis or tabes, for it goes *pari passu* in amount with the Wassermann *sero-diagnostic reaction for syphilis.*

African sleeping sickness is characterized by a progressive *lethargy,* paresis, tremors and the signs and symptoms of neural exhaustion without neural destruction; it comes on slowly and insidiously often years after infection and eventually terminates fatally by intercurrent disease or paralysis of the bulbar centres. Examination of the central nervous system explains the fatal lethargy; the perivascular and meningeal lymphatics are filled with lymphocytes and plasma cells and the neuroglia supporting cells have undergone a rapid proliferation. The effect of this morbid process is to deprive the neural elements of oxygen and nutrition; the neurones in consequence, although not destroyed, are nevertheless unable to function for more than a brief period.

**Poisons Introduced into the Body.**—The most widespread and potent cause of nervous and mental disease is the abuse of alcohol-containing liquids. At least 20 per cent of the inmates of the asylums of London are admitted with a history of alcoholism. Whether alcoholism is a cause or a result is still debatable. In not more than 10% is alcohol the efficient cause of the mental disease; in many it is only a contributory factor, and in not a few the lapse from moderation to intemperance is one sign of a mental disturbance. To people with unstable nervous systems a relatively small quantity of alcohol may act as a poison. Thus epileptics, imbeciles, criminals, potential lunatics, and the subjects of head injury are liable to become anti-social and dangerous to themselves and others by indulgence in quantities of alcohol which would have no harmful effect upon the mentally stable and sound individual. However, chronic alcoholics form a large proportion of those convicted for crimes of violence, homicide, suicide, and sexual offences. Another common effect of alcohol is *peripheral polyneuritis* (*see* NEURITIS), although frequently changes occur as well in the ganglion cells, from which the axis cylinders of the nerves have their origin. (*See* NERVOUS SYSTEM.) Alcoholic polyneuritic psychosis affecting women in many ways resembles delirium tremens (*see* DELIRIUM); the fact that neuritis occurs much more frequently in women is probably associated with the fact that when the female breaks through the resistance to her conflicts by the use of alcohol her regression is deeper and her indulgence greater. Many other poisons, notably lead and arsenic, the specific fevers before mentioned, syphilis and alterations of the blood due to imperfect metabolism, such as occur in diabetes and gout, may produce, or become important factors in producing, peripheral neuritis. The outbreak of arsenical neuritis from beer containing this poison in Manchester in 1900 (*see* ADULTERATION), is of interest from that fact that the symptoms closely resembled acute alcoholic neuritis. A distinctive feature, however, was the pigmentation of the skin and the severity of the nervous symptoms. A disease, common in the East, termed beri-beri (*q.v.*),

is a form of neuritis. Anaesthetic leprosy is an interstitial inflammation of the nerves due to the *Lepra bacillus*. Among the nervous diseases due to occupation may be cited lead-poisoning (*q.v.*). Lead also produces a chronic inflammation of the cerebral cortex, *Encephalitis saturnina,* causing a complex of symptoms, namely dementia, loss of memory, weakened intellect, paresis and epileptiform seizures, hallucinations of sight and hearing, and mental exaltation or depression. Mirror-makers suffer with characteristic fine tremors, from the slow absorption of mercury into the system. Workmen at indiarubber factories may suffer from severe mental symptoms, owing to the inhalation of the fumes of carbon bisulphide. Serious nervous symptoms have followed carbon monoxide poisoning. Cases which have recovered from the immediate effects have suffered with dementia and symptoms of disseminated sclerosis, the result of multiple haemorrhagic softenings.

Certain other poisons, besides alcohol, act upon the nervous system when continually entering the body as the result of a *habit,* namely, absinthe, ether, cocaine, opium, morphin, hashish and tobacco. Each of these has a selective influence upon certain parts of the nervous system. In illustration thereof may be mentioned impairment of central vision in tobacco amblyopia. Other diseases of like kind are under pellagra (*q.v.*), ergot (*q.v.*), botulism (*see* MEDICAL RESEARCH).

**Adequate and Pathological Stimulation.**—The nervous system in the form of systems, groups and communities of neurones, each with special functions, yet all woven together in one harmonious whole, develops in a particular way in consequence of the awakening influence of stimuli from without and from accumulated instinct stimuli from within. Consequently nervous structures which are not used at all, or badly used are liable to undergo regressive metamorphosis and atrophy; thus amputation of a limb in early life causes atrophy of the nervous structures which dealt with the sensations and movements of the part. This may be seen in the grey (synapses) and white matter (conducting pathways) of the spinal cord; there may also be found an atrophy of the psycho-motor neurones of the brain functionally related to the sensory and motor terminal areas of the involved limb. The converse is also true; the longer a perverted function exists, the more unlikely it is to disappear and ultimately to bring about irreversible structural changes.

Mental pain in the form of grief, worry, anxiety, fright, shock, violent emotions (pleasurable or painful), disappointed love, and excessive intellectual work, frequently precede and determine various types (*a*) of psychoses, *e.g.,* manic-depressive, paranoid; (*b*) of neuroses, *e.g.,* compulsion neurosis, hysteria, epilepsy, hystero-epilepsy; (*c*) or gross brain disease, *e.g.,* apoplexy, thrombosis, arteriosclerotic degenerations.

Visceral reflex irritation affords many examples of organ neuroses, the symptoms of which may be set up by irritation of the viscera, *e.g.,* intestinal worms. Teething and indigestible food are often the exciting cause in infants and young children of convulsions and spasms of the glottis (spasmophilic). Some anomalies of the female reproductive organs act as exciting causes in the release of hysterical reactions. Paroxysmal exacerbations of emotional disturbances are liable to occur at the menstrual period or menopause. Here the stimulus proceeds from the reproductive instinct. The irritation of a carious tooth may produce spasmodic tic or trigeminal neuralgia. Wax in the ear may occasion vertigo and tinnitus; and grave errors of refraction in the eyes may be an accessory factor in the causation of attacks of migraine. Irritation of the receptors of the vagus in almost any part of its widespread visceral origin may lead to vomiting. The characteristic pain of angina pectoris, which radiates down the inner side of the left arm, is partly explained by the fact that the cardiac branches of the sympathetic follow the vascular supply of the arm, and the stimulus from the diseased aorta or coronary vessels radiates as pain in the vascular area. The entire explanation is extremely complex[1]. This is one example of a great number of *referred pains* studied so extensively by the English observers, Head and Mackenzie.

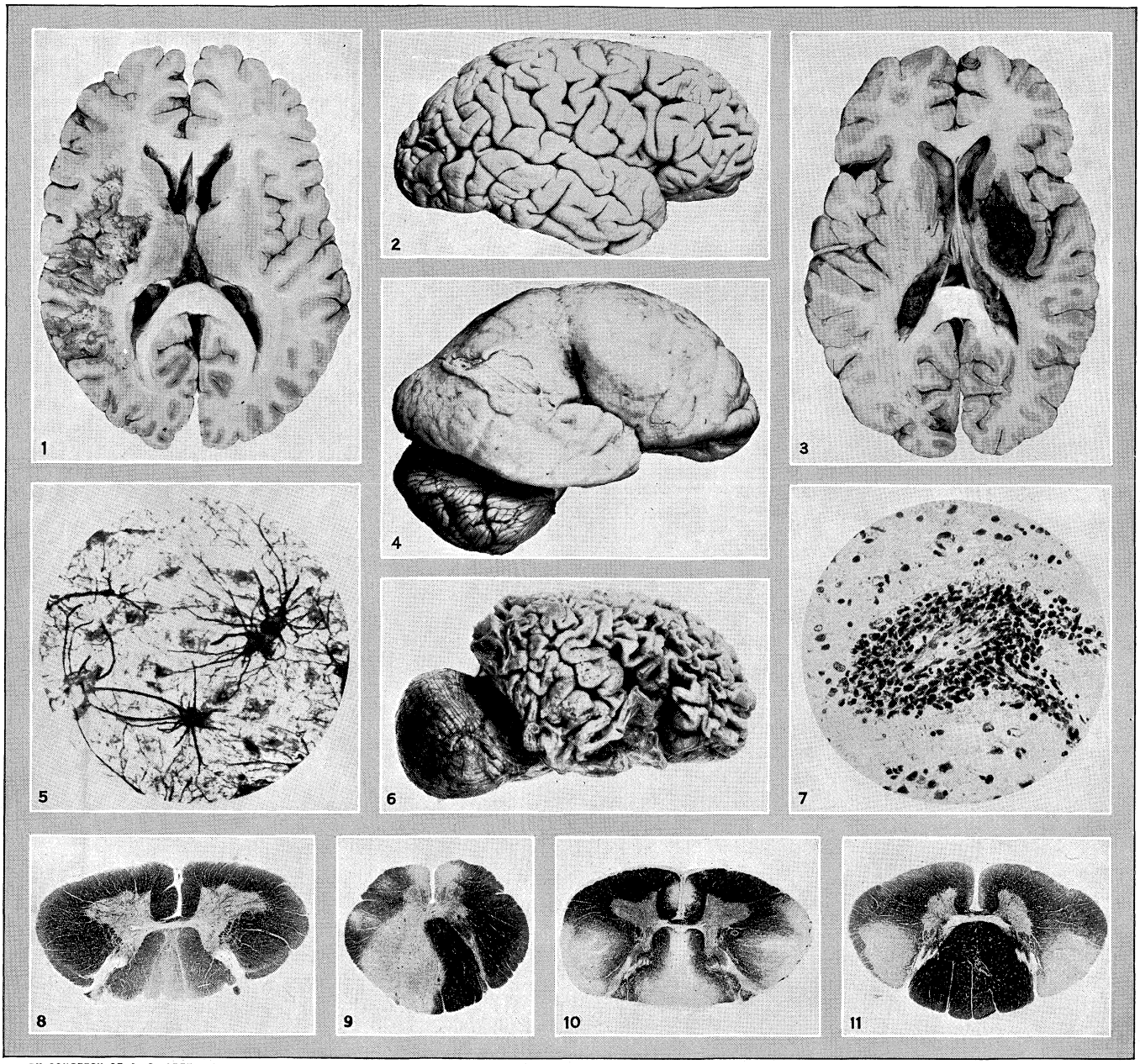
[1]Spiegel, Wien, Kl. Woch. 40, 1927, 853.

**Injury or Disease of Enclosing or Supporting Structures** may lead to paralytic or irritative lesions of the nervous system, or the two may be combined. Blows or wounds of the head and spine may damage or destroy the nervous structures by shock or direct injury. Concussion of the brain or spinal cord may occur, as a result of injury, without any recognizable damage of the enclosing structures or even the central nervous system. Shock, due to concussion, can thus be explained as resulting from molecular or bio-chemical changes in the nervous structures.

Direct injury may cause local destruction of the nervous tissue; but wounds and diseases of the enclosing and supporting structures, if non-infective, give rise only to such symptoms as accord with the nerve structure irritated or destroyed. Should, however, the wound or diseased structure become infected, the disease spreads and becomes generalized; likewise the symptoms. Of the many causes of infective inflammation of the brain itself, middle-ear disease is the most important. It is very liable, when neglected, to be followed by a septic meningitis, encephalitis and brain abscess, the most frequent seat of which is in the adjacent temporal lobe, but it may involve other parts of the brain as well, for example the cerebellum and frontal lobe. The peripheral nerves may be destroyed or irritated by direct injury, disease or new growth in adjacent tissues, or they may be involved in the callus thrown out round the seat of a fracture.

Diseases of the blood-vessels are among the most frequent causes of gross brain disease. Arteries or veins—more frequently the former—may become blocked or ruptured from various causes. The immediate effect is a disturbance or loss of consciousness, and the individual may be "struck down" (*see* APOPLEXY) and never regain consciousness (*see* COMA). Should consciousness return, more or less permanent loss or disturbance of function becomes obvious. Paralysis of some form, especially hemiplegia, is commonest. The cerebral arteries, usually the left middle cerebral may be occluded by embolism (*see* THROMBOSIS AND EMBOLISM). The area of brain supplied by that artery undergoes softening in consequence, resulting in paralysis of the opposite half of the body (hemiplegia) associated with aphasia when the paralysis affects the right side in a right-handed person (*see* Plate, fig. 1). When the embolus is infective, as in ulcerative endocarditis, it not only blocks the vessel but leads to an infective inflammation and softening of its coats, with the formation of an aneurism. The aneurism may suddenly rupture into the substance of the brain and produce apoplexy. Most cases of apoplexy from cerebral haemorrhage in young people are due to this cause. Softening may also arise from coagulation of the blood (thrombosis) in the arteries or veins. Many causes generally combine to produce thrombosis, viz., a weak acting heart and altered conditions of the blood. It is sometimes met with in the cachexia of phthisis and cancer, in typhus and pneumonia, after parturition and in marasmus at all periods of life, but especially in the very young and very old. But thickening, roughening, and a degenerated condition of the cerebral arteries known as atheroma, when associated with a weak acting heart is especially liable to give rise to thrombosis and softening, and is a very common cause of apoplexy, paralysis and mental deterioration in people who have passed middle life. General disease of the arteries of the body, with chronic Bright's disease and high arterial pressure, is frequently associated with the formation of minute aneurisms upon the cerebral arteries, which may rupture and cause apoplexy.

This is especially liable to occur in a vessel supplying the basal ganglia, the effused blood tearing through the motor efferent fibres (pyramidal tracts) lying between the optic thalamus and the corpus striatum (*see* Plate, fig. 3). The result is hemiplegia of the opposite side of the body. Disease of the arteries of the central nervous system, occurring in a person under 40, is generally due to syphilis, the virus of which produces an inflammation of the inner coats (*see* ARTERIES, DISEASES OF). The thickening and narrowing of the lumen with loss of elasticity of the arteries of the brain generally may suddenly or gradually set up cerebral anaemia and give rise to semi-comatose and comatose or even apoplectic states. Occlusion by the inflammatory proliferation or by the sudden clotting of blood in the diseased vessel may occur, the immedi-




BY COURTESY OF J. C. GREENFIELD

## THE HUMAN BRAIN AND SPINAL CORD IN HEALTH AND DISEASE

1. Horizontal section across a brain showing a softening in the left hemisphere due to a blockage of a cerebral artery. This caused right sided hemiplegia and aphasia
2. Right cerebral hemisphere of an adult man; normal state of convolutions
3. Horizontal section across a brain in which a haemorrhage in the right hemisphere had damaged the motor path to the left arm and leg causing left hemiplegia
4. Right half of the brain of a microcephalic idiot. There is complete absence of any convolutional pattern in the cortex of the brain, which closely resembles that of the sheep. The cerebellum is normally developed
5. Microscopic section of a degenerated area of cerebral cortex overlying a tumour, showing enlarged neuroglia cells
6. Right half of the brain of a microcephalic idiot (walnut type). Here the convolutions have shrunk and a bag of fluid replaces the temporal pole. This is due to a vascular lesion before birth
7. Microscopic section of the cerebral cortex of a case of general paralysis showing inflammatory cells surrounding a small vessel

8–11. Sections across the spinal cord in different common forms of spinal paralysis (the undamaged nerve fibres are stained black): 8. "Locomotor ataxy" in which the ascending or sensory fibres in the posterior columns degenerate. 9. "Disseminated sclerosis," in which patches of degeneration (pale areas) are scattered haphazard, damaging both sensory and motor fibres. 10. "Subacute combined degeneration," usually associated with anaemia, in which both sensory and motor fibres are affected. 11. "Motor neuron disease," in which all the descending or motor fibres degenerate

ate effect of which may be an epileptic or apoplectic fit; the result is softening; and as any or all of the arteries of the brain may be affected successively, simultaneously, or at random, the symptoms may be manifold. They may be general or local, and are often associated with inflammation of the membranes. The disease, under treatment, may abate, and the paralytic or mental phenomena partially or completely disappear, indicating the restoration, or partial restoration, of the circulation in the diseased arteries; sometimes with the lapse of treatment, and sometimes without, new symptoms manifest themselves, showing that the disease has attacked a fresh set of arteries. *Disseminated sclerosis* (*insular*) is another progressive random, morbid process, the pathology of which is not fully understood, but is probably due to some toxic cause. Islands of nervous tissue undergo a morbid change, commencing in the myelin sheath and ending in an increase of the supporting neuroglia tissue at the expense of the true nervous tissue (*see* Plate, fig. 11).

*Tumours* and new growths in the central and peripheral nervous systems may be primary or secondary; the former arise in the supporting, enclosing or nutrient tissue elements; the latter are metastatic deposits from tumours originating elsewhere. Tumours may be single or multiple, the special symptoms occasioned depending upon the seat of the tumour and whether it destroys or only irritates the adjacent nervous tissue. Tumours situated within the cranial cavity cause general symptoms, namely, optic neuritis, severe headache and vomiting; these symptoms, which are caused by increased intracranial pressure, are more severe in rapidly growing vascular tumours, even though small, than in large slow-growing tumours. Some tumours are highly vascular and a large thin-walled vessel may suddenly rupture and cause an apoplectic fit. If the growth is situated in a portion of the cortex having some special localizing function, *e.g.*, the motor area, it is likely to give rise to epileptiform convulsions, starting in a limb or definite group of muscles; but the irritation usually spreads to the whole motor area of the same side, and even extends to the opposite hemisphere, by an overflow of the discharge through the corpus callosum. In such case there is loss of consciousness. If, however, the tumour destroys the cerebral cortex of a particular region, it may give rise to a paralytic lesion, *e.g.*, paralysis of the arm.

Diseases of the blood-vessels, or of supporting and enclosing tissues, produce secondary degenerations of the nervous system. The symptoms, like the lesion, are obtrusive; frequently arising suddenly, they may in a short time terminate fatally, or tend towards partial or complete recovery. Various forms of motor and sensory loss and disturbance of function may arise, indicating destruction or disturbance of particular regions of the central nervous system; and degenerations in certain tracts and systems of fibres arise, corresponding in histological character with those observed when a nerve fibre is separated from its cell of origin by section (secondary degeneration of Waller and Türck). This form of degeneration must be distinguished sharply from primary degeneration, which is due to an inherent nutritional defect of the nerve cell and all its processes (the neurone), in which a regressive metamorphosis occurs; it starts in the myelin sheath and the fine terminal twigs of the axis cylinder and dendrons, and proceeds back to the main branches and trunk, eventually destroying the trophic and genetic centre itself, the nerve cell. These *primary* degeneration processes are insidious in origin, progressive in character, and nearly always fatal; they, therefore, are associated with a progressive evolution of symptoms.

To cite some examples: (1) *Locomotor ataxy* (tabes dorsalis), is a primary degeneration affecting the *afferent* sensory system of neurones. (2) *Progressive spinal muscular atrophy* is a disease of the *efferent* motor system of neurones of the brain and spinal cord. Infantile paralysis (*Anterior poliomyelitis*), is an acute inflammation causing destruction chiefly of the spinal motor neurones of the ventral horn. It differs from the progressive spinal muscular atrophies in its sudden onset and non-progressive character; it resembles them in producing paralysis of muscles without sensory disturbance. (3) *General paralysis of the insane* (general paresis) is a degeneration which begins in the association system of neurones of the cerebral cortex, but frequently is associated with degeneration of the afferent or efferent systems.

The psychoneuroses and benign psychoses have not been satisfactorily explained by definite morphological changes in the actual brain substance. We know little or nothing accurately about the morbid histology of certain chronic psychoses, or defect states, except as regards the morphological changes met with in cases of amentia and dementia. The large and illy circumscribed groups, called idiocy and imbecility, are associated with arrest of development of the brain, the naked-eye evidence of which may be afforded by small size and simplicity of convolutions of the brain as a whole or in part (*see* Plate, figs. 2, 4 and 6); and the microscopical evidence by arrest, or imperfect development, of structures connected with the higher functions of the mind, namely, the association neurones in the more superficial layers of the cerebral cortex. Various degenerative processes, either primary or secondary, broadly termed dementics, are associated with progressive decay and atrophy of the superficial layers of the grey matter of the cortex, and naked-eye evidence thereof is afforded by partial or general wasting of the cerebral hemispheres, accompanied with thickening of the pia-arachnoid membrane, atrophy of the convolutions, and with deepening and widening of the intervening sulci. Since the modern studies on this subject of V. Economo, Jakob, the Vogt's Josephy, Fünfgeld, Spatz, Spielmeyer and others have given a definite architectonic and myelotectonic knowledge of the cortex as well as the striatum the older studies of a former generation are obsolete. A newer cortical and subcortical pathology is being written and is to be found in special articles in this edition. At the present time a generalized neuropathology cannot be written.

The cerebro-spinal fluid fills up the space in the cranial cavity caused by the atrophy of the brain; consequently there is a great excess of this fluid. This wasting so characteristic a finding in general paralysis is especially due to atrophy of the cells and fibres of the superficial grey matter of the cortex, sections of which, examined microscopically, after suitable staining, show great poverty, or complete loss, of three sets of delicate myelinated fibres, namely, tangential, super-radial and the inter-radial corresponding to the line of Baillarger. This degeneration of the superficial association fibres of the cerebral cortex affects especially the frontal and central convolutions, and is the earliest and most constant microscopical change in general paresis. It is accompanied usually by meningeal and vascular changes, atrophy of the nerve cells, the proliferation of the neuroglia (fig. 5); especially characteristic is the perivascular infiltration with lymphocytes and plasma cells (*see* Plate, fig. 7). It was, indeed, thought that this condition of the vessels was pathognomonic of general paresis; it certainly is not, for it is found throughout the central nervous system in cases of African sleeping sickness and the arterial types of neurosyphilis. It has sometimes been known to occur in the neighbourhood of cerebral tumours but it is not found in uraemia or lead encephalitis.

**Microscopical Changes in Degeneration of the Neurone.**—About 1850, Waller demonstrated that a nerve fibre undergoes degeneration to its termination when separated from its cell of origin; hence the term "Wallerian degeneration." Embryological researches by Prof. His showed that the axis-cylinder process (the essential conducting portion of the nerve fibre) is an outgrowth of the nerve cell. The cell, therefore, is the trophic and genetic centre of the nerve fibre. Acute alterations and death of the nerve cells may occur from toxic conditions of the blood; from high fever (107°–110° F); arrest of the blood supply, as in thrombosis and embolism; or actual destruction by injury, haemorrhage or inflammation. These morbid processes produce, as a general rule, bio-chemical as well as morphological changes in the nerve cell and its processes. When a nerve cell dies, the nerve fibre undergoes secondary degeneration and death; that is to say, the whole neurone dies, and regeneration, at any rate in the higher vertebrates, does not take place. Restoration, or partial restoration, of function is due to other structures taking on the function, and the more specialized that function is, the less likely is restoration to take place. If, however, a peripheral

nerve is divided, its component fibres are merely severed from their cells of origin. All that portion of the nerve which is in connection with the nerve cells of origin practically undergoes no change. The peripheral portion undergoes degeneration, but from the central end of the nerve new axis cylinders again grow out and a new nerve is formed. With this regeneration comes restoration of function, which may be hastened by suturing the ends of the cut nerve. A similar regeneration, however, does not occur after section of fibres of the white matter of the central nervous system, and this may be due to the fact that the nerve fibres of the white matter of the cerebrospinal axis possess no nucleated sheath of Schwann, which plays an important part in regeneration; in the present writer's opinion, the neurilemmal sheath of the old fibre forms a new protoplasmic basis, into which the axis cylinder from above grows, the passage of stimulus determining its function. The writer, working in conjunction with Prof. Halliburton, has shown that the characteristic microscopical changes in the myelin sheath which occur in the process of degeneration are due to a splitting up of the complex phosphoretted substance "protagon" into glycero-phosphoric acid, choline and oleic acid by a process of hydration. The Marchi reaction, so useful for demonstrating degeneration of the central and peripheral nervous systems, is dependent upon the fact that the myelin sheath, after hardening in a solution of bichromate of potash, does not turn black when acted upon by osmic acid, whereas the simpler non-phosphoretted fatty product of degeneration is stained black. When the Marchi reaction of degeneration is fully developed, it has been ascertained that the nerve yields no phosphorus. The degeneration resulting from section of a nerve is termed *secondary*, to distinguish it from another, *primary*, due to slow and progressive decay of the whole neurone, beginning usually at the terminal twigs and proceeding back towards the cell body with its contained nucleus. These primary degenerations involve systems of neurones, correlated by function rather than by anatomical situation. Examples have been given already. The cause of primary degenerations is probably a defect inherited or acquired in the *vita propria* of the neurones affected. They slowly atrophy and disappear, and their place is filled up by an overgrowth of the supporting neuroglia tissue (*see* Plate, fig. 9). This overgrowth of dense tissue is termed sclerosis and was erroneously considered to be the cause, instead of the effect, of the atrophy of the nervous tissue. (F. W. Mo.)

BIBLIOGRAPHY.—Croonian lectures on the "Degeneration of the Neurone," by F. W. Mott, published in the *Lancet* (1900); and the same writer's "Introduction to Neuropathology," in Albutt's *System of Medicine*. Gower, *Handbook of the Nervous System;* von Monakow, *Gehirn Pathologie;* F. W. Mott, *Archives of Neurology,* vols. i, ii, iii and iv; A. van Gehuchten, *Les maladies nerveuses* (Louvain, 1926); Sir J. Jurves-Stewart, *Diagnosis of Nervous Diseases* (London, 1927); S. E. Jelliffe and W. A. White, *Diseases of the Nervous System* (V. edit. London, 1928, bibl.); H. Oppenheim, *Lehrb. d. Nervenkrankheiten* (Berlin, 1923; bibl. translation by Bruce); H. Claude, "Maladies du Système Nerveux," in Gilbert and Fournier, *Précis de pathologie interne,* vols. iii and iv (Paris, 1922). Spielmeyer, *Histopathologie des Nervensystems* (Berlin, 1922); Jakob, *Normale Anatomie und Histologie und allgemeine Histopathologie des Grosshirns* (Wien, 1927, bibl.); Bethe, v. Bergmann—*Handbuch der normalen u. pathologischen Physiologie: Nervensystem,* vol. x (Berlin, 1927); Tilney and Riley, *Form and Function of the Nervous System* (New York, 1925); Buzzard and Greenfield, *Pathology of the Nervous System* (London, 1921).

**NEUROPTERA,** the term used in zoological classification for that order of insects which includes the alder flies, snake flies, ant-lion flies, lacewings and their allies. They comprise small to rather large soft-bodied insects with usually elongate feelers and two pairs of similar, net-veined, membranous wings; the wings are closed rooflike over the body when at rest and the hind pair are almost always without a plicated posterior lobe. The mouth parts are for biting, the tarsi are five-jointed and there are no cerci or tail feelers. All Neuroptera undergo complete metamorphosis and the larvae are active and predatory with well developed antennae, sense organs and legs; they are mostly terrestrial but some are aquatic. The pupae have the appendages free and are generally enclosed in silken cocoons.

Rather more than 2,000 species of Neuroptera were known by 1945, and of those only a little more than 60 occur in the British Isles while about 200 species are found in the United States.

Neuroptera are all insects of weak flight, they are rarely abundant in individuals and feed mostly upon soft-bodied insects or liquid matter such as honey dew. Most of the species have beautiful net-veined wings which often exhibit a complex reticulation owing to the presence of numerous accessory veins. There are numerous veinlets arising from the costal vein and vein Rs is generally pectinately branched. In their larval stages they are exclusively predaceous. The order is divided into two suborders, viz., the Megaloptera and the Planipennia as given below.

### SUBORDER I. MEGALOPTERA

*Veins with little or no tendency to fork at the margins of the wings; vein Rs with but few extra branches. Larvae with biting mouth parts; pupae not enclosed in a true cocoon.*

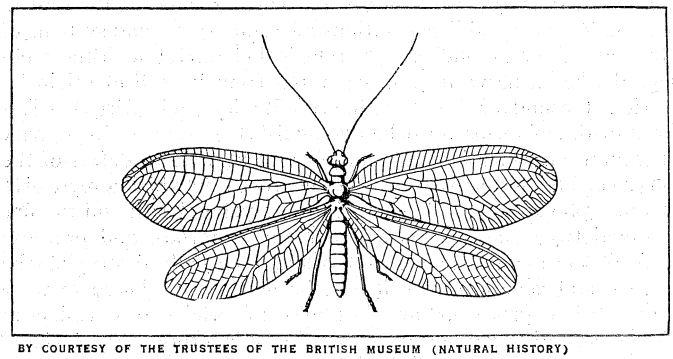
This group includes a small number of archaic insects separable into two superfamilies comprising about 200 species throughout the world. (1) The Sialoidea, all with aquatic larvae, include the alder flies (*q.v.*) (family Sialidae), so-called because in England the adults often frequent alders along the banks of streams. Their larvae respire by means of seven or eight pairs of slender, jointed, abdominal gills. The genus *Sialis* is widely distributed with two British and many North American species. Also included are the large dobson-flies (*q.v.*), belonging to the family Corydalidae and found in North and South America and parts of the old world. Smaller members of the same family are often known in America as fish flies (*q.v.*). (2) The Raphidiodea or snake flies (*q.v.*) are distinguished by the elongate prothorax and by the very long ovipositor in the female. They are terrestrial insects whose larvae are found under the bark of trees. Twenty species are found in North America (1945) and four species of the genus *Raphidia* occur in Britain.

### SUBORDER II. PLANIPENNIA

*Veins with evident forking at the margins of the wings; vein Rs usually with numerous branches. Larvae with piercing mouth parts; pupae enclosed in a cocoon.*

Included here are the major portion of the Neuroptera: they are nearly all terrestrial insects, only a small number being partially or truly aquatic in their larval stages. The Planipennia are divided into 16 families of which only the most important are mentioned.

The Ithonidae or moth-lacewings are confined to Australia: they are large, stoutly built, mothlike insects with primitive venation. Their larvae live in the soil where they prey upon those of chafer beetles, to which they bear a close general resemblance. The Hemerobiidae or brown lacewings are widely distributed and

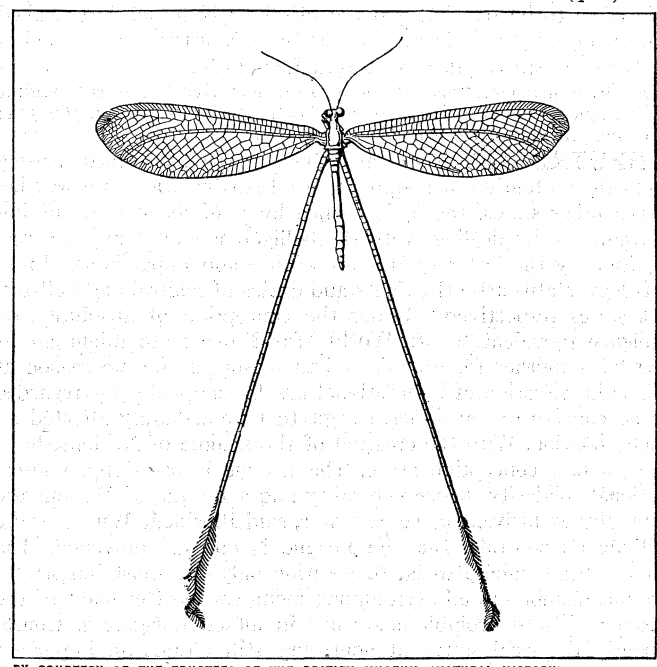


BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY)

FIG. 1.—A GREEN LACEWING (CHRYSOPIDAE)

fairly numerous in species. Their larvae along with those of the Chrysopidae or green lacewings (fig. 1) roam about vegetation preying upon aphides, mites, thrips and other soft-bodied insects (*see* LACEWING-FLY). The Osmylidae and Sisyridae have aquatic larvae: the insects of the first mentioned family are medium to large-sized species which differ from the lacewings in certain venational characters. *Osmylus fulvicephalus* is the largest British neuropterous insect and occurs locally along the borders of streams where there is dense vegetation. The Sisyridae differ in having very few cross veins to the wings besides being much smaller in size. They are brown or fuscous insects found along

the borders of rivers which contain the fresh-water sponge upon which their larvae feed and live. Three species of *Sisyra* occur in Great Britain and this genus, along with *Climacia,* is found in the United States. The Mantispidae or mantis flies (*q.v.*) are easily distinguished by the elongate thorax and the prehensile fore legs which resemble in form those of the common mantis (*q.v.*) and



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY)

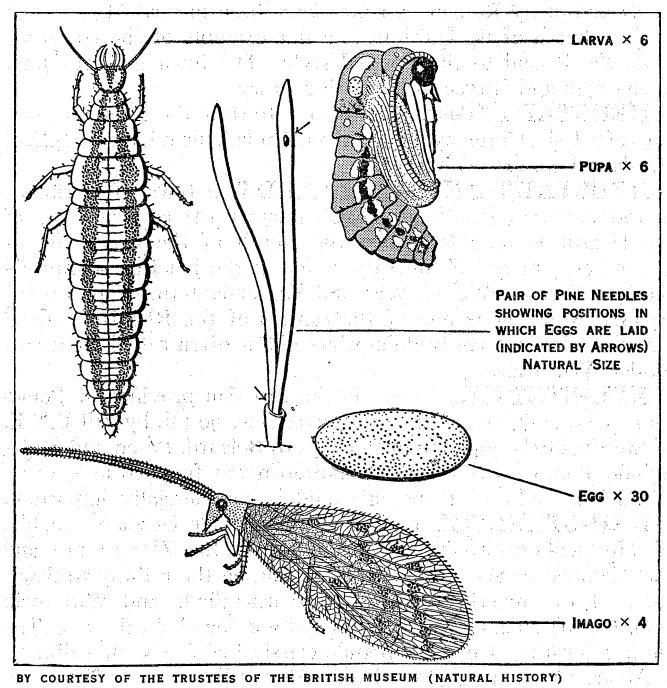
FIG. 2.—NEMOPISTHA IMPERATRIX (NEMOPTERIDAE)

are likewise used for seizing other insects which serve as their prey. The larvae of the European *Mantispa styriaca* are predacious upon young *Lycosa* spiders and during development they undergo striking changes of form constituting hypermetamorphosis. The family is mainly tropical but ranges into southern Europe and a few species occur in the United States. The Psychopsidae have very broad, rounded wings supported by a stout "mid-rib" and with a densely reticulated venation. Many are insects of striking beauty and their larvae have been found beneath bark of trees. The family has a wide discontinuous range occurring in South Africa, Tibet, China and Australia. The Nemopteridae (fig. 2) differ from all other Neuroptera in having very long threadlike or ribbonlike hind wings. Their larvae occur in caves on the floors of buildings among debris, etc., where they prey upon smaller forms of insect life. The family occurs in many of the warmer parts of the world including southern Europe but is absent from North America. The Myrmeliontidae or ant-lion flies (*q.v.*) bear a general resemblance to dragon-flies and have short knobbed feelers. Although most abundant in the warmer parts of the world, several species occur in Europe, one being found as far north as Sweden, but none are found in the British Isles: about 65 species inhabit the United States. Their larvae live on the ground where some make pitlike snares for entrapping their prey, while others hide away under stones or debris. The Ascalaphidae are closely related to the preceding family but can easily be separated by their much longer antennae as well as by venational differences. Their larvae either hide away on the ground or live concealed on the bark of trees. They are chiefly tropical insects, only a few species occurring in southern Europe and North America. The Coniopterygidae, or mealywings (*q.v.*), number about 50 species and are the smallest and most aberrant of all Neuroptera. They are covered with a white powdery secretion, their wings have comparatively few veins and the hind wings are much reduced in size. Their larvae roam about plants, preying upon aphides, scale insects and mites. Rather more than half a dozen species are found in Great Britain and a similar number occur in the United States.

**Natural History (fig. 3).**—The eggs of Neuroptera are ovoid and in several families, including the green lacewings, the female exudes a sticky secretion which she draws out into a hairlike stalk upon which the egg is laid for safety. The larvae, with few exceptions, are terrestrial or arboreal and in the Planipennia they are all characterized by the greatly drawn out mandibles and maxillae which are used for seizing and perforating the prey. The mandibles are grooved along their ventral surface and the maxillae, which closely resemble them in form, fit one into each groove: in this way the two sets of appendages function as a pair of tubes through which the body juices of their victims are sucked out. Larvae of the Planipennia are further remarkable for the fact that six out of their eight Malpighian tubes become transformed into silk glands, the silk being emitted through an anal spinneret. The larvae of all Neuroptera are carnivorous and mostly prey upon other forms of insect life. When fully fed those of the Planipennia construct silken cocoons and, prior to the emergence of the perfect insect, the pupa cuts open the cocoon with its mandibles and, being mobile, often travels some little distance before the imago emerges. Little is definitely known respecting the specific nature of the food of the perfect insects: many are nocturnal in habits and are attracted to lights, while most of the day-flying species are rarely seen on the wing.

**Geographical Distribution.**—Certain families of Neuroptera are nearly world-wide in their distribution, the Chrysopidae, for example, being found in almost all extensive areas of land excepting New Zealand: the Sialidae have an almost world-wide though discontinuous range, while the Raphidiidae are mainly restricted to the northern hemisphere. Several families, on the other hand, are almost confined to Australia which has a more complete and diverse fauna of Planipennia than any other region of the globe, although the Megaloptera are only represented there by a few species. Only 7 families of Neuroptera occur in the British Isles and 13 families are found in the United States.

**Geological Distribution.**—The Megaloptera are evidently an archaic group but their fossil remains, unless very perfect, are difficult to identify. The earliest undoubted remains of this suborder




BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY)

FIG. 3.—LIFE CYCLE OF BROWN LACEWING (HEMEROBIUS STIGMA)

have been found in the Permian rocks of Russia. The Planipennia first appear as fossils in Lower Permian beds of Kansas, where they are represented by the genus *Permoberotha.* They also occur in Upper Permian strata of the U.S.S.R. and Australia.

**Economic Importance.**—Neuroptera as a whole are distinctly beneficial to man in their larval stages. Larvae of the Sialidae form food for trout and other fishes, while those of the Planipennia prey upon many soft-bodied noxious insects. In Europe and North America the most beneficial families are the Hemerobiidae, Chrysopidae and Coniopterygidae, and in Australia larvae of the

Ithonidae destroy numbers of Scarabaeid grubs in the soil.

BIBLIOGRAPHY.—For the British species consult F. J. Killington, "Monograph of the British Neuroptera," Ray Society (London, 1936–37). Accounts of the larvae are given by C. L. Withycombe, *Trans.* Ent. Soc. (London, 1924), pts. 3–4 (1925). The Australian forms are discussed by K. C. McKeown in "Australian Insects," *Australian Zoological Handbook no. 6,* Royal Zool. Soc. (New South Wales, 1942); R. J. Tillyard, *The Insects of Australia and New Zealand* (Sydney, 1926). For the North American Neuroptera consult the following: Raphidiodea, F. M. Carpenter, *Proc. Amer. Acad. Arts and Sci.,* vol. 71, No. 2 (1936); Sialidae, H. H. Ross, *Illinois Natural History Survey Bull.,* vol. 21, art. 3 (1937); Mantispidae, J. Rehn, *Trans. Amer. Ent. Soc.,* vol. lxvi (1939); Myrmeleontidae, N. Banks, *Bull. Mus. Comp. Zoology,* vol. 68, No. 1 (1927); Hemerobiidae and related families, F. M. Carpenter, *Proc. Amer. Acad. Arts and Sci.* vol. 74, No. 7 (1940); Chrysopidae, R. C. Smith, *Mem. 58, Cornell Univ. Agric. Exp. Sta.* (1922). (A. D. I.; F. M. CR.)

**NEUSALZ,** a town in the Prussian province of Silesia, Germany, on the Oder, 20 mi. by rail N.W. of Glogau. Pop. (1939) 17,108. Neusalz became a town in 1743. Its largest industry is, perhaps, the manufacture of thread; there are also in the town ironworks, breweries, shipbuilding yards and electrical works. Lignite is mined in the neighbourhood and chemicals manufactured. It developed trade because of its numerous rail and river connections.

**NEUSS,** a town in the Prussian Rhine province, Germany, 4 mi. W. of Düsseldorf and 1½ mi. from the west bank of the Rhine, with which it is connected by the Erft canal. It lies at the junction of lines to Cologne, Viersen, Zevenaar (Holland), Düsseldorf, Düren and Rheydt. Pop. (1939) 60,506, of whom the majority were Catholics. Neuss, the *Novaesium* of the Romans, mentioned by Tacitus, formerly lay close to the Rhine. Drusus, brother of the emperor Tiberius, threw a bridge across the Rhine here, and his name is preserved in the Drususstor, the lower half of which is of Roman masonry. In 1474–75 Charles the Bold besieged the town in vain for 11 months, but it was taken and sacked by Alexander Farnese in 1586. Extensive excavations have been made and many Roman treasures have been unearthed.

The church of St. Quirinus is a fine example of the transition from the Round to the Pointed style. The town hall was built in the 17th and altered in the 18th century.

**NEUSTADT** (Polish, *Prudnik*), a town in the Prussian province of Silesia, Germany, on the river Prudnik, 60 mi. by rail S.E. of Breslau. Pop. (1939) 17,244.

**NEUSTADT-AN-DER-HAARDT,** a town of Germany, in the Bavarian Palatinate, situated under the eastern slope of the Haardt mountains and at the mouth of the valley of the Speyerbach, 14 mi. W. of Speyer, and at the junction of railway lines to Worms, Weissenburg and Kaiserslautern. Pop. (1939) 24,481. Neustadt is one of the centres of the Rhenish "grape-cure." It does a large trade in wines and is often called Neustadt-an-der-Weinstrasse.

**NEU-STETTIN,** a town in the Prussian province of Pomerania, Germany, on the small Streitzig lake, 90 mi. by rail E.N.E. of Stettin, at the junction of railways to Belgard, Posen and Stolpmünde. Pop. (1939) 19,946. Neu-Stettin was founded in 1313 by Wratislaus, duke of Pomerania, and is commercially important.

**NEU-STRELITZ,** capital of the former German republic of Mecklenburg-Strelitz, situated between the Zierker See and the Glambecker See, 60 mi. N. of Berlin, on the railway to Stralsund, at the junction of lines to Warnemünde and Wittstock. Pop. (1939) 26,225. Neu-Strelitz was not founded till 1726. The former ducal residence is a pseudo-classical edifice, with a library. About 1½ mi. to the south lies Alt-Strelitz (pop. 4,820), the former capital of the duchy.

**NEUSTRIA,** the old name of the western kingdom of the Franks, as opposed to the eastern kingdom, Austrasia (*q.v.*). The most ancient form of the word is *Niuster,* from *niust,* which would make the word signify the "most recent" conquests of the Franks. The word Neustria does not appear in Gregory of Tours, but is found for the first time in Fredegarius. Under the later Merovingian kings the princes reigning in the West were called kings of Neustria, and those reigning in the East, kings of Austrasia. Under the new Carolingian dynasty, the word Neustria was restricted to the district between the Loire and the Seine, together with part of the diocese of Rouen north of the Seine; while Austrasia comprised only the Frankish dominions beyond the Rhine, together, apparently, with Mainz, Worms and Spires on the left bank. The districts between Neustria and Austrasia were called *Media Francia* or simply *Francia.* In 843 Brittany took from Neustria the countships of Rennes and Nantes; and gradually the term Neustria came to be restricted to the district which was later called Normandy. By a similar usage, the term Neustria was applied in Italy in the 8th century to western Lombardy.

*See* F. Bourquelet, "Sens des mots France et Neustrie sous le régime mérovingien," in the *Bibliothèque de l'école des chartes,* xxvi. 566–574; Longnon, *Atlas historique de la France.*

**NEUTRALITY** has been defined as the legal status arising from the abstention of a state from all participation in a war between other states, the maintenance by it of an attitude of impartiality in its dealings with the belligerent states, and the recognition by the latter of this abstention and impartiality. From this legal status arise the rights and duties of neutral and belligerent states respectively. Under the conception of absolute sovereignty prevalent before World War I one state might go to war with another for a good or bad reason, or for no reason at all, and a violation of international law by one state was regarded as no concern of any other, except that immediately affected by such violation. With the creation of the League of Nations, however, a new conception arose. The League is based upon international solidarity, hence neutrality and a League of Nations are mutually exclusive. In the next war, said President Wilson, there will be no neutrals. But the League is not yet universal. The United States and Russia, to mention only the most important, are not members; and even among members the Covenant of the League fails to prohibit neutrality in all circumstances. Consequently the legal status of neutrality still retains an important place in international law.

**Rights and Duties of Neutrals.**—These may be subdivided into the rights and the duties of neutrals; and the rights and liabilities of trade. A neutral state is entitled to have the integrity of its territory and territorial waters respected by all the belligerents. By the Hague Convention of 1907 its territory is inviolable; it is entitled to notice of a state of war, unless it can be proved that it was aware of its existence, so that the date from which its liabilities commence may be ascertained (Hague Convention III., 1907). In the case of a civil war, its liabilities will commence only when a state of belligerency is established; for instance, Great Britain contended that the proclamation of a blockade of the coasts and ports of the seceding states by President Lincoln on April 19, 1861, was a recognition of such states as belligerents. That is to say, it is entitled to prevent and nullify, by force if necessary, war-like operations by any of the belligerents committed in violation of such integrity. It is also entitled to exact compliance by belligerents with its own municipal regulations, designed to maintain its neutrality and to perform its international obligations. If such regulations are enforced equally upon all the belligerents, they are not to be regarded as hostile or unfriendly. It is entitled to maintain its diplomatic intercourse with other neutral states and with the belligerents alike, except for such temporary interruptions as may be demanded by military necessity. It is entitled to offer its good offices or mediation to the belligerents with a view to the cessation of hostilities without the exercise of this right being regarded as an unfriendly act (Hague Convention I., 1907). Finally it is entitled to require belligerents not to interfere with the commercial intercourse of its subjects, unless such interference is warranted by International Law.

**Armed Neutrality.**—In his address to Congress on Feb. 26, 1917 President Wilson, after recounting the failure of diplomatic methods to protect the neutral rights of the United States from their violation by Germany, declared that "there may be no recourse but to armed neutrality, which we shall know how to maintain and for which there is abundant American precedent." There were also European precedents for armed neutrality.

In 1780 Russia issued a declaration of neutral rights, to which Sweden and Denmark adhered, which became known as the First Armed Neutrality. Spain, France, Holland and the United States—

all in a state of war with Great Britain—Prussia, Austria, Portugal and the two Sicilies, subsequently joined the league. The object of this declaration was to limit the list of contraband commodities. In 1800 Russia with Denmark, Prussia and Sweden formed the Second Armed Neutrality, the object of which was to exempt from visit and search neutral merchantmen under convoy.

**Duties of Neutral States.**—The primary duty of a neutral state is strict impartiality in its relations with both belligerents, whether such impartial conduct is obligatory or discretionary. There must not be any discrimination or preference. Even a favour granted to one must be extended to the other. A neutral state must not allow a belligerent to move troops, munitions of war or supplies across its territory or to erect or use therein wireless or other telegraphic apparatus for military purposes. It must intern belligerent forces which have taken refuge in its territory, but may leave at liberty escaped prisoners of war and permit the passage of the sick and wounded belonging to the belligerent forces (*Hague Convention* V., 1907). It must not allow any act of war, including the exercise of visit and search or capture, to be committed by a belligerent within its territorial waters. It must release a prize so captured with its officers and crew and intern the prize crew. It must not allow a prize court to be established on its territory nor on a vessel within its territorial waters. It must not allow either belligerent to use territory or territorial waters as a base of military operations against its adversary, nor may it furnish either belligerent with troops, ships, munitions of war, money or with commodities of direct or indirect use in the war. It must use due diligence in preventing the fitting out or arming of vessels within its jurisdiction and the departure of vessels intended to engage in hostile operations; the issue of commissions by either belligerent or the enlistment of men (*Hague Convention,* XIII., 1907, the Neutrality Act, 1818 U.S.A. and the Foreign Enlistment Act, 1870, 33–34 Vict. C. 90).

**Rights and Liabilities of Neutral Trade.**—Restraint on neutral trade with belligerents rests upon a compromise between two conflicting principles. On the one hand the subjects of a neutral state contend that they are entitled to carry on their normal trade with either belligerent, provided such trade is not directly calculated to prejudice the military operations of one belligerent, nor to promote those of the other. On the other hand a belligerent state claims that the subjects of a neutral state are not entitled to supply his enemy with commodities which are of direct and indirect use to his enemy in the conduct of the war. Between these two contentions there have been great divergencies both in theory and practice. A state is apt to take a different view when belligerent from that which it maintained as a neutral. But upon one matter there is no difference of opinion. It is generally recognized that it is for the belligerent and not for the neutral state to enforce the restraints on neutral trade; that it is the duty of the neutral state to acquiesce in such restraints in so far as they are not unwarrantable; and that the violation of such restraints by the subjects of a neutral state are not criminal and only involve the perpetrators in the seizure and loss of their property. The most important restraints on neutral trade are those imposed by the rules relating to blockade (*q.v.*); pacific blockade (*q.v.*); contraband (*q.v.*); continuous voyage; convoy (*q.v.*); unneutral service; and visit and search (*q.v.*).

**Continuous Voyage.**—The doctrine of continuous voyage has been referred to under CONTRABAND (*q.v.*). It was first applied by Lord Stowell to the engagement of neutrals in a trade closed to them in time of peace (*The Immanuel,* 2 C. Rob. 186 [1799]). In this case a neutral vessel sailing from Hamburg was condemned for carrying food, during the war between Great Britain and France, from Bordeaux to St. Domingo, a French colony. The doctrine was also applied by Lord Stowell in *The Yonge Pietor,* 4 C. Rob. 79 (1801), under the rule prohibiting trade with the enemy. In this case the goods were consigned to a neutral port with an ultimate destination by land to an enemy port. This gave rise to the doctrine of "continuous transport." Secondly the doctrine was applied during the American Civil War both to blockade and contraband.

At the Naval Conference (1908–9) it was found impossible to reach agreement upon the question of the engagement of neutrals in a trade closed to them in time of peace, but the Declaration of London did deal with the application of the doctrine of continuous voyage to blockade and contraband. By Art. 19 whatever might be the ulterior destination of a vessel or her cargo, she was not liable to capture if at the moment she was on her way to a non-blockaded port, although it was still open to the captor to prove that the alleged destination to a neutral port or open port was merely simulated. But such capture was permissible only within the area of operations or on a pursuit commenced therefrom. Art. 39 provided that absolute contraband should be liable to capture if shown to be destined to territory belonging to or occupied by the enemy or to his armed forces.

During the World War the doctrine of continuous voyage and continuous transport was applied by the Allied and Associated Powers to conditional as well as to absolute contraband, and was fully examined by Sir Samuel Evans in the *Kim* (1918) I.B. and C.P.C. 405. For the French practice, *see* the *Karimata,* Fanchille, *Jurisprudence Française en Matière de Prises Maritimes,* 62, 92; for the Italian see *S. S. Kyzicos,* Fanchille, *Jurisprudence Italienne en Matière de Prises Maritimes,* 57.

**Destruction of Neutral Prizes.**—By the law of nations merchantmen must always be brought in for adjudication and consequently must never be destroyed by their captors (the *Actaeon* [1818] 2 Dods: 48, the *Felicity* [1819] 2 Dods: 381, and *Maisonnaire* v. *Keating* [1815] 2 Gall: 325). The old rule, however, that neutral vessels must never be destroyed, was rejected by Russia in her naval instructions in 1868, 1895 and 1901; by France in 1870; by the United States in 1812 and 1898; by Japan in 1904 and by Germany in 1908. Art. 48 of the Declaration of London provided that "a neutral vessel which has been captured may not be destroyed by the captor but she must be taken into such port as is proper for the determination there of all questions concerning the validity of the prize." But this provision is qualified by Art. 49 which declares: "As an exception a neutral vessel which has been captured and which would be liable to condemnation, may be destroyed if the observance of Art. 48 would involve danger to the safety of the warship or to the success of the operations in which she is engaged at the time." By Art. 50, before destruction, all persons must be placed in safety and the ship's papers taken on board the warship, and by Art. 51 the captor must prove that the destruction was demanded "in the face of exceptional necessity."

Upon failure to prove this, the captor was bound to make full compensation, whether the capture was valid or not. It was contended at the time by some Powers that these guarantees virtually amounted to the renunciation to the right of destruction, but the present writer declared that Art. 49 would lead to piracy. And so it proved in the World War. Under the plea of "danger to the safety of the warship" and of "exceptional necessity," the German Government ordered the officers of submarines to sink enemy and neutral merchantmen alike at sight and without leaving a trace (*spurlos versenken*). It is estimated that 1,720 neutral vessels were thus destroyed by Germany and her allies, and over 2,000 neutral sailors killed or drowned.

By the Treaty of Washington, 1922, between the United States, Great Britain, France, Italy and Japan, a merchantman must not be destroyed unless the crew and passengers have been first placed in safety, and if the submarine cannot capture a merchantman in conformity with the rules applicable to other war vessels, it must permit the merchantman to proceed unmolested. Violation of these rules will be deemed an act of piracy and the plea of superior orders will be no defence. These provisions have not been ratified by France.

**Unneutral Service.**—A neutral individual is of course guilty of unneutral service who breaks blockade or carries contraband. But there are certain acts of a particularly distinctive service to which the term unneutral service is usually applied. These are divided into two classes by the Declaration of London according to the gravity of the act. In the first is included service which is only partial. By Art. 45 when a neutral vessel is engaged to

carry military persons or despatches, concurrently with employment of an innocent character, she is liable to be treated in the same manner as a neutral vessel engaged in the carriage of contraband. The vessel may be condemned and the cargo if it belongs to the owner of the vessel. These are sometimes described as analogues of contraband, and so she will be treated throughout as a neutral vessel. But a neutral vessel which identifies herself with the enemy falls into the second class: she is definitely guilty of "hostile service."

By Art. 46, a neutral vessel is liable to be treated as an enemy merchantman (1) if she takes a direct part in the hostilities; (2) if she is under the orders or control of an agent placed on board by the enemy Government; (3) if she is in the exclusive employment of the enemy Government; (4) if she is exclusively engaged at the time either in the transport of enemy troops or in the transmission of intelligence in the interests of the enemy. In these cases goods belonging to the owner of the vessel are liable to condemnation with the vessel. By Art. 47, an individual liable to military service found on board a neutral vessel may be made a prisoner of war; and by Art. 12 of The Hague Convention X., 1907, enemy sick or wounded found on board neutral hospital or merchant ships may be removed.

During World War I the German government having removed all persons liable to military service from the occupied territories of Belgium and France, Great Britain in Dec. 1914 declared they would no longer be bound by Art. 47 of the Declaration, and that they would arrest all reservists found on board neutral vessels. This action was avowedly by way of reprisal. Nevertheless neutral states protested that such persons were not actually incorporated in the armed forces of the enemy and so not within Art. 47. This is probably true, but apart from the Declaration, persons of military age returning to their country of origin for the purpose of military service are really "noxious persons," who, if found on board neutral ships bound to an enemy port or even to a contiguous neutral port, may be seized.

**Inviolability of Postal Correspondence.**—By The Hague Convention XI. of 1907 the postal correspondence of both neutrals and belligerents, whatever its official or private character may be, found on board a neutral or enemy ship is inviolable. If the ship is detained the correspondence must be forwarded by the captor at once. These provisions do not apply to correspondence destined for, or proceeding from a blockaded port. This right to inviolability does not exempt a neutral mail ship from the laws and customs of maritime war. The ship, however, may not be searched except when absolutely necessary, and then only with as much consideration and expedition as possible. Apart from the Convention neutral mail ships and other vessels carrying mails, even though the property of a neutral Government, are not by international law exempt from the ordinary process of the tribunals of a belligerent, unless expressly exempted by treaty. Thus, such vessels are still subject to visit and search.

During World War I, Hague Convention XI. did not apply since it had not been ratified by some of the belligerents. Nevertheless in the first year of the war the Allied Powers did not interfere with the mails found on neutral vessels. But when it was discovered that the Germans were sending contraband through the post and more particularly by means of the parcels post, they insisted upon the right of search and seizure. In their protest against this policy the United States admitted that there was a distinction between such articles as bonds and other securities which might be regarded as merchandise, and shipping documents and money-order lists which should be regarded as genuine correspondence. By such a distinction a right of censorship was obviously implied, but such a censorship on the high seas, owing to German submarine methods, was impracticable.

Neutral vessels were therefore either induced by the Allied Powers to enter allied ports voluntarily for the purpose of search and censorship, or were brought in involuntarily. In their protest against this practice the United States did not complain so much that the exercise of jurisdiction over such vessels was abused, as that the Allied Powers, by sheer naval force, compelled neutral steamship lines to cause their mail steamers to put into allied ports, and thus subject them to the control of the territorial sovereign. The Allied Powers justified this practice on the ground of necessity.

**Reprisals.**—Even neutrals may suffer by measures of reprisal taken by one belligerent without having any legal ground of complaint. The British Order in Council, Feb. 16, 1917, was issued as a measure of retaliation for the German declaration of Feb. 1, 1917, of unrestricted submarine warfare in certain designated zones. The Order provided that a vessel encountered at sea on her way to or from a port in a neutral territory affording means of access to the enemy territory without calling at a port in British or Allied territory should be deemed to be carrying goods with an enemy destination, or of enemy origin and should be liable to capture and condemnation. *The Leonora*, 3 B. & C.P.C. 181, 385 [1919] A.C. 974, was a Dutch vessel, with coal laden at Rotterdam for Stockholm. The coal was produced in Belgian collieries under the control of the German Government and sold by it to a Swedish company. In condemning the ship and cargo, Evans P. held that the Order did not entail unreasonable inconvenience upon neutrals, having regard to all the circumstances. Upon appeal Lord Sumner gave the following opinion: "There are certain rights, which a belligerent enjoys by the law of nations in virtue of belligerency, which may be enforced even against neutral subjects and to the prejudice of their perfect freedom of action, and this because without those rights maritime war would be frustrated and the appeal to the arbitrament of war would be made of none effect."

This and the previous case of *The Stigstad*, 2 B. & C.P.C. 179; 3 *ib.*, 347 [1919] A.C. 279, decided that retaliation is a belligerent right and that retaliatory measures may be enforced against neutrals. If, said Sir Erle Richards, retaliation be a legal right, neutrals can have no cause of complaint.

BIBLIOGRAPHY.—Pitt Cobbett, *Leading Cases on International Law*, vol. II. (1885, 4th ed. 1924); L. A. Atherley-Jones and H. H. L. Bellot, *Commerce in War* (1907); P. Fanchille, *Traité de Droit international public*, vol. II. (1921); C. C. Hyde, *International Law*, vol. II. (1922); W. E. Hall, *International Law* (8th ed. 1924); L. Oppenheim, *International Law*, vol. II. (4th ed. 1926); A. S. Hershey, *Essentials of International Public Law and Organisation* (2nd ed. 1927). (H. H. L. B.)

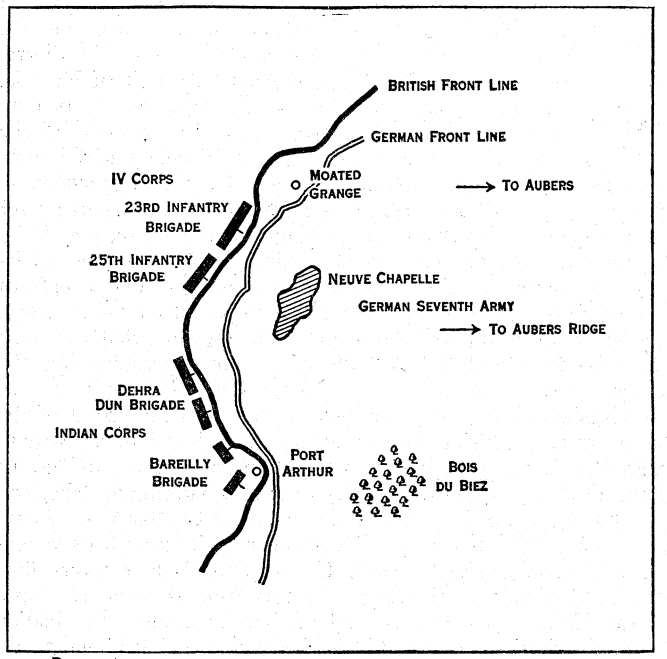
**NEU-ULM,** a town in Bavaria, Germany. Pop. 13,958 (1939). The town is situated on the Danube, opposite Ulm, and is a railway centre. It was incorporated as a town in 1857.

**NEUVE CHAPELLE, BATTLE OF** (March 10–13, 1915). Neuve Chapelle is a village in Pas de Calais west of Lille. Pop. (1936) 419. To understand the tactical idea upon which the battle of Neuve Chapelle was founded (the first of the siege warfare battles undertaken by the British army in France) it must be clearly kept in view that the British higher command had not grasped the fact that the war which now confronted them was an engineer-artillery war, and not a cavalry-infantry one. They considered that infantry could "open a door for an inroad of horsemen against the enemy's rear," and in spite of the failure of Neuve Chapelle, this quite impossible idea governed the tactics of Sir John French and Sir Douglas Haig up to the end of the war.

**Plan of Attack.**—On Feb. 12, General Haig recommended an offensive towards the Aubers ridge on a frontage of 2,000 yards between Port Arthur and the Moated Grange. Neuve Chapelle was to be the first objective, then a line east of the village, and finally the Aubers ridge, the occupation of which would threaten the enemy's communications between La Bassée and Lille. Sir John French, the commander-in-chief, approved of this plan, and fixed its date as soon after March 9 as weather would permit. The attack, or rather assault, was to be carried out by two corps, the Indian corps on the right and the IV. corps on the left. It was to be made after an intense artillery bombardment of 35 minutes' duration. Having broken the enemy's front, it was proposed to extend the attack to five miles in width, and so make room for the cavalry corps to pass through and pursue. The bombardment was to be carried out by 530 guns and howitzers, and the ammunition available was approximately 216,380 rounds.

**Operations of March 10.**—At 4.30 A.M. the assaulting battalions were in position. The morning was cold and misty, and visibility was bad. Sunrise was at 6.30 A.M., and exactly one hour

later the general bombardment was opened. At 8.5 A.M. the attack was launched, and its first phase was carried out with considerable success. At 8.50 A.M. Neuve Chapelle was entered, but here the advance of the right was brought to a standstill by the British artillery barrage which had lifted, and was now falling between the village and the Bois de Biez. The first real trouble was experienced on the two flanks, on the right from the Bois de Biez, and on the




PLAN OF THE BATTLE OF NEUVE CHAPELLE, MARCH 10–13, 1915

left from Manquissart, from both of which a heavy fire was directed on the attackers rendering it impossible for them to extend their front rapidly. By 1 P.M. the whole of the first objective, except part of the Port Arthur salient, was in British hands. Then came a delay. Sir Douglas Haig proposed to advance on the Aubers ridge at 2 P.M., but this attack had to be postponed. This enabled the Germans to push forward reserves to their second line position east of the village, which was only partially dug. From this line an effective cross fire was brought to bear on the north of Neuve Chapelle.

**Operations of March 11.**—During the night the Germans strengthened their new front line. The main attack was carried out by the IV. corps, and was directed on Aubers, the Indian Corps supporting it on the right. It was launched at 7 A.M., but was at once crushed by heavy machine gun fire opened from the concave position now held by the enemy. A little after noon the attack had to be abandoned. It was then clear that until the infantry assault could be prepared by an effective bombardment, to continue the action would lead to unprofitable slaughter.

**Operations of March 12.**—At 5 A.M. on the 12th the Germans made a strong counter-attack which, however, failed in its object. This was followed by an order from Sir Douglas Haig to continue the attack. It was ordered and then postponed with the inevitable confusion resulting. The IV. Corps was instructed to "push through the barrage of fire regardless of loss." The Bois de Biez was to be taken "at all costs." The 7th and 8th Divisions were to push on "regardless of the enemy's fire," with the inevitable result that hundreds of men were at once shot down. By nightfall it became obvious that the battle could not be continued, and early on the 13th Sir John French, having lost 12,892 officers and men, wired to Lord Kitchener: "Cessation of the forward movement is necessitated . . . above all by want of ammunition."

**Comments.**—The true reason for the failure was lack of understanding. An attempt was made to attack a fortress as if it were a deployed army in the field. The conception of surprise was admirable, but it was useless to expect to capture the Aubers ridge from a frontage of 2,000 yards. To do so the frontage should have been at least 12,000 yards, because the ridge was some 6,000 yards distant, and because in siege-warfare the normal depth of penetration is half the length of the initial base. Nevertheless, in this battle, the first of the British grand attacks, and the first in which the "barrage" was used, more common sense was shown in restricting the artillery bombardment to the shortest possible time than in any subsequent battle up to that of Cambrai in November 1917. The German defences were but half a mile deep, and it was possible to fracture them by artillery fire if the bombardment were rapid, for rapidity carried with it surprise.

BIBLIOGRAPHY.—J. E. Edmonds, *History of the Great War, 1915*, vol. i. (1927); *Statistical Abstract of the (British) Army 1914–1920*, (1920); A. Köster, *Die stille Schlacht;* G. E. Palat, *La Grande Guerre sur le Front Occidental* (1917– ), vol. ix.; M. Schwarte, *Der grosse Krieg* (1922– ), vol. ii. (J. F. C. F.)

**NEUVILLE, ALPHONSE MARIE DE** (1836–1885), French painter, was born at Saint-Omer, France, on May 31, 1836. From school he went to college, where he took his degree of *bachelier ès lettres*. He first took up painting in 1856, after passing through the Naval College at Lorient. For a time he worked in Picot's studio, but was painting independently when he produced his first picture, "The Fifth Battalion of Chasseurs at the Gervais Battery (Malakoff)." In 1861 he exhibited "The Light Horse Guards in the Trenches of the Mamelon Vert," at the Salon. His pictures of military life showed peculiar insight, but his full power was not reached till after the war of 1870, episodes in which he depicted in a famous series, including the "Bivouac before Le Bourget" (1872), "The Last Cartridges" (1873), the "Surprise at Daybreak" (1878), and a considerable number of drawings. He also exhibited in London some episodes of the Zulu War. In 1881 he was made an officer of the Legion of Honour for "The Cemetery of Saint-Privat" and "The Despatch-bearer." He also collaborated with Detaille in "The Panorama of Rézonville." De Neuville died on May 18, 1885.

*See* Montrosier, *Les Peintres militaires* (1881), and "De Neuville" in *Gazette des beaux arts* (1885).

**NEUWIED,** a town in the Prussian Rhine province, Germany, on the Rhine, 8 mi. below Coblenz, on the railway from Frankfort-on-Main to Cologne. Pop. (1939) 21,593. Neuwied was founded by Count Frederick of Wied in 1662, on the site of the village of Langendorf. Among those who sought refuge here was a colony of Moravian Brethren; occupying a separate quarter of the town, they carried on manufactures of porcelain stoves. Near Neuwied one of the largest Roman *castra* on the Rhine has been excavated. The principal building is the château, which contains a collection of Roman antiquities.

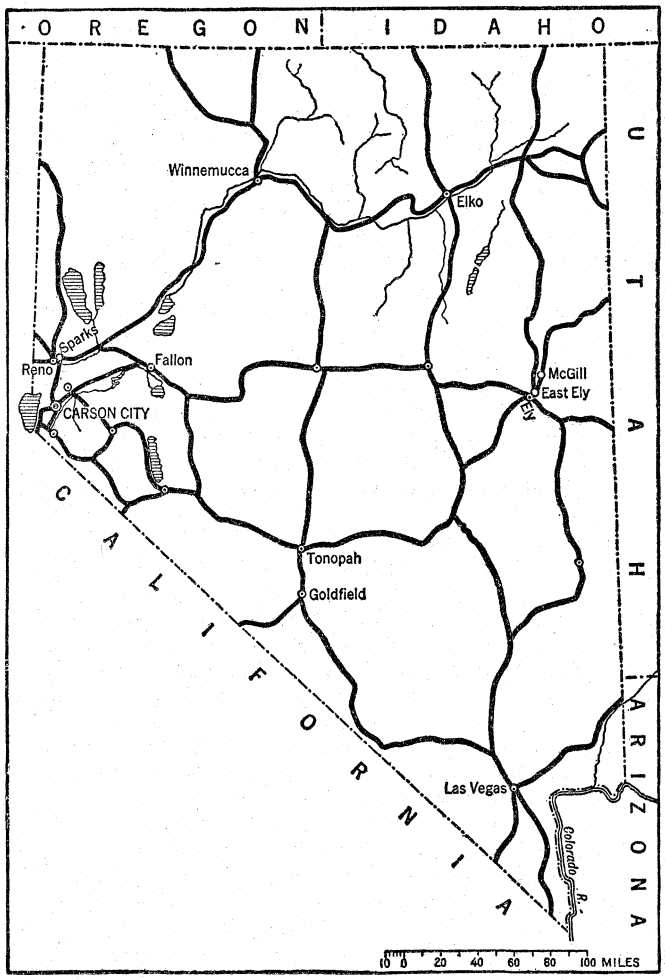
**NEVA,** a river of Russia, which carries off into the Gulf of Finland the waters of Lakes Ladoga, Onega, Ilmen and many smaller basins. It issues from the south-west corner of Lake Ladoga in two channels, which are obstructed by sandstone reefs, so that the better of the two has a depth of only 7 to 16 feet. A little farther down it becomes completely navigable, and attains a breadth of 4,200 ft.; but between the village of Ostrovki and that of Ust-Tosna it passes over a limestone bed, which produces a series of rapids, and reduces the width of the river from 1,050 to 840 and that of the navigable passage from 350 to 175 feet. Nine or ten miles before reaching its outfall the river enters Leningrad, and 5 or 6 m. lower down breaks up into the Great Neva (850 to 1,700 ft. wide), the Little Neva (945 to 1,365), and the Great Nevka (280 to 1,205), this last, 2 m. farther on, sending off the Little Nevka (370 to 1,130 ft.). Its total length is only 40 miles. In front of the delta are sandbanks and rocks which prevent the passage of vessels except by a canal, 18 m. long, 124 to 226 ft. wide, and admitting vessels with a draught of 18½ ft., from Kronstadt to Leningrad. When Lake Ladoga sends down its vast accumulations of block-ice, inundations of a dangerous kind occur, as in 1777, 1824, 1879, 1903, and especially in 1924.

According to observations extending from 1706 to 1899, the mean day of the freezing of the Neva is Nov. 25, the earliest Oct. 28, the latest Jan. 9, and the next latest Dec. 26. The mean day of opening is April 21, the earliest March 18, the latest May 12.

**NEVADA,** popularly known as the "Sagebrush" State, is one of the far western States of the American Union. It lies between 35° and 42° N. and 114° 2′ and 120° W., and is

bounded north by Oregon and Idaho, east by Utah and Arizona, south and west by California. The Colorado river separating it in part from Arizona is the only natural boundary the State possesses, the others being arbitrary lines of geodetic measurement. Nevada ranks sixth among the States in size, having an area of 110,540 sq.mi., 738 sq.mi. of which are water surface. Its extreme length north and south is 483 mi., and its extreme width east and west is 320 miles. Its name, a Spanish word meaning "snow-clad," was originally applied to the snow-capped Sierra Nevada range on the Pacific slope.

**Physical Features.**—With the exception of its north-east and south-east corners, the State lies wholly within the Great Basin, the floor of which is really a vast tableland between 4,000 and 5,000 ft. above the sea. This plateau, however, is not a plain, but contains many buttes, mesas and isolated mountain ranges, the latter running generally in a north and south direction and rising 1,000 to 7,000 ft. above the level of the plain. These ranges are from 5 to 20 m. wide at their bases, and the valleys between are about the same width as the bases. The total area of the valleys is about equal to that of mountainous land. In the north-east an unnamed range of highlands, broken and ill-defined, with a general east and west trend, forms the water-parting be-




MAP SHOWING THE MAIN ROADS IN NEVADA

tween tributaries of the Humboldt river in the Great Basin region and those rivers that flow to the Snake river in Idaho and Oregon and thence via the Columbia river to the Pacific ocean. This drainage area of the Snake amounts to about 5,000 sq.m., the Owyhee, Little Owyhee, Salmon and Bruneau rivers being the principal streams. In the south-east corner is the third drainage system. Here the Virgin river from Utah, after crossing the north-west corner of Arizona, enters the State and flows south-west for 60 m. until it joins the Colorado river. The latter stream flows for 150 m. along the south-east boundary towards the Gulf of California. The Colorado leaves Nevada at an altitude of but 470 ft. above sea-level, the lowest point in the State. The mean elevation of the State is 5,500 ft. and, with the exception of the dip to the Colorado in the south-east, the entire State lies above the 2,000 ft. line.

The Sierra Nevada range, which forms the western rim of the basin, sends into the State a single lofty spur, the Washoe mountains. At the foot of this range there is, relatively speaking, a depression, with an altitude of about 3,850 ft. above the sea, which receives the drainage of the eastern slopes of the Sierra, and what little drainage there is in the northern half of Nevada. From this depression eastward the general level of the plateau rises to an elevation of 6,000 ft. near the eastern borders of the State. The mountain ranges also increase in height and importance as far as the East Humboldt range, a lofty mass about 60 m. west of the Utah boundary. This range is the water-parting for nearly all the westward-flowing streams of the State, and is by far the steepest and most rugged within Nevada, a number of its peaks attaining a height of 11,000 or 12,000 feet. On its eastern slope the waters soon disappear within the bed of narrow canyons, but break out again at the foot in ice-cold springs that form the source of the Ruby and Franklin lakes; on its western side the descent is more gentle, and the waters form the south fork of the Humboldt river. The Humboldt is the most important of the basin streams. Rising in the north-east it flows in a tortuous channel in a general south-west direction for 300 m. and drains 7,000 or 8,000 sq. miles. It empties into Humboldt lake, the overflow from which goes into the so-called Carson sink. At no part of its course is it a large river and near its mouth its waters are subalkaline. The Truckee, Carson and Walker rivers flow with more vigour, receiving their waters from the eastern slopes of the Sierra Nevada range and discharging them into alkaline lakes. Of these lakes Pyramid is the largest, being about 33 m. long and 14 m. wide. Walker lake is as long but only six or seven miles in width. These larger lakes always contain water, varying only in area and depth, but the smaller lakes usually evaporate in the course of the summer. The latter are formed by waters that fall on barren mountain-sides and rush down in torrents, forming in the valleys shallow bodies of water yellow with mud held in suspension. Excepting the "alkali flats" no portion of the desert is devoid of vegetation, even in the driest seasons. In the Washoe mountains there is a heavy growth of conifers extending down into the valleys; but in many places these mountains have been almost deforested to provide timber for the mines. In other places these areas have been incorporated into national forests, in the endeavour to protect and foster the growth of timber and vegetation so as to regulate the drainage of the State. On all but the lowest ranges of the basin the piñon and juniper are found, but these rarely grow to a height over 15 ft.; and on the principal ranges above 6,800 ft. is the stunted mountain mahogany. But except for these infrequent wooded areas, the mountains are even more bare than the valleys, because their shrubs are dwarfed from exposure. The valleys are covered with typical desert shrubs, greasewood, creosote bushes and sagebrush, and with bunch grass, which is valuable for grazing. The skies of Nevada are clear nearly every day in the year. The mean annual precipitation varies from 3 in. in the south-west (Esmeralda county) to 12 in. in the east (White Pine county), and varies also according to altitude. Snow rarely lies on the ground in the valleys.

**Government.**—Nevada is governed under its original Constitution, adopted in 1864, and since amended in important respects. Proposed amendments must be passed by a majority in both houses of two consecutive legislatures before they can be submitted to the people.

The legislature, composed of a senate and assembly, meets regularly in January of every odd-numbered year, its sessions being limited to 60 days. The Constitution requires that the number of senators shall be not less than one-third nor more than one-half the number of members in the assembly, and that the membership of both houses shall not exceed 75. In 1941 there were 17 senators and 40 representatives. Senators are

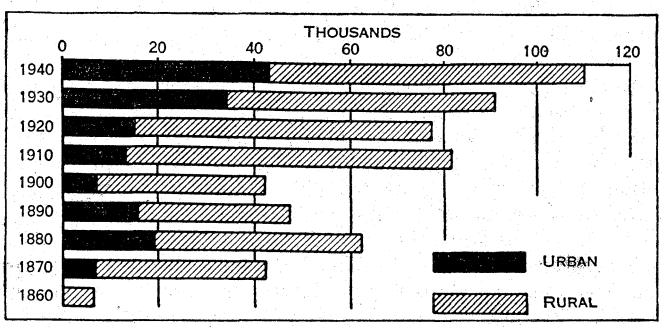
elected for four years—one-half the membership retiring every two years; representatives are elected biennially. The initiative and referendum were adopted by amendment in 1904.

The principal administrative officers are the governor, lieutenant governor, secretary of state, attorney general, controller, treasurer, inspector of mines, surveyor general and superintendent of public instruction, all elected for a four-year term. The governor does not possess the usual sole pardoning power but serves together with the justices of the supreme court, the clerk of the supreme court and the attorney general on the board of pardons. There are many administrative boards and commissions, the most important of them being the board of finance, board of examiners, Nevada tax commission, industrial commission, department of highways, board of agriculture, board of stock commissioners, board of education, board of health and board of irrigation.

The judicial department consists of a supreme court with a chief justice and two associate justices, chosen for six years, and eight district courts, the 2nd with two judges and seven with one judge, elected for four years. Each township has a justice of the peace chosen biennially by its voters. The statutes provide that only three-fourths of the jurors may be required to agree to a verdict in civil cases. Nevada was the first state in the world to execute condemned men painlessly by means of odourless lethal gas. Since 1931 a residence of six weeks in the state is necessary for divorce.

The county is the principal unit of local government. There were (1941) 17 counties in the state, some as large as several eastern states put together.

**Population.**—The population of Nevada in 1860 was 6,857; in 1880, 62,266; in 1910, 81,875; and in 1940, 110,247. This last figure represents an increase of 21·1% over the population in 1930. The population per square mile was 1·0, as compared with 44·2 for the United States as a whole. Of the 1940 population, 43,291, or 39·3%, lived in urban places, that is, in cities of




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF NEVADA: 1860 TO 1940

2,500 or more. The number of occupied dwelling units returned in the housing census of 1940 was 33,294, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 3·6 in 1930 to 3·3 in 1940. The white population of Nevada formed 94·3% of the total in 1940, as compared with 92·8% in 1930, practically all the nonwhite population being Indians, with a few Chinese and Japanese. The population of the state and of its principal cities is summarized in the following table:

| Area | Population | | | Percent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 110,247 | 91,058 | 77,407 | 21·1 | 17·6 |
| Urban | 43,291 | 34,464 | 15,254 | 25·6 | 125·9 |
| Rural | 66,956 | 56,594 | 62,153 | 18·3 | —8·9 |
| Percent urban | 39·3 | 37·8 | 19·7 | .. | .. |
| Principal cities: | | | | | |
| Reno | 21,317 | 18,529 | 12,016 | 15·0 | 54·2 |
| Carson City | 2,478 | 1,596 | 1,685 | 55·3 | —5·3 |

**Finance.**—The state legislature authorizes all expenditures, and in turn fixes a tax levy which shall produce revenue enough to meet these expenditures. The supervision of the assessment and collection of taxes is in the hands of the Nevada tax commission consisting of the governor, acting as chairman, and six commissioners appointed by him.

The receipts of the state for the fiscal year ending June 30, 1940 amounted to $9,262,868, the expenditures to $7,658,765. There was a treasury balance of $1,805,512. As in most states, a large share of the receipts is derived from property taxation.

The state had bonds outstanding July 1, 1940, in the amount of $385,000, incurred mostly for state building and highway purposes. This amount was more than offset by bonds and securities held by the state, income from which was $128,265.

On May 1, 1941, there were 21 individual banking institutions in the state, of which ten were branches, six were national banks and five were state banks. The resources of Nevada banks totalled $47,000,000, and deposits were listed as $42,667,000. The 1940 assessment for tax purposes amounted to $198,800,000.

**Education.**—The state board of education is composed of the governor, the state superintendent of public instruction and 5 members, elected one from each of the educational supervision districts of the state. There were in 1941 20,746 pupils enrolled in the public schools in the state, as against 18,041 in 1930. Of the total 1941 enrolment 5,832 were in the public high schools. In 1941 there were 251 elementary schools, 15 kindergartens and 45 high schools, staffed by 636 elementary teachers, 15 kindergarten teachers and 268 high school teachers.

The only institution of college rank is the University of Nevada located on an eminence overlooking the city of Reno. Its enrolment during the regular session, 1940–41, was 1,142, composed of 718 men and 424 women. The Mackay School of Mines, founded and endowed by the family of John W. Mackay, one of the "bonanza kings" of the Comstock Lode, is an outstanding department. A meteorological observatory is maintained at the top of Mount Rose.

**Libraries.**—The state library at Carson City, est. 1861, contains 236,527 volumes, including 50,222 volumes on law, constituting, because of the completeness of its early-day statutes of every state in the union, one of the leading law libraries in the United States. The University library, housed in the Alice MacManus Clark building, contains 75,210 bound volumes. Other libraries at the university are the Agricultural library, the Mackay Research library and the Mining library. A total of 42 libraries serve every section of the state.

**Charities and Corrections.**—A state orphans' home is located at Carson City, a state hospital for mental diseases at Reno, and a home for male juvenile delinquents at Elko. The state penitentiary is at Carson City.

**Agriculture and Livestock.**—Nevada is the most arid state of the United States because the high Sierra Nevada range interrupts the moisture-laden clouds from the Pacific. East of these mountains, the valleys, however rich their soils, are covered with sagebrush and appear like monotonous desert wastes, except where some stream annually overflows its banks to create natural meadows, or where the land has been cleared of sagebrush and artificially watered. Agriculture is dependent almost entirely upon irrigation; how much so is shown by the fact that of approximately 379,658 ac. of improved farm land cultivated in the state in 1939, 369,600 were under irrigation. During the period 1930–40 a decrease in the acreage of irrigated lands was caused by a number of dry years. Irrigation enterprises were completed as follows: Rye Patch dam, Wild Horse dam and Boca dam, the latter in California, in an effort to improve conditions. The hay crop in 1940 was still of first importance, amounting to 534,000 tons valued at $3,143,000, while the estimated value of all Nevada's farm products was but $10,000,000. In southern Nevada, hay and forage, wheat, tomato plants and barley are the principal crops, with berries, apples and other orchard fruits growing in both irrigated and unirrigated lands.

The total number of all cattle decreased from 419,000 in 1925 to 342,213 in 1937; most of these were raised for beef purposes, the number of milch cows being 22,000 in 1940. Sheep numbered 835,000, horses, 37,000 and swine, 21,000 in 1940. The 1937 wool clip yielded 6,500,000 lb. from 820,000 sheep.

The farm population in Nevada, similar to the trend in most of the mountain states, decreased from 16,441 in 1930 to 15,852 in 1940, a decrease of 3.6%. Between 1930 and 1940 the number of farms increased from 3,442 to 3,696, but the total harvested average of Nevada's 46 crops totalled 372,300 on Jan. 1, 1941.

*Harvested Area and Production of Principal Crops in Nevada*

| December 1940 | Acreage harvested in 1,000 ac. | Production in 1,000 bu. |
|---|---|---|
| Corn | 4 | 1,146 |
| All wheat | 19 | 483 |
| Oats | 7 | 280 |
| Barley | 15 | 540 |
| All hay | 325 | 534 tons |
| Potatoes | 2.3 | 391 |

**Mining.**—From 1907 metal production steadily increased until it reached its peak in 1917, in which year gold, silver, copper, lead and zinc were produced to the value of $54,424,580. The years 1918–21 were years of swift decline, the production in 1919

being less than one-half that of 1918, and that of 1921 but 50% of that of 1919. An upward turn came in 1923 when the gross production of all minerals rose to $28,598,627. From then through 1929 productions of metals continued to rise steadily, in the latter year production was valued at $36,776,000. The economic depression which set in at the close of 1929 caused a tremendous decline in mineral production; in 1932 it was only $6,568,000. By 1933 it had risen to $7,455,000; and to $35,876,782 by 1940.

Gold and silver were first to lift out of the depression due to the revaluation of the gold dollar and the Silver Purchase act in 1934. In 1935 the U.S. treasury's price for gold was $35.00 per fine oz., and $.719 per fine oz. for silver, as compared with the 1932 prices of $20.67 and $.282. As a result of this government action the production of gold, amounting to 98,590 fine oz. in 1933, rose to 144,275 fine oz. in 1934, and 367,400 in 1940. Its value rose from $2,519,968 in 1933 to $5,042,517 in 1934, and $12,859,000 in 1940. Silver production increased from 1,148,621 fine oz. in 1933 to 3,057,114 in 1934 and 5,105,000 fine oz. in 1940; with corresponding values of $402,017, $1,976,316 and $3,630,222. The production of lead increased from 880,896 lb. in 1932 to 21,981,874 lb. in 1934 and 14,920,000 lb. in 1940. The value in the latter year was $746,000. Zinc production which amounted to 254,795 lb. in 1932 increased to 12,456,000 lb. in 1940; the value increased from $7,644 in 1932 to $647,712 in 1940. Almost all the lead-zinc ore mined in Nevada contained substantial quantities of silver and gold and mines in the Pioche district were the largest producers.

Copper was especially hard hit by the economic depression which began in 1929 due to the sudden, sharp falling off of demand together with the large inventories of ore the companies accumulated in the next two years. Production fell off from 84,475,000 lb. in 1930 to 28,490,000 lb. in 1933. It rose to 41,611,000 lb. in 1934 and to 151,820,000 lb. in 1940, production being stimulated by the war demand in Europe and the increased domestic production for defence. The value of copper production increased from $1,823,335 in 1933 to $3,328,890 in 1934 and $17,155,660 in 1940, by far the largest share of the output in Nevada coming from the Ely district in White Pine county.

The year 1940 witnessed an increase in the production of the strategic metals. Quicksilver has been in great demand, the price reaching almost $200 a flask during the year. Other metals showing a marked increase were antimony, manganese, arsenic and tungsten. The production of nonmetals such as gypsum, borax and limestone showed a substantial increase in 1940. Plans were under way for the construction of a beneficiation plant for manganese ore at Las Vegas. Many mills have been constructed for the treatment of the strategic metals in Nevada. The production of gem stones in Nevada has been on a reduced scale. Nevada turquoise enjoyed a good market but the opal fields of Humboldt county have been idle.

**Manufactures.**—The manufacturing interests of Nevada are unimportant. There were in 1937 but 84 establishments employing 1,012 workers, paying $1,625,121 in wages and manufacturing goods to the value of $20,568,365, an amount less than that of any other state. This represents a decrease in value of manufactures from the $33,717,000 produced in the peak year of 1929.

**Transportation.**—Nevada is crossed east and west by three main lines of railway, the Southern Pacific and the Western Pacific in the northern part of the state and the Union Pacific system in the southern. Branch lines connect the more important mining towns with these lines. Railway mileage in the state reached its peak in 1915 when it amounted to 2,332 mi., by 1941 it had decreased to 1,917 mi. There were in 1940, 5,302 mi. of road in the designated state highway system of which 2,780 mi. were of dustless oil surface and 3,362 mi. improved state highways. This mileage includes the 1941 designations. During 1940, 219 mi. were constructed or reconstructed. The total disbursement for highways in the year 1940 was $4,185,029. Motor vehicle registrations on May 1, 1940 totalled 46,617, of which 45,759 were privately owned and 858 were publicly owned.

**History.**—The first recorded person of European descent to enter the limits of Nevada was Francisco Garcés of the Order of St. Francis, who set out from Sonora in 1775 and passed through what is now the extreme southern corner of the state on his way to California. Half a century later trappers of the Hudson's Bay Company led by Peter Skene Ogden entered Nevada from the north and discovered the Humboldt river. In 1827 Jedediah S. Smith, an American trader from St. Louis, crossed the state from west to east on his return from California after the first recorded journey from the Mississippi to the Pacific by the central route. In 1833 Capt. Bonneville's men were on the Humboldt, and during 1843–45 John C. Fremont made a series of explorations in the region. The first recorded emigrant train to California crossed the state in 1841. By the treaty of Guadalupe Hidalgo, negotiated in 1848 at the close of the war with Mexico, Nevada became U.S. territory. It was then a part of California known as the Washoe country, and so remained until 1850, when most of the present state was included in the newly organized territory of Utah. One of the first settlements was made in 1849 by Mormons at Genoa in the valley of the Carson river. Here in 1851 the earliest recorded public meeting in the state was held to frame a government for the settlers since the seat of the territorial government of Utah was considered too remote to afford protection to life and property. But the Utah authorities intervened and in 1854 the Utah legislature created the county of Carson to include all settlements in western Utah. In 1858 Carson City was laid out, and in the following year the people of Carson county chose delegates to a Constitutional Convention which met at Genoa and drafted a constitution. It was adopted by vote of the people, but this attempt to create a new state government proved abortive, and it was not until the mineral wealth of the Washoe country became generally known that congress took action. In 1861 the territory of Utah was divided at 39° W. (of Washington) and the western portion was called Nevada. The Comstock Lode, one of the richest deposits of precious metal known in the world, was discovered in 1859, and Nevada ceased to be merely a highway for gold-seekers on the way to California and became a stopping place. Virginia City became the most famous of all the mining camps of the far west.

An attempt to win statehood in 1863 was defeated, but in 1864 when it became evident that two more Republican votes were needed in the U.S. senate for reconstruction purposes, party leaders at Washington urged the people of Nevada to adopt a constitution and enter the union as a patriotic duty. The third Constitutional Convention in its history met at Carson City and drew up a constitution which was duly ratified, and in October of that year, President Lincoln proclaimed the new state. The eastern boundary was pushed eastward to its present location on the 37th meridian (W. of Washington) in 1866, and the southern boundary was also fixed in that year. Being "battle-born," Nevada was loyal to the union throughout the Civil War, and furnished a company of troops in 1861 which was joined to a California regiment. In 1863 the territory raised six companies of infantry and six of cavalry (about 1,000 men), which saw no actual service against the Confederates but were useful in subduing hostile Indians.

The history of the state since its organization has been largely a history of its mines. From 1864 to 1868 there was a general reaction in the industry due to unwarranted speculation and inflated values. After 1868 there came a period of consolidation, of more systematic workings, and of deeper development. In 1873 came the discovery of the "big bonanza" by Mackay, Fair, O'Brien and Flood, who became the four "bonanza kings" of Nevada. In 1873, $21,000,000 was taken from the Comstock and production increased until the maximum of $36,000,000 was reached in 1878. The Sutro tunnel intersected the lode in the latter year, and drained the mines. But the richer workings soon proved below the tunnel level and the shafts were sent deeper. In 1882 an immense flow of hot water was struck which flooded the principal mines up to the Sutro tunnel level. The miners were forced to return to the upper levels and work the lower grade ores. Production decreased and with the end in sight the market slumped. Also, the national government had abandoned its artificial maintenance of the price of silver. The period of depression lasted until

about 1900 when the discovery of a new mineral belt in southern Nevada brought renewed prosperity. Tonopah, 60 mi. from the railroad, became the new Mecca, and fast upon the heels of its discovery came that at Goldfield. A railway was completed to the new camps in 1904 and Tonopah proved to be one of the largest and steadiest producing districts of the state. Copper ores of vast extent were discovered at Ely at about the same time and the Nevada Northern railway was completed to this camp in 1907.

The depression immediately before 1900 served a good purpose in turning attention to the agricultural and livestock possibilities of the state. The river valleys under irrigation proved most fertile and these were soon settled by large-scale ranchers. On the river bottoms the ranchers raised their hay and controlled a still larger acreage of the upland grazing ground. Private irrigation systems were supplemented by federal undertakings, the most notable being the Truckee-Carson project. Many beautiful valley towns now have their prosperity founded on the permanent basis of agriculture rather than the uncertain one of mining.

Until the silver agitation of the '90s Nevada was safely Republican. The state's politics in the early period were replete with corruption, and many of its rich mine owners were accused of buying their seats in the United States senate. For four state elections the Silver party swept the state. After the issue subsided the old parties came into control. In the national elections of 1932, 1936 and 1940 the state returned Roosevelt and the Democratic ticket by heavy majorities. Since the legalization of gambling in 1931, and the reduction to six weeks of the residence requirement for divorce, Nevada has become a marriage, divorce and resort centre; during the period 1939–40 there were 4,835 divorces granted and 28,949 marriages solemnized in the state.

In 1936 Boulder dam was built across the Colorado river, situated 31 mi. from Las Vegas. This great dam, the highest in the world, attracts hundreds of thousands of tourists yearly, bringing $2,000,000 to Nevada.

BIBLIOGRAPHY.—Consult the latest reports of various state officers, departments and commissions. *Nevada History:* James G. Scrugham, ed., *Nevada* (1935); Effie Mona Mack, *Nevada* (1936); Fred Nathaniel Fletcher, *Early Nevada* (1929); *Reports* of U.S. Bureau of the Census. *General Literature of Historical Interest:* Carl Burgess Glasscock, *The Big Bonanza* (1931), *Gold in Them Hills* (1932); Franklin A. Buck, *A Yankee Trader in the Gold Rush;* George D. Lyman, *Saga of the Comstock Lode* (1934); Miriam Michelson, *The Wonderlode of Silver and Gold;* Dan. De Quille, *History of the Comstock, Big Bonanza.* (E. C. D. M.)

**NEVADA,** a city of southwestern Missouri, U.S.A., 90 mi. S.E. of Kansas city, at an altitude of 860 ft.; the county seat of Vernon county. It is on federal highways 54 and 71 and is served by the Missouri-Kansas-Texas and the Missouri Pacific railways. Pop. (1940) 8,181. It is the seat of a state hospital for the insane and of Cottey college for girls (1884). The national guard of Missouri has a camping ground nearby. There are chalybeate and sulphur springs in one of the city's parks. Coal is mined in the vicinity, and the city has flour and planing mills, galvanized iron works and other manufacturing industries. Nevada was platted in 1855, incorporated as a town in 1869 and chartered as a city in 1880. During the Civil War it was burned to the ground (1863).

**NEVADA CITY,** a city of eastern California, U.S.A., on Deer creek, at an altitude of 2,525 ft., 63 mi. N.N.E. of Sacramento; the county seat of Nevada county. It is served by the Nevada County Narrow Gauge railroad and motorbus lines. Pop. in 1930, 1,701; and in 1940, 2,445. It is a summer resort and a supply centre for the neighbouring mining camps. The county leads in California gold production, with an annual output of over $11,000,000. Gold was discovered there in the summer of 1849 by James W. Marshall, who in the preceding year had picked up the first nugget in California, near Coloma. The gold output was at its peak in 1850–51. Nevada City was incorporated in 1851 under a special act of the legislature (repealed in 1852).

Nevada City was reincorporated in 1856 and again in 1878.

**NÉVÉ** or **FIRN,** masses of compacted snow formed from the accumulated snow in the catchment area of a glacier, by processes of alternate thawing and freezing. The névé is the feeding ground for the valley-glaciers. (*See* GLACIER.)

**NEVERS,** a town of France, capital of the department of Nièvre, 159 mi. S.S.E. of Paris by the P.L.M. railway to Nîmes. Pop. (1936) 32,988. *Noviodunum,* the early name of Nevers, was later altered to *Nebirnum.* Many medals and Roman antiquities found there shows its importance when Caesar chose it as a military depôt. In 52 B.C. the town was the first place seized by the revolting Aedui. It became the seat of a bishopric at the end of the 5th century.

Having formed part of the duchy of Burgundy, the county of Nevers (Nivernais) was given by Duke Henry I in 987 to his stepson, Otto William, afterwards count of Mâcon, from whom it passed to his son-in-law, Landri. The first house of the hereditary counts of Nevers originated in Landri, and was brought to an end in 1192 by the death of Agnes, countess of Nevers, wife of Pierre de Courtenay (d. 1217).

The county subsequently passed into the houses of Donzy, Châtillon and Bourbon. Nevers is on the Loire where it joins the Nièvre. Narrow winding streets lead from the quay through the town, with many old houses (14th to the 17th centuries). The cathedral of St. Cyr is a combination of two churches, one Romanesque (11th century), the other Gothic (14th century). There is a fine square (16th century) tower on the south side. The church of St. Étienne is 11th century Romanesque. The ducal palace at Nevers (now occupied by the courts of justice and an important ceramic museum) was built in the 15th and 16th centuries and is one of the chief feudal buildings in central France.

An octagonal middle tower contains the great staircase, and its windows are adorned by sculptures relating to the history of the house of Clèves. The Porte du Croux, a square tower, with corner turrets (14th century) is among the remnants of the old fortifications.

Nevers is the seat of a bishopric under the archbishop of Sens, of tribunals of first instance and of commerce and of a court of assizes and has a chamber of commerce.

**NEVILLE** or NEVILL, the family name of a famous English noble house, descended from Dolfin, son of Uchtred, who had a grant from the prior of Durham in 1131 of "Staindropshire," Co. Durham, a territory which remained in the hands of his descendants for over four centuries, and in which stood Raby castle, their chief seat.

His grandson, Robert, son of Meldred, married the heiress of Geoffrey de Neville (d. 1192–93), who inherited from her mother the Bulmer lordship of Brancepeth near Durham. Henceforth Brancepeth castle became the other seat of the house, of which the bull's head crest commemorates the Bulmers; but it adopted the Norman surname of Neville (*Neuville*). Robert's grandson, another Robert (d. 1282), held high position in Northumbria, and sided with Henry III in the Barons' War, as did his younger brother, Geoffrey (d. 1285), ancestor of the Nevills of Hornby. This Robert's son, Robert (d. 1271), extended the possessions of the family into Yorkshire by his marriage with the heiress of Middleham. The summons of their son, Ranulf (d. 1331), to parliament as a baron (1294) did but recognize the position of the Nevills as mighty in the north country. Ralph (d. 1367), the second baron—whose elder brother "the Peacock of the North" was slain by the Douglas in 1318—was employed by Edward III as a commander against the Scots and had a leading part in the victory of Nevill's Cross (1346), where David Bruce was captured, and by which Durham was saved. His active career as head of his house (1331–67) made the name of Nevill a power on the Scottish march.

Of his younger sons, Alexander became archbishop of York (1374–88) and was a supporter of Richard II, attending him closely and encouraging his absolutist policy; he was one of those "appealed of treason" by the opposition in 1388 and was outlawed. He died abroad in 1392.

His younger brother, William, a naval commander, was a leading Lollard and a friend of Wiclif, and in 1388–89 acted with the lords appellant.

John, the 3rd baron (d. 1388), a warden of the Scottish marches

and lieutenant of Aquitaine, a follower of John of Gaunt and a famous soldier in the French wars of Edward III., continued the policy of strengthening the family's position by marriage; his sisters and daughters became the wives of great northern lords; his first wife was a Percy, and his second Lord Latimer's heiress; and his younger son, Thomas, became Lord Furnival in right of his wife, while his son by his second wife became Lord Latimer. His eldest son Ralph (1364–1425), 1st earl of Westmorland (*see* WESTMORLAND, EARLS OF), married as his second wife a daughter of John of Gaunt and secured heiresses for five of his sons, four of the younger ones becoming peers, while a fifth, Robert, was made bishop of Durham (1438–1457). Among his daughters were the duchesses of Norfolk, Buckingham and York (mother of Edward IV. and Richard III.) and an abbess of Barking. The Nevills were thus closely connected with the houses of Lancaster and York, and had themselves become the most important family in the realm. Of the earl's sons by his second marriage, Richard, earl of Salisbury (and three of his sons) and William, earl of Kent, are the subjects of separate notices.

The greatness of the Nevills centred in the "kingmaker" (Richard's son) and the heads of his house, after the 1st earl, were of small account in history, till Charles, the 6th earl, at the instigation of his wife, Surrey's daughter, joined Northumberland in the fatal northern rising of 1569 to the ruin of his house. His estates, with the noble castles of Brancepeth and Raby, were forfeited; Middleham, with the Yorkshire lands, had been settled by the 1st earl on the heirs of his second marriage.

Although the senior line became extinct on the earl's death abroad (1601), there were male descendants of the 1st earl remaining, sprung from George and Edward, sons of his second marriage. George, who was Lord Latimer, was father of Sir Henry, slain at Edgcote fight, and grandfather of Richard, 2nd lord (1469–1530), a soldier who distinguished himself in the north, especially at Flodden Field. His grandson (d. 1577) was the last lord, but there were male descendants of his younger sons, one of whom, Edmund, claimed the barony, and after 1601 the earldom of Westmorland, but vainly, owing to its attainder.

The heirs male of Edward, Lord "Bergavenny" (now "Abergavenny" co. Monmouth), who died in 1476, have retained their place in the peerage under that style to the present day. In 1784 the then Lord Abergavenny received an earldom, and the next lord erected at Eridge, Sussex, the present seat of the family, on which the marquisate of Abergavenny and earldom of Lewes were conferred in 1876. Its Sussex estates are derived through the Beauchamps, from the Fitz Alans, heirs of the Warennes.

*See* Rowland's *Historical and Genealogical Account of the Family of Nevill* (1830); Drummond's *Noble British Families* (1846); Swallow's *De Nova Villa* (1885); and Barron's sketch in *The Ancestor*, No. 6 (1903). Also Dugdale's *Baronage;* G. E. C[okayne]'s *Complete Peerage;* J. H. Round's *Feudal England;* and for the Nevill castles Mackenzie's *Castles of England.* For the Kingmaker, *see* Oman's monograph (1891).

**NEVILLE'S CROSS, BATTLE OF.** This battle of Oct. 17, 1346, took place after Crécy (*q.v.*) and while Edward III. was still abroad, besieging Calais. It foiled the opportunist Scottish invasion, and assured Edward's freedom to continue his French projects. But its main interest in military history is that it affords an example of the offensive power of the new tactical combination of archers and spearmen, in contrast to Dupplin, Halidon Hill, Crécy, Poitiers and Agincourt, which were all won by awaiting the enemy's onslaught. After crossing the border, King David Bruce was surprised by the quickness with which the English, under William de la Zouch, archbishop of York, concentrated to meet him. Driven to accept battle near Durham, the Scottish king took up his position to resist attack, his pikemen formed in three great "schiltrons." The English advanced, with their left leading, and the archers on this wing overlapped and swarmed round the Scottish right flank "schiltron." When this broke under the arrow-storm, they closed on the centre "schiltron" —already attacked in front. Its collapse, in turn, under the converging pressure, led to the capture of the king and the hurried retreat of the remaining left division of pikemen. Thus the archers proved their power against an immobile foe to pave the way for a successful assault by knights and men-at-arms.

**NEVIN, ETHELBERT** (1862–1901), American composer, was born at Edgeworth, Pa., Nov. 25, 1862. His musical talent displayed itself in childhood. He studied in Boston, 1884, before going to Berlin to continue work under Klindworth and Von Buelow, who encouraged his ability as composer. After teaching in Boston (1887–93), he returned to Europe residing for a time in Paris, Berlin, Florence and Venice as well as in Algiers. In 1900 he went back to the United States, becoming associated with Horatio Parker in the department of music at Yale university. He died at New Haven, Conn., Feb. 17, 1901. Ranked with the foremost of American song-writers, he was also the composer of many instrumental pieces, mostly in miniature form, marked by a delicate, melodious originality. Among his compositions were *Water Scenes* for the piano, including the favourite *Narcissus;* a piano suite, *In Tuscany;* the song cycles, *In Arcady* and *The Quest of the Heart's Desire,* the latter posthumously published as was also *Tempo di Valse;* a *Sketch Book* of songs and piano music; and *The Rosary,* the song that became instantly popular at a concert at Madison Square Garden, New York, Feb. 15, 1898, and has been a universal favourite ever since.

**NEVIS,** an island in the British West Indies, forming with St. Kitts one of the four presidencies in the colony of the Leeward Islands. Pop. (1942) 14,441. It lies in 17° 14′ N. and 62° 33′ W., and is separated from St. Kitts by a shallow channel 2 mi. wide at its narrowest point. The island is almost circular, and from the sea has the appearance of a perfect cone, rising gradually to a height of 3,596 ft. Total area, 50 sq.mi. Average temperature, 82° F. Cotton cultivation is the chief industry, small proprietors marketing their crops through the government ginnery. Sugar is also exported. The chief town, Charlestown, lies on the S. W., Alexander Hamilton, drafter of the U.S. constitution, was born there in 1757. Discovered by Columbus in 1493, Nevis was first colonized by the English in 1628; captured by the French in 1782, it was restored to Britain the next year.

**NEW ACADEMY.** Plato's school is known as the Academy, or the older Academy. For some time after Plato's death the school continued true to his teaching. But in the third century B.C., when Arcesilaus (316–241 B.C.), was head of the Academy, there came a great change. Arcesilaus developed a sceptical philosophy in opposition mainly to the Stoics. To mark this change in the trend of its teaching the school became known as the New Academy. *See* PLATO; ACADEMY, GREEK.

**NEW ALBANY,** a city of southern Indiana, U.S.A., on the Ohio river, opposite Louisville, Kentucky; county seat of Floyd county. It is on federal highways 31 and 150, and is served by the Baltimore and Ohio, the Chicago, Indianapolis and Louisville, the Pennsylvania and the Southern railways and river steamers. Pop. (1940) 25,414. The city lies on a plateau above the river and is surrounded by hills rising more than 600 ft. above the river. Four coalfields are close at hand and hydroelectric current is available. It has 37 manufacturing industries with an output of about $15,000,000; the leading products are plywood, furniture, iron and steel, edge tools, engines and boilers, men's clothing, leather, fertilizers and flour. Agriculturally, New Albany and vicinity produces more than $500,000 worth of strawberries annually. Dairy products are second in volume. A state tuberculosis sanitarium, Silvercrest, was completed in 1940. New Albany was platted in 1813 and chartered as a city in 1839.

**NEW AMSTERDAM,** a town of British Guiana, situated in 6° 20′ N. and 59° 15′ W. on the east bank of the Berbice river, about 4 m. from the mouth. Formerly the capital of the colony of Berbice, it is now the capital of the county of that name. It is composed almost entirely of wooden houses, having a population of 9,379 (1939). Colony house, standing in handsome grounds beside the botanical gardens, formerly the residence of the governor and seat of the legislature, now contains the treasury and supreme courts. New Amsterdam is connected by ferry, rail and a bi-weekly steamer service with Georgetown.

**NEWARK, DAVID LESLIE,** LORD (1601–1682), Scottish general, fifth son of Sir Patrick Leslie of Pitcairly, Fifeshire, commendator of Lindores, and Lady Jean Stuart, daughter of the

1st earl of Orkney. In his early life he served in the army of Gustavus Adolphus, where he rose to the rank of colonel of cavalry. In 1640 he returned to Scotland. He was major-general under Alexander Leslie, earl of Leven, at Marston Moor. He was then sent into the north-western counties, and besieged and took Carlisle. When, after the battle of Kilsyth, Scotland was at the mercy of Montrose and his army, Leslie was recalled from England in 1645, and made lieutenant-general of horse. In September he surprised and routed Montrose at Philiphaugh near Selkirk. He was then declared lieutenant-general of the forces. After a short period of service in England he returned to Scotland, and reduced several of the Highland clans.

In 1650 Newark was sent against Montrose, who was defeated and captured by Major Strachan, Leslie's advance guard commander; and later in the year, all parties having for the moment combined to support Charles II., Leslie was appointed to the chief command of the new army levied on behalf of Charles II. The result, though disastrous, abundantly demonstrated Leslie's capacity as a soldier, and it might be claimed for him that Cromwell and the English regulars proved no match for him until his movements were interfered with and his army reduced to indiscipline by the representatives of the Kirk party that accompanied his headquarters. After Dunbar Leslie fought a stubborn defensive campaign up to the crossing of the Forth by Cromwell, and then accompanied Charles to Worcester, where he was lieutenant-general under the king. On the defeat of the royal army Leslie was committed to the Tower, where he remained till the Restoration in 1660. In 1661 he was created Lord Newark, and received a pension of £500 per annum. He died in 1682. The title became extinct in 1790.

**NEWARK,** a municipal borough in the Newark parliamentary division of Nottinghamshire, England. Pop. (1938) 20,330. Area 5.3 sq.mi. It lies on the Devon near its junction with the Trent and is connected with the Trent navigation by a canal $1\frac{1}{2}$ mi. in length. It is 120 mi. N.N.W. from London by the L.N.E.R. Newark owed its origin, possibly in Roman times, to its position on the great road called the Fosse Way, in the Trent valley. Granted to the monastery of Stow by Godiva, it remained in the hands of the bishops of Lincoln until the reign of Edward VI. The castle was erected by Bishop Alexander in 1123, and the bridge about the same time. It was incorporated in 1549, and the charter was confirmed and extended by Elizabeth.

A weekly market on Wednesdays, and a fair on the eve, day and morrow of the Invention of the Holy Cross, are still held; another fair at St. Mary Magdalene and the four preceding days was granted by Henry III and is probably represented by the fair now held on May 14. A market for corn and cattle is still held on Wednesdays, and another on Tuesdays for fat stock has been added. The church of St. Mary Magdalene is notable for its tower and octagonal spire (223 ft. high). Its central piers, dating from the 11th or 12th century, remain, and the lower part of the tower is Early English. The upper parts of the tower and spire are Decorated, completed about 1350; the nave dates from between 1384 and 1393 and the chancel from 1489. There are a few old monuments and a 14th century brass. The castle is supposed to have been founded by Egbert, king of the West Saxons. It was known as the "key of the North." The Norman stronghold still shows a gatehouse, a crypt and the lofty tower. The building seems to have been reconstructed in the early part of the 13th century. During the Great Rebellion it was garrisoned for Charles I and endured three sieges. A late 15th century cross (the "Beaumond" cross) is preserved in the town. A grammar and song school was founded in the reign of Henry VIII.

The town trades in malt, coal, corn and cattle. There are iron and brass foundries, boilerworks, agricultural implement manufactories and breweries. Gypsum and limestone are obtained in the neighborhood.

**NEWARK,** the largest city of New Jersey, U.S.A., and the 18th in size in the United States (1940), a port of entry and the county seat of Essex county; on the Passaic river and Newark bay, 8 m. W. of lower Manhattan (New York city). It is served by the Baltimore and Ohio, the Central of New Jersey, the Erie, the Lackawanna, the Lehigh Valley and the Pennsylvania railways; steamship lines operating to Atlantic, Gulf and Pacific ports and Hudson river landings; interurban trolleys, entering the city's business centre via subway, motor bus and truck lines in all directions; and the Hudson and Manhattan railway, which provides 178 trains daily to and from New York city via tubes under the Hudson river; federal highway 1 and state highway 25 (over a high-level super bridge structure known as Pulaski skyway).

The Newark Metropolitan airport (250 ac.) was one of the pioneer American airports. It was opened in 1928.

Population in 1940, according to the federal census, was 429,760. This is more than doubled by the adjacent cities and suburbs, including the Oranges, Belleville, Nutley, Bloomfield, Montclair, Irvington, Maplewood, Elizabeth, Kearny, Arlington, Harrison and Bayonne.

The city has an area of 23.6 sq.mi.; 13 mi. of water front, 375 mi. of streets (357 mi. paved) and an assessed valuation for 1940 of $777,835,463. The site, bordered on the east by the Passaic river, is generally level, but rises gradually toward the west.

Port of Newark faces Newark bay at the mouth of the river. The city is laid out in an irregular pattern. It is closely built up in the business sections, largely with tall structures of modern type. Many of the older buildings are of a native brown sandstone. Broad street (120 ft. wide) and Market street (90 ft.) are the principal thoroughfares, and their intersection (the "Four Corners") is one of the busiest traffic points in the world. Near by is Military park (an irregular plaza used in colonial days as a drill ground), surrounded by public and semi-public buildings (including the Public Service terminal, completed in 1916). In this park is a magnificent bronze group of 48 figures on a gigantic scale, "The Wars of America," by Gutzon Borglum.

Facing Washington park, also near the heart of the city, are the public library and the Newark Museum of Industry, Art and Science (opened 1926). Conspicuous among the city's business structures are the buildings of the Prudential and various other insurance companies as well as that of the New Jersey Bell Telephone company. The county courthouse, designed by Cass Gilbert, has mural decorations by well known American artists, and in front of it is Gutzon Borglum's seated statue of Lincoln (in bronze). The hall of records, opposite the courthouse, was completed in 1928. Completion of a union railway and trolley station in 1937 enabled abolition of Manhattan Transfer in the New Jersey meadows and involved the construction of Newark's first subway.

Among the noteworthy old buildings are the Trinity Episcopal cathedral, near Military park, built in 1743 and used as a hospital during the Revolution; the House of Prayer with its stone rectory, over 200 years old, and the Old First Presbyterian church, founded 1666.

There are 44 playgrounds, with a combined area of 42 ac., and the parks within the city limits cover 951 ac., of which 912 ac. are part of the Essex county park system aggregating 3,833 acres.

Since 1917 the city has operated under a commission form of government. Five commissioners, elected at large every four years, constitute the governing body. Each commissioner is the director of one of the five departments of the city's business (public affairs, public works, revenue and finance, public safety, parks and public property). The director of public affairs serves as mayor. The public schools are administered by a non-partisan board of nine members (appointed). The city's water supply from the Pequannock river watershed (57,000,000 gal. daily) in recent years has been increased by the development of the Wanaque watershed (a joint project of eight north Jersey municipalities) which supplies a total of 100,000,000 gal. a day, of which 40,500,000 is allotted to Newark.

The quality of water supplied is equalled by that of but very few large cities. The sewage from Newark and 21 other municipalities is disposed of through trunk sewers (operated by the Passaic Valley Sewerage commission) into strong tidal currents well out into New York bay.

The public school system comprises 49 elementary, 7 senior and 3 junior high schools, 1 continuation school and 11 evening schools. There are 2 vocational schools under county direction in the city; 27 parochial schools and several private academies, including Newark academy, founded in 1774. The public library and museum have been pioneers in developing unconventional methods of serving the people.

The library has 621,966 volumes and an annual circulation of 2,314,977. The museum has exhibits valued at over $1,200,000. The New Jersey Historical society, with its exhibits and records, adds to the city's cultural assets. There are several special libraries in the city, including the Prudential Insurance company's valuable collection on vital statistics. Newark is the seat of the Newark College of Engineering (1885); the New Jersey College of Pharmacy (1891), now affiliated with Rutgers university; and the University of Newark (1935). The latter was formed by a merger of: the Newark Institute of Arts and Sciences, the Mercer Beasley Law school, the New Jersey Law school, the Seth Boyden school of business, and Dana college. There is also a State Teachers college. There are about 300 churches and congregations and Newark is the see of both a Roman Catholic and a Protestant Episcopal bishop. The philanthropic institutions and agencies are united in a welfare federation, financed by an annual Community Chest campaign. Daily newspapers are: Newark *Evening News* and *Star-Ledger* (morning). Sunday newspapers are the *Sunday Call* and *Star-Ledger*.

Newark has long been one of the leading manufacturing centres of the country. In 1937, with 1,277 plants, together employing 58,264 workers, and producing goods for the year valued at $421,649,502, it ranked first in value of output in proportion to city area. The industries are highly diversified. Among the principal products, measured by value in 1937, were paints, pigments and varnishes ($38,102,110); electrical apparatus, machinery and supplies ($33,994,407); malt liquors ($28,874,903); bread and other bakery products ($23,274,141); meat packing, wholesale ($22,303,034); chemicals ($14,838,409); leather ($10,039,785); machinery ($9,419,823); jewellery ($9,058,196). Newark is one of the important retail trade and wholesale trade centres as well. The 1939 federal census of business reports 7,986 retail stores having 28,454 employees, who received in wages $35,673,000. The sales totalled $249,372,000. For the same census year, there were in Newark 1,006 wholesale establishments, doing a business of $397,832,000 and employing 13,000, who received in wages $24,328,000. As an insurance centre also it has been long important. The ten large life, fire and casualty companies having their home offices there employ some 14,000 persons in Newark and have assets aggregating over $5,115,000,000. It is an important transportation centre by rail, highway, air and sea. It is a prominent distributing point for many of the nation's leading products. Its development as a seaport is comparatively recent. In 1914, the city began the creation of Port of Newark (on Newark bay, southeastern part of the city, a part of New York Port district) as a shipping terminal and industrial centre. With aid from the federal government the channel was deepened to 30 ft. and widened to 400 ft. Over 2,000 ac. have been prepared on reclaimed land for industrial sites, 10 public and 133 private docks and piers have been built. Water-borne commerce in 1939 on Newark district waterways reached 11,339,024 tons. There were 244 active building and loan associations with total assets of $118,675,589 for 1940. Savings institutions had deposits of over $129,000,000. Debits by commercial banks for 1940 totalled $4,186,785,088.

In 1666 (following the union of the towns of the New Haven Jurisdiction with Connecticut in 1664, and the consequent secularization of the franchise) a band of about 30 Puritans from Milford, Conn., led by Captain Robert Treat, settled at "Four Corners," and the next year they were joined by an equal number from Branford and Guilford, Conn. They bought practically all of what now is Essex county from the Indians for "fifty double hands of powder, one hundred bars of lead, twenty axes, twenty coats, ten guns, twenty pistols, ten kettles, ten swords, four blankets, four barrels of beer, ten pairs of breeches, fifty knives, twenty horses, 1850 fathoms of wampum, six ankers of liquor (or something equivalent), and three troopers' coats." The name was chosen in honour of their pastor, the Rev. Abraham Pierson (1608–78), who came from Newark-on-Trent, England. For 50 years or more the town remained essentially Puritan and was governed largely according to the Mosaic law. About 1730 Presbyterianism superseded Congregationalism, and in 1734 Col. Josiah Ogden (who had caused a schism by saving his wheat one dry Sunday in a wet season) led in founding the first Episcopal church (Trinity). Newark was incorporated as a township in 1693 and was chartered as a city in 1836. The townships of Orange and Bloomfield were set off from it in 1806 and 1812 respectively. From 1747 to 1756 the College of New Jersey (now Princeton university) was carried on there, under the presidency after the first few months of the Rev. Aaron Burr, who published in 1752 his famous textbook, the *Newark Grammar*. The manufacture of leather (especially patent leather) and shoes early became an important industry. There was a tannery there in 1770 and by 1837 there were 155 curriers and patent-leather makers. The jewellery industry dates from about 1830. Newark was the home of Seth Boyden (1788–1870), called by Edison "one of America's greatest inventors," who invented the processes for making patent leather (1818) and malleable cast iron (1826), besides many new machines and many improvements on older apparatus; of the Rev. Hannibal Goodwin, who in 1887, in the attic of the rectory of the House of Prayer, invented the flexible film which made the motion picture possible, and of Edward Weston, inventor of electrical measuring instruments. The city's population was 38,894 in 1850; 71,941 in 1860; 136,508 in 1880; and 246,070 in 1900. Between 1900 and 1910 it increased 41%; between 1910 and 1920, 19%; and between 1920 and 1930, 6·7%. Between 1930 and 1940, it decreased 2·8%.

There has been no important annexation of territory in recent years. (R. W. Bt.)

**NEWARK,** a village of Wayne county, New York, U.S.A., 30 mi. E. of Rochester, on the State Barge canal, and served by the Marion, the New York Central, the Pennsylvania and the West Shore railways. Pop. in 1940, 9,646. Twenty miles north are the summer resorts on Sodus bay (Lake Ontario), and Lakes Seneca and Canandaigua lie 15 mi. and 18 mi. respectively to the south. Newark has extensive nurseries (it is the rose centre of America) and a great variety of manufacturing industries, with a combined pay roll estimated at $1,750,000 annually, and an aggregate business of $15,000,000. It is the seat of a state school for mental defectives.

The village was founded about the time of the opening of the Erie canal (1825) and was incorporated in 1839.

**NEWARK,** a city of central Ohio, U.S.A., 33 mi. E. by N. of Columbus, at the confluence of the north and south forks of the Licking river; the county seat of Licking county. It is served by the Baltimore and Ohio and the Pennsylvania railways. Pop. 31,487 in 1940 (92% native white); in 1930 it was 30,596. The city lies 820 ft. above sea level, in a broad, fertile valley, surrounded on three sides by low hills. It is the home of Owens-Corning Fiberglas Corp., employing 2,000 persons and producing products of spun glass, for insulation, cloth etc. The industrial picture as a whole is outstanding for its diversification. Fiberglas, stoves, tires, glass and rope are leading products. At Heath, 2 mi. S.W. there is a large oil refinery. Granville, 6 mi. west, is the seat of Denison university (Baptist, 1831). In Newark and its immediate vicinity are some of the most extensive remaining earthworks of the mound builders, occupying 4 sq.mi. when first noticed (about 1800) by the white settlers, at which time they were covered with dense forests containing trees over 500 years old. They are of great variety, including a circular enclosure of 50 ac., connected by parallel banks with an octagonal mound (20 ac.), and a bas relief 6 ft. high in the form of a spread eagle measuring 240 by 210 feet. Newark was laid out about 1801 and was incorporated in 1813.

**NEWARK WORKS.** An elaborate and complicated group of prehistoric works at the junction of two branches of Licking river, near Newark, Licking county, Ohio. Situated on a plain

30 to 50 ft. above the bottom land, the works consist of a series of square, circular, and octagonal enclosures, with mounds, ditches and connecting avenues spreading over nearly four sq. miles. They are composed of two groups, nearly two mi. apart, connected by two walled avenues averaging 200 ft. wide. The western group consists of a large circle, 3 to 14 ft. high and with a mean diameter of 1,054 ft., connected with a symmetrical octagon by an avenue 300 ft. long and 80 ft. wide. Outside the octagon are two small circles, and at each corner of the octagon is a gateway, opposite which and 60 ft. within is a small mound 3 to 6 ft. in height. The length of the walls between the centres of the gateways averages 621 ft., from which the greatest variation is only four ft., except in one wall that falls 8 ft. short of the average. From the S. side of the octagon a walled avenue stretches southward two mi. or more, and from near its E. side two similar avenues extend eastward with a low wall on each side, one connecting with the square of the eastern group, the other running E. to the descent to the lowland north of the square. Disposed along these avenues are circles. The eastern group of the works consists of a large circle connected with the square mentioned by a broad avenue and several adjoining lines of walls. The wall of the circle is accompanied with an inside ditch 28 to 40 ft. wide and 8 to 13 ft. deep, while the wall itself is 35 to 55 ft. wide at the base and from 5 to 14 ft. high. There is a gateway at the N.E. with flanking extensions of the wall into the walled avenue leading to the square, the sides of which are 926 to 951 ft., yet the angles at the corners do not vary from the right angle more than one degree.

**NEW BEDFORD,** a city of Massachusetts, U.S.A., 56 mi. S. of Boston at the mouth of the Acushnet river, on an arm of Buzzards bay; a port of entry and one of the county seats of Bristol county. It is on federal highway 6 and is served by the New York, New Haven and Hartford railroad, by interurban trolley and motorbus lines and steamboats. Pop. (1920) 121,217 (40% foreign-born white, including the largest colonies in the country from the Atlantic islands and Portugal); in 1940 the population fell to 110,341. The city occupies 19.1 sq.mi. along the west side of the river and harbour, opposite Fairhaven, with which it is connected by two highway bridges. It is in the heart of the summer resort region of southern New England and is the port of sailing for the islands of Nantucket and Martha's Vineyard. The harbour is a tidal estuary, with a 30-ft. channel 350 ft. wide and a 14-ac. turning basin above the bridge. The state pier, completed in 1917, is a modern steamship terminal, 670 ft. long, with large storage space, built by the commonwealth of Massachusetts. Boulevards almost encircle the city, including a broad drive along the shore of the harbour to Clark's point, where Ft. Rodman (erected during the Civil War) guards the entrance. There are some handsome modern buildings, including the post office, the municipal building, the library and the high school. The library, established by a private society in 1802 and taken over by the city in 1853, was one of the first free public libraries in America. It has a fine collection of whaling prints and other material relating to the industry and much material relating to the Quakers. The Bourne Whaling museum contains, among other exhibits, a full-rigged whaleship completely equipped; and in the Seamen's Bethel (1831) just across the street are the memorial tablets described by Melville in *Moby Dick*. The last of the full-rigged whalers, the "Charles W. Morgan," set in a concrete basin on the estate of Col. E. H. R. Green at South Dartmouth (9 mi. S.W. of New Bedford), is kept as a museum. Free educational opportunities, in addition to those provided by the public-school system, are offered by a state textile school, the New Bedford vocational school and the Swain Free School of Design. The morning newspaper, the *Mercury,* was established in 1807. Daily papers are published in French and in Portuguese.

New Bedford has long been one of the principal centres for the manufacture of fine cotton goods. It ranks second to Washington in the proportion of women employed in gainful occupations and second to Fall River in the proportion of children 10 to 15 years of age so employed. Its aggregate factory output in 1937 was valued at $81,132,056, as compared with $125,541,548 in 1927. It is the spot cotton market of the north, and its warehouses have a large storage capacity. The traffic of the harbour in 1940 amounted to 739,697 net tons, of which 707,913 net tons were receipts and 31,784 net tons were shipments. In addition, there are large shipments of fish. The city's assessed valuation for 1940 was $96,326,125. Bank debits for 1940 aggregated $237,212,000.

The site of New Bedford was visited in 1602 by Gosnold, who traded with the Indians at the mouth of the Acushnet. It was originally part of the town of Dartmouth, settled in 1652 by colonists from Plymouth, who purchased the land from Massasoit. About 1665 there was a considerable influx of Quakers, who have ever since been an important and influential element in the population. There was no village on the site of the present city until 1760. In 1787 New Bedford was set off from Dartmouth and incorporated as a town, and in 1847 it was chartered as a city. Fairhaven was separated from it in 1812. The town was at first called Bedford (the family name of Joseph Russell, one of the founders), and later New was prefixed to distinguish it from Bedford in Middlesex county. On May 14, 1775, a local ship captured two armed British sloops just outside the New Bedford harbour. During the Revolution the harbour was a rendezvous of American privateers, and this led to an attack (Sept. 5, 1778) by a fleet and armed force under Earl Grey, which burned 70 ships and almost destroyed the town. The whaling industry became established there after Joseph Rotch, a Nantucket merchant, in 1765 built wharves and warehouses on the west side of the harbour, and New Bedford was long the principal whaling port of the world. For more than a century the industry flourished, with interruptions due to the Revolution, the embargo, the War of 1812 and the Civil War, reaching its peak in 1857, when 329 whaling ships were registered, representing an investment of $12,000,000 and employing 10,000 men ashore and afloat. The hunting grounds shifted after 1791 from off the Virginia and Carolina coast to the Pacific, and after 1848 to the Arctic waters. The first cotton mill was built in 1847 by Joseph Grinnell (1789–1885) and his associates, and began operation in 1848 with 15,000 spindles and 200 looms.

In 1940 the 13 mills making cotton yarn and cotton goods were equipped with 935,600 spindles (about 3·6% of the total in the United States) and 14,250 looms.

Because of the character of the goods made, New Bedford has suffered less than other New England cities from the competition of the new textile centres in the south.

**NEW BERN,** a city of eastern North Carolina, U.S.A., at the mouth of the Trent river, on the Neuse river estuary; a port of entry and the county seat of Craven county. It is on the Atlantic Coastal highway; is connected by a 12-ft. channel with the inland waterway from Boston to Beaufort; and is served by the Atlantic Coast Line and the Norfolk Southern railways and coastwise steamers. Pop. 12,198 in 1920 (55% Negroes); in 1930 it was 11,981, and in 1940, 11,815 by the federal census. The Neuse river is $1\frac{1}{4}$ mi. wide there, and it widens gradually to 7 mi. at its entrance into Pamlico sound, 30 mi. east. New Bern is a picturesque old city, on the peninsula formed by the two rivers, surrounded by forests of cypress and pines. It is the supply depot and commercial centre of the rich surrounding farm lands, and of the numerous fishing and hunting resorts of the region (Ocracoke, Morehead, Beaufort, Jacksonville, Havelock, Nags Head and Cape Lookout).

The city's manufacturing industries include the largest lumber mill in the southeast.

New Bern was founded in 1710 by a company of Germans and Bernese Swiss in search of religious freedom, under the leadership of Baron Christopher de Graffenried, and was incorporated as a city in 1723. The general assembly met there in 1738. In 1749 a printing press (the first in North Carolina) was set up, and the first academy in the province was established. For some years the city was the capital of the province, and it was the leading seaport until the Revolution. Many beautiful old buildings still stand, including one wing of "Tryon's Palace" (the residence of the royal governor, built in 1767–70, and reputed the finest struc-

ture in America at the time), the Presbyterian church (1822), and Christ church, which has a communion service presented by George II in 1752. The city was strongly fortified early in the Civil War, but was captured by federal troops on March 14, 1862, and subsequent attempts by the Confederates to retake it (March 14, 1863, and Feb. 1 and 5, 1864) were unsuccessful.

**NEWBERRY, JOHN STRONG** (1822–1892), American geologist, was born at Windsor, Conn., on Dec. 22, 1822. He graduated from Western Reserve in 1846 and from Cleveland Medical college in 1848, and completed his medical studies in Paris. In 1851 he began the practice of medicine in Cleveland, but abandoned it to accept an appointment as surgeon and geologist with an exploring party in northern California and Oregon. His reports on the geology, botany and zoology of the expedition were published in 1857. For the next four years he was employed on similar work in the region of the Colorado river, his researches extending over a large area in Utah, Arizona and New Mexico. In 1866 he was appointed professor of geology and palaeontology at the Columbia School of Mines, New York, where he commenced the formation of a magnificent collection of specimens. In 1869 he was made state geologist of Ohio and director of the (second) geological survey of that state, and in 1884 palaeontologist to the U.S. geological survey. He devoted much study to Triassic, Cretaceous and Tertiary plants, and in particular to those of the Larami stage. He also carried on researches among the Palaeozoic and Triassic fishes of North America. Among his other publications may be mentioned *The Origin and Classification of Ore Deposits* (1880). He died at New Haven, Conn., on Dec. 7, 1892.

A bibliography of his publications is given in *Bulletin of Geol. Soc. of America*, vol. iv. p. 393. "Memoir" (with portrait) by J. J. Stevenson in *American Geologist* (July 1893).

**NEWBERRY,** a town of South Carolina, U.S.A., the county seat of Newberry county; on federal highways 76 and 176, 43 mi. N.W. of Columbia. It is served by the Columbia, Newberry and Laurens and the Southern railways. Pop. (1940) 7,510. It is a cotton market and cotton-manufacturing centre, with over 200,000 spindles in its mills. The lumber industry, granite quarrying and the manufacture of cottonseed-oil products are important. It is the seat of Newberry college (1859). The town was settled about 1830 and was incorporated in 1894.

**NEWBOLT, SIR HENRY JOHN** (1862–1938), English author and poet, was born on June 6, 1862, the son of H. F. Newbolt, vicar of St. Mary's, Bilston. He was educated at Clifton college, and at Corpus Christi college, Oxford. He was called to the bar at Lincoln's Inn in 1887 and practised until 1899. His first book was a story, *Taken from the Enemy* (1892), and in 1895 he published a tragedy, *Mordred;* but the publication of his ballads, *Admirals All* (1897), created his literary reputation. These were followed by other volumes of stirring verse, *The Island Race* (1898), *The Sailing of the Long-ships* (1902), *Songs of the Sea* (1904). From 1900 to 1905 he was editor of the *Monthly Review.* His novels *The Old Country* (1916) and *The New June* (1909), attracted attention. During the World War he was controller of wireless and cables. He was knighted in 1915. In 1914 appeared *Drake's Drum and other Sea Songs,* and *Aladore;* his chief contribution to war poetry was *St. George's Day and Other Poems* (1918). In 1920 he published his *Naval History of the Great War.*

His other works include:—*Tales of the Great War* (1916), *The Book of the Happy Warrior* (1917), and *Submarine and Anti-Submarine* (1918), written primarily for the young; *A New Study of English Poetry* (1917); *Poetry and Time* (1919); *An English Anthology* (1921); *Studies Green and Gray* (1926); *New Paths on Helicon* (1927); and *Naval Operations—1917 to the Armistice.*

**NEW BRIGHTON,** a community on the northeast shore of Richmond borough (Staten island), part of New York city, U.S.A., since 1898. It is at the northeastern end of Staten island, about 6 mi. S.W. of the borough of Manhattan. At New Brighton is the Sailors' Snug Harbour, founded under the will of Robert Richard Randall (*c.* 1740–1801), who in 1771 became a member of the Marine Society of New York (an organization for the relief of indigent masters of vessels and their families), and in 1790 bought from Baron Poelnitz the "Minto farm," about 21 ac. of land in what is now the borough of Manhattan. This tract, with four lots, also in what is now Manhattan, and cash and stocks to the value of about $10,000 Randall bequeathed to a board of trustees, directing that the income should be used "for the purpose of maintaining and supporting aged, decrepit and worn-out sailors," who had served at least five years under the American flag, and that the institution established for this purpose should be called "the Sailors' Snug Harbour." The Sailors' Snug Harbour was incorporated in 1806, and its charter was amended in 1828 to permit the building of the institution on Staten island rather than on the Randall estate, which had already greatly increased in value. In 1833 the institution, with lands covering 160 ac., was opened in New Brighton with about 50 inmates. Randall's body was removed to the grounds in 1834, and in 1884 a life-size bronze statue of him, by Augustus Saint-Gaudens, was placed in front of the main building. At New Brighton are located Curtis and St. Peter's high schools, Staten Island academy, the Staten island branch of Manhattan college, Staten Island hospital, and the Staten Island Institute of Arts and Sciences museum.

*See* I. K. Morris, *Memorial History of Staten Island* (1900); C. G. Kolff, *A Short History of Staten Island* (1926); and Leng and Davis, *Staten Island and Its People* (1930).

**NEW BRITAIN,** an island of the Bismarck archipelago, lying east of New Guinea, in the Pacific ocean, between 5° and 6° S., and 150° E. (German, *Neu Pommern;* native, *Birara*). It formed part of the colony of German New Guinea from 1884 (when the German protectorate was declared), until 1914, when it was occupied by Australian troops, and in 1919 it was mandated by the League of Nations to the commonwealth of Australia, until its occupation by the Japanese in Jan. 1942. Rabaul, the administrative centre and principal town, became a major Japanese base in the naval and air war between the Japanese and the U.S. and Australian forces under the command of General Douglas MacArthur (*q.v.*). It was a frequent scene of concentrations of Japanese shipping and of United Nations air attacks. It is long and narrow, almost crescent in shape, about 300 mi. long, with a width varying between 28 and 50 mi. The largest island in the archipelago, its total area is about 10,000 sq.mi. The population of the patrolled areas in 1940 was 90,349.

Little explored and little developed, New Britain, despite its narrowness, had never been crossed by a white man by the time of World War II except at its northern extremity, because it is bisected from east to west by rugged mountain chains. The highest peak on the island, the Father (7,500 ft.), is an active volcano. There are no rivers of any importance, only a few swift streams.

Although the location of Rabaul (non-native population 4,674 in 1940) is open to some criticism (it is on a swamp in an earthquake zone and against an active volcano), the town was built with rather typical German solidity and possesses an excellent harbour, a consideration which doubtless induced the Japanese to select it as a major base. Most of the white population lives in the neighbourhood of Rabaul.

Coco-nut plantations represent the principal agricultural activity of the island. The largest cultivated area (83,913 ac. in 1940) is on the Gazelle peninsula, on the northern shore of the island. Other plantations are located on the southern shore. There are several excellent harbours and anchorages along the shores of the island, Simpson harbour, in Blanche bay, being most frequently used. Copra is the principal product of New Britain, with shell fishing an important subsidiary industry. Most of the copra is shipped from Rabaul, which is ordinarily a port of call for ships from Australia, the Solomons and other regions of the southwest Pacific.

The island is divided into four administrative districts: Rabaul, Kokopo (the former Herbertshöhe, seat of the German administration of New Guinea), Gasmata and Talasea. While the interior has been largely left to the aborigines, roads are gradually extending the area where travel is safe. A good deal of communication is by steamer, and in normal times there is regular service between Rabaul and the smaller ports of New Britain and the ports of New Guinea and Australia.

The natives of New Britain are Melanesians, with dark skins and

frizzy hair. They are akin to the natives of New Guinea (*q.v.*) in customs and language. Old practices of cannibalism and headhunting are to be found in the remote interior districts, but have largely disappeared in the coastal areas, with the building of roads and the establishment of a more settled administration. A curious kind of pidgin English developed for communication between the Europeans and the natives, who can be trained as workers and sometimes show considerable intelligence.

Vulcan island, with an area of several acres, appeared on the south side of Blanche bay during an eruption of a volcano known as Mount Mother.

An eruption of the Matupi and Vulcan volcanoes, near Rabaul, on May 29, 1937, killed 263. (W. H. CH.)

**NEW BRITAIN,** a city of Hartford county, Connecticut, U.S.A., 9 mi. S.W. of Hartford; served by the New York, New Haven and Hartford railroad. Pop. (1920) 59,316; (1930) 68,128 (69% native white; 30.5% foreign-born; 0.5% Negro); 1940, federal census, 68,685. The city has a land area of 13.7 sq.mi.; its parks cover 930 ac.; and it is the seat of a state normal school (established 1851) and a state trade school. It is an important manufacturing centre, with an output in 1937 valued at $62,867,465. Wages paid in that year amounted to $17,282,056. Hardware, cutlery and edge tools and foundry and machine-shop products are the leading manufactures. The city's assessed valuation in 1940 was $106,041,000.

Settlement within the territory now occupied by New Britain began in 1687. The town of New Britain was incorporated in 1850; the city was incorporated in 1871; and in 1905 the two were consolidated.

**NEW BRUNSWICK,** a province of the Dominion of Canada, lying between 45° 2′ and 48° 3′ N. and 63° 46′ and 69° 3′ W. Its length from north to south is 230 mi., its greatest breadth 190 mi., and it has a seaboard of about 550 miles.

**Geological and Physical Features.**—The geological aspect of New Brunswick is fully treated under the section *The Acadian Region* in the article on CANADA. Geographically the province represents the land area of the eastern coast of Canada surrounded by the Bay of Fundy, Northumberland strait, the Gulf of St. Lawrence and the Baie des Chaleurs. It comprises the entire basin of the river St. John, a river 450 mi. long, flowing into the Bay of Fundy and navigable for 88 mi. to Fredericton, and for small boats for 65 mi. farther. The province includes also the basin of the Miramichi and lesser rivers entering the Gulf of St. Lawrence and the southern half of the basin of the Restigouche entering the Baie des Chaleurs. The upland areas thus drained reach in places a height of 2,000 ft. above sea level and form in the centre of the province an unbroken forest country as yet little occupied or reached by railways or highways. All the lower valley of St. John and many coastal parts of the province represent first-class agricultural land and the coast line, especially along the Bay of Fundy, is well settled and offers a chain of commodious harbours. The high tides of the bay, reaching to 70 ft., occasion the peculiar phenomenon of the reversible waterfall at the mouth of the St. John and the rush of the tidal bore at the head of the Bay of Fundy. Only on its western side has New Brunswick in part a nongeographical boundary, the 69° 3′ meridian, a compromise line (Ashburton treaty, 1842) resulting from the search to find the "North West Angle" of Nova Scotia supposed (1783) to separate Nova Scotia from Massachusetts (later Nova Scotia from Maine).

**Climate.**—The cold air of the northern interior frequently flows over the province in winter. The average rainfall is about 40 to 45 inches. The snowfall is very heavy in the north of the province, where it exceeds 100 inches. The harbour of Saint John is open throughout the year.

**Area and Population.**—The area of the province is 27,985 sq.mi. of which 512 are fresh water. The population in 1941 was 457,401 (males 234,097). About 63% of the people are of British descent, descendants of the Loyalists who founded the colony, or immigrants during the prosperous period of the middle 19th century. The French number about 33%. The French population of the Chignecto isthmus represents, in the main, the original mainland Nova Scotia Acadians who were not included in the expulsion of the Acadians from the Nova Scotia peninsula in 1755. The aboriginal element of Algonquin stock is represented by the remnants of two tribes, the Malicites and the Micmac Indians, whose numbers showed a slight increase since confederation (1,400 to 1,700).

In point of religion the population is classified as 46% Roman Catholic, 20% Baptist, 15% United Church, 12% Anglican and 4% Presbyterian. The chief towns, with 1941 populations, are Fredericton, the capital (10,062), Saint John (51,741) and Moncton (22,763).

**Government.**—The British North America Act of 1867 and amendments assigned representation at Ottawa, 12 senators until 1873 (10 in 1943), and representation in the house of commons on the proportion of the population to that of Quebec, which has a fixed representation of 65. But the number of members by the B.N.A. Act of 1915 (5 and 6 Geo. V, c. 45) must not fall by decline of population below the number of senators, and stood at ten in the elections of 1940.

For the provincial government (capital Fredericton) there is a lieutenant governor, appointed and paid by the dominion, a legislative assembly of 48 members elected for five years unless sooner dissolved, a prime minister and ministry on the British constitutional tenure, and a fixed civil service nonpolitical tenure.

**Education.**—Almost all primary education is in public schools, nondenominational, compulsory and free of charge. In 1940 the enrolment was 93,633 in public day schools, 2,707 in private day schools and 308 in business colleges. University and college work is carried on in the (Provincial) University of New Brunswick at Fredericton, founded in 1800 and reorganized in 1859; the (Methodist) University of Mount Allison at Sackville; and the Roman Catholic college at Memramcook.

**Agriculture.**—The province contains a great deal of agricultural land, but the larger part of it, 13,300 sq.mi. in a total of 16,750 sq.mi., is still uncleared of forest. The occupied fields and pastures cover only 2,690 sq.mi. Latest returns before World War II showed New Brunswick's agricultural production as only 24% of its total, as against 81% in the agricultural province of Saskatchewan. Of the field crops the greatest acreage was in hay and clover (five-year average), 569,000 ac. at a value of $6,994,000, with 214,000 ac. in oats, 48,000 ac. in potatoes, ranking second in value. The province stands relatively low in livestock and cream and dairy produce.

**Forests.**—The most valuable and most widely spread tree is the black spruce (*Abies nigra*), from which is made a yearly increasing quantity of wood pulp for papermaking. The hemlock (*Abies Canadensis*), the cedar, birch, beech, oak, ash and many other valuable trees, are also widely spread. The chief ports for shipping are Saint John, at the mouth of the St. John river, and Chatham, at the mouth of the Miramichi.

The great forests, through which flow numerous rivers with excellent harbours at or near their mouths, have long made New Brunswick a centre of lumbering.

The forested land of New Brunswick, including land fit to clear for agriculture and land only of forest utility (lumber, pulpwood), covers about 21,770 sq.mi. of the total 27,473 of the province. Only some 190 sq.mi. of forest are classed as without commercial value. There are no national parks in the province.

Statistics of forest and forest industries in New Brunswick showed accessible standing merchantable timber 11,089,000,000 cu.ft., to compare with 81,931,000,000 cu.ft. for Quebec, and all Canada 212,000,000,000 cu.ft. The lumber production (1939) was 210,919 M.ft.b.m.

**Minerals.**—The mineral wealth of the province is small, though gold, iron, copper, lead, zinc and plumbago have been worked on a small scale at various times. Coal and gypsum are actively mined. Natural gas with oil is obtained near Moncton.

Statistics of mineral production before World War II in 1939 showed a total annual value of about $4,000,000 as compared with $30,000,000 for Nova Scotia; of this nearly $2,000,000 represented coal, and gypsum about $200,000.

**Fisheries.**—The fisheries of New Brunswick are extensive, though less so than those of Nova Scotia. This industry centres in the counties of Charlotte and Gloucester, herring, salmon, lob-

sters, sardines and cod forming the chief catch. The Restigouche, and other rivers near the northern border, are much frequented by anglers in search of trout and salmon.

The sea fisheries of New Brunswick as of the other maritime provinces and of Quebec receive annual bounties which began (1882) with the interest on the money paid by the United States under the Halifax award arising out of the treaty of Washington in 1871. The bounties are paid both to boat owners and employed fishermen. In 1939 the sum of $19,973 was divided among 2,689 persons. At the same date the New Brunswick fisheries produced a value of $5,000,000.

**Manufactures.**—The manufactures, apart from the shipping of Saint John, are connected with lumbering and with agriculture. The making of paper pulp and of furniture is important. Co-operation in the manufacture of butter and cheese has produced excellent results, and numerous cheese and butter factories are scattered through the province.

New Brunswick in 1939 had 803 manufacturing establishments out of 24,800 in all Canada, with some 14,500 employees out of 658,000. Of these provincial workers, 2,434 were in the pulp and paper industry, 2,404 in sawmills, 953 in fish curing and packing and the rest scattered.

**Communications.**—The trunk lines of railway communications are the Canadian National Railways system (the former Intercolonial), the seashore route from Quebec province to Moncton, with an inland route via Edmundston, and the Canadian Pacific "short line" from Montreal to Saint John and Fredericton via the state of Maine. The national Trans-Canada Airways system was established on a regular basis from Montreal to Moncton (Jan. 1, 1940), and six months later to Halifax. Civil air traffic (governmental and private) showed New Brunswick, from its geographical situation, far exceeding the volume of the other maritimes: passengers in 1940, 5,000 (Nova Scotia 1,000); freight 20,500 lb. (Nova Scotia 967 lb.).

**History.**—Until 1784 New Brunswick formed part, first of the French province of Acadia, later of the British province of Nova Scotia. The first settlement within its borders was made in 1604 by Pierre de Guast, sieur de Monts, with whom was Samuel de Champlain. Their colony at the mouth of the St. Croix river was soon abandoned, but throughout the French regime the district was frequented by bands of fur traders. In 1762 the first English settlement was made at Maugerville, on the St. John river, and in 1764 a body of Scottish farmers and labourers took up land along the Miramichi.

Scattered French settlers located themselves on the mainland side of the Bay of Fundy. They numbered about 4,500 at the time of the expulsion of their kindred across the bay, and their numbers were increased by about 500 of these as refugees.

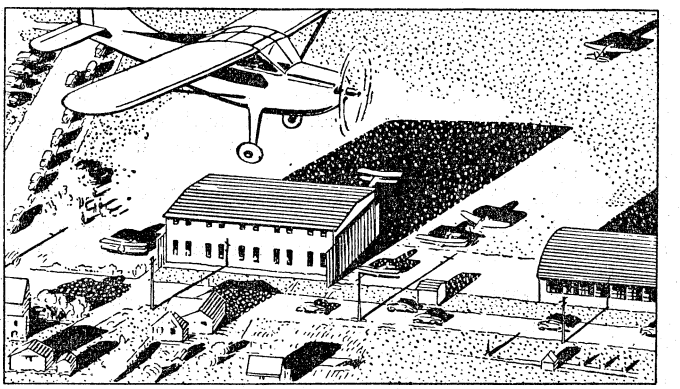
After the American Revolutionary War the great influx of Loyalists into the valley of the St. John led to the separation of New Brunswick from Nova Scotia in 1784. The close of the Napoleonic wars in 1815 brought a constant influx of immigration from Great Britain. The province had 74,000 inhabitants by 1824.

New Brunswick shared with Nova Scotia, in the middle period (1815–67), the prosperous development that arose from lumbering, shipbuilding and the fisheries, and (until 1849) from the preference of the British market for colonial timber and the effect of the Navigation acts (till 1849) in giving the maritime provinces the West Indian trade denied the United States. This occasioned a relative neglect of agriculture and led many immigrants to prefer settlement in upper Canada. The landmarks in the provincial history include the long diplomatic struggle between Britain and the United States over the delimitation of the boundary according to the cryptic terms of the treaty of 1783 which ended in the compromise of the Ashburton treaty of 1842. Provincial history turned also, as already stated, on the question of responsible government, granted after its adoption in Canada (1841–49) and then on reciprocity of trade with the United States (1854). The plan of Confederation for British North America, urged by Canada as a remedy for deadlock, and by the mother country after the warning of the American Civil War, found little favour in the province but was presently voted by the legislature as a reaction from the Fenian raids. The union with Canada, by removing customs revenue and blocking British trade, proved highly unpopular. Hence the history of New Brunswick, as of Nova Scotia, turned on the unsatisfactory relations of the federal and provincial governments: the agitation for repeal, or maritime union, and for economic compensation to offset the dominance of central Canada. (*See* also NOVA SCOTIA: *History.*)

BIBLIOGRAPHY.—The Canadian Census (decennial); *Canada Year Book* (annual); Sir J. W. Dawson, *Canadian Geology* (1891); James Hannay, *History of Acadia* (1879); L. O. Thomas, *The Province of New Brunswick* (1930); *Canada and Its Provinces,* 23 vols. (1914).

(S. LEA.)

**NEW BRUNSWICK,** a city of New Jersey, U.S.A., is the county seat of Middlesex county. It is on the Raritan river and the Lincoln highway, some 30 miles southwest of New York



AFTER PHOTO BY HULL, FOR HADLEY AIRCRAFT INC.

HADLEY FIELD AT NEW BRUNSWICK

city and 60 miles northeast of Philadelphia. It is served by the Pennsylvania and the Raritan River railways, motorbus lines and freight steamers and barges. Pop. (1920) 32,779 (27% foreign-born white); 1940 federal census 33,180.

The city rises from the river to high bluffs on the east and the west, commanding wide and picturesque views. It is the seat of Rutgers university and the Theological seminary of the Reformed Church in America, the oldest theological school in the United States, founded in New York city in 1784 and situated in New Brunswick since 1810. New Brunswick is one of the oldest cities of New Jersey, and has many buildings dating from the 18th century. The Buccleuch mansion, in a 60 ac. park, presented to the city by Anthony Dey, is one of the best preserved colonial houses in the state. On Burnet street still stands the house occupied by Gen. Howe in 1776–77. There is a fine modern stone bridge across the Raritan. The city has large manufacturing industries, employing about 15,000 persons and making a variety of products, ranging in size from motor trucks to knitting needles and valued in 1940 at $55,165,200. Surgical and medical supplies, motorbuses and trucks and fire apparatus are among its leading manufactures. The assessed valuation for 1940 was $41,470,660. Since 1906 the city has had a commission form of government.

A settlement was established here in 1681. It was at first called Prigmore's Swamp, later Inian's Ferry, until the present name was adopted in honour of the House of Brunswick. A city charter was granted by the royal governor in 1730 and by the state legislature in 1784. Washington entered New Brunswick on Nov. 28, 1776, but evacuated it on the approach of the enemy, and from Dec. 3 to April 13, 1777, it was occupied by the British under Lord Howe.

**NEWBURGH,** a royal and small burgh, Fifeshire, Scotland, on the Firth of Tay, 7 mi. N.W. of Ladybank junction by L.N.E.R. Pop. (est. 1938) 2,323. Its industries chiefly consist of the making of linen and oilskin goods, and there is a floorcloth factory. The trade in corn, fruit and potatoes, and the fisheries are important. About 1. mi. S.W. of the town stand the remains of Macduff's Cross, which marks the spot where the clan Macduff was granted rights and sanctuary and composition

for murder done in hot blood. Lindores abbey on the Tay is close to Newburgh. Of the Benedictine abbey, founded in 1178 by David, earl of Huntingdon, brother of William the Lion, there only remain the groined arch of the principal entrance, a portion of the west tower and other fragments. At Blackearnside, a forest of alders east of the village, Wallace defeated the earl of Pembroke in 1298.

**NEWBURGH,** a city of Orange county, New York, U.S.A., on the west bank of the Hudson river, opposite Beacon, 60 m. N. of New York city. It is on Federal highway 9W; is served by the Erie and the West Shore railways, motor-bus and truck lines; and is connected by ferry with the New York Central at Beacon. Pop. (1930) 31,275 (83·2% native white); in 1940, 31,883, a gain of 1·9%. The Hudson widens at this point into Newburgh bay. The city has 2 m. of water front, with a channel deep enough for ocean-going vessels. It occupies a commanding position on terraces rising abruptly from the river, and from the higher points the view embraces many miles of the Hudson and reaches to the Catskill mountains on the north-west. Newburgh has a retail trade amounting to $16,411,000 annually; a large shipping trade in orchard, farm and dairy products; and a variety of manufacturing industries, with an output in 1937 valued at $18,134,824. The assessed valuation for 1941 is $39,483,290. Since 1916 the city has operated under a commission-manager form of government. Newburgh was settled in 1709 by 53 Germans from the Rhenish Palatinate, led by their minister, Joshua Kockethal. Toward the middle of the century many of the Germans moved to Pennsylvania, and their lands were taken up by Scottish and English settlers, who in 1752 named the town after Newburgh, Scotland, from which some of them had come. Washington made his headquarters here from the spring of 1782 until Aug. 1783, in the Dutch farmhouse built by Jonathan Hasbrouck in 1750 (still standing in Washington park). Here he wrote his letter of May 27, 1782, rebuking Col. Nicola for the suggestion that he assume the title of king; here he made his reply to the "Newburgh Addresses" calling for action by the army to force Congress to redress its grievances; and here the arrangements were completed for demobilizing the Continental army. Newburgh was incorporated as a village in 1800 and as a city in 1865.

**NEWBURN,** urban district, Northumberland, England, on the Tyne, 5½ mi. W. of Newcastle by a branch of the L.N.E.Ry. Pop. (est. 1938) 19,370. Area 7.3 sq.mi. It has collieries and iron, steel, engineering, tool and fire-clay works; and there is a large industrial population. Roman remains have been discovered near Hadrian's Wall. The name of Scotswood, a manufacturing village between Newburn and the city, commemorates its occupation by the Scottish Covenanters in 1640. Newburn shared in the Tyneside depression of the 1930s, nearly 21% of the insured population being unemployed in June 1934.

**NEWBURY,** a municipal borough of Berkshire, England, 53 mi. W. by S. of Reading by G.W.R. Pop. (1938) 14,710. Area, about 4 sq.mi. Newbury (new town or borough) is first mentioned by Odericus Vitalis; it is probable, however, that the manor of Uluritone, entered in Domesday as held by Ernulph de Hesdain, covered a large part of the site. The manor subsequently passed to the crown and was held by Elizabeth before her accession. In 1627 it was granted by Charles I as a fee-farm to the corporation. Newbury was a borough by prescription; in 1187 its inhabitants are called "burgesses" and a document of the time of Edward I speaks of it as *burgus*. The borough was incorporated by a charter of Elizabeth (1596). It was extended in 1934. Newbury sent two representatives to the parliament of 1302.

The woollen industry declined early in the 17th century. The Weavers' Company, which still exists, was incorporated in 1601. Newbury castle, of which traces remained until the 17th century, is said to have been besieged by Stephen in 1152. An important woollen market, established in 1862, is held annually.

Newbury is situated on the Kennet, which is followed by the Kennet and Avon canal. The church of St. Nicholas is an early 16th century Perpendicular building. It is said to have been built mainly at the charge of John Winchcombe or Smalwoode (Jack of Newbury), an eminent clothier. A part of John Winchcombe's (Jack of Newbury's) house and the Jacobean cloth hall, now a public museum, still exist. The almshouses called King John's Court are supported by a foundation known as St. Bartholomew's Hospital, to which in 1215 King John granted by charter the profits of a fair on St. Bartholomew's day. Shaw House, on the outskirts, is an Elizabethan mansion; to the north is Donnington castle, retaining a Perpendicular gateway and other fragments. The suburb of Speenhamland was formerly an important posting station on the Bath road. At Sandleford Priory, to the south of Newbury, the site and part of the buildings of an Augustinian priory (*c.* 1200) were utilized in the erection of a mansion in 1781. The householders of Newbury have the right to elect boys and girls to the educational foundation of Christ's Hospital. Trade is agricultural and there are breweries and flour mills.

**Battles of Newbury (1643 and 1644).**—These two important battles during the English Civil War, more commonly called the *Great Rebellion,* are described under the latter heading. The first, on Sept. 20, 1643, arose out of the attempt of the Royal army to bar the path of the Parliamentary forces under the Earl of Essex, which was returning to its base at Reading after raising the siege of Gloucester. Although Essex's army failed to break the Royalist line, they had made so strong a moral and material impression that the Royalists opened the road to them. The situation was reversed in the second battle, Oct. 26, 1644, when the Parliamentary army had headed off Charles I. on his way back to Oxford from Basingstoke. This was the first great manoeuvre-battle of the war.

**NEWBURYPORT,** a city of north-eastern Massachusetts, U.S.A., one of the county seats of Essex county; 38 mi. N.N.E. of Boston, on the southern bank of the Merrimack river, 3 mi. from the ocean. It is on federal highway 1 and is served by the Boston and Maine railroad. Pop. (1920) 15,618; in 1930, 15,084; in 1940 it was 13,916, by federal census. It is an important manufacturing city with a diversified output, valued in 1937 at $6,158,495. Shipping, distilling and jewellery making were established industries in the town at the close of the American Revolution. There are statues of George Washington and of William Lloyd Garrison (by J. Q. A. Ward and by David M. French respectively) and many houses dating back to the 17th century, among them the stone "garrison" house in the form of a cross, with walls 4 ft. thick. Other houses of interest are the birthplace of William Lloyd Garrison, the homes of "Lord" Timothy Dexter and Caleb Cushing, and the Tracy mansion (1771), now part of the public library building. Indian Hill farm, birthplace of the journalist Ben Perley Poore, is 3 m. W. of the city. The Putnam Free school, now part of the public-school system, was founded early in the 19th century by an endowment from Oliver Putnam. The high school for girls (opened in 1843) was a pioneer institution. Newbury, including the site of Newburyport, was settled in 1635 under the leadership of the Rev. Thomas Parker (1595–1677) who had lived in Newbury, England. In 1764 a tract of 647 ac. was set off and incorporated as the town of Newburyport, which (with enlarged boundaries) was chartered as a city in 1851. In the early part of the 19th century Newburyport was one of the most flourishing commercial centres of New England. Fishing, whaling and ship-building were the principal interests until the Civil War, and its clipper ships were among the fastest and the best known on the seas. During the Revolution and the War of 1812 it sent out many privateers.

**NEW CALEDONIA:** *see* PACIFIC ISLANDS.

**NEWCASTLE, DUKES OF.** Within the space of a century there were no less than four successive creations of dukes of Newcastle in the British peerage. William Cavendish (*see* p. 280), nephew of the 1st earl of Devonshire, was raised to the dignity of duke of Newcastle-upon-Tyne in 1665. His son and successor Henry (1630–1691) died leaving daughters only, and one of these married John Holles (1662–1711), earl of Clare, who was created duke in 1694. This duke died also without male issue, leaving his estates to his sister's son, Thomas Pelham (*see* p. 280), who, with other dignities, had the title of duke of Newcastle-upon-Tyne conferred on him in 1715, and a second and similar ducal title (that of Newcastle-under-Lyme) in 1756. The first dukedom became

extinct at his death, but the second title was granted him with remainder to Henry Fiennes Clinton, earl of Lincoln, at once his nephew and nephew-in-law. From that time the dukedom has remained in the Clinton family. The two principal dukes are more fully noticed below.

1. WILLIAM CAVENDISH, duke of Newcastle (1592–1676), eldest surviving son of Sir Charles Cavendish and of Catherine, daughter of Cuthbert, Lord Ogle, and grandson of Sir William Cavendish and "Bess of Hardwick," was born in 1592 and educated at St. John's College, Cambridge. On the occasion of the creation of Prince Henry as prince of Wales in 1610 he was made a knight of the Bath, subsequently travelled with Sir Henry Wotton, then ambassador to the duke of Savoy, and on his return married his first wife, Elizabeth, daughter of William Basset of Blore, Staffordshire, and widow of Henry Howard, 3rd son of the earl of Suffolk. His fortune was immense, and he several times entertained James I. and Charles I. with great magnificence at Welbeck and Bolsover. In 1620 he was created Viscount Mansfield, in 1628 earl of Newcastle, and in 1629 the barony of Ogle was restored to his mother, this title, together with an estate of £3,000 per annum, descending to him. In 1638 he was made governor of the prince of Wales, and in 1639 a privy councillor. When the Scottish war broke out he assisted the king with a loan of £10,000 and a troop of volunteer horse, consisting of 120 knights and gentlemen. In 1641 he was implicated in the Army Plot, and in consequence withdrew for a time from the court. He was sent by Charles on Jan. 11, 1642 to seize Hull, but was refused admittance. When the king declared open war, Newcastle was given the command of the four northern counties, and had the power conferred on him of making knights. He maintained troops at his own expense, and having occupied Newcastle kept open communications with the queen, and despatched to the king his foreign supplies. In Nov. 1642 he advanced into Yorkshire, raised the siege of York, and compelled Fairfax to retire after attacking him at Tadcaster. Subsequently his plans were checked by the latter's recapture of Leeds in Jan. 1643, and he retired to York. He escorted the queen, who returned from abroad in February, to York, and subsequently captured Wakefield, Rotherham and Sheffield, though failing at Leeds, but his successes were once more ravished from him by Fairfax. In June he advanced again, defeated the Fairfaxes at Adwalton Moor on June 30, and obtained possession of all Yorkshire except Hull and Wressel Castle. He might now have joined the king against Essex, but continued his campaign in the north, advancing into Lincolnshire to attack the eastern association, and taking Gainsborough and Lincoln.

Thence he returned to besiege Hull, and in his absence the force which he had left in Lincolnshire was defeated at Winceby by Cromwell on Oct. 11, 1643, which caused the loss of the whole county. On Oct. 27, 1643 he was created a marquis. Next year his position was further threatened by the advance of the Scots. Against prevailing numbers he could do little but harass and cut off supplies. He retreated to York, where the three armies of the Scots, Fairfax and Manchester surrounded him. On July 1, Rupert raised the siege, but on the next day threw away his success by engaging the three armies in battle, contrary to Newcastle's desire, at Marston Moor. After this disaster, notwithstanding the entreaties of the king and the remonstrances of Rupert, Newcastle immediately announced his intention of abandoning the cause and of quitting England. He sailed from Scarborough accompanied by a considerable following, including his two sons and his brother, resided at Hamburg from July 1644 to Feb. 1645, and removed in April to Paris, where he lived for three years. There he married as his second wife Margaret (*see* below), daughter of Sir Thomas Lucas of St. John's, Colchester. He left in 1648 for Rotterdam with the intention of joining the prince of Wales in command of the revolted navy, and finally took up his abode at Antwerp, where he remained till the Restoration. In April 1650 he was appointed a member of Charles II.'s privy council, and in opposition to Hyde advocated the agreement with the Scots. In Antwerp he established his famous riding-school, exercised "the art of manage," and published his first work on horsemanship, *Méthode et invention nouvelle de dresser les chevaux* (1658, 2nd ed., 1747; translated as *A General System of Horsemanship,* 1743).

At the Restoration Newcastle returned to England, and succeeded in regaining the greater part of his estates, though burdened with debts, his wife estimating his total losses in the war at £941,303. He was reinstated in the offices he had filled under Charles I.; was invested in 1661 with the Garter which had been bestowed upon him in 1650, and was advanced to a dukedom on March 16, 1665. He retired, however, from public life and occupied himself with his estate and with his favourite pursuit of training horses. He established a racecourse near Welbeck, and published another work on horsemanship, *A New Method and Extraordinary Invention to Dress Horses and Work them according to Nature . . .* (1667). He wrote also several comedies, *The Country Captain and The Varietie* (1649), *The Humorous Lovers* and *The Triumphant Widow* (1677). With Dryden's assistance he translated Molière's *L'Étourdi* as *Sir Martin Mar-All* (1688). He contributed scenes to his wife's plays, and poems of his composition are to be found among her works; and he was the patron of Jonson, Shirley, Davenant, Dryden, Shadwell and Flecknoe, and of Hobbes, Gassendi and Descartes. He died on Dec. 25, 1676, and was buried in Westminster Abbey. By his first wife he had ten children, of whom one son, Henry, survived him, and became 2nd duke of Newcastle, dying in 1691 without male issue; the title then became extinct.

His second wife, Margaret, duchess of Newcastle (*c.* 1625–73), had been maid of honour to Henrietta Maria. The duchess cultivated literary composition with exuberant fervour, and kept a bevy of maids of honour obliged to be ready at all hours "to register her Grace's conceptions." Walpole speaks of her as a "fertile pedant." She published *Philosophical Fancies* (1653); *Poems and Fancies* (1653); *The World's Olio* (1655); *Nature's Picture drawn by Fancie's Pencil to the Life,* which includes an autobiography (1656); *Philosophical and Physical Opinions* (1655); Orations (1662); Plays (1662); Sociable Letters (1664); *Observations upon Experimental Philosophy* (1666); *Letters and Poems* (1676).

*The Life of William Cavendish, Duke of Newcastle,* by Margaret, duchess of Newcastle, has been edited by C. H. Firth (1886); it was criticized by Pepys as "the ridiculous history of my Lord Newcastle writ by his wife, which shows her to be a mad, conceited, ridiculous woman, and he an ass to suffer her to write what she writes to him and of him," but on the other hand eulogized by Charles Lamb as a work for which "no casket is rich enough, no case sufficiently durable to honour and keep soft such a jewel." *See* also *La Duchesse et le Duc de Newcastle,* by Émile Montégut (1895). The duchess's *Select Poems* were edited by Brydges in 1813, and her *Autobiography* in 1814. The latter, edited by Lower, was published with her *Life of the Duke of Newcastle* in 1872.

2. THOMAS PELHAM HOLLES, duke of Newcastle (1693–1768), whose official life extended throughout the Whig supremacy of the 18th century, was the elder son of Thomas, first Lord Pelham, by his second wife Lady Grace Holles, younger sister of John Holles, duke of Newcastle-on-Tyne, who died in 1711, and left the whole of his vast estates to him. In 1712 he also succeeded his father in his peerage and estates, and in 1714, when he came of age, was one of the greatest landowners in the kingdom. He vigorously sustained the Whig party at Queen Anne's death, and had much influence in making the Londoners accept King George. His services were too great to be neglected, and in 1714 he was created earl of Clare, and in 1715 duke of Newcastle-on-Tyne. He also became lord-lieutenant of the counties of Middlesex and Nottingham and a knight of the Garter in 1718, in which year he increased his Whig connection by marrying Lady Henrietta Godolphin, granddaughter of the great duke of Marlborough. In 1717 he first held political office as lord chamberlain of the household, and in 1724 was chosen by Sir Robert Walpole to be secretary of state in place of Lord Carteret. This office he held continuously for 30 years (1724–54), and only changed it for the premiership on his brother's death. His long tenure of office was mainly due to his great Whig connections and his wealth, but praise must also be given to his inexhaustible activity and great powers of debate. He continued in office on Walpole's fall in

1742, and became more powerful on his younger brother Henry becoming prime minister in 1743. On Henry Pelham's death in March 1754, Newcastle succeeded him as premier; but people who had been accustomed to him as secretary of state would not stand him as premier, and in Nov. 1756 he gave place to the duke of Devonshire. For his long services he was created duke of Newcastle-under-Lyme, with remainder to Henry Fiennes Clinton, 9th earl of Lincoln, who had married his niece Catherine Pelham. In July 1757 he again became prime minister—for Pitt, though a great statesman, was a bad party leader—on the understanding, according to Horace Walpole, that "Mr. Pitt does everything, the duke gives everything." Under this ministry England became famous abroad, but it gradually fell before the young king's affection for Lord Bute, who, after supplanting Pitt, became prime minister in the room of Newcastle in May 1762. The duke went into strong opposition, and lost his two lord-lieutenancies for opposing the peace of 1763. In 1765 he became lord privy seal for a few months, but his health was fast giving way, and he died in Nov. 1768. The duke was not a great man, but he was industrious and energetic. He worked tirelessly, though vainly, to hold the Whig Party together in the face of the determination of George III. to destroy it. In this if in nothing else Newcastle was statesmanlike: for it seems as though he alone clearly foresaw that calamity to the Party which only union and organization could have averted.

See *Memoirs of the Administration of the Right Hon. H. Pelham,* by W. Coxe (1829).

**NEWCASTLE,** a city and port of New South Wales, Australia, on the southern shore of the estuary of the Hunter River, where it enters the Pacific ocean, and 104 miles, by rail, from Sydney. It is built at the foot of, and up, a steeply-rising hill which backs the harbour (Av. ann. temps.: 72°–55° F; av. ann. rainfall: 42 in.). With a large and fertile hinterland (Hunter Valley, Northern Tablelands and Liverpool Plains) and abundant coal resources at its doors (reserves within area 15 miles W. and 7 miles S. amount to about 270,000,000 tons; reserves of total area: *c.* 9,000,000,000 tons), Newcastle was early a notable centre for the export of coal and primary produce. By 1922 it had exported some 186,000,000 tons (*c.* £111,000,000), but since about 1900 its mines have been steadily superseded by those of the Maitland field (*q.v.*) and, at the present time, owing mainly to social and economic causes, the coal industry is severely depressed. The possession of fuel, water, food-supply, and a good commercial position, and access to raw materials have, however, steadily attracted manufacturing industries and Newcastle is now one of the leading industrial areas in the southern hemisphere. The Broken Hill Proprietary Co. (*see* BROKEN HILL; AUSTRALIA: *Metallurgical Industries*) established in 1915 at Port Waratah large-scale steel-works and these have brought in their train numerous associated industries. Newcastle's industries may be roughly classified as metallurgical and metal-working; constructional engineering and ship-building; coke and chemical industries; the making of fertilisers, cement, fire-bricks, pottery; wood-working; flour-milling and food-making; besides numerous miscellaneous types. These are conducted in Newcastle itself or in one or other of the numerous centres (*e.g.,* Port Waratah, Walsh Island, Cockle Creek, Merewether, etc.) within easy reach of the port. The harbour (comprising North Harbour, the Basin and Port Waratah) has ample accommodation, is well sheltered and has modern installation for handling cargo and especially for loading coal. The entrance is by a channel (width 500–450 yd.; av. depth 23½ ft.) between breakwaters, within which a fairway (width 500 ft., depth 32 ft.) is being cut. The port, which for hinterland trade (*e.g.,* wool) tends to be overshadowed by Sydney, has lost much owing to the shallowness of its entrance and suffers from the necessity of continuous dredging both at the entrance and alongside the wharves. In respect of trade Newcastle is the third port of Australia and the second of New South Wales. Its normal trade is of the order of £3,500,000 per ann. Exports (coal, coke, tar, etc.; frozen meat; butter, eggs; timber; pig iron, steel rails and plates, etc.; fertilisers) usually exceed imports. Some 4½–5 million tons of shipping use the port annually, of which 2,000,000 tons are "overseas" vessels (*i.e.,* other than interstate or coastwise). Newcastle has railway connections, along the coastal lowlands, with Sydney and also northwards (Grafton, Lismore, *qq.v.*). Pop. (1933 census) 104,485 with suburbs.

**NEWCASTLE,** a seaside resort and urban district of Co. Down, Northern Ireland, on the W. shore of Dundrum bay, below Slieve Donard. Pop. (1937) 2,428. Area, 2 sq.mi. It is the terminus of the Belfast and County Down railway, being 36 mi. S. of Belfast. A fort guarded the passage of the river Shimna here in early times. In the Mourne mountains near by is the Silent Valley reservoir, completed in 1933, for the supply of Belfast. It impounds the Kilkeel river and has a capacity of 3,000,000,000 gal.

**NEW CASTLE,** a city of New Castle county, Delaware, U.S.A., at the head of Delaware bay, 6 mi. S. of Wilmington. It is on federal highway 40 and is served by the Pennsylvania railroad and steamship lines. Pop. 4,414 in 1940. It has a good harbour, airports and other manufacturing industries. New Castle played an important part in the territorial disputes of the Swedes, the Dutch and the English, from 1651, when Peter Stuyvesant built Ft. Casimir in the vicinity; and it was the capital of Delaware until 1777. The courthouse is one of the oldest public buildings in the U.S.A.; the Immanuel Protestant Episcopal church dates from 1689; and there are Dutch and English colonial dwellings still standing. The city was chartered in 1875.

**NEW CASTLE,** a city of eastern Indiana, U.S.A., 45 mi. E. by N. of Indianapolis; county seat of Henry county. It is served by the Big Four, the Nickel Plate and the Pennsylvania railways. Pop. (1920) 14,458 (96% native white); in 1930 it was 14,027, a loss of 3·0%; in 1940 it was 16,620. It is the trade centre of a rich farming area; has important manufacturing industries (with an output in 1937 valued at $19,000,000); and is the seat of the Indiana Village for Epileptics. The city was founded in 1819 and incorporated in 1839.

**NEW CASTLE,** a city of western Pennsylvania, U.S.A., the county seat of Lawrence county; 50 mi. N.N.W. of Pittsburgh and 20 mi. S.E. of Youngstown (Ohio), on the Shenango river and federal highways 224 and 422. It is served by the Baltimore and Ohio, the Erie, the Pennsylvania and the Pittsburgh and Lake Erie railroads. Population 47,638 in 1940 (15% foreign-born white). New Castle is an important commercial and industrial centre, with a trade population of over 100,000 and manufactures (notably fine chinaware, bronze bushings and bearings and other diversified products) valued in 1939 at $22,137,572. New Castle was founded in 1802. It was incorporated as a borough in 1869 and as a city in 1875.

**NEWCASTLE-UNDER-LYME,** market town, municipal and parliamentary borough, Staffordshire, England, 2 mi. W. of Stoke-on-Trent by the L.M.S. railway. Pop. (1938) 63,410. The parish church of St. Giles was rebuilt (1876) by Sir Gilbert Scott, with the exception of the tower, which dates from the 12th century. The Wolstanton County Grammar school, opened in 1928 and enlarged in 1934, was originally Orme's English school. The manufacture of hats was once the staple trade. There are cotton and paper mills; and tanning, brewing, malting and the manufacture of army clothing are carried on. Partly included in the parliamentary borough is the populous parish of Wolstanton, of which the fine church has good details of the 13th century, with a massive tower and spire. The mining town of Audley lies 4 mi. N.W., with a fine early Decorated church.

Newcastle-under-Lyme (*Neofchastell-sur-Lyme*) is not mentioned in Domesday, but it had a charter from Henry III (1235) confirming its privileges and making it a free borough. Other charters were later granted, the last in 1835. It owes its name to a castle built there in the 12th century to supersede an older fortress at Chesterton about 2 mi. to the north, and to the fact that it was situated under the forest of Lyme. Newcastle, which was originally held by the crown, was granted (1265) to Simon de Montfort, and subsequently to Edmund Crouchback, through whom it passed to Henry IV. In Leland's time the castle had disappeared "save one great Toure"; in the 17th and 18th centuries the town was flourishing. Grants of fairs were given by Edward

I, Edward III and Henry VI. In 1932 the borough was extended and industrial developments took place. Area 13.88 sq.mi.

**NEWCASTLE-UPON-TYNE,** city and county of a city, parliamentary borough and port, Northumberland, Eng. 272 mi. N. of London, on the L.N.E.Ry. Pop. (1938) 291,300. Area 17.8 sq.mi. It stands on the Tyne. The mouth of the river is 8 mi. below Newcastle and its banks are lined with docks and industrial towns.

Though Newcastle owes its origin to a Roman station, its modern growth has largely destroyed traces of antiquity. Of the old walls there are slight remains. The castle, from which the town takes its name, was erected by Henry II between 1172 and 1177 on the site of an older structure. It was originally the strongest fortress in the north of England, and its keep is now one of the finest specimens of a Norman stronghold remaining in the country. Fragments of its walls, with the principal entrance or Black Gate and the Watergate or southern postern remain. The keep, with walls 14 ft. thick, is in a state of good preservation, as is also the Norman chapel. The castle was purchased by the corporation in 1809, and a portion of it is used as an antiquarian museum. Near the castle is St. Nicholas church, forming the cathedral of the diocese of Newcastle, instituted in 1882. The diocese covers Northumberland, small portions of Cumberland and Durham and Berwick-on-Tweed. The church, which is principally Decorated, consists of nave, aisles, chancel and transepts, and the principal feature is the lantern tower, a fine specimen of early Perpendicular. Among other interesting old churches is St. Andrew's (11th century). St. John's is 14th century. A few fragments of the monastery of the Black Friars remain, and the chapel of the hospital of St. Mary at Jesmond is a ruin. Some of the modern streets are spacious and handsome. Richard Grainger (1798–1861), a wealthy local builder, devoted himself to beautifying his city. Grey street is his masterpiece. The guildhall was re-erected in 1658.

Among educational establishments is King's college, which comprises a medical school and Armstrong college and is a constituent of the University of Durham. The royal free grammar school, founded in 1525, occupies modern buildings in Jesmond. There are also Allan's endowed schools, founded in 1705; Rutherford college and the Commercial institute; and the Laing Art gallery, opened in 1904. The benevolent institutions include the dispensary (1777), fever house (1803), Royal Victoria infirmary (1906), Princess Mary Maternity hospital (1923), eye infirmary (1822), children's hospital, Trinity almshouses (1492), hospital of the Holy Jesus (1682), hospital (1701) for keelmen, *i.e.*, coal-bargemen.

Newcastle has 377 ac. of public parks besides the 1,000 ac. town moor. Jesmond is the chief residential suburb.

Both the Northumberland and Durham banks of the river are lined with manufacturing towns or suburbs. Of these the most important is Gateshead (*q.v.*) immediately opposite Newcastle; while those adjacent to Newcastle are Benwell, Fenham and Walker. Newcastle is connected with Gateshead by five bridges: (1) the old high level bridge (1849), a toll bridge, carries the L.N.E. railway with a road and footway beneath it; (2) the King Edward high level bridge (1906) carries the L.N.E. railway only; (3) the new Tyne bridge (1928), to relieve the old high level bridge, takes traffic to the Great North road; (4) the hydraulic swing bridge (1876), the lowest bridge, takes foot and vehicular traffic; (5) the Redheugh bridge (1871), a toll bridge, takes foot and general traffic. The Scotwood suspension bridge crosses the river outside the Gateshead boundary. The Roman bridge, the Pons Aelii, is said to have spanned the river where the hydraulic swing bridge now is. The suburban line to Jesmond, Gosforth and Benton was the first standard line to carry passengers by electric traction (1904). A municipal airport of 100 ac. was opened in 1935 at Woolsington, 6 mi. from Newcastle.

**Industries.**—Newcastle owed its prosperity to its situation on a tidal river, and to its immense stores of coal, which, besides being exported, stimulated many industries. The quay in front of the town forms a thoroughfare about a mile long, and by dredging a depth of water has been obtained permitting vessels of large tonnage to approach, although the berths of the ocean steamers are farther down the river. There is a large grain warehouse at the east end of the quay. There was severe depression in the Newcastle area in the 1930s, and about 25% of the large insured population was unemployed in Nov. 1934.

Exports include coal, chemicals, pig-iron, iron-work, steel, iron bars, plates and castings, machinery, fire-clay goods and copper. The chief imports are fruits, wheat, maize, oats, barley, iron and steel, petroleum, sulphur ore, timber and wood hoops, iron ore and potatoes. Passenger steamers serve the principal English ports, also Baltic ports and New York, while Newcastle is ordinarily one of the chief ports for the Norwegian tourist traffic. To the industries indicated by the exports may be added glass, lead and shot, brick and tile, earthenware, tool, rope and ships'-fitting manufactures and primarily shipbuilding. The Tyneside yards are among the most important in the world.

**History.**—Newcastle owes its origin to its position on the great Roman wall and on the estuary of the Tyne. The most important Roman remains are the foundations of a bridge, attributed to the emperor Hadrian. Before the Conquest it was called Monkchester, and was destroyed (9th century) by the Danes. It was again destroyed by William the Conqueror, but Robert of Normandy raised a castle there in 1080, and from that time the town was called Newcastle. Shortly afterwards it was fortified by Robert de Mowbray, but it was taken by William Rufus in 1095. In the reign of Stephen it was seized by David, king of Scotland, and after its restoration in 1157 Henry II rebuilt the castle and established a mint. The walls of the town are attributed to Edward I. During the 14th century Newcastle was three times defended successfully against the Scots, but in 1640 it was occupied for a year by the Scottish Covenanters under Leslie. It was then garrisoned by royalists, but again surrendered to the Scots in 1644 and Charles I was taken there in 1646 when he had yielded himself to the Scottish army. Charters were granted by William Rufus and Henry III and in 1400, 1556, 1589 and 1604. The county borough was created in 1888.

The coal trade began in the 13th century, but, partly owing to the act of parliament passed in the reign of Edward I forbidding the use of coal in London, did not become important until the 17th century. Glassmaking was a considerable trade in the 17th century, and in 1823 George Stephenson established iron works at Newcastle, where the first engines used on the Stockton and Darlington, and Manchester and Liverpool lines were made. Newcastle was represented in parliament by two members from 1295 to 1918, and after that date by four members.

**NEWCHWANG,** a Chinese port city in the province of Fengtien, Manchuria (40° 41′ N.; 122° 15′ E.), some 30 mi. above the mouth of the Liao river which enters the Gulf of Liao Tung. At the Treaty of Tientsin (1858), Newchwang was chosen as one of the ports to be opened to foreign trade, but it was Yingtze (or Yinkow) near the mouth of the Liao river which actually became the centre of foreign settlements and was opened to trade in 1864. In recent years there has been a tendency to designate the port correctly as Yinkow, but Newchwang remained the official name of the Treaty port. The town was in 1895 occupied by and later ceded to Japan, only to be retroceded to China under foreign pressure. During the Russo-Japanese War, it was first in Russian and later in Japanese hands, but was finally restored to China at the end of the war. The outlet of the Liao river is obstructed by a bar and the port is closed by ice for three or four winter months. It has railway connection with Peking and with the main Mukden-Dairen line of the South Manchuria railway by means of a short branch. Until 1907 Newchwang was the only treaty port of Manchuria and it shared in the rising prosperity of south Manchuria; but in more recent years its development has been checked owing to the remarkable rise of Dairen, though "prosperity" was returning with the new "Manchukuo" industrial development. With the Japanese occupation of Manchuria Newchwang was included in the puppet state of Manchukuo. The last full Chinese customs return for 1931 was St$5,919,428.

The chief imports were foreign cotton piece goods, cotton yarn, native cottons, aniline dyes; exports, mainly beans, bean oil, bean

cake, maize, cotton seed and coal. Until 1908 Newchwang was the centre of the bean oil and bean cake industry of Manchuria and of the export trade in these and other Manchurian products, but it has since been supplanted by Dairen. Before the outbreak of the war it was, however, the main Manchurian port for China trade, especially in bean cake for south China and bean oil for Shanghai. The main product of Newchwang is salt for industrial use (64% of all Manchuria). The reed of the neighbourhood is used for reed sacks (3,000,000 annually) and reed plants produce pulp material. Tashihchiao, 22 mi. east, is an important centre of magnesite mining. Cotton cloth weaving factories work for local consumption. Other products are hosiery, ribbons, towels, matches, soap, glass, knitting needles, bricks and dyes, etc. The sea fisheries of the neighbourhood are very important and employ about 3,000 fishermen and 550 boats, the annual yield of fishery products being worth more than 500,000 yen. The population in June 1938 was 159,470, of which 5,612 were Japanese, 1,611 Koreans, the remainder being Chinese; 1940 census, 180,871.

**NEWCOMB, SIMON** (1835–1909), American astronomer, was born in Wallace, Nova Scotia, on March 12, 1835. He became a resident of the United States in 1853, and graduated at the Lawrence scientific school of Harvard university in 1858. He was an assistant in the American *Nautical Almanac* office 1857–61. In 1861 he became professor of mathematics in the United States navy, and was assigned to duty at the United States Naval Observatory. For more than ten years he worked with the various meridian instruments, and when the 26in. equatorial was erected in 1873 he was put in charge of that instrument. In 1877 he was assigned to duty in charge of the American *Nautical Almanac* office, a post which he held until March 1897. In 1884 he became professor of mathematics and astronomy at the Johns Hopkins university, continuing, however, to reside at Washington. He was also editor of the *American Journal of Mathematics* for many years. In view of the wide extent and importance of his labours, the variety of subjects of which he treats, and the unity of purpose which guided him throughout, Simon Newcomb must be considered one of the most distinguished astronomers of his time. A study of his works reveals an unusual combination of skill and originality in the mathematical treatment of many of the most difficult problems of astronomy, an unfailing patience and sagacity in dealing with immense masses of numerical results, and a talent for observation of the highest order. On taking charge of the *Nautical Almanac* office, he became very strongly impressed with the diversity existing in the values of the elements and constants of astronomy adopted by different astronomers, and the injurious effect which it exercised on the precision and symmetry of much astronomical work. Accordingly he resolved to "devote all the force which he could spare to the work of deriving improved values of the fundamental elements and embodying them in new tables of the celestial motions." The formation of the tables of a planet has been described by Cayley as "the culminating achievement of astronomy," but the gigantic task which Newcomb laid out for himself, and which he carried on for more than 20 years, was the building up, on an absolutely homogeneous basis, of the theory and tables of the whole planetary system. The results of these investigations have, for the most part, appeared in the *Astronomical Papers of the American Ephemeris,* and have been more or less completely adopted for use in the nautical almanacs of all countries. A valuable summary of a considerable part of this work was published in 1895, as *The Elements of the Four Inner Planets and the Fundamental Constants of Astronomy.* In 1866 Newcomb had published an important memoir on the orbit of Neptune, which was followed in 1873 by a similar investigation of the orbit of Uranus (*Smithsonian Contributions to Knowledge,* vols. xv. and xix.). About 25 years later new tables of these planets were issued by him (*Astronomical Papers of the American Ephemeris,* vol. vii., pts. 3 and 4) based on unpublished investigations in which the elements were determined from the best available observations up to that time. In the meantime the theory of Jupiter and Saturn had been thoroughly worked out by G. W. Hill, Newcomb's distinguished collaborator in the *Nautical Almanac* office, and thus was completed one important section of the work projected by Newcomb in 1877.

### NOTABLE ACHIEVEMENTS

Among Newcomb's most notable achievements are his researches in connection with the theory of the moon's motion. His first work on this abstruse subject, entitled *Théorie des perturbations de la lune, qui sont dues á l'action des planètes,* is remarkable for the boldness of its conception, and constitutes an important addition to celestial dynamics. For some years after the publication of Hansen's tables of the moon in 1857 it was generally believed that the theory of that body was at last complete, and that its motion could be predicted as accurately as that of the other heavenly bodies. Newcomb showed that this belief was unfounded, and that as a matter of fact the moon was falling rapidly behind the tabular positions. With the view of examining this question, he undertook the reduction of every observation made before 1750 which appeared to be worthy of confidence. The results of this work were published in 1878. The discussion of the observations made after 1750 was interrupted by his work on the planetary tables carried on during his connection with the *Nautical Almanac* office. After his retirement from active service in the navy he was enabled, due to a grant from the Carnegie Institution of Washington, to secure the necessary assistance from 1903 to 1909 to bring to completion the work of his great programme on the motion of the moon. This was finished less than a month before his death. The observations used in his work covered an extreme range in time of about 2,600 years and seemed, as he himself said, "to prove beyond serious doubt the actuality of the large unexplained fluctuations in the moon's mean motion."

On taking charge of the 26in. equatorial at the United States Naval Observatory, Newcomb devoted it almost exclusively for the first two years to observations of the satellites of Uranus and Neptune. The results of these skilfully conducted observations were published in a memoir on *The Uranian and Neptunian Systems.*

As early as 1860 Newcomb communicated an important memoir to the American Academy, *On the Secular Variations and Mutual Relation of the Orbits of the Asteroids,* in which he discussed the two principal hypotheses to account for the origin of these bodies—one, that they are the shattered fragments of a single planet (Olbers's hypothesis), the other, that they have been formed by the breaking up of a revolving ring of nebulous matter.

In the *Astronomical Papers of the American Ephemeris* will be found a large number of contributions from Newcomb's pen on some fundamental and most important questions of astronomy. Among these are papers on *The Recurrence of Solar Eclipses, A Transformation of Hansen's Lunar Theory, Development of the Perturbative Function and its Derivatives.* His memoir *On the Motion of Hyperion, a New Case in Celestial Mechanics,* is in some respects one of his most original researches. He discussed the transits of Venus of 1761 and 1769, and those of Mercury from 1677 to 1881. At the international conference, which met at Paris in 1896 for the purpose of elaborating a common system of constants and fundamental stars to be employed in the various national ephemerides, Newcomb took a leading part, and at its suggestion undertook the task of determining a definite value of the constant of precession, and of compiling a new catalogue of standard stars. The results of these investigations were published in 1899, and were in general use for a quarter of a century. In the intervals of these immense labours, on which his reputation as an astronomer rests, he found leisure for works of a lighter character; *e.g.,* his *Popular Astronomy* (1878), his *Astronomy for Schools and Colleges* (1880), written in conjunction with E. S. Holden, and *Astronomy for Everybody* (1903). After his retirement from official life he published an excellent popular treatise on *The Stars* (1901). Several of these books have been translated into one or more of seven different foreign languages. A more recondite work is his *Compendium of Spherical Astronomy* (1906). He also wrote on questions of finance and economics, as well as in the field of fiction.

He received honorary degrees from ten European and seven American universities. He was a member of 45 foreign societies. He was awarded the gold medal of the Royal Astronomical society in 1874, the Huyghens gold medal of the Holland Society of Science in 1878, the Copley medal of the Royal society in 1890, the Bruce gold medal of the Astronomical Society of the Pacific in 1897, the Schubert prize of the Imperial Academy of Sciences, St. Petersburg, in 1897, and the Sylvester prize of Johns Hopkins university in 1901. He died at Washington on July 11, 1909, and was given a military funeral befitting his rank as a rear admiral in the United States navy.

An autobiography, *Reminiscences of an Astronomer,* appeared in 1903; and a bibliography of his life and works containing 541 titles is given by R. C. Archibald in *Memoirs of the National Academy of Sciences,* xvii, "First Memoir," pp. 19–69. This also contains, pp. 1–18, "Biographical Memoir" by W. W. Campbell. (W. S. E.)

**NEWCOMEN, THOMAS** (1663–1729), English engineer, one of the inventors of the steam engine, was born at Dartmouth. While employed as ironmonger in his native town, he corresponded with Robert Hooke about the possibility of obtaining motive power by exhausting the air from a cylinder provided with a piston, Denis Papin and the marquis of Worcester having already made investigations on this subject. In 1698 he entered into partnership with Thomas Savery (*c.* 1650–1715), who had patented a method for raising water from mines. Newcomen's improvements on Savery's invention were so successful that they produced together a pumping-engine which served as a model for nearly three-quarters of a century. For a description of the "atmospheric steam-engine," then known as a "fire-engine," which they constructed in 1705, *see* STEAM ENGINE. John Cawley (or Calley) was also associated with them in this invention. Newcomen died in 1729, probably in London.

**NEWDIGATE, SIR ROGER** (1719–1806), English antiquary, was born on May 30, 1719. He was the 5th baronet of Harefield (in Middlesex) and Arbury (in Warwickshire), and grandson of Sir Richard Newdigate, an English chief justice during the time of Richard Cromwell's protectorate. He had an active political career, but is chiefly remembered for his collection of antiquities including marbles, casts of statues and vases. Two marble candelabra found in Hadrian's villa at Rome he purchased for £1,800 and presented them to the Radcliffe library at Oxford. Among his other generosities to the university were a chimney piece, for the hall of University college, and the sum of £2,000 for the removal by Flaxman of the Arundel collection of marbles to the Radcliffe library. The "Newdigate" prize of 21 guineas for English verse, which is open for competition each year to the undergraduates of Oxford university, was founded by him and was first awarded in the year of his death. He died at Arbury on Nov. 23, 1806.

**NEWEL,** in architecture, originally the central shaft around which a spiral or semi-circular staircase winds. Now more commonly any post at the intersection of a stair with a landing, in which case it is a vertical post which receives the rail and is framed into the supporting strings or beams of the stair construction. By extension, the term is also applied to any post in the railing larger than the other posts or balusters.

**NEW ENGLAND.** That portion of the eastern coast of North America lying between the 41st and 45th degrees of north latitude received its name of New England in 1614 from Capt. John Smith, who explored those shores on behalf of the Virginia company of English merchants.

Physiographically, New England possesses great variety and also a unity derived from isolation. Such physical isolation and unity is, however, deceptive, for New England faces on three fronts. The long and deeply indented coast line from its easternmost point on the Bay of Fundy to the tip of Cape Cod turns New England toward the maritime provinces of Canada, toward the fishing grounds of the Newfoundland banks and toward the ports of northern Europe, from which it is some hundreds of miles less distant than are its rival ports in the middle states. New England's southern shore from Cape Cod to the Hudson river invites close relations with the states to the south, that part lying west of the Connecticut river especially falling within the area of the metropolitan influence of New York rather than any New England centre. The northwestern region, on the other hand, turns its back on the rest of New England and finds its outside connection through Lake Champlain and the Richelieu river or through Lake Memphramagog with the Canadian province of Quebec.

Although parts of the coast of New England had been known to European fishermen early in the 16th century and it is certain that outlying islands and capes were visited frequently after 1560, no permanent settlement was achieved until the next century. That New England remained open so long after its exploration as a refuge for minority groups seeking homes rather than adventure was due to the fact that its inhospitable climate, stubborn soil and lack of profitable natural products did not invite capitalistic exploitation. That the early settlements of Pilgrims and Puritans remained undisturbed was due to the fact that this area was not a gateway to the interior; its rivers afforded access to no regions where settlers or capital were needed.

Surprising freedom from Indian opposition during the critical first decades of settlement is explained by the decimation of the native population by plague in the years 1610–20. By the time the Indians rallied for a concerted attempt (called King Philip's War) to expel the white intruders, the colonists were barely able to survive the attack. In that struggle the systematic land allotments and close village social structure clearly vindicated itself as a military advantage. On the social side also it proved its worth in affording opportunity for early district elementary schools, a college (Harvard, 1636) and, in the larger settlements, a few of the amenities of an urban civilization.

While substantial financial resources assured the success of the Puritan colony of the Massachusetts Bay company, the survival of the feeble and ill-supported settlement of the Pilgrims at Plymouth proved that a living could be won from the wilderness by extraordinary effort and self-discipline. Both examples prompted other undertakings. Roger Williams and Ann Hutchinson, refugees from the theocracy of Boston, with no backing from the home government, made tiny settlements on Narragansett bay south of the jurisdiction of the Massachusetts Bay colony, and secured recognition as a separate colony of Rhode Island with a charter from the crown. On the other hand, new immigrant groups enlarged by malcontents from Massachusetts established strong settlements on the southern coast and secured royal recognition as the colony of Connecticut in 1661. In four directions colonial attempts of a distinctly different type were attempted. Based on Champlain's discovery in 1609 of the lake which bears his name, the French government in Canada attempted to establish *seigneuries* on the slopes of the Green mountains bordering that lake. On the coast of Maine, Sieur de Monts in 1604 and a band of Jesuits in 1613 tried to found colonies. North of the Merrimac river Capt. John Mason received a grant from the crown and sent settlers to the mouth of the Piscataqua (Portsmouth). His plans for an aristocratic domain modelled on the mediaeval County Palatine as well as his appointment as royal governor-general of all New England came to naught with his death in 1637. His settlers fell under the rule of the Massachusetts Bay company until created into a royal province in 1679. Farther northeast another royal proprietor, Gorges, planned to colonize but failed in competition with the Puritan settlers. His heirs sold their claims to Massachusetts in 1674 and the region under the name of the District of Maine remained a part of Massachusetts until erected into an independent state in 1820.

The New England colonies had attracted little attention from the restored Stuarts until complaints of the independent attitude of the Massachusetts authorities in the persecution and exclusion of Quakers and Anglicans and a disregard of the Navigation acts drew down the royal displeasure. James II attempted to systematize his northern colonies by consolidating all the New England colonies with New York and New Jersey under a single royal governor. From an administrative point of view the scheme was sound. This new "Dominion of New England" would also have

enabled the English to oppose the threatened aggressions of the French more effectively, but the methods of James's agent, Randolph, and his governor, Andros, roused bitter opposition in New England. The cancellation of their charters the colonists regarded as a destruction of their constitutional rights. When the news of the glorious revolution in England reached Boston, Andros was overthrown, Connecticut and Rhode Island quietly resumed their old charter governments and Massachusetts obtained at the court of the new sovereigns, William and Mary, a restoration of many of her old rights under a new "province" charter (1691). By 1800 every acre of the land in the three southern New England states had been parcelled out in townships, and the frontier of almost contiguous settled communities pushed up to the 45th parallel—viz., a line from Vergennes on Lake Champlain to Bangor on the Penobscot. The qualities and characteristics which have distinguished the New Englanders and the institutions which New England has given to America were developed in the colonial period. At first, the most pronounced characteristic was the capacity for co-operative action. From this sprang the public school system, the town government, the Congregational Church organization. By the Revolution, however, the individualism which appeared sporadically in the early years came to be general and reached its height in Jonathan Mayhew, William Bentley, the Adamses, Thoreau and Emerson and in the educational theories of Charles William Eliot. Much has been said of the spiritual heritage of the Puritans and Pilgrims, and ideals with which they came to New England; but economic conditions may explain many peculiar features of New England life. Unquestionably the New England colonists suffered from lack of division of labour. The nature of the soil, the lack of easily accessible markets, the difficulty of securing a surplus of any great staple to exchange for other necessities forced each family to provide for its own wants. This produced a people of singular ingenuity and resourcefulness but without specialized skills. It offered no premium for systematic development of agriculture or industries except the few in which New England had a natural advantage both in production and in marketing. Of these the greatest was shipbuilding. This industry began almost at once with Winthrop's "Blessing of the Bay" launched on the Mystic river in 1631. On nearly every navigable stream in close proximity to the supply of timber arose small shipyards where the neighbouring farmers, trappers or fishermen employed their time in off-seasons in turning out vessels. For these they found a ready sale, because the English Navigation acts admitted colonial-built vessels to the status of English ships in the monopoly of the carrying trade of the expanding empire.

To the mother country New England seemed, until well into the 18th century, one of the least valuable of her overseas possessions. The area had not lived up to the expectations of the statesmen and merchant-capitalists who had encouraged its settlement, even as a source of ship-timber and furs. As a market for English products New England's slow growth of population, after the initial Puritan exodus, was disappointing. Its self-sufficiency contrasted markedly with the constant reliance placed by other settlements upon the board of trade for financial aid and political direction. As a result New England was ruled under a policy of "salutary neglect." The leadership of New England in American colonial resistance to the Acts of Parliament from 1763 to 1774 was due largely to three factors—first, the fact that the natural course of New England economy contravened the principles of mercantilism on which British imperial policy was based. Second, the attempt to enforce the application of those principles in the Sugar act and other acts of trade had precipitated a serious reaction from the prosperity which New England had enjoyed during the French Wars from 1689 to 1763. Just at that time, by the Stamp act, Grenville attempted to force the colonies to pay some portion of the cost of maintaining the newly won empire. Finally, New England town meetings afforded a unique sounding board for such men as Samuel Adams; and her colonial assemblies, accustomed to represent the mercantile element against the royal governors, gave a pseudoconstitutional appearance to action for intercolonial "congresses" to bring pressure by boycotting British goods.

New England played her chief part in the Revolution during the years 1765–77 in defining the issues and in precipitating actual hostilities. Though these centred in Boston, sentiment for and against rebellion and independence was fairly evenly distributed throughout New England, the line of cleavage being one of class and occupation rather than of locality. After the British evacuated Boston on March 17, 1776, New England saw little of active hostilities, except for the part played by her militia in checking Burgoyne's advance at Bennington, Vt., and in the struggles over the possession of Newport, R.I. Her irreconcilable temper convinced the British that attempts at conciliation or subjugation had greater chance of success elsewhere. The revolt against the mother country brought less of the civil war between rebels and Tories in New England than occurred farther south, chiefly because the Tory oligarchy had a very narrow basis in New England, was early overthrown and retired with the Red Coats to exile in Nova Scotia, New Brunswick and the West Indies. Control of the new state governments which were almost immediately formed fell into the hands of conservative elements who assumed the political offices and social leadership vacated by the fugitive loyalists.

The period of disorganization which followed the cessation of hostilities brought great suffering to many communities and certain classes in New England. The utter disruption of the old courses of commerce within the British empire no longer supplemented by privateering and wartime trade with other countries caused a lack of specie. Every state fell a prey to a greater or less degree to the paper money craze. Rhode Island, in particular, suffered so heavily that civil war threatened. The refusal of the Massachusetts legislature to relieve the pressure of debts and taxes by stay laws and further issues of paper money led to a rebellion under the leadership of Daniel Shays. Although New England leaders played prominent parts in the federal convention, the actual ratification of the new constitution proved a difficult matter in Massachusetts and New Hampshire and was rejected in Rhode Island until 1790. Such sentiment as turned New England toward the creation of "a more perfect union" came mainly from the creditor and mercantile classes and sections; chiefly it was due to the hope for a stable national currency and credit and for a national tariff system which could be used as a lever to pry from reluctant European governments the opening of their home and colonial posts to American trade.

For nearly a decade after the inauguration of the new government under Washington the superior organization of the dominant commercial interests committed New England as a whole to the Federalist party, but Jefferson gradually organized the latent anti-Federalist and Democratic elements until in the election of 1800 he was able to carry several representative districts.

The basis of New England's prosperity in the Federalist period seems to lie in the application of Yankee energy and resourcefulness to the exploitation of the peculiar advantages of New England in foreign trade. Her ships, restricted in their enterprises in the older fields under control of the British crown, turned to the Mediterranean and to the Pacific and Indian oceans. In 1786 Samuel Shaw established in Canton the first American mercantile house in China. In 1787 the "Grand Turk" brought to Salem the first of the many oriental cargoes which made that port famous. In 1792 Capt. Robert Gray's "Columbia" carried the Stars and Stripes around the world for the first time and laid the foundations not only for the American claim to Oregon but also the very profitable trade with the northwest coast, where furs were obtained which could be exchanged in China for silks and tea. Salem became for a time the tea market of America and Europe and the third city in the union. The heyday of New England's mercantile success was shared to a considerable extent by all classes. There was speculation in timberlands and a rapid shift of population into the frontier states—Maine, New Hampshire, Vermont, western New York and Ohio. The Napoleonic wars altered this picture. Although equipped to compensate the loss inflicted on her commerce by English and French wartime restriction through the enormous profits made in privateering and in block-

ade running, the New England shipper could not survive the devastating effect of the Republican embargo policy. The war of 1812 was regarded in New England as Mr. Madison's war, forced upon him by the *Warhawks* of the west, and was viewed as another and convincing demonstration that the annexation of Louisiana and the development of the western states was ruinous to the interests of the old commercial states of the northeast and justified that group in seceding from a union in which they would clearly form a hopeless minority. Convinced of the injustice done to their section, New Englanders disregarded the embargoes, carried on illicit trade with the English in Canada and West Indian ports, discouraged recruiting and subscriptions to war loans and refused to celebrate victories gained by the French over the common enemy, the British.

In three respects only did New England enter the war. She supplied men and ships to the navy, was especially active in fitting out privateers and tried in vain to prevent by her own militia the occupation by the British of her seaboard east of the Kennebec river and the harassment of her coastal waters by British frigates. A threatened secession movement in 1804 had been headed off by the wiser Federalist leaders like George Cabot and Alexander Hamilton, but by 1814 the sentiment had got beyond the control of the moderates and resulted in the convention at Hartford, which demanded an amendment of the Constitution to protect New England interests. The termination of the war left this movement high and dry; it brought its sponsors—the Federalist party and New England generally—into disrepute among the nationalistically-minded rising generation of statesmen from the south and west. The interference with her commerce wrought by the embargo together with the interruption of the usual flow of manufactured merchandise from England and the continent caused some New England capitalists to transfer their money from shipping to the new textile plants which had been introduced during the last decade of the 18th century. At Beverly and Waltham in Massachusetts, at Pawtucket and Woonsocket in Rhode Island, the new spinning and weaving machines had been set up. Saved by the war from immediate competition of English textiles, these factories gained a start. The termination of the war saw a great importation of English goods. Faced with ruin, the mill owners of New England joined with the infant woollen manufacturers of Pennsylvania to secure a protective tariff in 1816. As part of a general burst of nationalism the policy of protection and creation of a home market as advocated in Hamilton's famous report on manufactures was adopted. Increased rates were sought after the depression of 1819 and by 1824 New England politicians of all parties were faced with a new sectional issue. Manufacturing as a New England occupation grew steadily through the next generation, bringing with it the social, economic and political problems of concentration of population and constant demand for cheap labour and widening markets. In the same period, 1816–50, the rapid expansion of the agricultural regions of the south and west brought into the eastern markets the cheaper cotton as well as the cheaper foodstuffs. The former stimulated more textile activity—the latter drove the less well-situated farmers to abandon their farms and migrate to the west.

Several of the shibboleths, such as "Manifest Destiny," which swept the national government in the first half of the 19th century, left New England cold. Her own northern and eastern regions of New Hampshire, Vermont and Maine were losing their frontier character. The northern boundary, long subject to dispute even to the extent of an armed clash known as the Aroostook War of 1838, was finally determined by the Webster-Ashburton treaty in 1842. While hostile to western expansion, and to the policy of cheap public lands which went with it, New England had contributed mightily to people the new areas. Miss Lois K. Mathews' *Expansion of New England* admirably relates the direction, quantity and peculiar quality of the migration from the New England states. Through this transplantation of population to the new states of the old northwest and later to Iowa, Kansas and Oregon, New England continued to exert the peculiar influence of her Puritan traditions. In the great problem which confronted the inhabitants of the great areas of the Mississippi valley and the western plains—transportation—New England took little interest until railroad building came into the class of capitalistic enterprises. Its location excluded it from the competition in canal, highway and railroad building for access to the west and the port of Boston fell behind its rivals. Yet New England had locally been a pioneer in railroad experimentation. One of the first railroads in America was built in 1826 to carry granite blocks from the Quincy quarries to tide water. In the '40s, short lines were built connecting Boston with Providence, Lowell, Portsmouth, Worcester, Springfield, New Haven and New York. In 1850 Massachusetts ranked third to New York and Pennsylvania in railroad mileage.

The humanitarian movements of the '30s produced lively response in New England. Not only were the social problems incident to concentration of population in her mill-towns provocative of controversy over questions such as the length of a working day and conditions of labour, the right to strike and the association of workers, but the assembling of people within easy reach of such potent agencies for education and enlightenment as schools, colleges and lyceum lectures had a stimulating effect on the popular interest in all sorts of questions. In this soil flourished many new ideas—advocates of liberal movements in religion, like William Ellery Channing, Theodore Parker and Horace Bushnell, crusaders for temperance like Neal Dow, who in Maine secured the first prohibition law in the United States, or for abolition of slavery like William Lloyd Garrison, for public high schools like Horace Mann; the Concord group—Ralph Waldo Emerson, Henry D. Thoreau and Bronson Alcott—gave New England an international reputation for "transcendental philosophy"—and with Longfellow, Holmes and Lowell made this section the literary centre of America. The colleges and the academies that had survived the Revolution largely as sectarian institutions or theological schools now took on more liberal aims and methods and sent their graduates all over the country. At Litchfield, Conn., the first real law school in America flourished, under the guidance of Chancellor Kent, and produced such men as John C. Calhoun. Harvard college, where the triumph of liberalism over the more orthodox Puritan party in Boston in the early 18th century had led to the founding of Yale by conservatives, carried its liberalism still farther and in mid-19th century, borrowing its educational methods largely from Germany, gradually widened its curriculum on an elective basis and developed graduate schools of law, medicine, arts and science. In Providence the Baptists had founded Brown; at Middletown, Conn., the Methodists established Wesleyan; in the Connecticut valley arose Amherst; in the Berkshires Williams college, and in Maine appeared Bowdoin, Bates and Colby. In Vermont a state university was established through the benevolence of Ira Allen.

The position of New England in the Civil War accords with the double character of that struggle—the abolition of slavery and the preservation of the union. The same men who gave their lives for the latter issue had heaped abuse upon the men like Garrison who had agitated for 20 yrs. in favour of the former issue. On the other hand, Wendell Phillips had denounced the clergy and the Cotton Whigs for their willingness to compromise with the slave owners, and a great convention at Worcester advocated New England's secession from a union which required its members to enforce the Fugitive Slave law and to recognize slaveholders' property rights in human flesh. Once war began, New Englanders supported the administration steadfastly although the persistent demands of Charles Sumner and other abolitionists for immediate emancipation frequently caused embarrassment to President Lincoln. During the Reconstruction period New England remained consistently Republican in spite of a Liberal wing led by Charles Francis Adams.

New England commerce suffered severely during the Civil War. The whaling fleet, once the pride of New Bedford and Nantucket, was broken up by Confederate raiders, and its monopoly of the illuminating oil market was destroyed by introduction of kerosene oil and gas. By the change from wooden to iron and then to steel ships, and by the rising costs of operation under the American flag, all the natural advantages in the construction and operation of ships which New England formerly possessed were lost.

Again as in 1812, New England's answer was to shift her capital from shipping to manufacturing. Again as in the 1830s and '40s she succeeded, but toward the close of the century was faced with competition from new centres in the south and west, equally well equipped with power sites, with capital and within easier reach of the source of raw materials and of the markets.

The electrical age developed early in New England. From a small local plant in Lynn the Thompson Houston Co. developed in two decades into the General Electric Co., extending its chain of factories across the continent. The Bell Telephone Co., initiated by Boston capital and engineers, had a similar history. Again New England capital and engineering skill led by the Boston firm of Stone & Webster spread electric trolley lines into nearly every state in the union and

led in the development of hydro-electric power. Vulcanized rubber process was another New England specialty which saw its greatest application in the midwest. Probably New England's greatest contribution to the typically modern American facility in mass production stemmed from the late 18th century, when the idea of replaceable parts, specialized part manufacture and assembly sprang from Connecticut clock makers and was applied successively to firearms, sewing machines, typewriters, agricultural implements, machine tools and automotive machinery. The names of Pratt and Whitney are associated with much of this development.

The necessity of self-sufficient communities in colonial days produced the "Jack-of-all-trades" quality in the Yankee which made him especially efficient in the early stages of industrial development, when resourcefulness in adaptation of materials and ingenuity in their use were required. As manufacturing processes became standardized and semi-automatic machines were evolved, the bulk of the work could be done by the semi-skilled or even unskilled labour supplied by the great waves of immigration of the late 19th century. The population of New England by the 1940s reflected this change, but the persistent value of the Yankee all-round mechanic is seen in the preference shown for New England by industries requiring a high percentage of value added by labour to the total cost of the product.

Throughout the national period New England not only supplied most of her own capital but was most of the time a chief exporter of capital to other sections—western land mortgages, steam and electric railways, mining, stockyards, hydro-electric developments Typical of the enterprises thus financed in the early 20th century were the Chicago, Burlington & Quincy R.R. and the Calumet & Hecla mines.

The distribution of foreign-born or native-born of foreign parentage followed roughly the diffusion of industry from the coastal cities to inland towns. In some rural areas the immigrant largely replaced native farming stocks. In the old Puritan town of Salem in 1940, at least one-third of the population was of recent French-Canadian origin. Most of the chief textile and metal manufacturing centres began to depend in the 20th century on immigrant labour of non-English speaking stock. In neither the boom years nor the depression years between 1914 and 1941 did New England prosper or suffer so much as most sections of the U.S. This is explained by the diversity of New England's investment of capital, the variety and generally limited size of the industrial units, the high percentage of skilled labour capable, with the plant, of conversion from one product to another. A further factor making for stability was the conservatism of New England banking, the large percentage of savings bank accounts and insurance policy holders and the persistence of a considerable fraction of the population on small, partly self-sufficient farms.

The fisheries, earliest of New England's enterprises, survived periodic depressions and revolutionary changes in techniques. Although by 1920 largely mechanized and dependent on refrigeration, it still retained elasticity in personnel, equipment and methods enabling it to support a considerable part of the sea coast population, although only a minority remained of the older native stocks. After 1880 the water power upon which colonial and early 19th century milling and manufacturing had depended gave way to steam-coal power plants. After 1915 hydro-electric lines brought power to a large part of the section, but did not displace oil or coal steam-generated plants near the coast.

Apart from the decline in her relative position in commerce, the chief respect in which New England altered in comparison with other sections of the union was in the character of her population. From being the most homogeneous section of the original states, New England became one of the most cosmopolitan areas. The first development of industries on a factory basis was effected by drawing the native New England stock from farms to factories without reliance on the recent immigrants. It was not till after 1840 that the number of non-English immigrants began seriously to affect its political or social structure. The great immigration of Irish after the famine in 1846 produced in the many industrial towns some serious disturbances, and New England shared the anti-foreign sentiment which took political shape in the Know-Nothing party. The immigration of large groups of non-Protestant southern and eastern Europeans between 1890 and 1914 altered the situation rapidly. Although the number of native-born of English ancestry even then formed a minority in New England as a whole, and was almost negligible in the industrial centres, the *blocs* of foreign-born or those of non-English ancestry tended largely to offset each other for political and social or economic purposes. Of these "foreigners" the Irish took the most active part in politics. Except for a short period in 1912 during strikes in the textile centres, the influence of radical leaders was slight among the working classes. Trade unionism existing in most industries was generally directed in conformity with the conservative policy of the American Federation of Labor. That there has been no general attack on the principles of capitalism is due in part to the fact that the New England states have been leaders in legislation favourable to labour as respects conditions and hours of work, and in part to the conservative attitude of the Catholic church on this issue and, to a less ascertainable degree, to the high proportion of small capitalistic enterprises employing highly skilled labour. (P. P. C.)

**NEW FOREST,** one of the few woodland regions left in England, covering 92,365 acres in the southwest of Hampshire, between the Solent, Southampton Water and the river Avon. The crown has the right to keep enclosed and planted 16,000 acres. Pop. of rural district (1938) 36,660. Area 148.4 sq.mi.

The New forest is one of the five forests mentioned in Domesday. It was a hunting-ground of the West Saxon kings, but derives its name from the afforestation schemes carried out by William I in 1079. One of the chief sources of the wealth of the forest in early times was the herds of pigs fed there. The New forest, being under the forest laws, was affected by the forest clauses of Magna Carta and by the Forest charter (1217), which mitigated their severity. The chief officer was the justice in eyre who held the justice seat, the highest forest court. The lower courts were the Swainmote and Wodemote, the former of which is still held, in a modified form, in the Verderers' hall of the King's house at Lyndhurst. The circuit of the justices in eyre, or their deputies, continued down to 1635; they were virtually ended by the Act for the Limitation of Forests (1640), though Charles II attempted to revive them, and they were not legally abolished until 1817. The lower officers of the forest, who held merely local appointments, were the verderers, the regarders, the foresters, the woodwards and the agisters. There was also a lord warden, who was usually a nobleman and performed no judicial functions. The Deer Removal act (1851) resulted in the almost total extinction of the forest deer. Under the act of 1877 the forest is administered as a national park. About one-fourth of the area is under cultivation by private owners and tenants, and the remainder is open woodland, bog and heath. The principal village within the forest is Lyndhurst (pop. [1932], 2,594), with the verderers' court, in charge of the crown portion of the forest. On the western outskirts lies the town of Ringwood (*q.v.*). Beaulieu village on the estuary of the Beaulieu river has ruins of Beaulieu abbey, founded by King John for Cistercians. The gatehouse is restored as a residence, and the Early English refectory as a church. There are considerable remains of the cloisters, chapter house and domestic buildings.

**NEWFOUNDLAND.** Newfoundland, with its dependency Labrador, is a member state of the British commonwealth of nations, in northeastern North America. The total population (1935 census) was 289,588; the capital, St. John's, had a population of 39,886.

**Physical.**—Newfoundland is said to be the tenth largest island of the world forming a separate country. It lies across the Gulf of St. Lawrence, separated from the main continent by the Strait of Belle Isle on the northwest and by Cabot strait on the south. Newfoundland forms a rough isosceles triangle, with sides about 300 mi. long. Its area is 42,734 sq.mi. The coastline, which totals about 6,000 mi., is much indented, with headlands and peninsulas thrust out boldly into the Atlantic, or into the Gulf of St. Lawrence. Two of these, the Avalon peninsula and the Northern peninsula, form an appreciable portion of the island.

Newfoundland is of very ancient geological formation. The major part of the island is composed of Pre-Cambrian rock. Thus, it may be said that Newfoundland is the northern extension of the Appalachian highlands. Physiographically, Newfoundland is a low plateau, rising to its maximum elevation (2,540 ft.) in the Long Range mountains on the west coast, and decreasing to about 700 ft. on the east coast. Elsewhere are isolated elevations, Hodges hill (2,200 ft.); Main Topsail (1,829 ft.). Drainage, accordingly, is toward the east and the northeast. Only two major rivers, the Humber and the St. George, pierce the mountains of the west coast. The other great rivers, the Gander, the Exploits, and the Terra Nova, empty into eastern bays. Innumerable lakes and ponds dot central Newfoundland. The most considerable are Red Indian lake, Grand lake and Gander lake. Glacial action and erosion have affected the island profoundly, by scraping the highlands of soil, and by filling the valleys with glacial drift. Rounded hills, U-shaped valleys and coastal fiords are other evidences of the same extensive forces.

The climate of Newfoundland is moderated by the close presence of the ocean. The extreme range of temperature is between 0° and 81° F. February is the coldest; August, the warmest month. Both rainfall and snowfall are heavy, although the latter

is not so heavy as in neighbouring parts of Canada. In general, the western coast of Newfoundland experiences a much more continental form of climate than the east coast. The southern and western coastline, between St. John's and the Bay of Islands, is never icebound. Elsewhere, ice blockades, due to wind conditions, are known to occur.

**Economics.**—Geographical factors have influenced powerfully the economy and the characteristics of Newfoundland. The arctic currents keep the coastal waters cool, thus producing ideal conditions for the fisheries. They make for late springs, temperate summers and damp autumns, thus putting agriculture under a handicap. These circumstances make Newfoundland a producer of a number of relatively simple staples; hence, the island has not attracted a large population, nor has it developed industry.

Farming in Newfoundland developed slowly. It was not till 1813 that land could be held for agricultural purposes. The shortness of the season and the lack of fertility of the soil in the more settled areas of the island were additional hindrances. In spite of numerous efforts in the 19th century, farming was not undertaken on any extensive scale. The majority of the farms are very small, usually in the nature of garden plots cultivated to supply the fisherman with his year's vegetables. In the Avalon peninsula, chiefly in the Waterford valley, and also on the west coast, in the Codroy valley and on the Bay of Islands, some mixed farming is done. On the larger farms of 100 to 200 ac., cereals can be grown. Elsewhere, however, farming usually takes the form of vegetable raising. The relatively high prices these commodities command in the local market stimulate their production. In 1937 the value of all field crops was estimated to be between $2,000,000 and $3,000,000. Stock raising is of a very minor character. A comparison of the 1921 and 1935 censuses reveals a decline in the number of all domestic animals, with the exception of sheep, goats and poultry. This was paralleled by a similar decline in cereal production: 1921, 9,220 bu.; 1932, 1,500 bu. Following 1932 the quantity of cereals rose slightly, the census of 1935 reporting 3,700 bu. of grain threshed. The acreage under cultivation increased substantially from 89,000 ac. in 1921 to more than 110,000 ac. in 1939. Cultivated fruits have little export value, but wild fruits are sent in large quantities to the United States. Successive governments have attempted to stimulate farming, usually by granting bonuses for land clearing. The commission of government (see *Political and Social*) continued this policy. It established, also, a demonstration farm, to which an agricultural school is attached. District agricultural officers were appointed to advise the farmers as to crops, fertilizers, and so on. The department of rural reconstruction sought to develop subsistence farming as a means of increasing the independence of the fisherman. It gave its support to various self-help organizations and co-operative societies. By this means, the government attempted to mitigate some of the prejudices against which, and the difficulties under which, farming labours.

The forest industries are very important. Woodlands cover at least 25,000 of the 42,734 sq.mi. of the island. The best timber lands are found along the rivers and in the bottom lands, chiefly in the Exploits valley on the northeast coast, and in the Humber valley on the west coast. The commonest woods are black and white spruce and balsam fir. These are extremely valuable, not only for local manufacturing purposes, but also for the fabrication of newsprint. In some sections are considerable stands of white pine; in others, birch and juniper. More than 600 sawmills draw on these forests for building material, cooperage stock and various lumber products. The value of these reaches the figure of about $1,000,000 annually. Pit props, as well as newsprint, are exported to the United Kingdom. The production of newsprint is one of the most important activities of Newfoundland. The pioneer in this enterprise was the Anglo-Newfoundland Development company which began to manufacture paper in 1909. In 1925 another paper mill was opened at Corner Brook. In 1938 the total value of newsprint from the several plants within the island was $10,219,983. The administration of forests and the rental of timber limits are vested in the department of natural resources.

The mineral resources of Newfoundland are believed to be considerable. Formed as it is of ancient rock, it is said to contain almost all metallic substances. Iron and zinc-lead are the chief minerals commercially exploited. Iron mining is carried on at Bell Island in Conception bay. The ore beds appear in the cliffs on the north side of the island, and seem to extend far under the sea. The ore is known as Wabana, and is of first-class quality. In 1895 mining was actively commenced. In 1921 all the mines on Bell Island were acquired by the Dominion Steel and Coal corporation of Sydney, Nova Scotia. After the first ore was taken out in 1895, the Bell Island mines produced more than 28,000,000 tons of ore, valued at more than $75,000,000. The bulk of this is exported to the company's furnaces at Sydney.

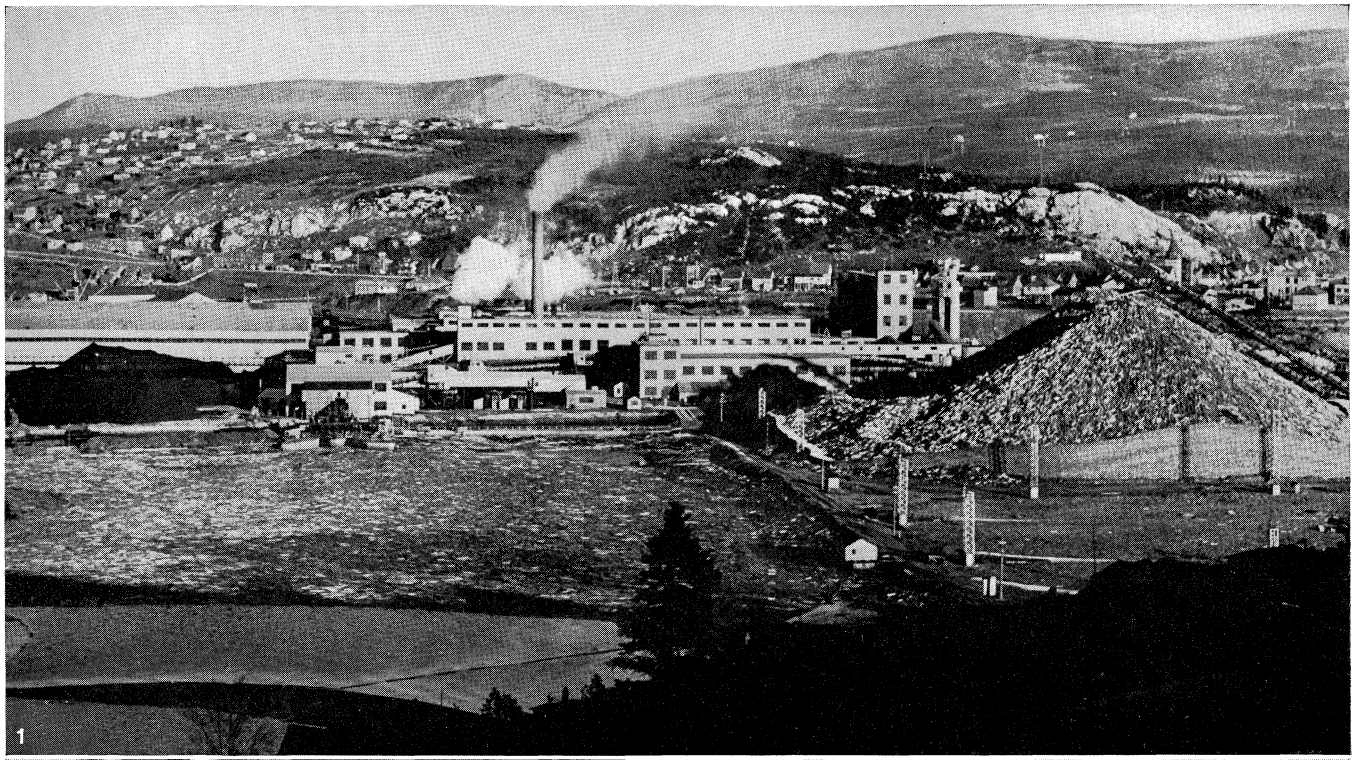
In central Newfoundland, on Red Indian lake, copper, zinc and lead are mined. As early as 1906 the outcroppings were discovered, but it was not till after 1925 that the extraction of the metals became feasible. Operations were begun in 1927, and in 1931 the plant was further extended. The mine is equipped with the most modern machinery including a crushing plant with a capacity of 2,000 tons a day, a concentrating mill with a capacity of 1,500 tons, and a hydroelectric plant of 2,500 horsepower. Between 1929 and 1932 the Buchans Mining company produced more than 325,000 tons of zinc and 140,000 tons of lead. Export is made by way of the Anglo-Newfoundland Development company's port at Botwood.

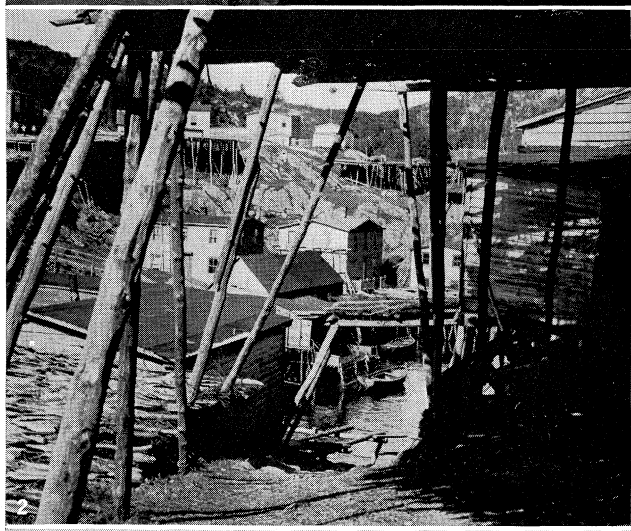
There are indications of other minerals in considerable amounts elsewhere. Coal is found in the neighbourhood of St. George's bay on the west coast, with an estimated content of 147,000,000 tons. Copper mining was carried on profitably around Notre Dame bay between 1864 and 1918 when the mines were exhausted. In 1933 fluorspar veins were developed in the St. Lawrence peninsula. By 1939 two companies were engaged actively in the exploitation of this mineral. In various sections of the island, silver, nickel, chromium, antimony, asbestos and vanadium exist. In 1934 the commission of government organized a geological survey in order to make known the resources of the country. The earlier survey in 1934 examined various gold deposits; later surveys, the old copper-bearing areas on Notre Dame bay. In connection with the geological survey, a number of bulletins were issued, and a detailed map of the dominion prepared. Throughout 1937–38 a survey of the iron deposits of Labrador was made.

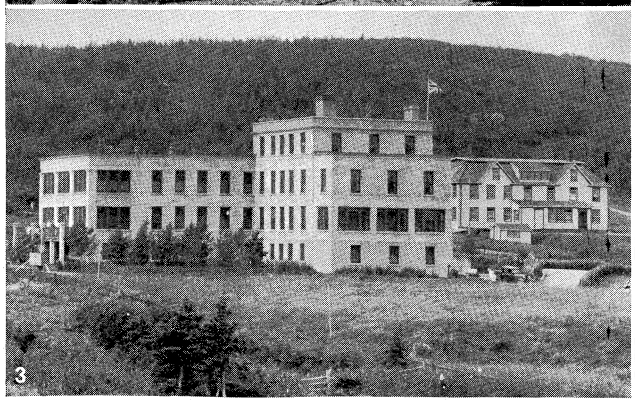
The fisheries are conventionally regarded as Newfoundland's chief industry. Proximity to the Grand Banks (*q.v.*) makes Newfoundland one of the world's greatest fishing stations. Fishing employs the most considerable number of persons in the dominion, and until recently, it provided the largest single element in the national income.

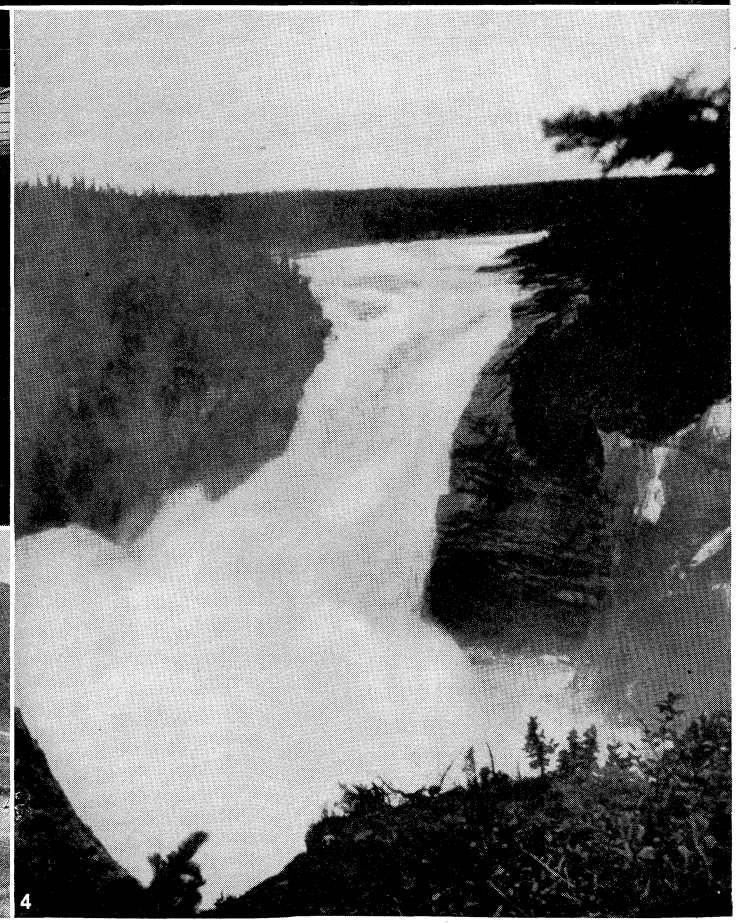
The codfishery is the oldest of the Newfoundland fisheries. It is pursued in three forms, in shore, on the Grand Banks and off the coast of Labrador. The shore fishery is followed from the coast in the summer months. It is engaged in by individual fishermen in small boats. Normally it accounts for more than one-half of the total catch. The cod is cured by the fisherman and his family on the "flakes" (*i.e.*, wooden stages) which form such a distinctive feature of the Newfoundland shore. The dried cod are disposed of to the local merchant. The bank fishery is a deep-sea fishery conducted from schooners, locally called "bankers." The actual operation of fishing is done by dories, which play out lines carrying 1,000 hooks. The "bankers" make three voyages annually, in spring, summer and autumn. The catch is stored on board, heavily salted, to be cured when the ships return to land. The bank fishery represents about one-tenth the total catch. The Labrador fishery is followed in the summer and the autumn either as a shore or as a sea fishery. The Labrador fish are processed locally, or carried in salt bulk to Newfoundland.

The other fisheries are of distinctly less importance. A considerable amount of salmon is dispatched frozen to Canada and to the United Kingdom. Lobsters are taken on the south coast. Smelt and halibut are sent iced to the Canadian market. Herring are caught at all points around the coast, but only on the west coast has this fishery any commercial importance. The seal and









COURTESY OF (2, 3, 4) CARNEGIE MUSEUM, PITTSBURGH, PA.; PHOTOGRAPHS, (1) LEE WULFF, SHUSHAN, N.Y., (2, 3) S. T. BROOKS, (4) J. K. DOUTT

## VIEWS OF NEWFOUNDLAND AND LABRADOR

1. Paper mill, Corner Brook, Newfoundland
2. The main "city street" under the fish flakes, platforms for drying fish, at La Manche, a fishing port on the southern shore of Newfoundland. La Manche dates back to Newfoundland's earliest occupation by Europeans
3. Grenfell hospital, St. Anthony, Newfoundland, the headquarters of the Grenfell activit'es in Newfoundland and Labrador. The large building is used mainly as a receiving hospital for serious cases, while the building to the right is used as an orphanage
4. Grand falls, Hamilton river, Labrador. Famed for their magnificence, the falls are more than 300 ft. high

the whale fisheries have declined greatly, the latter being virtually nonexistent.

The various fisheries are conducted on a credit basis. As a commodity is disposed of usually in a distant market, such an arrangement is almost inevitable. At the beginning of the season, the fisherman appeals to the local merchant for fishing equipment and for household supplies; at the end, his catch is valued, and any balance is squared in cash or goods. Should there be no balance, the fisherman remains in debt. The effects of the credit system, economically and psychologically, are deplored by all students of Newfoundland life. The ramifications of indebtedness are extended by the fact that the local merchants operate on a credit granted by the great exporting houses of St. John's. Various efforts have been made to overthrow this ancient system. The most recent was in 1933, when the royal commission suggested the statutory substitution of a fraction of payment in cash. This proved unworkable. Later efforts in the direction of mutual-aid societies, fishermen's co-operatives, and so on, give greater promise of success.

The chief markets for Newfoundland fish are the Mediterranean and Caribbean countries and Brazil. The export trade is primarily in dried, salted fish; little attempt is made to export cod, canned, filleted, or smoked. During the 1930s, disturbances in the overseas markets profoundly affected the fish trade. Between 1928 and 1938 the value of the codfish catch fell from $11,500,000 to $4,000,000. As the codfisheries, directly or indirectly, affect about one-third the entire population, the consequences of price decline are catastrophic. The ways and means successive governments have sought to offset these fluctuations are discussed in the section devoted to history.

Trade conditions make Newfoundland an exporter of primary products. Originally, this was exclusively dried codfish. In the 20th century, however, forest and mineral products outstripped the codfish export in value. In 1938 the figures were as follows: paper, $13,800,000; minerals, $10,900,000; fish, $7,400,000. As a result of these changes in economic structure, the American countries, Canada and the United States, have come to play an increasingly important role in the export and import trade. In 1933–34 Canada supplied 39.96% of the dominion's imports; the United States, 28.18%; the United Kingdom, 23.51%. After 1935 the United States increased its business progressively in Newfoundland. An important trade agreement was made between the two countries in 1938. Under the terms of this agreement, the United States substantially reduced duties on a number of Newfoundland fish products, as well as upon frozen small fruits and certain minerals. At the same time, Newfoundland reduced its tariff on 47 United States manufactured commodities. It was further provided that, in virtue of the tariff agreement between Canada and the United States, concessions made by the United States to Canada should apply to Newfoundland. The great bulk of Newfoundland trade is conducted through the port of St. John's. Distribution is largely in the hands of the St. John's wholesale houses. The city has an excellent harbour, and is connected by rail with the other chief centres in the island.

**Communications.**—Communications are made with steamship through St. John's, or through Port-aux-Basques at the western end of the island. The dominion government operates steamers between Port-aux-Basques and Sydney, where connection is made with the Canadian railways. Aeroplane service is maintained also both for transatlantic and for North American travel. In 1937 the British air ministry began to construct the Newfoundland airport at Gander lake. At the same time, an agreement was made between Newfoundland, the United Kingdom, Canada and Eire for the operation of the Atlantic route. Agreements were made also with the Pan American Airways for connections with the United States points. For both oceanic and continental flying, Newfoundland occupies an increasingly important position. It is not without significance that every major transatlantic flight from that of Sir John William Alcock and Arthur Whitten Brown in 1919 has used Newfoundland as a necessary part of the project. Within the island, the most important medium of transportation is the Newfoundland railway, a publicly-owned utility, which crosses the country from west to east. The railway links such centres as St. John's, Grand Falls, Corner Brook and Port-aux-Basques. The railway is narrow gauge; accordingly locomotives and rolling stock are considerably lighter than those in use on North American lines. There are, in addition, about 1,150 mi. of highway and 6,000 mi. of local road. Most of the mileage is in the Avalon peninsula, but there are important road connections in other areas, particularly in the neighbourhood of Corner Brook, Grand Falls and Millerton. The commission of government began the building of a trans-island highway. Newfoundland is an important cable relay station. It was in 1858 that the first cable connection was made between Newfoundland and Ireland, but it was not till 1866 that permanent connections were successfully made. The dominion government maintains wireless stations both in the island and in Labrador. It was in Newfoundland in 1901 that the first successful wireless transmission was effected.

**Political and Social.**—Constitutionally, Newfoundland is a member state of the British commonwealth of nations. In 1832 the island attained a form of representative government, and in 1855, self-government. From that date till 1934 the administration of the dominion followed the conventional British overseas type: a governor appointed by the crown acting on the advice of an executive council, which in turn was dependent upon the support of a legislative council and a legislative assembly. The council was appointed; the assembly, elected on practically universal adult suffrage, women having been enfranchised in 1925. The executive councillors were also heads of the great departments of state, finance, public works, justice and so on. In 1934, owing to very grave economic difficulties, this type of responsible government was temporarily suspended. A body described as the commission of government assumed office in 1934, as a result of recommendations of the royal commission (see *History: Commission of Government*). The commission consists of six members, three Newfoundlanders and three members appointed from the United Kingdom. The governor in commission communicates with the secretary of state for dominion affairs. The duties of the former executive councillors were reclassified and distributed among the six commissioners. The analogy between the commission and the executive council cannot be pursued beyond this point. The commissioners are advisers only; they do not formulate policy, nor do they share collective responsibility for their actions. The commission of government is an instrument unique in commonwealth practice, called into being in response to a temporary emergency.

St. John's is the only incorporated municipality in Newfoundland. Its affairs are administered by an elected council, which possesses the power of raising local taxation. Elsewhere, the functions of local government are exercised by the central authority from St. John's. The Newfoundland constabulary and the Newfoundland rangers serve as dominion and as municipal police.

Revenues of the Newfoundland government are drawn chiefly from customs duties and excise taxes. These are supplemented by an income tax and by various minor taxes. Previous to the establishment of the commission of government, the rate of duty on imported goods stood at about 55% ad valorem, with the addition of a sales tax and a surtax. The revenue acts of the commission of government completely altered the tariff system. The existing rates were much scaled down, and the sales and the surtax abandoned. In addition to the income tax and excise taxes, rents are levied on leased crown lands. In 1937–38 the revenues of the dominion government from all sources amounted to $12,287,686.

Commercial banking in Newfoundland is in the hands of the chartered Canadian banks. A government bank, the Newfoundland bank, conducts a deposit business. The Canadian dollar is the accepted currency of the dominion. In 1938 the savings deposits in all the banks stood at $30,443,913.

Education in Newfoundland is denominational in character. The denominational system reaches far back into the history of the island. The first school in Newfoundland was set up at Bonavista in 1726, by the Society for the Propagation of the

Gospel, the great Church of England missionary organization. Schools for Roman Catholics were supplied by the Benevolent Irish society, beginning in 1826. It was not till 1836 that government aided education, when a grant of £2,100 was voted. The Education Act of 1876 formally recognized the denominational principle by accepting Catholic, Anglican and Methodist schools, and by dividing the government grant to education on a proportional basis. Successive amendments to the act have not substantially altered this arrangement, the appearance of the Salvation Army, Seventh Day Adventists and Pentecostals being marked by schools conducted by those bodies on the same basis as those of the older churches. In St. John's, the larger denominations maintain "colleges," or secondary schools. These represent an investment of some $3,000,000 on the part of the churches. In 1920 a department of education, under the direction of a minister of education, was created. In 1935 the commissioner for home affairs became responsible for education.

Under the present system (1945), local authority is vested in boards of education. These are appointed by the governor in commission. The boards are responsible for the allocation of the government grant for salaries. In 1938 this grant amounted to $1,310,337, or about one-tenth of the revenue of the dominion. It may be said therefore that the central government provides for the current operation of the schools; the local board, for such capital outlays as buildings. Until 1909 the school buildings were provided entirely by the local boards. In that year the government voted $100,000 for building purposes.

Newfoundland schools are, therefore, denominational in administration, rather than in curriculum. In 1935 the commission of government attempted to consolidate the educational system, by appointing a single departmental executive, the secretary for education, who was responsible to the commission. In 1939 another amendment to the Education act replaced this functionary by three denominational officers. Thus, the control exercised by the churches continued unimpaired.

Higher education is conducted through the Memorial University college at St. John's. This was opened in 1925 as a permanent memorial to the Newfoundlanders who served in World War I. The university gives courses in the first two years of arts and the pure sciences, and in the first three years of engineering. The university provides teacher training, and sponsors a very active adult educational program.

In 1933 a curriculum commission was appointed and an inspector from the United Kingdom invited to report on education throughout the dominion. As a result of the recommendations of these authorities, the educational program was much modified. Very interesting experiments were made in such agricultural settlements as Markland, where the general principles of the Norwegian folk schools were adapted to Newfoundland needs.

The International Grenfell association carries on important educational and medical work in the northern outports and on the Labrador coast. Commenced in 1892 by Sir Wilfred Grenfell, the association now maintains a chain of schools and hospitals, and an orphanage. The association stresses spiritual as well as physical rehabilitation.

**Population.**—The population of Newfoundland was 284,872 (census of 1935); that of Labrador, 4,716; total, 289,588. This represents a substantial increase over the 1921 figure of 263,033. The population of St. John's in 1935 was 39,886; that of the chief outports, Corner Brook, 6,374; Bell Island, 6,157; Grand Falls, 4,244; Bonavista, 4,022; Harbour Grace, 2,215; Carbonear, 3,367. The term "outport" is applied to all centres outside St. John's. There are some 1,292 settlements on the island, of which 1,192 have less than 500 inhabitants.

The modern Newfoundlanders are the descendants of English, Irish and Channel Islands settlers of the 18th and 19th centuries. About 98% of the people of the dominion are of British stock. Newfoundland possesses, therefore, a remarkably homogeneous population. Such cleavages as exist are denominational, rather than racial or social. Newfoundland is divided numerically almost equally between the Church of England, the Church of Rome and the United Church. In the chief towns there is considerable overlapping; elsewhere, the various churches monopolize the outports. The churches form the centre of community life, and nowhere in the Anglo-Saxon world does the church play a more decisive part in the lives of the people. The historic fishing industry powerfully influences the distribution of the population. The census figures show that about one-third of the total population is dependent on the fisheries for its livelihood. About one-half (46.9%) lives in the Avalon peninsula, and well over three-quarters (77.5%) on the eastern, or the Atlantic, face of the island.

Population movements in Newfoundland have followed an arresting pattern. The period of immigration lay in the first quarter of the 19th century. Between 1800 and 1850, the population rose from about 15,000 to almost 60,000. This increase seems to have been due to a remarkable influx from Ireland. Thereafter, immigration declined, till by the third quarter of the century, it was negligible. Population nearly doubled every generation: 1836, 75,094; 1869, 146,536; 1901, 220,984. From the beginning of the 20th century, a strong current of emigration set in to the United States and Canada. This exodus is said to have reached the figure of 15,000 a year. Large emigration probably supplies the normal means of accommodating the rapidly increasing population: it is an emphatic commentary on the small power of absorption of the industries of the dominion.

## LABRADOR

Labrador occupies the seaward side of the peninsula of that name. It is bounded on the east by the Atlantic ocean, on the west by Quebec, on the north by Cape Chidley, and on the south by the Strait of Belle Isle. Labrador contains about 112,000 sq.mi. of territory. Its natural resources have not been surveyed with any degree of completeness. There are probably 40,000 sq.mi. of commercially valuable woodlands. The minerals have not been exploited. In 1935 the commission of government granted 20,000 sq.mi. in western Labrador to a Canadian mining corporation. The water power of Labrador is known to be considerable. On the Hamilton river is situated the Grand falls, more than twice the height of Niagara. More than 4,000,000 horsepower of electric energy is believed to be available from this source alone. The population of Labrador is composed of persons of European descent, Indians and Eskimos. The Moravian Brethren and the Grenfell association maintain schools and mission stations in this area. The derivation of the term Labrador is unknown. Southern Labrador was visited by Jacques Cartier in 1534.

## HISTORY

**Discovery and Exploitation.**—The precise date of the discovery of Newfoundland by Europeans cannot be determined. Recent investigation upon the subject of transatlantic navigation suggests that Newfoundland and the Grand Banks fishing ground were well known considerably before John Cabot made his voyage in 1497. Ships from Bristol and the western English ports were engaged in the Icelandic and northern fisheries from at least a century earlier. Cabot gave emphatic advertisement to the wealth of the western waters, an advertisement reinforced by the Portuguese explorer, Gaspar Corte-Real, in 1501. By the first quarter of the 16th century, French, Basque, English and Portuguese adventurers were fishing regularly off Newfoundland. By 1534 the chief features of the coastline were known and named. The term Newfoundland is probably a modernized form of the generic "new-found-land," which was used in the Cabot charter of 1496.

Newfoundland occupied a vital place in the scientific and military activity of the 16th century: it was associated with the search for the North-West passage, and it was of great strategic importance in the Anglo-Spanish maritime contest. In 1583 Sir Humphrey Gilbert formally annexed Newfoundland, and in the course of the next 30 years, attempts were made to colonize the island. In 1610 the London and Bristol company planted a colony at Cupids, on Conception bay. The leader of the Cupids colony was John Guy. Colonization was attempted also in the Avalon

peninsula by Sir William Vaughan, Lord Falkland and Sir George Calvert, later Lord Baltimore. The Baltimore colony at Ferryland promised well, till its proprietors procured the patent for Maryland in 1632. In 1637 all Newfoundland, including the Baltimore holdings, was transferred to Sir David Kirke and his associates. Although the Kirke family seems to have retained possession till the 1670s, efforts at permanent settlement were at an end. Seventeenth-century economic theory and practice far preferred the codfisheries to established colonies.

BY COURTESY OF THE NEWFOUNDLAND TOURIST TRAFFIC DEVELOPMENT BOARD

COAT OF ARMS GRANTED TO NEWFOUNDLAND BY ROYAL LETTERS PATENT DATED JAN. 1, 1637

**The Old Colonial System, 1633–1800.**—Throughout the 16th century, the codfisheries attracted great annual expeditions from maritime Europe. In England, these reached the position of supreme national importance. Poole, Bristol, Exeter, Teignmouth and the other western ports became the centres of English enterprise, thus establishing, in the Newfoundland trade, a dominance which endured for more than two centuries. In contrast to the practice of the continental Europeans, the English adventurers engaged in "dry fishing." That is, having made their catch, the English dried the codfish on the island. Under favourable climatic conditions, from five to six weeks were sufficient for this process. The cod were then shipped overseas, the best fish going to the Mediterranean, the least valuable to the slave plantations in the West Indies. Marketing was done by large merchant vessels, or "sack" ships. The sack ships brought to Newfoundland the all-essential salt; in the late autumn, they returned to England with wine or oil, or with the more precious bullion from abroad. In the eyes of the 17th- and 18th-century theorist, these transactions had a double value: first, they made England the beneficiary of the profitable export trade in dried cod. Secondly, the western fisheries were a great nursery of hardy seamen. It is not surprising, therefore, that the fisheries were regarded as being of fundamental importance to England's security and prosperity. It was manifestly contrary to national policy to permit permanent settlement, or to allow the fishermen to winter in Newfoundland. It was equally in the interests of the western merchants to discourage settlement. Accordingly, they very adroitly identified their private interests with the widely accepted mercantilist theories, and argued that possession of the fisheries was synonymous with maritime supremacy.

In pursuance of this policy, the western merchants secured valuable fishing privileges. One of these, the Western charter, issued in 1634, and reissued in 1661 and 1670, prohibited settlement on the coast of Newfoundland. The culmination of discriminatory legislation was reached in 1698. The act (10 and 11 William III cap. 25) refused to recognize the private ownership of fishing stages, and forbade any islander to appropriate a stage till all the overseas fishermen were accommodated. Thus, the monopoly of the adventurers was secured, and Newfoundland relegated to the role of accessory to the overseas fisheries.

The intensification of maritime rivalry probably forced the issue. In 1662 the French established themselves at Placentia; in 1665 the Dutch burned St. John's, even at that early date a centre of English trade. Beginning with 1696, the French made concerted attempts to conquer Newfoundland, clearing the English out of their establishments in the Avalon peninsula, and, early in 1697, attacking their stations in Conception bay. These exploits were repeated by the French in 1705, and again in 1709. By the terms of the treaty of Utrecht (1713), the French recognized English sovereignty over Newfoundland, although they retained valuable fishing privileges between Cape Bonavista and Point Riche. These concessions graphically indicate the high value set on the fisheries by both French and English. The ultimate settlement of these claims was postponed for nearly two centuries (see *External Relations*). During the Seven Years' War (1756–63), Newfoundland became again a centre of conflict, St. John's being lost and retaken by the English in 1762. During the American and French Revolutionary Wars, Newfoundland's coasts were ravaged afresh.

The subordination of Newfoundland's social and political development to the codfisheries was complete. After the failure of the early colonization schemes, authority was chaotically exercised by the fishermen themselves, under the title of "Fishing Admirals." In 1729 an officer of the royal navy was appointed governor. His tenure was seasonal, as was that of his successors till 1817. The naval governors wholeheartedly sought to aid the overseas fisheries as auxiliary to national policy. As late as 1775, Palliser's act (15 Geo. III cap. 31) attempted to forestall settlement by refusing to recognize the right of private ownership. In 1791 a civil court was instituted, and, in 1792 a supreme court. In this way the earliest attempt was made to introduce an element of constructive order into Newfoundland affairs.

The population of the island was almost entirely seasonal, the fishermen returning each autumn to England; as late as 1683–84, there were only 120 permanent residents on the island. Throughout the 18th century, numbers increased from 3,400 in 1754 to more than 12,000 in 1774. Settlement spread north from Cape Bonavista and west from Placentia. The newcomers were drawn increasingly from Ireland to provide inexpensive labour for the codfisheries. Food and supplies were brought in from New England. Thus were the less favoured members of the empire subordinated to maintain England's monopoly of the Newfoundland staple industry. The great prosperity the fisheries enjoyed in the late 18th century probably accounts for the steady increase in population, which by 1804 reached 20,000. The peak year was 1814–15, when more than 11,000 immigrants arrived in St. John's from southern Ireland.

To these newcomers, the prosecution of the shore fisheries was left chiefly. The prosperous deep-sea fishermen became resident merchants, buying dried cod, fish oil and seal skins for speculation abroad. Their headquarters were St. John's, which to its old character of a fishing station added that of a distributing and financial centre. Between the poor English and Irish "youngsters" (*i.e.*, employees), and the merchant oligarchs, a vast social and economic gulf was set. This cleavage may explain the disturbances in Newfoundland during the French Revolution, particularly the abortive mutiny of part of the local defense force in 1800. By the end of the 18th century, therefore, the hold of the "old colonial system" on Newfoundland life was weakening sensibly.

**Representative and Responsible Government.**—As early as 1802, Governor James Gambier proposed that a form of representative government be granted Newfoundland. A decade and a half later, the colonial secretary instructed the governor (Admiral Sir Francis Pickmore) to advise the British government in the matter of administrative reform. The leading advocates of self-government in the island were Dr. William Carson, a politically inclined Scots physician, and Patrick Morris, an Irish-born merchant. Opposed to any reform were the agents of the great western interests and the local merchants. In 1832 representative institutions were established, with a bicameral legislature, the lower house of which was elected on a very broad franchise. From an early period, discord developed between the two houses. The legislative councillors were residents of St. John's, and representative of the economically dominant "fishocracy" of the merchants: the assembly was a much more popular body. So serious did the collisions become, that in 1841 the constitution was suspended. In 1843 it was restored partially, a unicameral, or "amalgamated legislature" being set up. In 1847, however, the old constitution was restored. The amalgamated houses enacted much useful legislation: a general education act; a road-building program; aid to agriculture. From 1848 onward, agitation was set in train for complete responsible government. The colonial office withheld approval till 1855. In that year, full legislative responsibility was admitted, on the analogy that what had been recognized in Nova Scotia and Canada, could not be withheld in

Newfoundland. An adequate civil list and a parliamentary redistribution were effected, and, thus equipped, Newfoundland emerged as a completely self-governing community.

**Economic Maturity, 1800–70.**—Increasing economic maturity underlay the constitutional changes aforementioned. The early 19th century was characterized by the growth of the inshore fisheries, as distinct from the bank fisheries. The war years, especially from 1800 to 1815, drastically curtailed the deep-sea fisheries. The bank fisheries did not recover their former importance, the dominant economic position passing to the shore fisheries. These fisheries were prosecuted by resident Newfoundlanders, and their rise was responsible for the political changes of 1832. During the war years, the Newfoundlanders established a virtual control over the Mediterranean market for dried cod. In 1813 and 1814, they established an important new market in Brazil. Peace brought a disastrous fall in the price of dried fish, occasioning a prostration in business which lasted till 1818 or 1819. Thereafter, till the middle of the 19th century, the export of cod remained remarkably constant, between 900,000 and 1,000,000 quintals annually (1 quintal=112 lb.). Their export value remained steady also, although rising slowly in the 1850s and 1860s.

An important adjunct to economic prosperity was the seal fishery. From the middle of the 18th century, the people of the northern bays took a few seals annually by means of nets. Somewhat later, small boats were employed. These ships sailed each spring for "the ice," in order to intercept the great herds of seal on their migrations. In 1831 and 1844, phenomenal catches were made, 686,830 and 685,530 respectively. The industry gave employment to a large number of men, and brought handsome returns to the capitalists who directed it. In 1857, 13,600 men shipped for the ice; the catch was valued at $1,700,000. After the middle of the century, sealing declined. In its heyday, the industry had very important economic and social consequences. It brought wealth and dignity to outports like Brigus, Carbonear and Harbour Grace. It stimulated local shipbuilding. It gave welcome employment, since it began three months earlier than the summer codfisheries.

Throughout this period, concerted efforts were made to broaden the economic basis of island life. Sir Thomas Cochrane, the first governor under the representative system, attempted to forward road building and farming. Under the direction of Sir John Harvey in the '40s, agricultural societies were formed in an effort to put farming on a rational and extensive basis. The success of these efforts may be judged by the progressive increase of land under cultivation: 1836, 11,062 ac.; 1845, 29,656 ac.; 1855, 41,108 ac. The majority of such holdings were small, usually being worked as auxiliary to the all-absorbing fisheries. Nevertheless, they did impart a degree of self-sufficiency and permanency to Newfoundland life.

Allied to the fisheries were overseas commerce and banking. Newfoundlanders were excellent shipbuilders, and frequently sailed the vessels they constructed to the Mediterranean and the Caribbean. Foreign shipping, chiefly Spanish and German, crowded St. John's. The history of banking in Newfoundland begins with the opening of a branch of the Bank of British North America in 1836. In 1844 the Newfoundland bank was incorporated; in 1854 the Union bank; in 1857 the Commercial bank. These last three were local institutions, and their success demonstrates the competence of Newfoundlanders to direct all phases of their economic life in the mid-19th century. The introduction of steam navigation in 1844, and of the electric telegraph in 1852, as well as the negotiation of a reciprocal trade treaty with the United States in 1854, brought Newfoundland into the main current of North American affairs.

The social development of the island kept pace with the economic. The merchant class became Newfoundland by birth and outlook, and, with the rise of the enterprising Irish shopkeeper, began to lose its exclusively Anglican caste. The outport merchants, with the increasing importance of the seal fishery, played a more decisive role in business life. St. John's was transformed gradually into a commercial centre and colonial capital. In 1800 the population of the city was about 3,000, living along two narrow paths which straggled on the north side of the harbour. A series of disastrous fires in 1816, 1817 and 1819 largely destroyed the ancient malodorous fishing town, and made possible a degree of planning. In 1846 another fire hastened this process, and opened the way for such improvements as a general water supply system, the St. John's Water company being incorporated in 1846. In this period, some of the most conspicuous landmarks of St. John's took form. In 1841 the cornerstone of the Roman Catholic cathedral was laid; in 1855 the church was consecrated. In 1843 the building of the Anglican cathedral was commenced.

The Newfoundland churches owe their modern organization to the early 19th century. In 1847 the Roman Catholic diocese of St. John's was erected. Catholic worship had been conducted regularly as early as 1627 in the Baltimore colony; a prefecture was created in 1784, and a vicariate in 1796. The early clergy were Irish Franciscans, an arresting commentary on the close integration of social and religious forces. The opening of a diocesan seminary, in 1857, made possible the training of a native clergy and the formation of a completely indigenous church. The Anglican diocese of Newfoundland was created in 1839. Provision for Anglican worship was made as early as 1583, and the first Anglican minister reached the island in 1610. The consecration of Bishop Edward Feild in 1844 introduced the modern period in church extension and education. Methodism was introduced into Newfoundland in 1764, establishing itself strongly in the northern outports. In 1855 the Methodist churches joined the Eastern British American conference, thus breaking the administrative connection with England. The entrance of the Methodist Church into the United Church was effected in 1925. Organized Presbyterianism dated from 1842. The other chief religious bodies, Salvation Army, Adventists, and Pentecostals came into being at a later time.

In the decade of the 1860s, Newfoundland passed through a confusing period. The conventional historian employs alarmist language to describe the lean years 1860–68, and ascribes the economic collapse and social demoralization to the decline of the fisheries. A critical examination of the available evidence suggests that equally potent factors were poor harvests, occasioned by prolonged drought, and the dislocation of the southern market for cod, produced by the U.S. Civil War. Against this dark picture must be contrasted the unchallenged statement, made in 1864, that Newfoundland was in a sounder financial position than any other British American community. By 1869 good harvests, supplementing abundant fisheries, brought prosperity. In 1869, also, the proposition of including Newfoundland in Canada was rejected at a general election. Whatever local or temporary issues were involved, the rejection may be regarded as symptomatic of the economic well-being of Newfoundland in the mid-century.

**The Age of Local Enterprise, 1870–95.**—The quarter century (1870–95) was one of general prosperity. This may be ascribed to the progressive broadening of economic life through farming and mining, and also to the stimulus of railway building. An additional reason was the high price the increasing exports of dried codfish commanded. In an era of general price decline, the price level of dried fish remained almost stationary. Thus, the fisherman had the absolute advantage of a high selling price, and the relative advantage of greater purchasing power. Moreover, the capitalistic enterprises of the period were locally managed and financed. The intrusion of alien direction and control following 1895 may be regarded as closing one period in Newfoundland history.

The search for economic self-sufficiency was initiated as early as the '60s. The rapid increase in population (1857, 124,288; 1869, 146,536; 1874, 161,374) gave a note of urgency to these investigations. In 1862 two committees of the legislature examined the fisheries and agriculture, and, in 1864 the geological survey of the island was begun. Independent of, but associated with this, was the discovery of copper ore at Tilt cove on Notre Dame bay. Working was begun in 1864, and, by 1879 the mine had yielded $1,572,514 of copper and $32,740 of nickel. Other mines, notably at Bett's cove, gave even greater yields, produc-

ing minerals valued at $2,982,836 between 1875 and 1879. The discovery of considerable deposits of lead, coal and other minerals on the west coast increased optimism, and stimulated efforts to promote ways and means to exploit these new forms of wealth. A succession of generous harvests and good fisheries added to the income of private persons. Governmental revenues increased, reaching the figure of $841,588 in 1874. Accordingly, means of expansion were at hand.

Railway construction became the great end of national policy. In 1875 Sir Sandford Fleming, the engineer of the Canadian Pacific, surveyed a practicable route from St. John's to St. George's bay. Difficulties raised by the colonial office, lest such a line trespass on French privileges, delayed the construction of the railway as originally projected. In 1880 a joint committee of the legislature recommended the building of a railway northward, as the best means of making accessible the mining and agricultural regions of Notre Dame bay and of the Exploits valley. In 1881 a company was incorporated and construction begun. The company was aided by government subsidies of $180,000 per annum for 35 years, and a land grant of 5,000 ac. for each completed mile. At the same time, new enterprises were initiated at St. John's. In 1882 a ropewalk was established for the manufacture of fishing gear, netting, cordage and cables, thus freeing Newfoundland from its dependence on foreign sources for these indispensable supplies. Between 1882 and 1884, a large dry dock was constructed. Other industries developed locally, foundries, machine shops and engineering works, all associated with the railway or with shipping. The social importance of these industries was great. The railway in its first year paid out $200,000 in wages, and more than $500,000 in supplies. In 1882, for the first time, the revenues of the island exceeded $1,000,000. This figure, along with the construction work and the large numbers employed, constitutes a distinct landmark in the progress of Newfoundland.

In the early 1890s two disasters altered completely the pattern of Newfoundland growth. In 1892 three-quarters of St. John's was devastated by fire. The damage to property was computed at $20,000,000, of which less than one-quarter was covered by insurance. In Dec. 1894, the two leading banks, the Commercial and the Union, failed, while the Government Savings bank was compelled to suspend payment. The notes of these banks, the normal currency of the island, became valueless, business stagnated and workingmen were dismissed. As the Union bank was under obligation to provide the half-yearly interest (about $225,000) on the public debt, the crisis assumed a very serious shape. A loan from the United Kingdom serving for immediate relief, Newfoundland sought permanent solution by union with Canada. The ungenerous insistence of the Canadian government on certain debt settlements caused the negotiations to break down early in 1895. Left to their own devices, Newfoundland public men, directed by Sir Robert Bond, succeeded in raising loans in Montreal, New York and London, thus staving off the danger of complete financial collapse.

The bank failures brought to an end a distinct era in Newfoundland history. Local enterprise had been overwhelmed by disaster. The Canadian banks entered the island, and their notes replaced the local Newfoundland dollar. Five years previously, Sir Robert Reid of Montreal had become influential in pushing the construction of the transinsular railway. By these means, alien direction invaded the business life of Newfoundland.

**The Era of Foreign Investment, 1900–30.**—For the first 30 years of the 20th century, Newfoundland development followed a consistent pattern. Foreign enterprise increasingly sought to exploit Newfoundland's natural resources. As a corollary, Newfoundland standards of living sought approximation to standards elsewhere. World War I intensified this process. The liquidation of long-standing differences with France and the United States was a feature of this period. Thus, in the 20th century, the insularity of Newfoundland sensibly disappeared, as the dominion merged into the general economic and social framework of North America.

As early as the 1890s, foreign investment was attracted to railway construction and mining. The decision to build a transisland railway brought in Sir Robert Reid, a Scots-Canadian promoter of great practical experience. The financial disaster of 1894–95 induced the government, in 1899, to transfer to Reid virtually all the island's communications, railway, shipping lines and telegraph, as well as the St. John's dry dock and extensive timber and mining rights. Strong protest produced an amendment of the contract in 1901, whereby the more objectionable monopolistic features were surrendered at the price of some $2,500,000. Construction was pushed vigorously; in 1893 the railway reached Norris Arm on the Exploits; in 1897, Port-aux-Basques. Fast steamships were put in service between this point and Sydney. The profitable working of these enterprises proving increasingly difficult, in 1923 the government assumed their operation as part of the public charge. In 1895 the exploitation by a Canadian company of the iron deposits on Bell Island commenced. The Bell Island mines supplied the Cape Breton blast furnaces, as did also the limestone quarries at Port au Port on the west coast. The railway and the mines were thus early examples of the exploitation of natural resources by foreign interests. They represented also powerful forces drawing Newfoundland into the American economy.

In 1905 the Anglo-Newfoundland Development company was constituted for the manufacture of newsprint. The company was originated by Lord Alfred Charles Northcliffe, who wished to make his chain of newspapers independent of foreign countries for supplies of print. The location of the original plant was at Grand Falls, where the company received power rights on the Exploits river, and timber limits amounting to 2,000 sq.mi. The first paper was produced in 1909. For export purposes, the company installed docks and sheds at Botwood, which was connected with Grand Falls by private railway. Since its establishment, the Anglo-Newfoundland Development company has been much expanded. In 1923 it acquired the pulp mill of the Albert Reed company at Bishop's Falls. It also increased its timber holdings to 7,400 sq.mi. The plants at Grand Falls and Bishop's Falls were modernized completely. The rise in production may be accepted as an accurate commentary on the company's efficiency. In 1909 and 1910 the original mill produced 30,000 tons of newsprint. By 1912 production was doubled; in 1933 it stood at 100,000 tons annually. In carrying out surveys, officials of the company discovered outcroppings of lead-zinc ore on Buchans river. It was not till 1925, however, that these deposits were made profitably exploitable. The American Smelting and Mining company undertook development under agreement with the parent Anglo-Newfoundland company. Mining operations were begun in 1927. In 1931 the plant was enlarged, obtaining a production capacity of about 1,200 tons of ore daily. The newsprint and mining undertakings represent the first large-scale enterprises in central Newfoundland. In both instances, the industries laid out model towns adjacent to their plants, maintaining therein schools, hospitals, recreational centres and churches. The Anglo-Newfoundland Development company is the connecting link between the pre-World War I and postwar periods, and its continued success demonstrates the continuity of large-scale enterprise.

World War I provoked an immediate response in Newfoundland. The number of naval reservists was increased, and plans were laid for the creation of an expeditionary force. On Oct. 12, 1914, the first contingent reached England. Newfoundland troops served with distinction in France and in the near east. In all, nearly 7,000 men were raised, of whom 5,482 went overseas. The casualties were 1,300 killed and 2,314 wounded. The royal naval reserve provided more than 2,000 men. In 1918 the dominion adopted compulsory military service. Sir William Lloyd, the prime minister, represented Newfoundland at the peace conference in Paris. The war produced great (if transitory) prosperity. In 1918 the export value of cod per quintal (1 quintal=112 lb.) reached the unprecedented height of $14.46. Bank deposits, which before the war, stood at $8,000,000, after the war were estimated at $21,000,000.

In the postwar era came the exploitation of the timber re-

sources of the west coast. The potentialities of the region were well known, but it was not till after 1919 that development was undertaken seriously. The leader was Sir Richard Squires, then the prime minister, and one of the most vocal exponents of exploitation by means of foreign capital. In 1933 the Sir W. G. Armstrong, Whitworth and Company undertook to build a paper mill and to develop hydro-electric power. Both the British and Newfoundland governments were interested, guaranteeing the principal and the interest on the stock issued. The estimated outlay was placed at $20,000,000. Radical changes in plan, involving the relocation of the mill at Corner Brook, raised the actual cost of construction to $45,000,000. The first paper was produced in 1925. From the beginning, the mill was burdened by this heavy capitalization. It was further handicapped by difficulty in finding an opening for its products in the highly competitive newsprint market. In 1927 the mill was transferred to the International Paper company of New York. Complicated financial arrangements were effected between the new company and the older interests, especially the Newfoundland government. The Corner Brook plant had many advantages: it was modern, it drew on 7,200 sq.mi. of woodland, and it was admirably situated for water carriage. A townsite, complete with houses, schools, hotel and hospital, to accommodate the employees was laid out. Nevertheless, the operations of the mill were carried on under difficulties. In the early 1930s, the depression reduced the plant to a four-day week, with a daily production of about 500 tons. In 1939 the Bowater-Lloyd pulp and paper interests of the United Kingdom acquired the Corner Brook mill.

The consequences of capitalistic enterprise to Newfoundland life have been very striking. A skilled proletariat has grown up, dependent upon wages and accustomed to steady labour. The pay roll of the new industries is impressive. In its 55 years of operation, the railway paid out $94,000,000; after 1905 the Anglo-Newfoundland company, $60,000,000; in 8 years, the Buchans mine, $8,000,000; in 14 years, the International Paper company, more than $31,000,000. In the Avalon peninsula, and in the modern industrial centres, the credit system disappeared in large measure. The rise of the wage system was accompanied by demands for greater comforts, and for better facilities in education and in public health. On the other hand, increase in specialization made the Newfoundlander more easily the victim of recurring commercial depressions. It is significant that the earliest successful trade unions were formed in this period. Some of these were local, but the more powerful were affiliates of the American international unions, or of the railway brotherhoods. Organized labour was studiously nonpolitical. The nearest approach to a politically minded working-class movement was the Fisherman's Protective union, organized by Sir W. F. Coaker in 1908. The co-operative movement began in 1917, with the formation of the Newfoundland Industrial Workers' association. It has continued fairly successfully among skilled workers particularly in the paper and mining towns.

**External Relations, 1713–1927.**—External relations were adjusted happily with France and with the United States in this period. Disputes over the definition of the fishing rights enjoyed by France date back to the 18th century. The Anglo-French treaties of 1713, 1763 and 1783, all gave French fishermen the right of seasonal occupation of the Newfoundland coast. As ultimately defined, the "French Shore" embraced the entire west coast, and the northeast coast south to Cape St. John. It was a constant challenge to Newfoundland sovereignty and hindered the settlement of some of the most favoured sections of the island. In 1904 the issue was resolved with finality, by France receiving compensation elsewhere, and withdrawing completely from Newfoundland. The islands of St. Pierre and Miquelon off the south coast remained in French hands. Disputes with the United States were more domestic in character. Before the American Revolution, all British Americans had participated freely in the fisheries. Limits were placed upon United States participation in 1783. In 1818, however, substantial concessions were made to the United States, by opening the southwest coast for taking, curing and drying fish, and the west coast for fishing. The Reciprocity treaty of 1854 enlarged the rights of the United States fishermen. By the treaty of Washington (1871), provision was made for arbitrating the points at issue. In 1877 the arbitration award was made, under the terms of which Newfoundland received about $1,000,000 compensation. Newfoundland attempted unsuccessfully to link the fisheries and reciprocal trade. In 1888, however, the opposition of Canada caused negotiations to break down; in 1890 increasing economic nationalism in the United States rendered the discussions nugatory. In 1910 conflicting interpretations of the fishery agreements were submitted to further arbitration before the Hague tribunal. The findings of the court favoured Newfoundland.

In 1927 the imperial privy council made its adjudication of the Labrador-Quebec boundary. The decision turned on the interpretation of various letters patent, royal proclamations, and acts of parliament. By this pronouncement, some 110,000 sq.mi. were recognized officially as Newfoundland territory. The Labrador coast award may be regarded as symbolizing the new orientation of Newfoundland. The dominion now possessed a definite continental interest to set against the ancient oceanic economy.

**World Depression and Its Consequences, 1929–33.**—In 1931 Newfoundland began to experience the effects of the world depression. These were intensified by the heavy service charges on the Newfoundland debt. Throughout the 1920s, the program of railway consolidation and highway construction, along with increased aid to education raised the national debt from $43,000,000 to $101,000,000. Moreover, the budgets had not been balanced after 1920, the annual deficits amounting to an average of $2,000,000. The deficits were met by loans, which, of course, added to the general indebtedness. The onset of the depression, therefore, found Newfoundland in a very dangerous financial position. By an unfortunate coincidence, Newfoundland's best customers for newsprint, minerals and dried cod were themselves affected seriously. Employment declined in Canada and the United States, forcing home scores of seasonal workers. Throughout 1930, 1931 and 1932, the shore fisheries were low, with the result that in the winter of 1932–33, about one-quarter of the population was on relief. In 1931 a loan for $8,000,000 received no tenders. Upon request, a financial adviser for the government was dispatched from the United Kingdom. In 1932 loans were successfully raised from the Canadian banks and from local subscriptions. An unusual feature of this agreement was the provision which gave the Imperial Oil Company of Canada a monopoly of the import of petroleum products in return for an annual subsidy of $300,000. Drastic cuts were made in expenditure, and taxes steeply increased. During 1933, however, no improvement was visible, and additional loans were sought from the governments of Canada and the United Kingdom: January, Canada-United Kingdom loan, $1,250,000; July, United Kingdom loan, $1,850,000. At the same period, application was made for the appointment of a royal commission to inquire into Newfoundland affairs. Thus, economic stringency reduced Newfoundland to helplessness. In common with other primary producers, the dominion suffered from the catastrophic fall of price levels. The great capital outlays of the 1920s had no opportunity to become productive; rather, they formed an additional liability, since they were financed on money borrowed from abroad. Additional problems were presented by the expense of providing social services for the small population scattered around the island's immense coastline, and seasonally employed in the unremunerative fisheries. While political immaturity and administrative inefficiency may have contributed, it is clear that the fundamental causes of Newfoundland's troubles were economic.

**Commission of Government, 1934– .**—In February, a royal commission was appointed. It consisted of three members, a Newfoundlander, a Canadian and a representative from the United Kingdom. The terms of reference stressed the examination of Newfoundland's financial situation and prospects. The royal commission met throughout the summer of 1933, gathering information on Newfoundland life. A report of these investigations, along with certain recommendations was published in the autumn of 1933.

The report was a very comprehensive document, containing an extensive survey of Newfoundland's existing condition and past history. The ills of the dominion were set down to the functionings of a perverted parliamentary system, which had been exploited for party and personal gain. As solution, the royal commission recommended the temporary suspension of responsible government. It recommended, also, that the government of the United Kingdom should assist Newfoundland financially till such time as the dominion became self-supporting. Other recommendations touched the rehabilitation of the fisheries, the revision of the educational system, and so on. The constitutional proposals were startling since they envisaged the establishment of an unique body, the commission of government, which should

exercise both legislative and executive functions. A candid analysis of the report suggests that the royal commissioners misunderstood the nature of Newfoundland's difficulties, and that they were anxious chiefly to protect the holders of Newfoundland securities. These were, principally, British, Canadian and United States. In the 1920s, Newfoundland had borrowed about one-half its funds from New York. It is probable that the dominion office feared the consequence to British financial prestige of the default of Newfoundland; hence the extraordinary measures suggested to insure solvency. Early in the winter, the Newfoundland legislature debated the report, and accepted the recommendations. The British parliament thereupon examined the measure, which became law in Dec. 1933. The chief critic of the proposed change was the Labour party. It attacked the bill as designed to assist the *rentier* class, and as constituting a dangerous precedent in dictatorship.

In its operations, the commission of government encountered a number of difficulties. The most obstinate were the low prices tendered for Newfoundland's primary products. As such prices were determined by world conditions, their improvement was beyond the power of local administration. The export of paper products declined steadily from the 1936 figure of 299,182 tons, to 180,920½ tons in 1938. Exports to the United Kingdom seem to have been less severely affected than exports to the United States. The returns of the codfisheries fluctuated considerably. The coincidence of short catches, political disturbances in the Mediterranean market, and the economic prostration of Brazil (the largest single buyer of codfish) created very difficult problems in marketing. Substantial gains were made, however, in mining. This was true, especially in the export of iron ore from the Bell Island mines. A reflection of the armament program of the European states may be discerned in the high level of ore sales to Germany. In 1938 orders from this source offset decreasing orders from Canada and the United Kingdom. In the main, the first five years of commission government witnessed considerable business recovery. The general trade of Newfoundland expanded impressively from $43,097,065 in 1933–34 to $62,800,000 in 1938. This last was the highest figure after 1931. A convenient index of conditions within the island is afforded by the amounts of money spent on relief: in 1933–34, this reached the sum of $1,550,000; in 1937, $1,144,318; in 1938, $1,148,904. In assessing these figures, account must be taken of the rising scale of relief outlays. Economic conditions may be said, therefore, to have favoured the commission of government.

The program of the commission was assisted by advances from the British treasury. Deficits in ordinary expenditure were met by grants-in-aid; money for capital outlays was borrowed from the Colonial Development fund. The annual deficits were in the neighbourhood of $1,500,000. In order to effect economies, the commission carried out an extensive conversion scheme. In this way, the cost of debt service was reduced by more than $2,000,000 annually. The government of the United Kingdom guaranteed both interest and principal of the new sterling 3% stock issued to replace the old Newfoundland securities. In matters of finance, the commission of government, like the parliamentary regime which preceded it, was unable to find an equilibrium between expenditure and income. The artificial character of the budgetary balances must not be overlooked.

The most substantial advances made by the commission were in administration and in administrative reform. At an early period, the tariff was subject to thorough revision. Customs duties had been for long the staple of Newfoundland finances, producing in normal times about three-quarters of the dominion's revenues. During the depression years, the tariff had been so steeply increased that the law of diminishing returns was operating. The commission simplified and reduced the tariff (Revenue act, 1934). The result was a considerable increase in revenue, which rose from $7,043,504 in 1935 to $8,683,181 in 1938. At the same time, the collection of customs duties was more rigidly enforced. A measure of reciprocal trade with the United States was effected in 1938. This measure reduced charges against such imports as foods and textiles, and expanded Newfoundland's market for minerals and fish.

Closely associated with such reforms was the reorganization of the civil service. This body had worked under great difficulties, during the early '30s when salaries were cut, and when tenure of office was uncertain. The last parliamentary government introduced sweeping changes in the selection and the promotion of administrative officials. This plan, the commission continued, supplementing it by drawing civil servants from Britain on loan, and by sending Newfoundlanders to the United Kingdom for special training. By increasing security of tenure, the commission was able to attract into the public service a number of promising younger men. With its certain financial support, the commission was enabled to restore the much needed grants for school purposes. While the educational reforms did not proceed from the commission, nevertheless, they depended upon government countenance and support. In a like manner, public health was benefited by the organization of clinics, by the enlarging of the hospitals at St. John's, and by the introduction of hospital ships to visit the remote outports.

Another promising accomplishment of the commission was land settlement. The experiment was begun in the winter of 1933–34 by a group of St. John's citizens. The success of the Markland scheme attracted the attention of the government. Under the direction of the Land Settlement board, and later under the department of rural reconstruction, the Markland scheme was repeated elsewhere. To subsistence farming, winter logging, fishing and lobster canning were added. The moral value of such settlements was very great. Stimulation to the co-operative movement was given formally in the Co-operative Societies act (1939), which sought to make the principle of self-help operative throughout the dominion. In sponsoring these measures, the commission of government indicated its awareness of problems other than the material.

In its efforts to rehabilitate the fisheries, the commission of government encountered unusual problems. In 1934 the department of natural resources advanced supplies to 3,000 selected fishermen. In 1935 this plan was replaced by a hire-purchase scheme for nets, small boats, and so forth. A schooner-building program was put in train, in an effort to restore the fisheries of the Grand Banks. Cold-storage plants and bait depots were placed along the coast, and a steamship was equipped to serve the distant outports. The more active intervention of the government in the fisheries was brought about by the creation of a Herring board (1934) and the Newfoundland Fisheries Board act (1936). The latter was a comprehensive measure, governing the sale and the export of fish, and regulating the various phases of processing. Exporters were licensed by the board. Complementary to this measure was the Salt Codfish Association act, which empowered all exporters to form themselves into an association. The officers of this body, along with nominees of the crown, form the advisory council of the Newfoundland Fisheries board. This experiment in marketing has operated with fair results. In 1936 it succeeded in maintaining the price of dried codfish in the face of a Portuguese consortium. Its intervention with respect to Greece and Puerto Rico was less happy. The commission of government provided also a number of emergency measures to assist the fishing interests. In 1937 a rebate of $1 a hogshead was accorded salt; in 1938 this was increased to $1.50. In 1938, also, by guaranteeing the export merchants against loss, the price of Labrador fish was raised to $3 a quintal. More in the nature of long-term efforts was the stimulation given to the export of frozen fish products. Throughout 1939 negotiations pended between the commission of government and the General Sea Foods corporation of the United States. At the same time, surveys were made of the other fishery resources, haddock, halibut, and so on. By these means, the government sought to adapt the ancient fishing industry to serve modern North American tastes.

In June 1939 King George VI and Queen Elizabeth visited Newfoundland on the conclusion of their North American tour. That the dominion had made appreciable immediate progress was manifest. In terms of long-range advances, the record was less promising. Economically, Newfoundland was not self-supporting. The budget balances were illusory, since they were drawn from the United Kingdom. Exploitation of the natural resources was still incomplete. The problem of transforming the absolutism of the commission of government into some form of democratic representation had not been considered.

BIBLIOGRAPHY.—Sir Wilfred Grenfell, *The Story of a Labrador Doctor,* 10th ed. (London, 1932); Sir Wilfred Grenfell, *Forty Years for Labrador* (London, 1933); T. Lodge, *Dictatorship in Newfoundland* (London, 1939); R. G. Lounsbury, *The British Fishery at Newfoundland, 1634–1713* (1934); A. H. McLintoch, *The Establishment of Representative Government in Newfoundland* (London, 1941); R. A. MacKay, ed., *Studies in the Economy and History of Newfoundland* (Toronto, 1945); J. Reeves, *History of the Government of Newfoundland* (London, 1793); D. W. Prowse, *History of Newfoundland,* 2nd. ed. (London, 1896); J. D. Rogers, *Newfoundland* (Sir Charles Lucas' Historical Geographies of the British Empire; rev., 1939); J. R. Smallwood, ed., *The Book of Newfoundland* (St. John's, 1937); R. H. Tait, *Newfoundland* (1939); *Cambridge History of the British Empire,* vol. 6 (Cambridge, 1930); *Newfoundland, Royal Commission Report* (London, 1933). (J. I. C.)

**NEW GLARUS,** a town and a village of Green county, Wisconsin, U.S.A., about 26 mi. S.W. of Madison, on the Little Sugar river, a branch of the Rock river. Pop. town (1940) 539; village, which was separated from the town in 1901 (1940) 1,068. New Glarus is served by a branch of the Chicago, Milwaukee and St. Paul railway.

It has agricultural and dairying industries, a large milk condensing plant and the only Swiss embroidery factory in Wisconsin. It had its origin in a colonizing experiment made by the canton of Glarus, Switzerland, in 1845.

Agents sent by the canton chose the site of New Glarus largely because the rocky slopes of the valley suggested their Alpine home. The settlers brought with them a "form of government" drawn up by the Cantonal Council of Glarus and providing in great detail for a system of schools, for what was practically a State church (Reformed Lutheran) supported by tithes, for a system of poor relief, for a system of courts and for a set of town officers elected on a limited property franchise. The original plan provided also for an equitable distribution of land to each head

of a family. Old World traditions are upheld in an annual Labour Day week end outdoor presentation of Schiller's *Wilhelm Tell*.

**NEW GLASGOW,** a manufacturing and mining town of Pictou county, Nova Scotia, Canada, on the East river, near its entrance into Pictou harbour, and the Canadian National railway, 104 mi. N.E. of Halifax. Pop. (1941) 9,210. Extensive coal mines are in the vicinity, and there are manufactures of iron and steel, mill machinery, door and sash factories, as well as several ship-building yards.

**NEW GRANADA** (Span. *Nueva Granada*), the title under Spanish colonial administration of that part of South America now known as the republic of Colombia, which at one time was extended to include Venezuela and Ecuador. It also was for a time the title of the united territories of Panamá and Colombia under republican auspices. The Bogotá plateau was invaded from the Caribbean coast and conquered in 1537 by Gonzalo Jiménez de Quesada, who, in honour of his native province, called it the "Nuevo Reino de Granada." In 1550 an *audiencia real* under the viceroyalty of Peru was established at Santa Fé (Bogotá), but in 1564 this isolated group of Spanish settlements was transformed into a presidency. In 1739, owing to the unmanageable size of the viceroyalty of Peru, it was divided and a new viceroyalty was created from the various provinces lying in the northwestern angle of the continent, extending from Tumbez northward to the northern limits of Panamá, and eastward to the Orinoco, to which the name of Nueva Granada was given. The new viceroyalty included the provinces of Tierra Firma (now the republic of Panamá); Maracaibo, Carácas, Cumaná and Guyana (now included in Venezuela); Cartagena, Santa Marta, Rio Hacha, Antioquia, Pamplona, Socorro, Tunja, Santa Fé, Neiva, Mariquita, Popayán and Pasto (now included in Colombia); and Quito, Cuenca and Guayaquil (now included in Ecuador). In 1777 the provinces of Maracaibo, Carácas, Cumaná and Guyana were detached from the viceroyalty to form the captaincy-general of Carácas; otherwise it remained as above until the termination of Spanish rule in South America.

For the republic of Colombia (1819–30), the republic of New Granada (1831–61), the United States of Colombia (1861–86) and the republic of Colombia (1886 to date), *see* COLOMBIA.

**NEW GUINEA,** island, of estimated area 312,329 sq.m., stretching from the equator in the north-west to 12° 5′ S. in the south-east and from 130° 50′ E. to 151° 30′ E.; separated from Australia by the shallow Torres strait and Arafura sea. On its eastern side lies the Bismarck archipelago. Pop. 1,312,013.

### STRUCTURE AND PHYSICAL GEOGRAPHY

The island consists of a long central mountain chain of complex formation, a northern coastal range, and a small planed down hill country on the south coast, west of the mouth of the Fly river, together with the alluvial surfaces formed mainly by the rivers under the influence of equatorial rains. The structure shows, in the west, the influences of great earth movements ranging from the Banda sea. These give arcs (1) Banda islands, (2) Buru, Ceram, West Timorlaut, (3) East Timorlaut, Kei islands, coastal mountains of south-west New Guinea from the Baik mountains to Cape Fatingar, thence via Misol island, Obi island, and then north on the west side of Halmahera. This curve is separated, in West New Guinea, from the central chain by the deep McCluer inlet. The central chain stretches from northwest to southeast. In Dutch New Guinea the name Nassau mountains is applied to the chain as a whole.

In this chain the snow line is to be found approximately at 14,600 ft. and Mt. Idenburg (15,150 ft.) and Mt. Carstens (16,400 ft.) have glaciers. The next section is the Orange mts. with Mt. Wilhelmina (15,312 ft.). There seems to be a more or less parallel range 25–45 mi. to the north of this succession of ranges, and in it a height of 12,500 ft. has been observed in the Weijland mountains. The composite nature of the great chain is maintained eastwards and it is believed that the main watershed lies in the Mandated and not in the British territory. In the former a height of 13,700 ft. has been found in the Otto mts.; on the south flank the chain grades into a complex of mountains of lesser height. The south-eastern part of the chain called the Owen Stanley range (Mt. Albert Edward, 13,220 ft.) declines gradually to the end of the long peninsula.

Towards the west the central chain is formed principally of palaeozoic sandstones and slates on which much younger rocks, nummulitic sandstone and limestone are laid. In Dutch New Guinea, the lower mountain country is of Miocene rock. Towards the south-eastern peninsula there are again old rocks, some with gold-bearing quartz, especially along the axis, as well as granite and folded Tertiary limestone on both coasts of the peninsula; here also, and in the d'Entrecasteaux islands is much evidence of volcanic activity (Miocene, Pliocene, Pleistocene and recent).

The northern coastal range in Dutch New Guinea is said to reach a height of about 6,900 ft.; it declines towards the mouth of the Sepik, beyond which it rises again to a height of about 10,500 ft. and ends at King William's cape. It is formed of ancient elements with diorites, gabbro, andesites, etc., mostly covered with Tertiary and even possibly younger sediments, and is probably still in process of uplift; recent coral reefs adorn some cliff sides and may reach a level of some 5,500 feet. There is abundant evidence in New Guinea of large earth movements from Miocene times onwards, with a probable maximum in the Pliocene or Pleistocene. The southern hills between the mouths of Digul and Fly rivers are an extension of Australia structurally. Between these lines of hills there run lowlands, floored near the Idenburg river by Pliocene sandstones.

The most important rivers are the Mamberamo, reaching the sea north of the Nassau range; the Sepik, also on the north, navigable by seagoing steamers for 180 m.; the Fly river flowing into the Gulf of Papua, navigable by a whale boat for 600 miles; and the Digul in the south-west. Many of the rivers have gold, but it is important in few places save the Louisiade archipelago beyond the south-east extremity and Woodlark island. Murua (Woodlark island) beyond the d'Entrecasteaux islands has banded quartzite much valued for making adzes. Petroleum occurs near the coast of the Gulf of Papua and in the so-called Bird's Head.

**Climate.**—In the northern summer the south-east trades dominate New Guinea; they bring rain to the south-east peninsula but the rain diminishes farther west on the south side as the wind is affected more and more by the passage across the corner of Australia. Northward on the east coast the rain at this season appears to be very heavy where the land faces south-east. Farther west there is little rain while the south-east trades blow. In the southern summer, New Guinea is on the wind-path from Asia, round to the very marked Australian low pressure centre. The wind is swinging round from the north-west to north-easterly direction and it brings heavy rain to northern New Guinea and to the southern part of the Dutch Territory. In one place in the rain shadow of the northerly mountains an annual rainfall of 96 in. has been measured, but on the exposed heights, especially between 3,000 and 6,500 ft., it must be enormously greater. In the lowlands the convection currents rule all the year round, but the amount of rain varies. The temperature remains near the average of about 81° declining to about 72° and rising to about 92° as rough monthly averages. 72° is not far from the average morning, and 92° not much above the average noon, temperatures.

**Flora and Fauna.**—The general vegetation is that of the rain-forest, but under the conditions of great heat the rain-forest cannot grow where there is a long dry season. The tree limit is more than 10,500 ft. above sea-level. Towards the mountain tops one finds European (*Rubus, Ranunculus, Leontodon, Aspidium*), Himalayan, New Zealand (*Veronica*), South American (*Drymus, Libocedrus*) and even Antarctic species. From 6,000 ft. upwards fine Agapetes (*Ericaceae*), pines (*Araucaria, Libocedrus*) and palms adapted to hill-life abound. In the lower lands palms are very abundant, and along the tidal courses of rivers those of the genus *Nipa* are common; sago palms are numerous in the seasonal swamps while grass and cane swamps occur where the land remains long under water. On the Alang steppe is the tall, tough grass, *Imperata arundinacea*.

New Guinea was probably united to Australia as recently as Pleistocene times, whereas its last effective connections farther

west are much older. It thus belongs in the main to the Australian region with nine species of Echidna (*Monotremata*) and 84 of marsupials among which are two genera peculiar to the island (*Distoechurus* and *Dorcopsis*). Small kangaroos live on the borders of steppe and forest in the higher lands. Bats abound and there is a pig (*Sus papuensis*), a dingo and 50 indigenous species of rats and mice chiefly on the steppe, and a few squirrels. The bird fauna includes well over 500 species and at least 50 genera are peculiar to the island. Birds of prey hover over the steppe and catch rats and mice, but apparently they avoid the great forests and here flourish the famed birds of paradise, which are absent from all the islands east of New Guinea. The Bismarck islands have birds allied to those of New Guinea but 74 species are peculiar to them. Turtles and tortoises are plentiful on the coast and have curious relationships with South American forms; many lizard species are peculiar to the island but comparatively few snakes. Amphibia are abundant and of Australian affinities. Insects are very numerous and the butterflies are gorgeous. Land molluscs are related to those of India and Malaya.

## POLITICAL DIVISIONS

**British New Guinea** (TERRITORY OF PAPUA).—Area about 90,540 sq.mi., European population 1,822. Natives estimated 337,000. A British protectorate was declared in 1884 after the government of Queensland had annexed the land in 1883, and after various changes it became (1906) the Territory of Papua under the governor-general of Australia, with a lieutenant-governor of its own. An executive council of one unofficial and eight official nominees helps the lieutenant-governor and also forms part of the legislative council, which has five additional unofficial nominees. There are eight magisterial districts and a central court at Port Moresby, and an appeal thence to the high court of the commonwealth. Some simple regulations of native government are administered with the help of village constables. About 190,000 ac. of land have been leased, chiefly by planters, and over 62,000 are cultivated, chiefly for coco-nuts, rubber and sisal.

(A. C. H.; X.)

**Mandated Territory of New Guinea.**—The northern section of south-east New Guinea (formerly called Kaiser Wilhelmsland) was mandated in 1919 by the League of Nations to the government of the Commonwealth of Australia, together with the Bismarck archipelago (New Britain, New Ireland, and adjacent islands), the Admiralty islands and several outlying groups, and the northern Solomon islands (Bougainville and Buka). North-eastern New Guinea lies between 2° 15′ and 8° S., and 141° 30′ and 148° E. It had been declared a German protectorate in 1884 when not a single white man lived there. Plantations arose in the islands and on the mainland, and three German mission societies soon formed settlements in New Guinea. Under the mandate, the system of indirect rule through native chiefs has been continued. The administrator advises the governor-general of Australia who can legislate by ordinance. There are ten district officers, six of whom are in the islands. The headquarters is at Rabaul. No slavery or forced labour is permitted, but natives are not allowed to leave the territory, and labour indentures are made. No one may supply natives with firearms, ammunition, alcoholic liquor, opium or derivatives of opium.

The total native population was estimated at 581,342 (1938), excluding territories not yet under control and also excluding 41,849 indentured labourers. Of the above population *c.* 250,000 are on the mainland. The non-native elements number 6,283 including 1,737 Chinese, 3,472 British and 473 Germans. The area of the mainland mandated territory is 68,500 sq.mi. Products include coco-nuts, cacao, rubber and cotton.

Both Papua and the mandated territory of New Guinea were battlefields between Japan and Australian-U.S. forces in World War II. The initial Japanese penetration into the area occurred Jan. 23, 1942, when landings were effected on New Britain and New Ireland, and in the Solomons. On the following March 8, a Japanese convoy landed forces at Salamaua and Lae on the northeast coast of New Guinea. Still later, troops landed at Buna and Gona, tiny shore points in northern Papua. The Japanese then began a concerted drive southward across the Owen Stanley mountains toward Port Moresby. By Sept. 1942 they had passed the crest of the range, taken Kokoda and Kagi, and were threatening Port Moresby, key to the invasion of Australia. There they were stopped by difficulties of supply and by tropical disease. The Allies counterattacked on Sept. 25 and a week later recaptured Kokoda; recrossing the Owen Stanley mountains, they entered Gona on Nov. 24, 1942, Buna village on Dec. 15, and Sanananda Point on Jan. 22, 1943.

BIBLIOGRAPHY.—*Official Handbook of the Territory of New Guinea, etc.* (Canberra, n.d., 1937?).

**Dutch New Guinea.**—Dutch New Guinea, which lies between 10° S. and the equator, comprises practically half of the entire island of New Guinea. The boundary line between it and British New Guinea starts from the south coast and follows the line 141° E. up to the Fly river, which river then forms the boundary until 141° E. is reached, when the meridian becomes the boundary again, right up to the north coast. The area is 151,789 sq.mi., and the population is estimated at 350,000, of whom 310 are Europeans or Eurasians. The territory is practically undeveloped; save for the extreme western coastal portion opposite Ceram, and parts of the northern coast, its coasts are imperfectly charted, and large stretches in the interior are only superficially explored. The northern half is mainly hilly, with a very high range of mountains traversing it east by west, though along the northern coast and on either side of the Mamberamo river, which flows into the sea at Cape d'Urville, are great alluvial tracts of land; the extreme west is almost wholly hilly; the south very flat, with vast swamps near the coast, especially in the south-west, where Prince Frederick Henry island, separated from the mainland by the narrow and tortuous Princess Marianne strait, is perfectly flat and marshy, and covered with dense forest. Into McCluer gulf (Teluk Berau), which divides the western portion of Dutch New Guinea almost into two, flow several rivers, including the Seljar and Ketero, the former navigable, for small vessels, for 34 and the latter for 23 miles. Along the south-western coast stretch, in succession, from north to south, the Mimika, Utakwa, North-West river, Lorentz, Utumbuwe, Eilanden, Digul and Merauke. Some of these are situated so close to each other that they are connected by channels navigable for small, light-draught boats, several are navigable for distances of from 25 to 50 mi. for steamers of 12 ft. draught, and the Digul the largest, is 6 mi. wide at its mouth and has been ascended for nearly 400 mi. by a steamer of 6 ft. draught. The south-western coast is flat and fairly even, until the Charles Louis mts. are reached, where it becomes high and much indented. Flat tracts alternate with high ground along the western coast, very much indented after McCluer gulf, and the north coast, from Cape Sorong along Little Geelvink bay, to the middle of the coastline of Great Geelvink bay, is generally high, especially where, near Manokwari, the Arfak mts. come very near to the sea. The remaining shores of Geelvink bay, to Cape d'Urville, and beyond, as far as Sarmi point, are low, flat and alluvial, but from here to Humboldt bay it is mostly high, rugged and rocky. The entrance to Great Geelvink bay is blocked by several islands, the northernmost being the Schouten group, Suk, or Supiori, to the west, and Biak, or Wiak, to the east. The former is 17 mi. long and has hills reaching 1,600 ft.; the latter is 45 mi. long and 23 mi. wide, with a hill 800 ft. high at the southern end, otherwise it is only 50 ft., above sea-level. Farther within the bay is the important island of Jobi, or Jappen, 110 mi. long and 15 wide, with a ridge of mountains 2,500 ft. high running along the centre, the south coast being indented with deep creeks, fronted by wooded islets and reefs. Between Ceram and the north-west coast of Dutch New Guinea lies Misol, 50 mi. long and 23 broad (narrow in the west, wide in the east), with numbers of very small islands to the north and south of it. It is flat in the north and hilly in the south, no point being over 1,800 ft., the coast is rocky, but swampy in places, and there are three rivers, navigable for a few miles. Separated from the north-west coast by the narrow Galewo straits is Salwatti, a round island, 30 mi. across, with regular coasts, and limestone hills on the north coast, 1,000 ft. high, but low and swampy in the east, and no rivers of

note: east of Salwatti is the small island of Popa. North of Salwatti, separated by Pitt strait, is Batanta, 40 mi. long and only from 4 to 8 mi. wide, densely wooded and mountainous (highest point 3,676 ft.). Due north of Batanta is the island of Waigiou, 28 mi. wide, nearly 80 in length, and separated from New Guinea by Dampier strait, 30 mi. in width. It is covered with forest.

Commerce and industry in Dutch New Guinea are almost unknown. The people generally live in a very wild state, head-hunting and cannibalism are all too prevalent; some are semi-nomadic, others entirely, and as they live largely on sago, and this is obtainable almost everywhere, in large quantities, with a minimum amount of labour, while the coconut abounds, and the sweet potato, sugar-cane, plaintain, papaya and tobacco are grown with little trouble, there is no incentive to work, apart from hunting the cassowary, pig and kangaroo, for their flesh, and fishing, the only lucrative employments followed being those of hunting the bird of paradise, collecting the wild nutmeg, the mace of which is much esteemed and marketed specially in Macassar, and the preparation of copra. Men and women go about almost entirely naked, the men armed with bow and arrow, axes of polished stone, and daggers of the jaw-bone of a crocodile or the thigh-bone of a cassowary. There are head men of villages, but they have little power, the people of the coast are often at war with those of the scrub lands of the interior, and there is enmity between these and the mountain folk: language varies considerably. There are no extensive roads.

In the whole of South New Guinea there is only one settlement, Merauke, a few miles inland up the Merauke river. A Dutch *Gezaghebber* resides here, there is a small garrison, a hospital, Catholic mission church, and settlement, and a few shops, mostly run by Chinese traders, a wireless station, and a small wharf, where vessels of the Dutch Royal Packet company land passengers and collect copra and other cargo. Merauke was established in 1902, as the result of a military expedition. The nearest Dutch settlement to Merauke is at Kaimana, on the McCluer gulf, 500 mi. distant. Here, and at Kokas and Fak Fak (headquarters for West New Guinea, where there is a *Gezaghebber*), there are small trading stations with Malay, Chinese and Arab settlers; Fak Fak is the most important, where proximity to Ceram and generations of outside influence have resulted in settled and semi-civilized conditions among some of the Papuans. All three places are ports of call for vessels of the Dutch Royal Packet company, also Sorong, on the northwest coast, opposite Salwatti, and Manokwari (Doreh), on the northeast coast, which is the seat of an assistant resident and the headquarters of administration for North New Guinea. Wasior, on Little Geelvink bay, is another port of call, also Sarmi, Demta, Hollandia and Humboldts bay, and here, too, are Chinese and Malay traders, dealing mostly in copra and bird of paradise plumes, and there is some exploitation of the hinterland. The development of Dutch New Guinea will probably be more rapid than that of North New Guinea, for there is good land available and more chance of being able to utilize imported labour, when this can be procured. Trade is being developed with Jappen island, where Dutch Royal Packet vessels call at two ports, Seroei and Wooibaai; and with Biak, of the Schouten islands, the port of which is Bosnik.

A treaty dated 1660 between the Dutch East India company and the three states of Ternate, Tidore and Bachian, acknowledged the company to be "lord of the Papuans or all their islands which are subject to the king of Tidore." This gave the Dutch a nominal sovereignty over the Tidorese fiefs on the islands of Waigiou, Salwatti and Misol, and as on the latter two islands there were kingdoms possessing a vague sovereignty over parts of the mainland of New Guinea, while the suzerainty of Tidore was acknowledged in the neighbourhood of McCluer gulf, eventually the Dutch succeeded to these somewhat shadowy rights. Their first establishment was in 1828, when Fort de Bus was erected, but before this, in 1814, Dutch sovereignty in North-West New Guinea had been admitted, practically, by Great Britain by the convention of 1814, which restored to the Dutch their colonies as they had existed prior to 1803. In 1828 the Dutch government declared North-West New Guinea, as a dependency of Tidore, a part of the Dutch East Indian colonies, which claim was confirmed in 1848, the frontier then being stated to run straight from Cape Bonpland to the north coast. In 1884, when South-East New Guinea was declared a British protectorate, the meridian of 141° E. was acknowledged as the frontier between British and Dutch territory, and later, in 1885, the same meridian was accepted by the Dutch as defining the frontier of German New Guinea. A convention entered into by Holland and Great Britain in 1895 made a slight alteration in the boundary (the Fly river) and made the navigation of the Fly river free to subjects of both powers, except for the carriage of munitions of war. In 1898 Tidorese territory was assigned to the Ternate residency, in 1911 West New Guinea was attached to the Residency of Amboyna. The division of territory is North New Guinea, West New Guinea, and South-West New Guinea, all three being parts of the residency of the Moluccas. The coastline of Dutch New Guinea except for the southeastern part was conquered by the Japanese in World War II. (E. E. L.; X.)

BIBLIOGRAPHY.—S. W. Reed, *The Making of Modern New Guinea* (Philadelphia, 1943). Among older works *see* E. C. Rye, "Bibliography of New Guinea," *Supplementary Papers, Royal Geog. Soc.* (1884). *See* also British New Guinea, *Annual Reports,* Parliamentary Papers of Queensland (before 1901); *Annual Reports* of the Lieut. Governor of Territory of Papua; *Koloniaal Verslag* (Colonial Report), Annual; *Annual Reports to the League of Nations on the Administration of the Territory of New Guinea; Mitteilungen aus den deutschen Schutzgebieten* (1888 etc.). Recent works include: *Reports,* Cambridge Anthropological Expedition to Torres Straits (1907); C. G. Seligman, *The Melanesians of British New Guinea* (1910); R. Neuhauss, *Deutsch Neu Guinea* (1911); E. Werner, *Kaiser Wilhelmsland,* Freiburg-i.-B. (1911); J. H. P. Murray, *Papua or British New Guinea* (1912), *Papua of To-day* (1925); W. H. R. Rivers, *History of Melanesian Society* (1914); H. Detzner, *Ergebnisse von Reisen in Neu Guinea* (1914–18); *Geogr. Tages, Leipzig* (1922); L. B. Gibbs, *Dutch New Guinea* (Botanical) (1917); G. Landtman, "Folk Tales of Kiwai Papuans," *Acta Soc. Sci. Fenn.* (Helsingfors, 1917), "Papuan Magic in Building Houses," *Acta Aboensis Humaniora,* vol. i., (1920); W. N. Beaver, *Unexplored New Guinea* (1919); E. W. Chinnery, "Opening up of new territories in Papua," *Geogr. Journ.* (London, 1920); A. C. Haddon, "Migrations of Cultures in British New Guinea," *Journ. Roy. Anthro. Inst.* (1920); R. Thurnwald, *Die Gemeinde der Banaro* (Stuttgart, 1921); F. de Bruyn, "Contrib. Geol. Nouv. Guinée," *Bull. Lab. Geol.* (Lausanne, 1921); C. A. W. Monckton, *Some Experiences of a New Guinea Magistrate* (1921), *Last Days in Papua* (1922); W. R. Humphries, *Patrolling in Papua* (1923); H. J. Bijlmer, *Nova Guinea* (anthropological) (Leyden, 1923); E. R. Stanley, *Geology of New Guinea* (1923); F. Hurley, *Pearls and Savages* (1924); W. Behrmann, *Das W. Kaiser Wilhelmsland in Neu Guinea, Zeitsch. Ges. Erdkunde* (1924); W. Klein (ed.), *Nieuw Guinee,* 3 vols. (Amsterdam, 1935–38).

## ANTHROPOLOGY

The island of New Guinea and its island-clusters, together with those adjacent island-groups, of which the principal are the Louisiades and the Torres Straits islands, is a region of considerable racial and cultural diversity. The territory of New Guinea, the north-eastern quarter of the island, is, however, still very incompletely surveyed ethnologically, and of the inhabitants of Dutch New Guinea, our knowledge is comparatively slight.

**Racial History.**—Although there is considerable variety of racial type, the inhabitants of New Guinea belong almost entirely to the ulotrichous (frizzy-haired) branch of mankind. The principal varieties are the Negritos, the Papuans and the Melanesians. The only typical Negritos that have been found in New Guinea are the Tapiro at the source of the Mimika river in the Snow mountains of Dutch New Guinea, and the Pesechem. The Mafulu, the Kai and some others have probably a Negrito element.

The Papuan, the dominant stock in New Guinea, is dark, of short stature and generally long-headed. Evidently, Papuan man occupied not only New Guinea, but also Melanesia in very early times (*see* OCEANIA: *Racial History*), later migrations from Indonesia having on the whole less racial than cultural effects. The Melanesian element in New Guinea is certainly comparatively recent, and appears to be a mixture of Papuan with Indonesian and proto-Malay, a mixture which may in part have taken place in Indonesia. The Melanesian influence is strongest in the north and north-eastern coastal regions; and on the south-east coast of Papua the immigrant nature of this Melanesian type is clear.

**Principal Groups.**—Taking the whole New Guinea area, and

working from west to east, some of the principal culture-areas (or tribes where these exist) may be enumerated. Belonging to New Guinea rather than Australia we have the islands of Torres Straits with a well-developed and distinctive culture. Two groups on the mainland between the Fly and the Dutch boundary may be mentioned, the Tugeri, partly in British but mainly in Dutch territory where they are known as Marind-Anim (their name for themselves) and the Kiwais. A culture of which little is known occurs in the neighbourhood of Lake Murray, between the Strickland and the Fly; and between the Fly and the Aramia, we have a tribe, the Gogodara, containing many distinctive characters. In the Gulf of Papua, from a little west of the Kikori river to Cape Possession, four main groups are distinguished by Dr. Haddon, Kerewa, Urama, Namau and Elema, and far from the coast on the upper waters of the St. Joseph river the Mafulu show distinctive characters, physically and culturally. To the east of these Papuan districts we meet the farthest westward extension of Melanesian-speaking peoples. There are two main groups of these Papuo-Melanesians, the Western Papuo-Melanesians, the Roro, Mekeo, Motu and others, and the eastern Papuo-Melanesians or Massim, inhabiting the eastern extremity of New Guinea and the islands beyond, including the whole of the Louisiades, except possibly the island of Rossel, the inhabitants of which speak a non-Melanesian language. Passing westward along the north coast, Melanesian-speaking peoples give way for a while to Papuan-speaking peoples, such as the Orokaiva.

In the territory of New Guinea (excluding the Bismarck Archipelago, *q.v.*), the Bukaua, Huon gulf and the adjoining Jabim are Melanesian in culture, while the Tami of the neighbouring islands seem to be fairly pure Melanesian. Farther north the Kai, who inhabit the Rawlinson and Sattelberg ranges, are Papuan with Pygmy admixture. Both Papuan-speaking and Melanesian-speaking peoples occur along the coast farther north and west. Flourishing cultures occur on the Sepik river, and something is known of the Banaro on the Keran river.

In Dutch New Guinea something is known of the Geelvink bay district, where Melanesian-speaking peoples occur. On the west coast we find Papuans on the Mimika river, and at the headwaters of this river are the Tapiro pygmies.

**Mode of Life.**—With very few exceptions the inhabitants of New Guinea are horticulturists, cultivating coconuts, yams, taro, bananas and a number of other food plants. Sago is also an important food in some parts, constituting the main article of diet in the swampy region of western Papua. Fish are caught by net and spear, and occasionally by hook; and the harpooning of the dugong is an important feature amongst certain of the coastal peoples. The pig, domesticated and wild, is the only important flesh-food, though the wallaby and many birds are caught by various devices. Betel-nut is chewed with lime and pepper-plant, and the use of tobacco is now universal. Kava, the Polynesian drug, is limited to one or two places. Family houses are usually small, and are often built on piles. They may be scattered, as amongst the Massim, or grouped in big villages, as amongst the Motu and Gulf peoples. Club-houses in which initiated males live most of their lives occur in many parts and may be of considerable size; structures of this kind which entail enormous labour occur on the Sepik and in the Papuan gulf. Canoes are simple dugouts, or provided with an outrigger. Double canoes occur amongst the western Papuo-Melanesians. The Motu, joining several canoes together, make vessels of considerable size. For clothing the men usually wear some sort of girdle, and the women a petticoat of shredded palm; the Papuans of the north-west coast of Papua clothe the waist with tapa-cloth. Armlets of cane or of shell are common; necklaces of shell, dogs' teeth or seeds. The septum of the nose is commonly pierced to admit a nose-stick, usually of clam-shell, and the lobes of the ear are pierced and decorated in the east with turtle-shell rings and sapi-sapi beads. Tattooing has an irregular distribution, being confined to women in the case of the Massim, who are tattooed from forehead to thighs. Considerable artistic skill is shown, particularly by the Melanesian-speaking inhabitants, the carved and fretted woodwork of the Massim being of unusual excellence. Pottery is in general use among the Melanesian-speaking peoples. The drum is the commonest musical instrument, though absent from Rossel island in the Louisiades. Slit wooden gongs, with a most limited distribution, are found north of Huon gulf, in the territory of New Guinea, and in Dutch New Guinea. With these gongs are associated sacred flutes, which, however, are also found in the northern division of Papua.

**Social Organization.**—Although the family (*q.v.*) is an important unit in the social structure of all New Guinea peoples, a wider group, the clan (*q.v.*), seems in general to be more fundamental. Moreover, family relationships are not usually distinguished by name from many more remote relationships, and relationship terms used between persons who can trace genealogical relationship are also used in a systematic way between persons who are unable to trace any genealogical connection. This system, known as the classificatory system, takes a variety of forms in New Guinea, and social organization is unintelligible without an understanding of this system. Within the clan the classificatory system establishes a comparatively small number of relationships, and in general members of the same generation within a clan address one another as brothers and sisters, and the tie uniting members of one clan will be found to be similar to that uniting brothers and sisters by one father or mother. Both matrilineal clans (membership of which is determined by descent through the mother), and patrilineal clans (membership of which is determined by descent through the father), are found in New Guinea. The principal matrilineal area is the Massim district of Papua, and in this area the clans are totemic. (*See* TOTEMISM.) Each clan is associated with four linked totems, bird, plant, fish and snake, and the bird-totem is not eaten by members of the clan. A person will also avoid the bird-totem of his father's clan, the totems of which are necessarily different, since the rule of clan-exogamy (marrying out of the clan) is strictly observed. Amongst the patrilineal Papuans of the west, the clan seems to become of rather less importance, and totemism occurs only in an attenuated form in the Gulf region.

In the east the clan figures as the important unit in the rituals of marriage and death, and the series of feasts more or less connected with these events, which play a dominant part in the life of the Massim. Reciprocal exchanges of pigs and objects of value between persons more or less representative of clans is an important part of all such activities, as in the Big Feast which extends from the Massim as far as the Mafulu. This reciprocity between clans was also shown in warfare, cannibalism being a ceremonial act of revenge on the part of one clan for the death of one of its members by another clan.

In the social organization of the Papuans of the west, as well as the Papuans of the northern division, and the Jabim, Bukaua, Tami islanders and others in the territory of New Guinea, the outstanding feature is the existence of tribal initiation-ceremonies. The Elema tribes commence this initiation of the males at about the age of eight, when the boy is first taken into the club-house of the village and shown the bullroarer, the noise of which has previously been a mystery to him. Only after two or three years is his initiation complete, and the process involves not only various ordeals and instruction for the initiates, but a great deal of ceremonial in which the whole of the village, and maybe other villages, are involved. In other initiation rites the swallowing of novices by a monster and subsequent resurrection is prominent, this occurring both amongst the extreme western tribes of Papua and in the Huon peninsular district of the territory of New Guinea.

**Religion.**—A cult of the dead occurs throughout New Guinea, and only rarely is a cult of gods associated with it. The Big Feast of eastern Papua is to a large extent a collective celebration of the dead, though in the Soi feast of the Massim a being is continually addressed, who is not strictly an ancestor, and is supposed to have performed supernatural feats in olden times, and to have introduced the pig into New Guinea. This being is related to a number of other superhuman beings who lived in the past, but they can hardly be regarded as objects of a religious cult. On Rossel island, on the other hand, at the extreme east of the Massim area, we find an elaborate god-cult and constant care of the gods, who control the processes of nature by a priesthood.

The religion of the Elema tribes in the west of Papua may be described as an ancestor-cult, the name for ancestor being the same as that for all sacred objects; but some of these ancestors are regarded as deities who temporarily assumed a human form, giving birth to various tribes.

That death results from sorcery or is brought about by ghosts is probably a universal belief in New Guinea. The magic employed by sorcerers for this end is usually of the sympathetic type, some part of the victim being utilized by the sorcerer, or some imitative action being made to the accompaniment of a spell. Divination is also common, and where it is believed that ghosts may cause sickness divination is used to discover whether a ghost or sorcerer is responsible. On Rossel island an alternative cause of death is the desecration of the sacred ground of a god. (W. E. A.)

BIBLIOGRAPHY.—General: A. C. Haddon, "The Decorative Art of British New Guinea," *Cunningham Memoir*, X., Royal Irish Academy (1894); G. A. J. van der Sande, *Nova Guinea*, vol. iii. (Leyden, 1907); C. G. Seligmann, "A Classification of the Races of British New Guinea," *Journal of the Royal Anthropological Institute*, vol. xxxix. (1909); R. Neuhauss, *Deutsch-Neu Guinea* (1911); J. H. P. Murray, *Papua or British New Guinea* (1912); A. C. Haddon, "Migration of Cultures in British New Guinea," *Journal of the Royal Anthropological Institute*, vol. l. (1920).

Special Areas: *Reports of the Cambridge Expedition to Torres Straits* (1907– ); C. G. Seligmann, *The Melanesians of British New Guinea* (1910); R. W. Williamson, *The Mafulu* (1912); A. F. R. Wollaston, *Pygmies and Papuans* (1912); B. Malinowski, "The Natives of Mailu," *Transactions of the Royal Society of South Australia*, vol. xxxix. (1915); D. Jenness and A. Ballantyne, *The Northern D'Entrecasteaux* (1920); B. Malinowski, *Argonauts of the Western Pacific* (1922); P. Wirz, *Die Marind-anim von Holländisch-Süd-Neu-Guinea* (Hamburg, 1922); J. H. Holmes, *In Primitive New Guinea* (1924); F. E. Williams, "The Natives of the Purari Delta," *Anthropology Report, No. 5* (*Territory of Papua*) (Port Moresby, 1924); W. J. V. Saville, *In Unknown New Guinea* (1926); G. Landtman, *The Kiwai Papuans of British New Guinea* (1927); W. E. Armstrong, *Rossel Island* (1928). *See* also *Annual Reports* of the Government of Papua and the Territory of New Guinea.

## HISTORY

**Exploration.**—Although New Guinea may have been seen by Antonio d'Abreu in 1511, its first visitor was apparently Dom Jorge de Meneses, who in 1526 took shelter at "Isla de Versija," either Warsia on the north coast, or Waigiu island. Two years later Alvaro de Saavedra discovered "Isla de Oro," probably one of the Schouten islands, and sailed along the north coast. The name "Nova Guinea" is due to Ynigo Ortiz de Retez (or Rotha) who landed on the north coast in 1546, and thought the natives resembled those of West Africa. The chart of Ortelius (1580) shows "Nova Guinea" as an island seventeen years before the fact was proved by Luis Vas de Torres sailing through the straits now bearing his name.

Dutch navigators, Willem Jansz (1605), Jacques le Maire and Willem Schouten (1616), Jan Carstensz (1623), Gerrit Pool (1636), Abel Tasman and others, appeared after the conquest of the Moluccas. In 1700 William Dampier sailed along the northern coast, and Philip Carteret (1767) and L. A. de Bougainville explored the islands. James Cook re-discovered Torres Straits, and landed in New Guinea near Prince Frederick Henry island (1770). Thomas Forrest (1774) wrote an interesting account of the island (*Voyage*, 1780). Although parts of the coast were surveyed by La Perouse (1788), John MacCluer (1790), D'Entrecasteaux (1793, *Voyage* by Rossel), and also by Duperrey (1823), D. H. Kolff (1826), and Dumont d'Urville (1828), very little knowledge was gained of the country or people.

The Papuan Gulf and shores eastward were visited by F. P. Blackwood (1842–6, *Voyage of the Fly*, by J. B. Jukes), Owen Stanley (1846–50, *Voyage of the Rattlesnake*, by J. Macgillivray), Charles B. Yule (1864) and J. Moresby (1874). In 1875 Schleinitz explored the north coast and islands. During this period scientific observers visited the islands, notably A. R. Wallace (1858), Odoardo Beccari (1871–76), Maria d'Albertis (1871–78), C. B. H. Rosenberg (1869–70, *Bijdragen*, 1875), and Nicholas von Miklucho-Maclay (1871–81). Expeditions were made for the Netherlands India Government by P. van der Crab, E. Teysmann, J. G. Coorengel, A. J. Langeveldt van Hemert and P. Swaan (*Bijdragen*, 1879). Missionaries of the Utrecht Missionary society were at Port Dorey in 1858, and English missionaries have resided in the south-east since 1871. Of these, Samuel Macfarlane (1875), James Chalmers (1877–1901), and George Brown (1875–1897) have described both country and people. Otto Finsch (1882), and Theodore Bevan (1884–87) explored the southern rivers. Since the annexations, explorers and observers have been constantly at work. During and since the administration of Sir William MacGregor (1888–98), large areas of British territory were surveyed, and the natives pacified by a system of patrols (*Annual Reports*). The island was first crossed in 1897. James Chalmers was murdered in 1901. The anthropology has been made known by C. G. Seligman, V. M. Egidi, W. Mersh Strong, R. W. Williamson, B. Malinowski, W. J. Saville, E. B. Riley, G. Landtman, J. H. Holmes, A. C. Haddon and others. In 1922 Leo Austen ascended the Fly river to the Netherlands boundary.

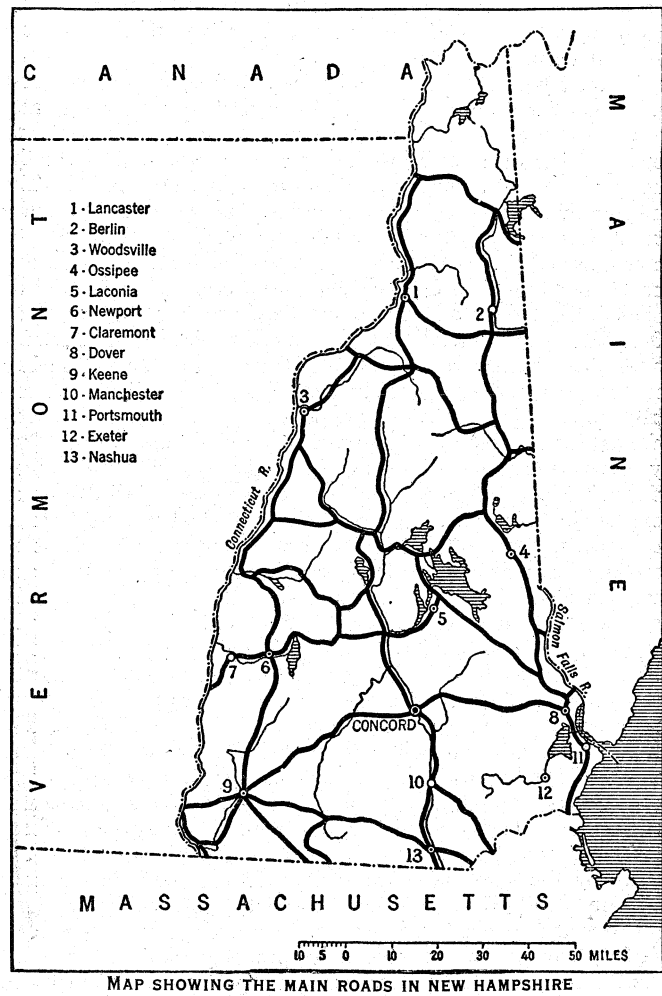
In German territory the Sepik (Kaiserin Augusta) river was visited by Otto Finsch (1885) and the Ramu river by Schleinitz (1887). In 1893 O. Ehlers and N. Piering lost their lives in crossing the island. Other explorations were carried out by C. Lauterbach (1896), Poch (1904), Heine (1908), Full and Friederici (1908). The northern part of Netherlands territory was explored by C. E. A. Wichman, G. A. J. van de Sande, and H. A. Lorentz (1903) and the south by Lorentz (1909–*Nova Guinea* by A. Wichman). South-west New Guinea has been explored (*Netherlands Geographical Society* 1908) and Central New Guinea in 1920 (H. J. T. Bijlers, 1923). In the 1930s a number of expeditions explored the interior (*e.g.*, R. Archbold).

**Annexations.**—In 1793 New Guinea was annexed by the (English) East India company, who placed a garrison for some time on Manuswari island in Geelvink bay. As suzerain of the sultan of Tidore the Dutch (after 1848), claimed control over the northern coast as far as Humboldt bay. In 1828 they established a fort in Triton bay and took possession of the south-west coast as far as the 141st meridian. Their claim to the western half of the island was admitted by Britain and Germany in 1885. In 1905 the sultan of Tidore ceded his rights to the government.

In 1864 Yule annexed the south coast for the British crown, and Moresby in 1873 took possession of the islands of Eastern New Guinea. The possible dangers to the commerce of Queensland and Australia generally, should the island come into the possession of a foreign power, led to a demand for annexation. The Germans in 1882 having advised their government to annex, the Queensland government in 1883 actually annexed all the mainland opposite their shores and east of the 141st meridian, but, as with the annexations of Yule and Moresby, this action was disavowed by the home government. In 1884 Germany annexed the north-east coast and adjacent islands, and Commodore Erskine proclaimed a British protectorate over the region east of the 141st meridian as far as East cape and the islands to Kosmann island. In 1885 the German New Guinea company was chartered to acquire and occupy those portions of the island not under British or Dutch sovereignty, the mainland being styled Kaiser Wilhelmsland, and the islands the Bismarck archipel. A boundary agreement was made in the same year, the British territory being named British New Guinea. In 1888 the protectorate became a dependency controlled by Queensland and in 1906 was renamed the Territory of Papua. In 1889 the German New Guinea company surrendered their charter. After the capitulations in 1914, the German territory was occupied by an Australian administration. As the Territory of New Guinea, it passed to Australia under mandate from the League of Nations. (See *Political Divisions*, above, for World War II; *see also* WORLD WAR II.)

BIBLIOGRAPHY.—Accounts of voyages published under the explorers' names are not noted here. A few others are mentioned in the text. Many Dutch expeditions are described in the *Bijdragen tot de taal-land-en volkenkunde van Nederl. Indië*, and Tijdschrift Kon. Aardrijkskundig Genootschap. German explorations are recorded in *Nachrichten über Kaiser Wilhelmsland*. English surveys will be found in *Annual Reports on British New Guinea (and Papua)*. Other works are: A. Dalrymple, *Historical Collection* (1770–71); Burney, *Chronological History* (1803); Meyners d' Estree, *La Papouasie* (Paris, 1881).

**NEW HAMPSHIRE,** popularly known as the "Granite State," is one of the New England group of the United States of America and one of the original thirteen. The State lies between 42° 40′ and 45° 18′ 23″ N., and between 70° 37′ and 72° 37′ W. It is bounded north by the Canadian province of Quebec; east by Maine, by the Salmon Falls river, which separates it in part from Maine and by the Atlantic ocean; south-east and south




MAP SHOWING THE MAIN ROADS IN NEW HAMPSHIRE

by Massachusetts; west and north-west by Vermont (from which it is separated by the Connecticut river—low water mark on the west bank of the Connecticut is New Hampshire's west boundary), and by Halls Stream which separates it from Quebec. The State has an area of 9,304 sq.mi., of which 280 sq.mi. are water surface.

**Physical Features.**—In the north central portion of the State, the White mountains, a continuation of the Appalachian system, rise abruptly in several short ranges and in outlying mountain masses from a base level of 700 to 1,500 ft. The highest, Mount Washington, attains an elevation of 6,293 feet. The principal ranges, the Presidential, the Franconia and the Carter-Moriah, have a north-eastern and south-western trend. The Presidential, in the north-eastern part of the region, is separated from the Franconia on the south-west by the Crawford or White Mountain Notch, about 2,000 ft. in depth, in which the Ammonoosuc and Saco rivers find a passage, and from the Carter-Moriah, parallel to it on the east, by the Glen-Ellis and Peabody rivers, the former noted for its beautiful falls. On the Presidential range, which is about 20 m. in length, are Mount Washington and nine other peaks exceeding 5,000 ft. in height. On the Franconia, a much shorter range, are Mount Lafayette, 5,269 ft.; Mount Lincoln, 5,098 ft.; and four others exceeding 4,000 feet. The highest peak on the Carter-Moriah range is Carter Dome, 4,860 ft.; but seven others exceed 4,000 feet. Separating Franconia and Pemigewasset ranges is the romantic Franconia Notch, overlooking which from the upper cliffs of Profile mountain is The Great Stone Face, immortalized by Nathaniel Hawthorne.

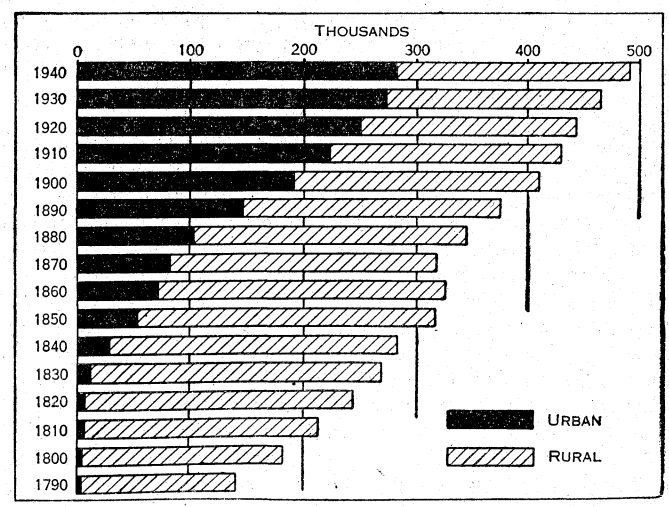
The part of the State which lies north of the White mountains is occupied by ridges and wide rolling valleys, the ridges rising occasionally to heights of 2,000 ft. or more. South of the mountains a plateau-like surface—a part of the New England uplands—extends from the intervales of the Connecticut river to the eastern border of the Merrimac valley. Between the Merrimac valley and the sea is the only low surface in the State; a considerable portion of this region is less than 500 ft. above the sea. The seashore, about 18 m. in length, is mainly a low sandy beach. The only harbour is at Portsmouth near the mouth of the Piscataqua. About 9 m. from the shore are the bleak and nearly barren Isles of Shoals, divided between New Hampshire and Maine.

The lakes and ponds, numbering several hundred, were formed by glacial action and the scenery of many of them is scarcely less attractive than that of the mountains. The largest and most widely known is Lake Winnipesaukee, 20 m. long and from 1 to 8 m. wide is dotted by 274 islands, mostly verdant, and has clear water and a rather level shore, behind which hills or mountains rise on all sides. The rivers with their numerous falls and the lakes with their high altitudes furnish a vast amount of water-power for manufacturing,—the Merrimac, in particular, into which many of the larger lakes, including Winnipesaukee, find an outlet.

Fertile soil in New Hampshire is confined largely to the bottomlands of the Merrimac and Connecticut rivers. In the south-eastern section is also a moderately productive soil derived largely from the disintegration of slate. Elsewhere south of the mountains, the surface soil is mostly *hard pan* or *till,* this being deepest on the drumlins. In the mountain region the soil is mostly a sandy loam composed of disintegrated granite gneiss and organic matter; on the lower and more gentle slopes as well as in the valleys this is generally deep enough for a luxuriant vegetable growth but on the steeper slopes it is thin or the rocks are bare.

**Climate.**—The winters are usually long and severe, and the summers cool and fine. The mean annual temperature ranges from about 42° at only moderate elevations in the White mountain region and farther north to 47° at low altitudes in the south-east. The greatest extremes of temperature occur in the deep mountain valleys where it sometimes rises to 102° or above, in summer, and falls to −38° or below in winter; higher up on the mountains it is never so warm and along the sea-coast both extremes are considerably less. The mean precipitation for the entire State is about 40 inches. The distribution is even throughout the year, but summer and autumn are slightly more wet than winter and spring. Among the mountains and in the northern part of the State the annual fall of snow is from 7 to 8 ft., but in the south-east corner it is little more than one-half that amount. The prevailing winds are generally north-west, but in the vicinity of the sea they are south-east during summer.

**Population.**—The population of New Hampshire in 1790 was




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF NEW HAMPSHIRE: 1790 TO 1940

141,885; in 1820 it was 244,161; in 1850, 317,976; in 1880, 346,991; in 1910, 430,572; and in 1940, 491,524. This last figure represents an increase of 5·6% over the population in 1930. The population per square mile was 54·5, as compared with 44·2 for the United States as a whole. Of the 1940 population, 283,225, or 57·6%, lived in urban places; that is, in cities and in towns having the major part of their population living in a village of 2,500 or more. The number of occupied dwelling units returned in the housing census of 1940 was 133,010, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 3·9 in 1930 to 3·7 in 1940. The white population of New Hampshire formed 99·9% of the total in 1940, as compared with 99·8% in 1930. The number of males per 100 females in the entire population of the state was only 99·6. There was a considerable excess of females in the urban population, the sex ratio being 95·9 for the urban population and 104·7 for the rural. The population of the state and of its principal cities is summarized for recent censuses in the following table:

| Area | Population | | | Percent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 491,524 | 465,293 | 443,083 | 5·6 | 5·0 |
| Urban | 283,225 | 273,079 | 279,761 | 3·7 | 9·0 |
| Rural | 208,299 | 192,214 | 163,322 | 8·4 | −0·2 |
| Percent urban | 57·6 | 58·7 | 63·1 | .. | .. |
| Principal cities: | | | | | |
| Manchester | 77,685 | 76,834 | 78,384 | 1·1 | −2·0 |
| Nashua | 32,927 | 31,463 | 28,379 | 4·7 | 10·9 |
| Concord | 27,171 | 25,228 | 22,167 | 7·7 | 13·8 |

**Government.**—New Hampshire was the first of the original states to establish a government wholly independent of Great Britain. This was designed to be only temporary, but was in operation from Jan. 5, 1776 to June 2, 1784. The constitution provided for a general court consisting of a senate and a house of representatives and made the council a body advisory to the state president; the 1784 instrument was amended in 1792; with the amendments adopted in that year it is in large measure the constitution of today. For 60 years there was no change whatever, and only three amendments, those of 1852 (removing the property qualifications of representatives, senators and the governor), were adopted until 1877, when 12 amendments were adopted—the most important being those providing for biennial (instead of annual) State elections in November (instead of March), and those doing away with the previous requirement that representatives, senators and the governor "be of the Protestant religion." Five amendments were ratified in 1889, four in 1902 and four in 1912. The most important of those adopted in 1912 was one providing for the election of the governor and members of the council by a plurality instead of a majority vote. New Hampshire is the only state in which amendments to the constitution may be proposed only by a constitutional convention, and once in seven years at the general election a popular vote is taken on the necessity of a revision of the constitution. By an act approved on April 9, 1909 provision was made for direct nominations of candidates at primaries.

There is a governor's council of five members, one from each councillor district, which has advisory duties and shares with the governor most of his powers. There is no lieutenant governor. The governor and the councillors are elected for a term of two years. The governor and the council appoint all judicial officers, the attorney-general, auditor, important administrative boards, coroners and certain naval and military officers; they have power to pardon offences; and they may exercise some control over expenditure through the constitutional requirement of the governor's warrant for drawing money from the treasury. The governor may veto within five days, besides Sunday, after it has been presented to him, any bill or resolution of which he disapproves, and a two-thirds vote of the members of both houses is required to pass over his veto. A senate and a house of representatives, which together constitute the general court, meet at Concord on the first Wednesday in January of every odd-numbered year, and at such other times as the governor may appoint for a special session, principally for the making of laws and for the election of the secretary of state, the state treasurer, and the commissary general. The senate is composed of 24 members, one from each senatorial district. Membership in the house of representatives varies according to a plan adopted in 1931, by which towns having less than 600 inhabitants elect representatives according to a special schedule. There were 427 representatives chosen in 1938 and 423 in 1940. Both senators and representatives are elected for a two-year term.

For the administration of justice the state has a supreme court and a superior court, each county has a probate court, and some towns as well as the cities have a municipal court. The supreme court consists of a chief justice and four associate justices; the superior court, of a chief justice and five associate justices. The supreme court sits at Concord on the first Tuesday of every month except July and August; while the superior court holds two or three sessions a year in each of the ten counties. Each county has a single probate judge, who has jurisdiction over the probating of wills, insolvency proceedings, decisions regarding adoption of children, and similar judicial functions. Supreme, superior and probate judges are appointed by the governor and council to serve until they are 70 years of age. Municipal judges are similarly chosen. Like justices of the peace, they have jurisdiction in criminal cases where the punishment is by fine not exceeding $20, by imprisonment not exceeding six months, or by both, and in minor civil cases. A municipal court has the same jurisdiction as that of justices of the peace, and municipal judges possess in addition, concurrent jurisdiction with the superior court in certain cases where the title to real estate is not involved and the damage demanded does not exceed $100. Justices of the peace are appointed for a term of 5 years only, but they may be reappointed. Local affairs are administered by counties (ten in number), towns (townships), village districts and cities. In each county a convention, composed of representatives from the towns, meets every two years to levy taxes and to authorize expenditures for grounds and buildings whenever more than $1,000 are required. For the discharge of other county functions the qualified electors of each county elect every two years three commissioners, a sheriff, a solicitor, a treasurer, a register of deeds and a register of probate; two auditors also are appointed annually by the supreme court. The county commissioners have the care of all county property, as well as of county paupers; and once every four years they are required to visit each town of their county, inspect the taxable property therein, determine whether it is incorrectly assessed and report to the state board of equalization. In each town a regular annual meeting of the qualified electors is called on the second Tuesday in March for the transaction of miscellaneous business and the election of town officers.

**Finances.**—The total valuation of property for the purposes of taxation in 1940 was $552,478,471; the total of taxes assessed in towns and unincorporated places was $19,440,596.02 or $34.10 per $1,000. The chief sources of the income of the state have been local property taxes, motor vehicle licence fees, the gasoline (petrol) tax, railroad taxes, interest from sinking fund securities, legacy taxes, the tax on foreign insurance companies, a tax on telephone companies, the sales tax on tobacco, and a tax on interest and dividends. The tobacco tax was enacted by the state legislature in 1939, replacing the direct state tax on property. The assessed valuation of property in 1939 reached its low point since 1922, but the valuation for 1940, as given above, represented an increase of $2,365,119 above that for 1939. The total receipts and disbursements for the year ending June 30, 1940, were $39,575,339.71 and $39,111,037.32, respectively. The cash balance on hand July 1, 1940, was $1,244,916.50 as compared with $780,614.11 a year before.

**Education.**—New Hampshire formed a part of Massachusetts when, in 1647, the general court of that province passed the famous act requiring every town in which there were 50 householders to maintain a school for teaching reading and writing, and every town in which there were 100 householders to maintain a

grammar school. During the 19th and early part of the 20th century various experiments for improving the public school system were tried. The public school system, as now constituted, has at its head a state board of education composed of the governor and seven other persons, two of whom are trustees of the University of New Hampshire. The actual administrative work is carried on by a commissioner of education, appointed by the board of education for an indefinite term, and a deputy commissioner. Each town is constituted a school district, and some special districts are organized under special acts of the legislature. For the purpose of inspecting and supervising all institutions in which state money is spent, the several school districts in the state are combined into supervision unions consisting of one or more school districts. The schools are maintained chiefly out of the proceeds of a district school tax, which must not be less than $3.50 on each $1,000 of assessed property. To this is added a "literary fund" (designed originally for founding a college) from various sources. All children between the ages of 8 and 16 are required to attend either a public or an approved private school for the full term unless they are more than 14 years old and have completed the studies prescribed for the elementary schools, or have been excused by the school board on account of physical or mental infirmity. The school enrolment, for the year ending June 30, 1936 showed 78,441 attending public schools and 31,473 attending parochial and private schools, excluding kindergartens. Of the total public school enrolment 58,051 were in the elementary grades, and 20,390 in high schools. There were 8,831 in private high schools. The total expended on public education in the year ending June 30, 1938 was $7,458,043.95.

The only state institutions of higher education are the Plymouth Normal school (1870) at Plymouth, the Keene Normal school (1909) at Keene, and the University of New Hampshire, organized as a department of Dartmouth college in 1866, but reorganized as the New Hampshire College of Agriculture and Mechanical Arts and removed to Durham as a separate institution in 1891. It was given its present name in 1923 by an act of the legislature. Other institutions of higher learning in the state are Dartmouth college (non-sectarian, 1769), at Hanover, and Saint Anselm's college (Roman Catholic, 1893), at Manchester.

**Charities and Corrections.**—The state charitable and correctional institutions include the New Hampshire school for feeble-minded children, at Laconia; the New Hampshire soldiers' home, at Tilton; the New Hampshire industrial school, at Manchester; the New Hampshire hospital for the insane, and the state prison, at Concord; and the New Hampshire sanatorium for tuberculars, at Glencliff in the town of Warren. The state also makes annual appropriations for the care and education of blind and deaf and dumb persons in institutions outside of the state. Each county has an almshouse and house of correction.

**Agriculture.**—Agriculture on the farms of New Hampshire still working has been greatly modified, the production of vegetables, fruits, dairy products, poultry and eggs largely supplanting the production of cereals. The total acreage in farms decreased from 3,249,458 in 1910 to 1,809,314 in 1940. During the same period the number of farms decreased from 27,053 to 16,554, and average acreage per farm from 120.1 to 109.3. The value of all farm property, including lands and buildings, had likewise decreased from $103,704,196 to $62,206,391; average value per acre in 1940 was $34.38. Of the total number of farms in the state in 1940 (16,554), 15,342 were worked by owners or part owners, 1,054 by tenants, and 158 by managers. The total value of all farm crops in 1935 was $22,200,000. Hay was the principal crop; in 1935 the acreage was 388,000 and the yield was 416,000 tons, valued at $5,325,000. Potatoes were the crop second in importance, valued at $1,046,000. The yield of fruit in 1934 included 489,440 bu. of apples and 538 bu. of peaches. Dairying has long been an important industry in New Hampshire. In 1934, the milk production was 42,928,454 gal., and the production of butter was 1,324,016 pounds. The value of the poultry and egg product of 1934 was $5,531,711. The live stock on the farms of the state on Jan. 1, 1936 included 17,000 horses, 13,000 sheep, 16,000 swine and 125,000 cattle. Potatoes are grown in large quantities north and west of the White mountains; and this district leads in the number of cattle and sheep.

**Forests and Fisheries.**—Except on the summits of the higher mountains New Hampshire was originally an unbroken forest of which the principal trees were the white pine, hemlock, sugar maple, yellow birch, beech, red oak and white oak in the south, red spruce, balsam and white birch on the upper mountain slopes, and red spruce, white pine, sugar maple, white spruce and white cedar in the other parts of the north. In the year 1930 the U. S. forest service reported a timberland acreage of 4,435,000 of which 998,000 ac. were in saw timber areas, 694,000 ac. were cordwood, and 2,743,000 ac. were stocking areas. Of this total 441,000 ac. or 9.94% were owned by the federal government and 824,000 ac. or 18.58%, by the state counties or municipalities. The forests of the state produced, in 1937, 157,000,000 board feet of lumber and in 1933, 78,802 tons of wood pulp. The New England hurricane of Sept. 1938 resulted in a very large increase in lumber production from salvaged timber.

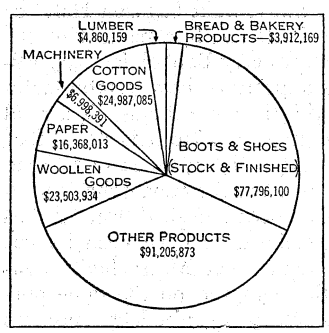
New Hampshire, with only one coastal county (Rockingham), in 1937 was credited with less than 0.1% of New England's fishing yield.

The total yield of its fisheries amounted to 664,000 lb., valued at $96,000.

**Minerals.**—The most important of the mineral products of New Hampshire, which has long been known as "the Granite State," is granite, which is quarried in the southern part of the state in the area of Lake Winnipesaukee; gneiss, near Concord, Merrimack county, near Milford, Hillsboro county and east of Manchester in Rockingham county; in Sullivan county, near Sunapee; and in the east central region in Carroll county, near Conway and Madison. The value of stone quarried in New Hampshire in 1937 was $442,772, somewhat over one-third the total value of all mineral products of the state. Of this total ($1,219,869) the only other large items were clay products (valued at $300,219), sand and gravel ($252,784), crude feldspar ($155,925) and mica, sheet and scrap ($24,516). Mica, first mined at Grafton, Grafton county, in 1803, was later found in other parts of the state in such quantities that for 60 years New Hampshire was the largest producer of mica in the United States.

**Manufactures.**—The values of the products for all manufacturing industries of New Hampshire combined for 1924, 1935 and 1939 were $333,124,503; $209,384,111; and $237,396,015, respectively.

The number of industrial establishments (1,078, 788 and 806) and the number of wage earners (75,310, 54,212 and 55,781) showed a corresponding trend. Textiles and boots and shoes represented in 1937 approximately one-half the total. Cotton goods, the leading industry for over a century and a quarter since its introduction in the year 1804, ranked second in 1937. The 18 cotton mills operating in 1937 employed 7,315 wage earners and had an output valued at $24,987,085. The manufacture of boots and shoes, now the chief industry of the state, accounted for 103 factories, gave employment to 19,404 wage earners and had a product valued at $77,796,100. Woollen and worsted goods in 1937 ranked third in importance with 27 establishments producing goods worth $23,503,934. The other leading industries and the value of their product in 1937 were paper ($16,368,013), machinery ($6,998,391), and lumber ($4,860,159), bakery products ($3,912,169). Most of the manufacturing centres of the state are south of Lake Winnipesaukee. An exception is Berlin, the chief manufacturing centre north of the White mountains, important for its manufacture of paper and wood pulp.



RELATIVE IMPORTANCE OF PRINCIPAL MANUFACTURES, 1937

**Transportation.**—With the exception of the Grand Trunk line in the northern part of the State the several steam railways

are owned or leased by the Boston and Maine. This company was the first to operate a railway within the State, service being maintained between Boston, Mass., and Dover, N.H., as early as 1842. The steam railway mileage decreased from 1,234 to 1,007 during the years 1925–1937. The electric railway mileage in 1937 was only 53, having shown a steady decline in recent years. The amounts spent by the highway department have varied. A total of $7,787,000 was disbursed during the calendar year 1938, which also covers federal-aid funds. This amount includes expenditures for construction, maintenance, interest and principal payments on highway bonds, transfers to local units, etc.

**History.**—Martin Pring was at the mouth of the Piscataqua in 1603 and, returning to England in the same year, gave an account of the New England coast from Casco bay to Cape Cod bay. Samuel de Champlain discovered the Isles of Shoals and sailed along the New Hampshire coast in 1605, and much more information concerning this part of the New World was gathered in 1614 by Capt. John Smith, who in his *Description of New England* refers to the convenient harbour at the mouth of the Piscataqua and praises the country back from the rocky shore. Under the leadership of Sir Ferdinando Gorges there was formed in 1620 the Council for New England, which procured from King James I. a grant of all the country from sea to sea between 40° and 48° N. lat., and which made nine grants bearing upon the history of New Hampshire. The first of these grants was to John Mason, who has been called "the founder of New Hampshire," on March 9, 1622. The name New Hampshire was first applied to a grant which lay between the Merrimack and Piscataqua, and given to John Mason on Nov. 7, 1629. The first settlement of which there is indisputable evidence was established in 1623 by David Thomson at Little Harbor, now in the town of Rye. Thomson was the head of a company which was organized for fishing and trading and whose entire stock was to be held jointly for five years. He built a house on Odiorne's Point overlooking Little Harbor, and, although he removed to an island in Boston Harbor in 1626, he may have continued to superintend the business of the company until the expiration of the five-year term. At least there was a settlement here which was assessed in 1628, and it may not have been completely abandoned when colonists sent over by the Laconia Company, which had received a grant on Nov. 17, 1629, arrived in 1630. The Laconia Company received its first grant under the erroneous impression that the Piscataqua river had its source in or near Lake Champlain, and its principal object was to establish an extensive fur trade with the Iroquois Indians. The company sent over colonists who occupied the house left standing by Thomson, and, not far away, built "Mason Hall" or the "Great House" in what is now Portsmouth, a name (for the entire settlement) that replaced "Strawberry Banke" in 1653. Edward Hilton with a few associates appears to have established a settlement on Dover Point about the time of Thomson's arrival at Little Harbor, and in the Hilton grant of 1630 it is stated that he had already built houses and planted there; as early as 1630 this settlement was named Dover. In 1638 the Rev. John Wheelwright, an Antinomian leader who had been banished from Massachusetts, founded Exeter on land claimed to have been bought by him from the Indians. In the same year Massachusetts encouraged friendly Puritans to settle Hampton on the same purchase, and about a year later this colony organized Hampton as a town with the right to send a deputy to the general court. Serious dissensions had already arisen between Puritan and Anglican factions in Dover, and Capt. John Underhill, another Antinomian, became for a time a leader of the Puritan faction. Puritan Massachusetts was naturally hostile to the Antinomians at Exeter as well as to the Anglicans at Strawberry Banke. Under these conditions Massachusetts discovered a new claim for its northern boundary. The charter of that colony was drafted under the impression that the Merrimack flowed east for its entire course, but now an investigation was in progress which was to show that its source in Lake Winnipesaukee was several miles north of any of the four settlements in New Hampshire. Accordingly, Massachusetts resolved to make the most of the clause in the charter which described the northern boundary as three English miles north of the Merrimack river, "or to the northward of any and every part thereof," to ignore the conflicting grants to Mason and to extend its jurisdiction over the offending settlements.

The heirs of Mason protested, but little was done about the matter during the period of Puritan ascendancy in the mother country. Immediately after the resignation of Richard Cromwell, however, Robert Tufton Mason (a grandson of the original proprietor), who had become sole heir in 1655, began petitioning first parliament and later the king, for relief. The commission appointed by the king in 1664 to hear and determine complaints in New England decided that Mason's lands were not within the jurisdiction of Massachusetts, and made an attempt to set up a government under which his claims could be tried, but this was a failure. Mason then petitioned again, and this time Massachusetts was requested to send agents to England to answer his complaints. They arrived in Dec. 1676, and the case was tried before the Lords Chief Justices of the King's Bench and Common Pleas in April, 1677. Mason presented no claim to the right of government, and as to the title to the lands claimed by him the court decided that this was a question between him and the several tenants to be determined by the local court having jurisdiction in such matters. Thereupon Mason, in Jan. 1679, petitioned the king to appoint a governor who should have jurisdiction over all the lands which he claimed, and on Sept. 18 of this year New Hampshire was constituted a separate province with a Government vested in a president and council appointed by the king and an assembly chosen by the people. This was the principal outcome of Mason's persistent efforts to establish his rights to the land.

From 1686 to 1689 New Hampshire formed a part of the Dominion of New England, which, after the first few months, was under Sir Edmund Andros as governor-general. There being no provincial authority in New Hampshire at the close of this period, a convention of the leading citizens of its four towns attempted to establish one. Upon the failure of this attempt, a temporary nominal union with Massachusetts was formed, but in 1692 Samuel Allen, the assign of Mason, caused a royal Government to be established with his son-in-law, John Usher, as lieutenant-governor, and during the remainder of the colonial era New Hampshire was separate from Massachusetts except that from 1699 to 1741 the two had the same governor. The boundary disputes between Massachusetts and New Hampshire were long and bitter. Both provinces granted townships within the disputed territory; Massachusetts arrested men there who refused to pay taxes to its officers, and sought to defer the settlement of the dispute. New Hampshire, being on the more friendly terms with the home Government, finally petitioned the king to decide the matter, and in 1737 a royal order referred it to a commission to be composed of councillors from New York, Nova Scotia and Rhode Island. This body agreed upon the eastern boundary but evaded deciding the southern one. Both parties then appealed to the king, and in 1741 the king in council confirmed the decision of the commission in regard to eastern boundary and established a southern boundary very favourable to New Hampshire. The western boundary was not yet defined, and as early as 1749 a controversy over that arose with New York. The governor of New Hampshire granted in the disputed territory 138 townships which were rapidly settled, but there was a reluctance to incur the expense of a contest with so powerful a neighbour as New York. In 1764 New York procured a royal order declaring the western boundary of New Hampshire to be the western bank of the Connecticut river.

At the outbreak of the Revolution New Hampshire had about 80,000 inhabitants, the great majority of whom were with the patriot or Whig Party during that struggle. By June, 1775, the once popular governor, Sir John Wentworth, was a refugee; on Jan. 5, 1776, the fifth Provincial Congress established a provisional Government; June 15 the first assembly elected under that Government declared for independence; and on Aug. 16, 1777, the important victory at Bennington was won by New Hampshire and Vermont troops under the command of Gen. John Stark, who had a commission from New Hampshire. Six States had ratified the Federal Constitution when the New Hampshire convention met at Exeter on Feb. 13, 1788, to accept or reject that instrument, and so

great was the opposition to it among the delegates from the central part of the state that after a discussion of ten days the leaders in favour of ratification dared not risk a decisive vote, but procured an adjournment in order that certain delegates who had been instructed to vote against it might consult their constituents. Eight states had ratified when the convention reassembled at Concord on June 17, and four days later, when a motion to ratify was carried by a vote of 57 to 47, adoption by the necessary nine states was assured.

National elections in New Hampshire were carried by the Federalists until 1816, except in 1804 when President Thomas Jefferson won by a small majority; but within this period of Federalist supremacy in national politics the Democrat-Republicans elected the governor from 1805 to 1812 inclusive except in 1809. In 1816 the Democrats won both state and national elections; and out of the transition from Federalist to Democratic control, which was effected under the leadership of William Plumer (1750–1850), a prominent politician in New Hampshire, arose the famous Dartmouth College case. As the trustees of this institution were Federalists with the right to fill vacancies in their number, the Democrats attempted to gain control by converting it into a state university and increasing the number of trustees, but when the case reached the U.S. supreme court that body pronounced (1819) the charter a contract which the federal constitution forbad the state to violate. Heretofore the Federalist regime had taxed the people to support the Congregational Church, but now the Baptists, Methodists and Universalists joined the Democrats, and in 1819 this state support was abolished by the "Toleration Act." Because of Daniel Webster's arguments in the Dartmouth College case, and because his party had favoured the support of the Congregational Church by public taxation, he became very unpopular in this his native state. Accordingly, his denunciation of President Andrew Jackson's bank policy added strength to the Jacksonian Democracy, and, later, his Whig connections were the greatest source of the Whig party's weakness in New Hampshire. John Quincy Adams was an intimate friend of William Plumer, the Democratic leader, and carried the state both in 1824 and 1828. The Whigs never won a national or state election, and often their vote was only about one-half that of the Democrats. But the Democrats broke into two factions in 1846 over the question of slavery (*see* HALE, JOHN PARKER); the American or "Know-Nothing" party elected a governor in 1855 and 1856; and then control of the state passed to the Republican party which held it until 1912, when the Democrats carried the state for Wilson. The Democrats were again successful in the presidential election of 1916, but thereafter the state returned to its Republican tradition until 1936 and 1940, when it supported Roosevelt. The state government remained Republican.

BIBLIOGRAPHY.—C. H. Hitchcock, *Geology of New Hampshire* (Concord, 1874–78); W. Nutting, *New Hampshire Beautiful* (Farmington, Mass., 1923); and the *Annual Reports* of the forestry commission, and the fish and game commission; *Government:* J. F. Colby, *Manual of the Constitution of the State of New Hampshire* (Concord, 1902), containing an historical sketch of the constitution of the state; the *Manual for the use of the General Court;* the *Reports* of the various state departments and boards; and L. S. Morris, *The Government of New Hampshire* (Concord, 1922). A bibliography of local history is found in O. G. Hammond's *Check List of New Hampshire Local History,* published by the New Hampshire Historical society in 1925. J. Belknap, *The History of New Hampshire* (Philadelphia, 1784–92); G. Barstow, *The History of New Hampshire to 1819* (1853); *New Hampshire Provincial, State and Town Papers* (1867–1910); F. B. Sanborn, *New Hampshire* (Boston, 1904) in the *American Commonwealths Series;* W. H. Fry, *New Hampshire as a Royal Province* (1908); E. S. Stackpole, *History of New Hampshire* (1916–18): *Collection* of the New Hampshire Historical society; H. Pillsbury, *New Hampshire,* 9v. (1927–1929); New Hampshire foundation, *New Hampshire: a study of its cities and towns* (1936).

(H. W. K.; W. E. Ss.)

**NEW HARMONY,** a village in Posey county, Indiana, on the Wabash river, about 22 mi. N.W. of Evansville. Pop. (1940) 1,390. It is served by the Illinois Central railway. New Harmony had its beginning in 1814–15, when it became the home of a communistic religious sect known variously as the Harmonists, Harmonites and Rappites, founded in Germany towards the end of the 18th century by George Rapp (1757–1847), a native of Iptingen in Württemberg. Rapp and his followers, who sought to form a community after the manner of the primitive Christian Church, were persecuted in Germany, and in 1803–04 emigrated to Butler county, Pennsylvania. There they established in 1805 a community known as Harmony, consisting of some 600 persons, who held their property in common and in 1807 adopted celibacy. In 1814 Rapp sold most of his Pennsylvania land and bought about 24,735 ac. (in the next ten years more than 14,000 ac. in addition) on the Wabash river in Indiana Territory. In 1814–15 Rapp and a thousand of his followers settled on the Indiana tract, their headquarters being established at New Harmony or Harmonie as they called it. The settlers, mostly Germans, devoted themselves to agriculture, weaving and leather-working so industriously that they prospered from the start. Rapp, however, in 1825 disposed of his lands and property to Robert Owen, having returned with part of his followers to Pennsylvania and founded a new community known as Economy, in Beaver county, where he died in 1847. Intent on founding a socialistic community, Owen went to the United States in 1824, and purchased Rapp's lands and livestock for $182,000. He interested several well-known scientists in his settlement, and with them went to New Harmony in the spring of 1826. Within six months the community numbered over 1,000. The greater part of the settlers, however, were impractical theorists or adventurers. Constitution after constitution was adopted, and with the adoption of each new constitution and with each new religious discussion a group would secede and form a separate community—in 1828 there were ten. The whole organization broke up in 1827, and Owen left New Harmony in 1828. The Workingmen's Institute Public library, founded in 1838 by William Maclure, had in 1941 29,000 volumes; the collection is rich in works dealing with socialism.

*See* "The Harmony Society," *German-American Annals* (1904); G. B. Lockwood and C. A. Prosser, *The New Harmony Movement* (1907); Meredith Nicholson, *The Hoosiers* (1901); Morris Hillquit, *History of Socialism in the United States* (1903); Frank Podmore, *Robert Owen* (1906); G. H. Holiday, "An Indiana Village, New Harmony" (1906); and Caroline Dale Snedeker, *Town of the Fearless* (1931).

**NEWHAVEN,** a seaport and urban district of Sussex, England, 56 mi. S. from London by the Southern railway, on the English channel at the mouth of the Ouse. Pop. (est. 1938) 7,062. Area 2.8 sq.mi. The port is protected by fortifications. A harbour was first granted to Newhaven in 1713, and during the early 18th century it possessed a large shipping trade. It is a packet station. The tidal harbour is enclosed by two piers and a breakwater, the area being about 30 ac. and the quayage 1,400 yd. There is ordinarily a large traffic with France in wines, spirits, silk, fruit, vegetables and general provisions.

**NEW HAVEN,** the second largest city of Connecticut, U.S.A, a port of entry, the county seat of New Haven county and the seat of Yale university; in the southwestern part of the state, on Long Island sound, 72 mi. E.N.E. of New York city. It is on federal highway 1, and is served by the New York, New Haven and Hartford railroad, interurban trolleys, motorbus and truck lines and coastwise steamers. Pop. (1920) 162,537 (28% foreign-born white); (1930) 162,655; (1940) 160,605.

The city of New Haven occupies 17.9 sq.mi. at the head of a broad, deep bay, into which empty the Quinnipiac, the Mill and the West rivers. New Haven's site is a level, sandy plain, behind which rises a line of hills, terminating in two spurs, East Rock (360 ft. high) and West Rock (400 ft.), respectively $2\frac{1}{4}$ and 2 mi. from the Green. On the central Green of 16 ac., reserved for the public when the town was laid out, are three churches built in 1814: Trinity (Protestant Episcopal), United (Congregational) and Center (Congregational; designed by Ithiel Towne). Facing the Green are some of the buildings of Yale university (*q.v.*), a large hotel and the principal public buildings. The Harkness tower of the memorial quadrangle of the university can be seen from the Green, and near by is the old Grove Street cemetery, containing the graves of many famous Americans. The Yale bowl (seating 70,896) is in the western part of the city. New Haven has long been called "the city of elms." Parks, playgrounds and public squares cover 2,119 acres. In West Rock park

is a cave where the regicide judges Whalley and Goffe are said to have been hid for several weeks when pursued by royal officers in 1661. Nathan Hale park contains old Ft. Hale (used in 1812), with its moat and defences well preserved. A large tract at Lighthouse point (the eastern end of the harbour) is developed as a municipal bathing beach and seaside park. New Haven is the seat of a State Teachers' college (established 1893), Albertus Magnus College for Women (Roman Catholic), Arnold College for Hygiene and Physical Education, New Haven college, Woman's college (1933), and Connecticut College of Pharmacy. The public school system includes 42 grade, 1 Boardman trade, 2 senior and 4 junior high schools. There are 12 parochial schools, and a number of widely known private academies for boys and girls, including the Hopkins Grammar school, established in 1664. Among the newspapers are the morning *Journal-Courier* (1766), the evening *Register* (1812), the *Connecticut Echo* (weekly).

New Haven is an important commercial and industrial city. The general offices of the New York, New Haven and Hartford railroad are there, and just outside the city is its Cedar Hill freight classification yard, covering 1,160 ac. The traffic of the harbour amounted to 4,243,634 tons in 1940 and 4,051,589 in 1939. There are 375 wholesale houses, doing a large business. The manufacturing industries are widely diversified and highly specialized, with an output in 1939 valued at $100,838,135. Among the leading products are guns, ammunition, hardware and clocks. A coke plant manufactures gas which is piped to towns as far as Hartford. Bank debits in 1940 aggregated $866,722,890. The city's assessed valuation for 1940 was $305,861,579. It operates under a mayor and aldermen form of government. The death rate is low.

In the spring of 1638 a company of English Puritans, led by Theophilus Eaton and the Rev. John Davenport, established a settlement here. It was governed under a "plantation covenant" until June 4, 1639, when the "free planters" adopted a theocracy. In 1643–44 the towns of Guilford, Milford, Stamford, Branford and Southold on Long Island were admitted to the "New Haven Jurisdiction." The government of the Jurisdiction was of the strictest Puritan type, but some of the 45 "blue laws" ascribed to it were enactments of other New England Colonies, and some were pure invention. In 1664 New Haven, with the other towns (except Southold) of the Jurisdiction, became part of the Colony of Connecticut, and in 1784 it was chartered as a city. From 1701 to 1873 New Haven was one of the capitals of Connecticut. A State house (designed by Ithiel Towne after the temple of Theseus) stood on the Green, or market place, from 1827 until 1889. In 1716 the Collegiate School of Connecticut, which developed into Yale university, was moved to New Haven from Saybrook. After 1763 a thriving trade with the West Indies, Newfoundland and neighbouring ports on the Atlantic coast began to develop, which flourished, with some periods of depression, until the War of 1812; and after 1800 commerce sprang up with China, the East Indies, the Pacific and the South Seas. A collector of the port was appointed in 1760. In 1769 the merchants at a public meeting unanimously agreed not to import goods from England, but in June 1770, they renounced the agreement and voted to open the port. When the news of the embargo of Boston arrived, a committee of correspondence was formed at once; and through the Revolution the people supported the American cause with ardour, though there were many Loyalists in the town, 75 of whom had property confiscated. On July 5, 1779, the town was invaded and sacked by Gen. Tryon, but he was driven out before he could burn it. When the War of 1812 opened there were fully 600 seamen in the city (among them Captain Isaac Hull), all engaged in privateering or in the regular naval service of the United States. Manufacturing began early. Shoes were shipped from the town in 1647 and iron works were opened in 1656. The loss of foreign trade through the War of 1812, the opening of the Farmington canal in 1828, and the building of the railroad in 1833–38 gave such impetus to industrial development that manufacturing rapidly became the chief interest of the city. In 1820 the population was 8,327; in 1860, 39,267; in 1900, 108,027. New Haven has been the birthplace or the home of many inventors, including Eli Whitney, Eli Whitney Blake, Charles Goodyear, Thomas Sanford, James Brewster, David Bushnell, S. F. B. Morse, Elias Loomis, Chauncey Jerome and Henry S. Parmelee; and it was the home of Noah Webster and Willard Gibbs.

**NEW HEBRIDES,** an island group in the western Pacific, under French and British joint administration. Area about 5,700 sq. miles. Population (1939 est.), 43,118 (40,000 natives; 3,118 others). For full account of geography, etc., *see* PACIFIC ISLANDS.

## HISTORY

The Portuguese Pedro Fernandez de Quiros, sighting Espiritu Santo in 1606, thought he had discovered the great southern continent then believed to exist, and named it Australia del Espiritu Santo. Louis de Bougainville visited the islands in 1768, and Captain Cook, who gave them the name they bear, in 1774. The subsequent visits of several explorers, the exploitation of the sandal-wood, and other products by traders and the arrival of missionaries helped to open up the islands and to give them a certain commercial importance by the middle of the 19th century. Trade was mainly with New Caledonia, and France was thus indicated as the dominant power in the New Hebrides; even British planters pressed France to annex the islands in 1876, but in the following year some of the missionaries urged the same course on England. In 1878 the islands were declared neutral by Great Britain and France. The presence of British and French settlers under independent authority led to unsatisfactory administration, especially in regard to the settlement of civil actions and jurisdiction over the native population. As to the establishment of commercial supremacy, French interests clashed with Australian, and in 1882 M. John Higginson of New Caledonia (d. 1904) consolidated the former by founding the trading society which afterwards became the *Société française des Nouvelles-Hébrides.* In 1886 one of the most serious of many native outbreaks occurred, necessitating a French demonstration of force from New Caledonia. An Anglo-French convention of Nov. 16, 1887, provided for the surveillance of the islands (protection of life and property) by a mixed commission of naval officers. The Anglo-French agreement of 1904 had a clause providing for an arrangement for proper jurisdiction over the natives and for the appointment of a commission to settle disputes between British and French land owners.

On Oct. 20, 1906, a convention was signed in London, confirming a protocol of the preceding Feb. 27, and providing that "the group of the New Hebrides, including the Banks and Torres Islands," should form "a region of joint influence," in which British and French subjects should have equal rights in all respects, and each power should retain jurisdiction over its own subjects or citizens. The claim of other powers to share the joint influence was excluded by the provision that their subjects resident on the islands must be under either British or French jurisdiction. A British and a French high commissioner were appointed, each assisted by a resident commissioner; provision was made for two police forces of equal strength, and the joint naval commission of 1887 was retained for the purpose of keeping order. The high commissioners were given authority over the native chiefs. A joint court was established, consisting of two judges, appointed respectively by Great Britain and France, and a third, to be president, and not a British subject or French citizen, appointed by the king of Spain. The convention provided against the establishment of a penal settlement and the erection of fortifications.

This convention was bitterly criticized in Australia on the ground that many of the provisions which nominally established equality between British and French would operate in practice to the advantage of the Freneh; and there was no little dissatisfaction on the ground that the Australian Government was neither represented at the preliminary conference, nor fully consulted during the negotiations. A second protocol of Aug. 1914, ratified by France and England on March 18, 1922, guaranteed British, French and native interests, fixed the conditions of land-tenure and provided regulations for the recruiting of native labour. Cannibalism still prevails on Espiritu Santo, Malekula and Pentecost Islands.

See *Parliamentary Papers*, France, No. 1 (1888 and 1906); and "Correspondence relating to the Convention. . . ." (Cd. 3288) (1907); M. Johnson, *Cannibal Land* (*New Hebrides*) (1922). (*See* also PACIFIC OCEAN.)

**NEW IBERIA,** a city of Louisiana, U.S.A., 125 m. W. of New Orleans, on Bayou Teche and Federal highway 90; county seat of Iberia parish. It is served by the Missouri Pacific and the Southern Pacific railways, and by river steamers and barges. Pop. 8,003 in 1930; 13,747 in 1940. This region is the home of the "Acadians" from Nova Scotia, a rich agricultural country. Within a few miles are Avery, Jefferson and Weeks islands, all of which have salt mines. On Jefferson island was the home (Bob Acres) of Joseph Jefferson, and on Avery there is a bird refuge. The city was laid out in 1835 and chartered in 1839.

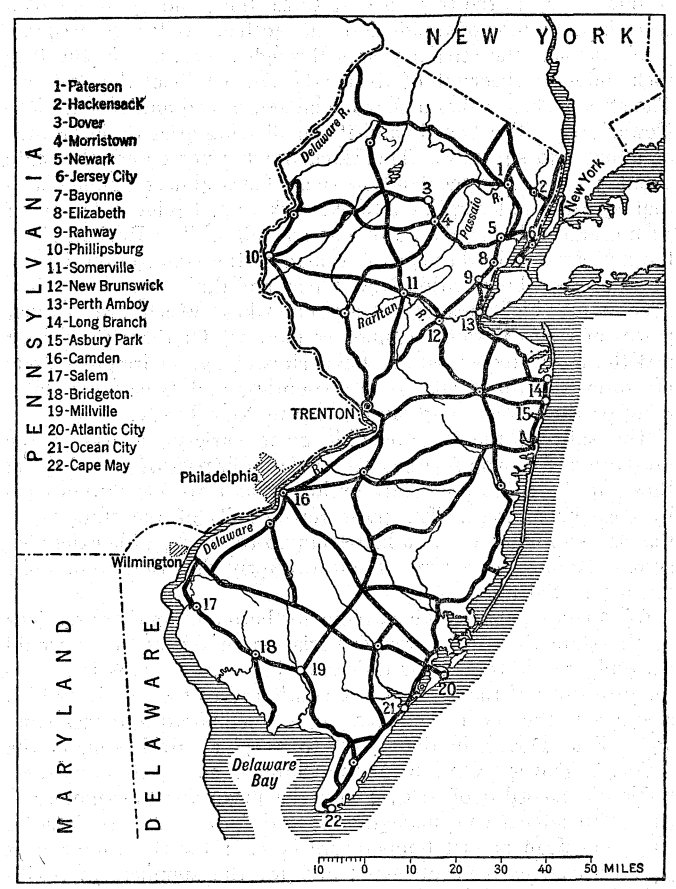
**NEW IRELAND** (native *Tombara*), an island of the Bismarck archipelago, lying east of New Guinea, in the Pacific ocean, and northeast of New Britain, practically at right-angles to its northern end. It is long and narrow, very mountainous (maximum height, 6,500 ft.), with no rivers of any size. Geologically, it is older than New Britain (*q.v.*, *see* also NEW GUINEA), but it has not the definite volcanic appearances of that island. The coast line is fairly even, and there are good harbours at Kaewieng, Namatanai and Muliama. It is divided into two districts, northern (Kaewieng), and southern (Namatanai), the latter including the small island of New Hanover. Kaewieng is a port with a wharf capable of berthing ships up to 2,000 tons. There are fair roads in many places, and ordinarily there is steamer communication with New Britain and the mainland. The natives resemble those of New Britain. New Ireland formed part of German New Guinea; it was captured by Australian forces in 1914, and was mandated by the League of Nations to Australia. The island was seen by Jacob Lemaire and William Cornelis Schouten in 1616, recognized as separate from New Guinea by Dampier, in 1700.

New Ireland was invaded by the Japanese Jan. 23, 1942. Kaewieng became a Japanese naval base second in importance in this part of the Pacific only to Rabaul in New Britain. Japanese shipping there was bombed by United Nations air forces.

**NEW JERSEY,** popularly known as the "Garden State," is one of the Atlantic coast States of the American Union, lying between 41° 21′ 22·6″ and 38° 55′ 40″ N. lat., and 75° 35′ and 73° 53′ 39″ W. longitude. It is bounded, north by the State of New York, east, by the Hudson river, which separates the State from New York, and by the Atlantic ocean; and south and west by the Delaware bay and river, which separate New Jersey from Delaware and Pennsylvania. All the boundaries except the northern are natural. New Jersey has an extreme length, north and south, of 166 mi., an extreme width, east and west, of 57 mi. and a total area of 7,836 sq.mi. Its inland water area is 314 sq.mi.

**Physical Features.**—There are within the State four distinct topographic belts—the Appalachian, the Highlands, the Triassic Lowland and the Coastal Plain. The folded Appalachian belt crosses the north-west corner of the State, and includes the Kittatinny mountain and valley. The mountain has a north-east-south-west trend, crossing the Delaware river at the Delaware Water Gap and continuing south-west into Pennsylvania. Where the crest of the ridge enters the State its elevation is 1,539 ft.; at High Point, 1¼ m. S.W., the ridge attains a height of 1,805 ft., the highest point within the State. A short distance south-west of this point, in a depression in the crest, is Lake Marcia, at an elevation of 1,570 feet. At the Water Gap the ridge is cut through to its base, and the Delaware river flows through the opening. This gap, 900 ft. wide at the base and 4,500 ft. wide at the top, with sides rising very abruptly to a height of 1,200 ft. and more, is an impressive sight. The Kittatinny valley, south-east of and parallel to the Kittatinny range, is about 40 m. long and 12 m. wide and has an average elevation of 700 feet.

South-east of the Kittatinny valley, and parallel with it, lies the second topographic belt, the Highlands. This region embraces an area of 900 sq.m., having a length, north-east to south-west, of 60 m. and a width varying from 9 to 18 miles. It consists of an upland plateau now dissected by streams into a series of ridges. The average elevation of the Highlands is about 1,000 feet. The third belt, called the Triassic Lowland, occupies about one-fifth of the surface of the State. Its north-western border is marked by a line drawn south-west across the State through Pompton, Morristown, Lebanon and Highbridge to the Delaware; its south-eastern border by a line drawn from Woodbridge to Trenton. The surface is irregular, with altitudes ranging from about sea-level to 900 feet. A noteworthy feature of this area is the series of




MAP SHOWING THE MAIN ROADS IN NEW JERSEY

trap rock ridges. The best known of these is the Palisades ridge, or simply the Palisades, which lines the western bank of the Hudson river. The trap extends to the Kill van Kull channel, and includes, among other ridges, the so-called First and Second Watchung (or Orange) mountains west of the group of suburbs known as the "Oranges." South-east of the Triassic Lowland lies the fourth topographic belt, the Coastal Plain, containing an area of 4,400 sq.m., or slightly more than one-half the entire surface of the State. This belt, bordered on the east, south and west by water, is highest near its centre and lowest along its margins. One-third of the Coastal Plain is below 50 ft. in altitude; two-fifths are between 50 and 100 ft.; and somewhat more than a fourth of the area is over 100 ft. above sea-level. About one-eighth of the area consists of tidal marsh, lying chiefly between the long sandy ridges or barrier beaches of the Atlantic coast and the mainland. For the entire State the average elevation is 250 feet.

The four topographic belts of the State correspond very closely to the outcrops of its geological formations; the rocks of the Appalachian belt being of Palaeozoic age; the formation of the Highlands, Archaean; that of the Triassic Lowland, Triassic; that of the irregular hills of the Coastal Plain, Cretaceous and Tertiary. The great terminal moraine of the glacial epoch crosses the north-east-south-west topographic belts of the State, in an irregular line west and north-west, from Staten Island, N.Y.

The Delaware river, from its junction with the Neversink river to the capes, flows along the western and southern borders of the State for a distance of 245 mi., and has a total drainage area in New Jersey of 2,345 sq. miles. Of equal importance is

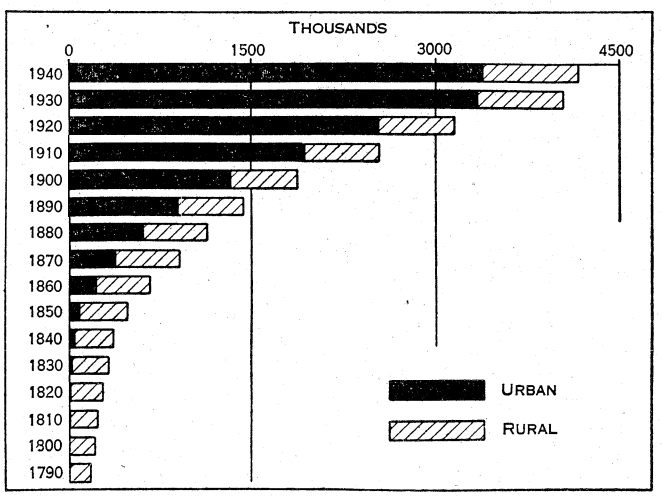
the Hudson, whose lower waters, forming the northeastern boundary of New Jersey for a distance of 22 mi., drain a very small part of the state, but have contributed materially to the state's commercial development. Of the streams of the highlands and the Triassic lowland, the Passaic river is the most important. Rising in the northeast—in the southern part of Morris county—it pursues a winding northeasterly course, passing through a gap in the trap rock at Little falls, and by means of a cascade and a mile of rapids descends 40 feet. At Paterson (*q.v.*), 3 mi. farther, the stream passes through a crevasse in the trap rock and has a sheer fall of 70 ft. (the Great falls of the Passaic). The stream then makes a sharp bend southward and empties into Newark bay. The Passaic and its small tributaries drain an area of about 950 sq. miles. The Hackensack river enters the state about 5 mi. W. of the Hudson river, flows almost parallel with that stream, and empties into Newark bay, having a length of 34 mi. and a drainage area of 201 sq. miles. The Raritan river, flowing eastwardly through the centre of the state, is the largest stream lying wholly within New Jersey and drains 1,105 sq. miles. Among the highlands are numerous lakes, which are popular places of resort during the summer months. Of these the largest and the most frequented are Lake Hopatcong, an irregular body of water in Morris and Sussex counties, and Greenwood lake, lying partly in New York and partly in New Jersey.

The soils of the state exhibit great variety. Those of the northern and central sections are made up in part of glacial drift; those of the south are sandy or loamy and are locally enriched by deposits of marl. The most fertile soils of the state lie in the clay and marl region, a belt from 10 to 20 mi. wide extending across the state in a general southwesterly direction from Long Branch to Salem.

**Climate.**—Between the extreme northern and southern sections of the state there is a greater variation in climate than would naturally result from their difference in latitude. This is due to the proximity of the ocean in the south and to the relatively high altitudes in the north. The mean annual temperature ranges from 49·2° F at Dover, in the north, to 55·4° at Bridgeton, in the south. At Dover the mean for the winter is 28°, with an extreme minimum recorded of −13°; and the mean for the summer is 70°, with an extreme maximum recorded of 102°. At Atlantic City the mean annual temperature is 52°; for the winter it is 34°, with an extreme of −7°; and for the summer, 70°, with an extreme of 104°. The beaches of New Jersey have rapidly built up with towns and cities that have become popular summer resorts —among the best known of these are Long Branch, Asbury Park, Ocean Grove, Atlantic City (also a winter resort) and Cape May. The normal annual precipitation is 47·7 in., varying from 46·6 in. on the seacoast to 49·1 in. in the highlands and the Kittatinny valley.

**Population.**—The population of New Jersey in 1790 was 184,139; in 1820 it was 277,575; in 1850, 489,555; in 1880, 1,131,116; in 1910, 2,537,167; and in 1940, 4,160,165. This last figure represents an increase of 2·9% over the population in 1930. The population per square mile was 553·1, as compared with 44·2 for the United States as a whole. Of the 1940 population, 3,394,773, or 81·6%, lived in urban areas, these comprising all cities, towns and boroughs and villages of 2,500 or more, and a few densely populated townships. The number of occupied dwelling units returned in the housing census of 1940 was 1,100,585, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 4·1 in 1930 to 3·8 in 1940. The white population of New Jersey formed 94·5% of the total in 1940, as compared with 94·8% in 1930, practically all the nonwhite population being Negro. The number of males per 100 females in the population of the state was 99·4. The population of the state and of its principal cities is summarized in the following table:

| Area | Population | | | Percent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 4,160,165 | 4,041,334 | 3,155,900 | 2·9 | 28·1 |
| Urban | 3,394,773 | 3,339,244 | 2,474,936 | 1·7 | 32·4 |
| Rural | 765,392 | 702,090 | 680,964 | 9·0 | 10·8 |
| Percent urban | 81·6 | 82·6 | 78·4 | .. | .. |
| Principal cities: | | | | | |
| Newark | 429,760 | 442,337 | 414,524 | −2·8 | 6·7 |
| Jersey City | 301,173 | 316,715 | 298,103 | −4·9 | 6·2 |
| Paterson | 139,656 | 138,513 | 135,875 | 0·8 | 1·9 |
| Trenton | 124,697 | 123,356 | 119,289 | 1·1 | 3·4 |
| Camden | 117,536 | 118,700 | 116,309 | −1·0 | 2·1 |
| Elizabeth | 109,912 | 114,589 | 95,783 | −4·1 | 19·6 |
| Bayonne | 79,198 | 88,979 | 76,754 | −11·0 | 15·9 |
| East Orange | 68,945 | 68,020 | 50,710 | 1·4 | 34·1 |
| Atlantic City | 64,094 | 66,198 | 50,707 | −3·2 | 30·6 |
| Passaic | 61,394 | 62,959 | 63,841 | −2·5 | −1·4 |




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF NEW JERSEY, 1790–1940

**Government.**—The state is governed under the constitution of 1844, with amendments of 1875, 1897, 1927 and 1939. The only other constitution under which the state has been governed was that of 1776. The right of suffrage is conferred upon all citizens of the U.S., 21 years of age and over, who have resided in the state for one year and in the county for five months preceding the election. The executive power is vested in a governor, who is elected for a term of three years and may not serve two successive terms, though he may be re-elected after he has been out of office for a full term. He receives a salary of $20,000 a year. If the governor die, resign or be removed from office, or if his office be otherwise vacant, he is succeeded by the president of the senate, who serves until another governor is elected and qualified. The governor's appointive power is unusually large. With the advice and consent of the state senate, he selects the secretary of state, attorney general, superintendent of public instruction, chancellor, chief justice, judges of the supreme, circuit, inferior and district courts, and the so-called "lay" judges of the court of errors and appeals, in addition to the minor administrative officers. The state treasurer, comptroller, motor vehicle and alcoholic beverage control commissioners are elected by the legislature.

The legislative department consists of a senate and a general assembly. In the senate each of the 21 counties has one representative, chosen for a term of three years, and about one-third of the membership is chosen each year. The members of the general assembly are elected annually, are limited to 60 and are apportioned among the counties according to population, with the important proviso, however, that every county shall have at least one member. The annual salary of senators and members of the general assembly is $500. The governor may (since 1875) veto any item in any appropriation bill, but any bill (or item) may be passed over his veto by bare majorities of all members elected to each house. Bills not returned to the legislature in five days become law, unless the legislature adjourns in the meantime. Amendments to the constitution must first be passed by the legislature at two consecutive sessions (receiving a majority vote of all members elected to each house), and then be ratified by the voters at a special election.

The judicial system is complex and is an interesting development from the English system of the 18th century. At its head is a court of errors and appeals composed of the chancellor, the justices of the supreme court and six specially appointed judges.

The latter serve for a term of six years and receive a salary of $40 per day. The supreme court consists of a chief justice and eight associate justices appointed by the governor for seven years. The chief justice receives an annual salary of $19,000; the associate justices each receive $18,000 annually. The circuit court has concurrent jurisdiction with the supreme court except in criminal cases. The 12 circuit court judges are appointed by the governor for a term of seven years and receive an annual salary of $16,000. The court of common pleas, which may be held either by the judge of the court of common pleas (county) or by a justice of the supreme court, may hear appeals from the "small cause court," and has original jurisdiction in all civil matters except those involving the title of real estate. The court of quarter sessions, which may likewise be held by either the judge of the court of common pleas or by a justice of the supreme court, has jurisdiction over all criminal cases except those of treason or murder. The court of oyer and terminer is a higher criminal court and has cognizance of all crimes and offences whatever. This court is composed of any supreme court justice and the judge of the court of common pleas. Writs of error in cases punishable with death are returnable only to the court of errors and appeals. The orphans' court has jurisdiction over wills, the right of administration and guardianship, etc., but it may refer any matter coming before it to a master in chancery. The court of chancery is administered by a chancellor, ten vice-chancellors and numerous masters in chancery. Besides the ordinary chancery jurisdiction it hears all applications for divorce or nullity of marriage. The chancellor, who is appointed by the governor for a term of seven years, receives an annual salary of $19,000. Vice-chancellors are appointed by the chancellor for a term of seven years, and receive $18,000 annually. The district court is composed of 31 judges appointed by the governor for a term of five years. The jurisdiction of this court is limited to the county in which it is held; it has authority over suits of a civil nature in which the sum involved does not exceed $500. Each county has a surrogate whose duties mainly relate to will cases. In each township there are from two to five justices of the peace, and in cities, police justices. Suits involving not more than $200 and minor offences may be tried in justice's or police courts.

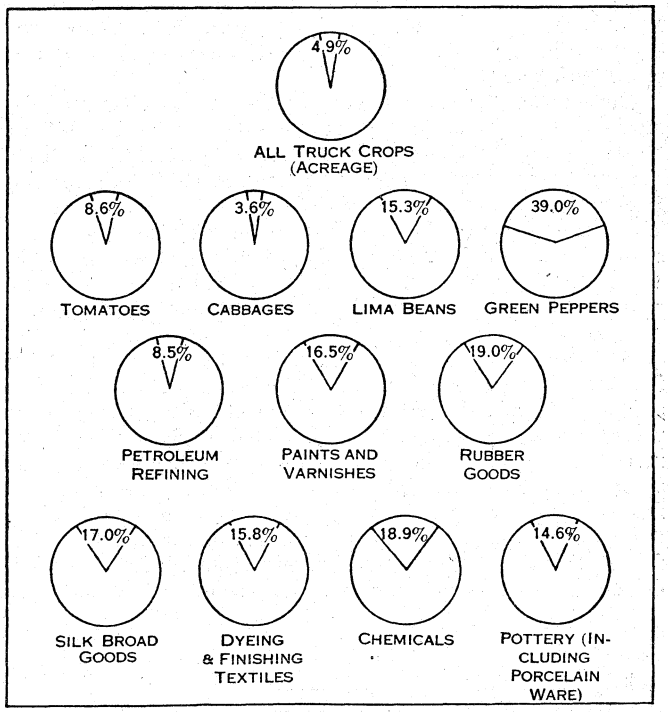
For the purposes of local government the state is divided into counties (21), cities, townships, towns and boroughs. The government of the towns is administered through a council, clerk, collector, assessor, treasurer, etc., chosen by popular vote; that of the townships is vested in the annual town meeting, at which administrative officers are elected. Any township with more than 5,000 inhabitants may be incorporated as a town, with its government vested in a mayor and council. Any township or part thereof with less than 4 sq.mi. of territory, and less than 5,000 inhabitants, may be incorporated as a borough, with its government vested in a mayor and council. In 1911 a law was passed allowing cities to adopt a commission form of government; in 1923 the city manager form was authorized.

**Finances.**—The state tax department was created July 1, 1931, and superseded the state board of taxes and assessments. The department discharges all tax duties except those relating to review, hearing and determination of appeals concerning the assessment, collection, apportionment or equalization of taxes. These latter functions are vested in the state board of tax appeals. The chief officer of the department is the state tax commissioner. In 1931 the following bureaus were consolidated under the state tax commissioner: inheritance tax, motor fuel tax, billboard tax, corporation tax, railroad tax and valuation, public utility tax, local tax, beverage licence tax and administrative. The net assessed valuation of real and personal property, exclusive of bank and trust company stock, in 1940 was $5,489,669,439, a decrease of $129,134,237 from the valuation for 1939. In the state fund, the total receipts for the year ending June 30, 1940, were $144,160,626, and the total disbursements, $140,759,588. The bonded indebtedness of the state on June 30, 1940, was $161,146,000, distributed as follows: soldiers bonus bonds, $12,000,000; state highway extension bonds, $19,000,000; state highway road bonds, $50,000,000; state highway bridge bonds, $4,000,000; serial bonds, including relief, $76,030,000; emergency relief bonds, floated since 1933, $25,625,000.

**Education.**—The Russell Sage foundation, after an exhaustive examination of the public-school system of the various states, ranked New Jersey in 1920 first among the states east of the Mississippi river and fourth in the whole country. The public-school system is administered under the direction of a state board of education and a commissioner of education. The former consists of ten members, not more than one of whom shall be from the same county and not more than five from the same political party. At least two of the members must be women. The commissioner of education is appointed by the governor and confirmed by the senate. He decides controversies that arise under the school law, appoints county superintendents and apportions state funds. All children between the ages of five and 20 are entitled to attend the public schools in the district in which they reside. Attendance at either public or private school every day such school is in session is required of all children between the ages of seven and 16, unless taught at home or physically or mentally unfit to attend. Children between the ages of 14 and 16 who have completed five grades may be granted a certificate permitting them to work, but they must attend a continuation school. A pension and annuity fund law provides for teachers after reaching 62 years of age or after 35 years of service.

In 1939–40 the total enrolment of pupils was 785,195, of whom 204,548 were in high schools. The number of teachers was 28,640. About one-half of the pupils received manual or industrial training of some sort. The total expenses of operating the public schools in 1939–40 was $111,736,671, or $251,825 less than in the year 1938–39. Total salaries for teachers in all types of schools in 1940 were $60,747,349. The average salary paid teachers, exclusive of superintendents and assistant superintendents, was $2,100.

In addition to the regular public schools, the state maintains normal schools at Trenton, Montclair, Newark, Paterson and Glassboro, a school for the deaf at Trenton, and a Manual Training and Industrial School for Colored Youth at Bordentown. An agricultural college and experiment station has long been maintained in connection with Rutgers college, now Rutgers university, at New Brunswick. In 1918 the legislature designated Rutgers as the state university of New Jersey. The New Jersey College for Women affiliated with the state university was opened in




PROPORTION OF TOTAL U.S. PRODUCTION OF CERTAIN CROPS (1940) AND MANUFACTURED PRODUCTS (1937) PRODUCED IN NEW JERSEY

Sept. 1918. There are industrial schools in Newark, Hoboken and Trenton supported in part by the state. Among the institutions of higher education not receiving state aid are Princeton university (*q.v.*) at Princeton; Stevens Institute of Technology at Hoboken; Upsala college at East Orange; Seton Hall college at South Orange; St. Joseph's college at Princeton; Georgian Court college at Lakewood; College of St. Elizabeth at Convent Station; Alma college at Zarephath; Newark university at Newark; Drew Theological seminary at Madison; Princeton Theological seminary at Princeton; and Immaculate Conception Theological seminary at South Orange.

**Charities and Corrections.**—The state supports the following charitable and correctional institutions all under the supervision of the state department of institutions and agencies: hospitals for the insane at Trenton, Marlboro and Greystone Park; a sanatorium for tuberculous diseases at Glen Garden; a village for epileptics near Skillman; a home for feeble-minded women at Vineland; state colonies for feeble-minded males at New Lisbon and Woodbine; a home for disabled soldiers at Menlo Park; a home for disabled soldiers, sailors and their wives at Vineland; a reformatory for women, near Clinton; and men's reformatories at Annandale and Rahway; a state home (reform school) for boys, near Jamesburg, and for girls, near Trenton; and a state prison at Trenton.

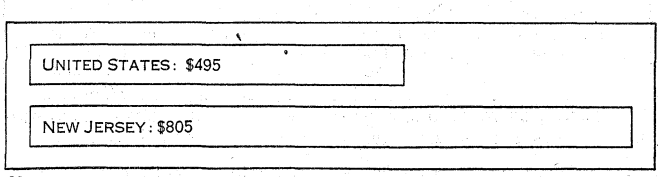
**Agriculture.**—The farm acreage of New Jersey gradually increased between 1900 and 1940, the total acreage for these two years being respectively 2,840,966 and 4,814,080. During the same period the number of farms decreased from 34,294 to 25,835.

The census bureau stated the value of farms had dropped from $234,313,485 in 1935 to $227,805,686 in 1940. Farm income for 1940 was $105,870,000. The total farm population in New Jersey in 1940 was 146,459. In 1930 it was 131,096.

Between 1930 and 1940 the average value of a New Jersey farm fell from $11,776 to $8,818. The mean value an acre declined from $169.99 to $121.54, according to the U.S. census bureau. In 1940 New Jersey threshed 1,103,347 bu. of wheat, raised 914,204 bu. of oats, 115,610 bu. of barley and 260,540 bu. of rye. It produced 7,439,827 bu. of Irish potatoes, as compared with 4,733,520 in 1930, and 2,160,987 bu. of sweet potatoes, as compared with 1,498,899 in 1930.

The number and value of each of the various classes of livestock in the state on Jan. 1, 1941, were estimated as follows: horses 33,000 ($3,960,000); mules 4,000 ($528,000); all cattle 211,000 ($20,941,000); milch cows 154,000 ($18,480,000); hogs 81,000 ($826,000); sheep 6,000 ($36,000). The dairy industry is confined chiefly to the production of milk and butter for consumption in New York city, Philadelphia and other large cities. Poultry raising is an important industry, and during the decade 1930–40 the number of chickens increased from 4,096,656 to 5,388,339.

**Manufacturing.**—Manufacturing has long been the leading industry of New Jersey. In 1940 the value of the products of the state's 7,984 manufacturing establishments was $3,428,947,188; wages paid to 433,471 employees amounted to $521,568,632. This marks an increase in industrial output over the $1,686,128,634 value of production in 1933, but it is behind the production figure of $3,923,261,505 for 1929. New Jersey ranked first among the states in 1940 in the dyeing and finishing of textiles, manufacture of chemicals, paints and varnishes, tanning materials and dyestuffs, elevators and elevator equipment, and rubber goods other than tires and footwear. The state's industrial importance is due, in great part, to the excellent transportation facilities, and to the proximity of large markets and of great natural resources, such as the clays of New Jersey and the coal and iron of Pennsylvania.




VALUE OF MANUFACTURES OF NEW JERSEY PER CAPUT COMPARED WITH THAT FOR THE U.S. (1937)

The chief manufacturing centres in 1940, as judged by the value of their products were Newark, Jersey City, Camden, Paterson, Kearny, Trenton, Bayonne, Elizabeth and Passaic. Newark is the centre for electrical machinery, paints and varnishes, jewellery, tanning and finishing leather, chemicals and bread and bakery products. Paterson's chief industries are the dyeing and finishing of textiles and the manufacture of silk. Jersey City is the centre of the state's slaughtering and meat-packing industry. Trenton is famous for its pottery and porcelain ware. The ten principal industries of New Jersey, based on the value of their products in 1939, were as follows:

| Industry | Wage earners | Value in dollars |
|---|---|---|
| Petroleum refining | 6,115 | $213,963,061 |
| Chemicals | 11,796 | 192,184,743 |
| Primary smelting and refining | 3,672 | 246,917,393 |
| Electrical machinery apparatus and supplies | 14,393 | 74,527,777 |
| Shipbuilding and ship repairing | 12,300 | 72,352,349 |
| Wholesale meat packing | 3,070 | 78,094,977 |
| Paints and varnishes | 3,209 | 62,585,006 |
| Food and kindred products | 7,491 | 119,519,893 |
| Clothing | 10,764 | 50,814,472 |

Other manufactures ordinarily valued at more than $25,000,000 are: foundry and machine shop products; canning and preserving fruits and vegetables; silk and rayon goods; rubber goods; cigars and cigarettes; and worsted goods.

**Minerals.**—The total value of the state's mineral products was $24,408,545 in 1938. The total value of clay production in 1938 was $5,593,753. Of this total, the value of products other than pottery and refractories was $5,210,105. The total zinc output of the state in 1938 was 85,839 short tons, valued at $10,891,683. In Warren and Sussex counties are abundant materials for the manufacture of Portland cement. In 1938 the chief stone products were trap rock, limestone, sandstone and granite, having a total value of $2,678,766. The manufacture of iron in New Jersey dates from 1674, when the metal was reduced from its ores near Shrewsbury, Monmouth county. The product of the iron mines in 1938 was only 139,890 long tons.

**Transportation.**—The total railway mileage of New Jersey on Jan. 1, 1939, according to the Interstate Commerce commission, was 2,132 as compared with 2,299 in 1930. Owing to its geographical position, the state is crossed by all railways reaching New York city from the south and west, and all those reaching Philadelphia from the north and east. The eastern terminals of the southern and western lines running from New York city are situated on the western shore of the Hudson river, in Jersey City, Hoboken or Weehawken; whence passengers and freight are carried by ferry to New York. An exception is the Pennsylvania railway which has constructed a tunnel under the Hudson river, and established a terminal on Manhattan island. Jersey City and Hoboken are also connected with New York by electric railway tunnels under the Hudson river; the Holland and Lincoln tunnels connect lower New York city with Jersey City. The electric railway companies within the state operated 727 mi. of track in 1937.

New Jersey was the first state in the union to pass (1891) a state aid highway act. Since that early beginning, New Jersey has spent many millions of dollars in constructing and maintaining a state highway system, which on Jan. 1, 1940, consisted of 1,657 mi. of an authorized total of 2,141 mi. In 1940 a total of 1,200,000 motorists were registered.

The water-borne commerce of New Jersey in 1938, exclusive of that of Hoboken and Jersey City which is included in the port of New York, amounted to 172,354 cargo tons of imports and 62,018 cargo tons of exports. The chief ports were Bayonne, Newark, Perth Amboy and Carteret.

**History.**—The earliest inhabitants of New Jersey of whom there is any certain record were the Leni-Lenape or Delaware Indians, a branch of the Algonkin family. They were most numerous in the southern and central portions of the state, preferring the river valleys. In the year 1758 an Indian reservation, said to have been the first established within the present limits of the United States, was established at Edgepelick or Brotherton (now called Indian Mills) in Burlington county.

The first authenticated visit of a European to what is now New Jersey was made under French authority by Giovanni da Verrazano, a Florentine navigator, who in the spring of 1524 sailed within Sandy Hook and dropped anchor in the waters of upper

New York bay. In the following year Estevan Gomez, a Portuguese sailor in the service of the emperor Charles V., is said to have made note of the Hudson and Delaware rivers. Voyages to this region for exploration, trade and settlement, however, may be said to have really begun with the year 1609, when Henry Hudson explored the region between Sandy Hook and Raritan bay and sailed up the river which now bears his name. In 1614 Cornelis Jacobsen Mey explored the lower Delaware, and two years later Cornelis Hendricksen more thoroughly explored this stream. In 1623 the first party of permanent homeseekers arrived at New Amsterdam, and a portion of these formed a settlement on the eastern bank of the Delaware and built Ft. Nassau near the site of the present Gloucester City. On the western bank of the Hudson the trading post of Hobocan Hackingh, on the site of the present city of Hoboken, was established at an early date. From these places and from New Amsterdam the Dutch spread into the Raritan valley.

In the meantime colonists of another nationality had set foot on the shores of the lower Delaware. In 1638, 50 Swedish colonists landed on the western bank of the Delaware and built Ft. Christina on the site of the modern Wilmington. Five years later, on the eastern bank a triangular fort, called Elfsborg, was constructed near the present Salem. But the Swedish rule was short-lived, as in 1655 the settlements surrendered to Peter Stuyvesant and passed under the control of the Dutch.

On March 12, 1664, Charles II. granted to his brother James, duke of York, all the lands between the Connecticut river and the eastern side of Delaware bay, as well as all the islands between Cape Cod and the Hudson river. An expedition was sent from England in May, under the command of Richard Nicolls, and in the following August the English flag floated over New Amsterdam. In October, Sir Robert Carr took possession of the settlements on the Delaware, and terminated the rule of the Dutch. The few inhabitants of what is now New Jersey acquiesced in the new order. While the expedition commanded by Nicolls was still at sea, the duke of York, by deeds of lease and release, transferred to Lord John Berkeley, baron of Stratton and Sir George Carteret (*q.v.*), all that part of his new possessions extending eastward from the Delaware bay and river to the Atlantic ocean and the Hudson river, and northward from Cape May to a line drawn from the northernmost branch of the Delaware, "which is 41° 40′ lat.," to the Hudson river in 41° N. latitude. To this tract the name of Nova Caesarea, or New Jersey, was given in honour of Carteret, who governed the isle of Jersey in 1643–51. In order to attract immigrants, the proprietors in Feb. 1665 published their "Concession and Agreement," by which they made provision for a governor, a governor's council, and an assembly chosen by the freemen and having the power to levy taxes. Special inducements in the way of land grants were offered to persons embarking with the first governor. In the meantime Governor Nicolls of New York, ignorant of the grant to Berkeley and Carteret, had approved certain Indian sales of land to settlers within New Jersey, and had confirmed their titles to tracts in what became known as Elizabethtown, Middletown and Shrewsbury. In 1669 trouble arose between the proprietary governor and the inhabitants of the towns of Shrewsbury and Middletown over the collection of quit-rents. This caused the duke of York to declare that the grants made by Nicolls were null and void; the king enjoined obedience to the proprietors, and quiet was restored. Another change was impending, however, and in Aug. 1673, when a Dutch fleet appeared off Staten Island, New Jersey for a second time became a part of New Netherland. The period of Dutch rule was short, and by the Treaty of Westminster, of Feb. 9, 1674, the territory was restored to England. The Crown lawyers decided that the rights of the proprietors of New York and New Jersey had been extinguished by the conquest, and that by treaty the lands had been reconveyed, not to the proprietors, but to the king. On June 13, 1674, Charles II. accordingly wrote a letter confirming the title and power of Carteret in the eastern half of New Jersey. No similar grant was made to Berkeley, as on March 18 he had sold his interest in the province to John Fenwicke, sometime major in the parliamentary army and later a member of the Society of Friends, and Edward Byllynge (d. 1687), a Quaker merchant. Financial embarrassments soon caused Byllynge to assign his share in trust for his creditors to three Quakers, William Penn, Gawen Lawrie and Nicholas Lucas. Later they acquired Fenwicke's share also. The Quakers then set about seeking a division of the province more to their advantage and, Sir George Carteret having been persuaded by the duke of York to surrender his grant of July 1674, the so-called "quintipartite deed" was executed on July 1, 1676. This instrument defined the interests of Carteret, Penn, Lawrie, Lucas and Byllynge, by fixing a line of partition from Little Egg harbour to a point on the Delaware river, in 41° 40′ N., and by assigning the province east of this line (East Jersey) to Carteret and the province west of this line (West Jersey), about five-eighths of the whole, to the Quaker associates.

A very liberal frame of Government for West Jersey, drafted presumably by William Penn, and entitled "the Concessions and Agreements of the Proprietors, Freeholders and Inhabitants of West Jersey in America," was adopted in March 1677. This vested the principal powers of Government in an assembly of 100 members, who were to be chosen annually and to be subject to instructions from their constituents. Religious toleration was assured. In Aug. 1677 the ship "Kent" arrived in the Delaware, with 230 Quakers from London and Yorkshire. These founded a settlement, which became the modern Burlington, and in the next few months several hundred more colonists arrived. But the new colony was never actually governed under "the Concessions and Agreements"; for when in 1680 the duke of York confirmed the title to the land to Byllynge and his associates he conveyed the right to govern to Byllynge alone. Although he was one of the signers of the "Concessions and Agreements," Byllynge now commissioned Samuel Jennings as governor of the province, and the other proprietors acquiesced, appointing Byllynge governor and permitting Jennings to serve as his deputy. Jennings immediately called the first assembly, and this body passed a body of fundamental laws providing for a governor and council.

The death of Sir George Carteret in 1680 gave the zealous Andros another chance to lay claim to jurisdiction over New Jersey. On April 30, 1680, a detachment of troops dragged Philip Carteret, the governor of East Jersey, from his bed and carried him prisoner to New York. Here he was confined for four weeks, and was released only on his promise not to exercise any authority until the matter could be referred to England for adjudication. When the assembly of East Jersey met in June, Andros appeared before it as governor and recommended such measures as he deemed advisable, but the deputies refused to pass them. In England, too, his conduct was disavowed and he was called home to answer charges that had been preferred against him. Sir George Carteret had bequeathed his province to eight trustees, who were to administer it for the benefit of his creditors. Early in 1682, after several unsuccessful attempts to effect a sale by other means, the province was offered for sale at public auction, and was purchased by William Penn and 11 associates for £3,400. Later each of these 12 sold one-half of his share to another associate, thus making 24 proprietors; and on March 14 the duke of York confirmed the sale, and gave them all the powers necessary for governing the province. The Government of the 24 proprietors was liberal. Recognizing the necessity of some one in the province with full power "to do all things that may contribute to the good and advancement of the same," they directed the appointment of the American Board of Proprietors—a body of men identified with the province, who with the deputy-governor were to look after the proprietary interests in such matters as the approval of legislation and the granting of lands, and thereby prevent the delay caused by the transmission of such matters to England for approval. In 1686 Perth Amboy, the newly created port of East Jersey, became its seat of Government.

After his accession to the throne in 1685, James II. showed an unyielding determination to annul the privileges of the colonies, and to unite New York, New Jersey and the New England colonies under a single Government. In order, therefore, to save their rights in the soil, the proprietors of East and West Jersey

surrendered their claims to jurisdiction. Andros, previously appointed viceroy of New England, thereupon received a new commission extending his authority over New York and the Jerseys, and in Aug. 1688 he formally annexed these provinces to the dominion of New England. The seizure of Andros by the people of Boston in April 1689, following the news of the revolt in England against James II., gave the Jersey proprietors an opportunity to resume their rights.

In April 1702 all rights of jurisdiction were transferred to the Crown, while the rights to the soil remained in the proprietors. The provinces of East and West Jersey were then united under a Government similar to that of the other royal provinces. Until 1738 the governor of New York was also governor of New Jersey; after that date each colony had its own governor. The legislature met alternately at Burlington and Perth Amboy, until 1790, when Trenton was selected as the capital of the State.

The four decades following the change to royal Government were years of development disturbed, however, by friction between the assembly and the royal governors, and by bitter disputes, accompanied by much rioting, with the proprietors concerning land-titles (1744–49). Independence of the absentee landlords was again claimed by virtue of the grants made by Nicolls nearly a century before. Agriculture at this time was the main pursuit. Between East and West Jersey certain political and religious differences developed. The former, settled largely by people from New England and Long Island, was dominated by Puritans; the latter by Quakers.

The last colonial assembly of New Jersey met in Nov. 1775. From May 26 to July 2, 1776, the second provincial congress met at Burlington, Trenton and New Brunswick and for a time became the supreme governing power. Following the recommendation of the continental congress, that the colonies should create independent Governments, the provincial congress drafted a provincial constitution, which, without being submitted to the people, was published July 3, 1776. In the State were fought some of the most important engagements of the war. When Washington, in the autumn of 1776, was no longer able to hold the lower Hudson he retreated across New Jersey to the Delaware near Trenton and seizing every boat for miles up the river he placed his dispirited troops on the opposite side and left the pursuing army no means of crossing. With about 2,500 men he recrossed the Delaware on the night of Dec. 25, surprised three regiments of Hessians at Trenton the next morning, and took 1,000 prisoners and 1,000 stands of arms. In a series of movements following up his success he outgeneraled the British commander, Lord Cornwallis and on Jan. 3, 1777, defeated a detachment of his army at Princeton (*q.v.*). The American army then went into winter quarters at Morristown. As the British army under Gen. Clinton was retreating, in June 1778, from Philadelphia to New York, the American army engaged it in the battle of Monmouth (June 28, 1778); the result was indecisive.

After the war New Jersey found its commercial existence threatened by New York and Philadelphia, and it was a feeling of weakness from this cause rather than any lack of State pride that caused the State to join in the movements for a closer Federal Union. In the Federal convention at Philadelphia one of the New Jersey delegates, William Paterson (1745–1800), presented what was called the "New Jersey plan" of union, representing the wishes of the smaller States, which objected to representation in a National Congress being based on wealth or on population. The New Jersey plan left its impress in the provision of the Constitution (approved in the convention on July 7) for equal representation in the national Senate. The Federal Constitution was ratified by a unanimous vote in the State convention which met at Trenton on Dec. 18, 1787.

The State's own Constitution, which had been adopted in 1776 and amended in 1777, retained a number of features of colonial Government ill-adapted to a State increasingly democratic. The basis of representation was the county rather than population; property qualifications were placed on members of the legislative council and of the assembly. These and the property qualifications for suffrage, which was granted to "all inhabitants of this State of full age, who are worth 50 lb. proclamation money, clear estate in the same," etc., were soon considered undemocratic; and the democratic tendency of certain election officers may be seen from their construing the words "all inhabitants of full age" to include women, and from their permitting women to vote.

Agitation for constitutional reform resulted in a constitutional convention, which met at Trenton from May 14 to June 29, 1844, and drafted a new frame of government, introducing a number of radical changes. This instrument was ratified on Aug. 13 at the polls. The election of the governor was taken from the legislature and given to the people; the powers of Government were distributed among legislative, executive and judicial departments; representation in the assembly was based on population; and the property qualification was abolished.

Toward the political questions that disturbed the American people immediately before the Civil War the attitude of the State was conservative, although a few vestiges of the slavery system remained until the adoption of the 13th amendment to the Federal Constitution. In 1852 the free-soil candidate for the presidency received only 350 votes in New Jersey; and in 1856 the Democratic candidate received a plurality of 18,605 votes, even though William L. Dayton, a citizen of the State, was the Republican nominee for the vice-presidency. In 1860 three of the State's electoral votes were given to Douglas and four to Lincoln. During the Civil War New Jersey furnished 89,305 men for the Union cause and incurred extraordinary expenditures to the amount of $2,894,385. The State readily consented to the 13th and 14th amendments to the Federal Constitution, but in 1868 withdrew its consent to the latter. The 15th Amendment was rejected by one legislature, but was accepted by its successor, in which the Republican Party had obtained a majority.

Industrially the early part of the 19th century was marked in New Jersey by the construction of bridges and turnpikes, the utilization of water power for manufactures, and the introduction of steam motive power upon the navigable waters. The war of 1812 with England interrupted this material progress, and at its beginning was so unpopular, especially with the Quakers, that the Federalists carried the elections in the autumn of 1812. Material progress in New Jersey after the war is indicated by the construction of the Morris (1824–36) and the Delaware and Raritan (1826–38) canals, and the completion of its first railway, the Camden and Amboy, in 1834.

In the years following the Civil War there was a bitter railway war. New Jersey, in order to encourage canals and railways, had granted monopolistic privileges to several of the earlier companies; by consolidation they had virtually gained a monopoly over the route between New York and Philadelphia. In 1871 these entire properties were leased for 999 years to the Pennsylvania Railway Company. This combination threatened to monopolize traffic, and it was opposed by several of the newer railways and by the general public; in 1873 the State passed a general railway law giving other railways than the Pennsylvania the right to connect New York and Philadelphia.

This same period was marked by great industrial development. Towards corporations the policy of New Jersey was very liberal; there was no limit fixed either to capitalization or to bonded indebtedness; and the tax rate was lower for large than for small corporations. Under this liberal policy so many large combinations of capital were incorporated under the laws of the State that it was sometimes called "the home of the trusts." This method of encouraging corporations was reversed by the passage in 1913 of a series of acts widely known as the "Seven Sisters," the purpose of which was the elimination of the power of trusts to create monopoly, limitation of production, price fixing and restraint of trade. In the meantime laws had been passed limiting public service franchises to 20 years, unless extended to 40 years by the voters of the municipality concerned. The laws governing elections were radically changed in 1911 and subsequently, by provisions extending the application of the direct primary law and providing the blanket ballot and safeguards against frauds. A proposed amendment to the State Constitution in 1915 giving women full suffrage was defeated by over 50,000 votes.

From the Civil War to 1910 the majority of governors elected were Democrats.

From 1910 to 1940, except in 1916, 1928, 1934 and 1938 the Democrats also won the gubernatorial elections although normally the legislature was Republican.

In the presidential elections after 1892 the state went Democratic only once, in 1912, before the election of 1932. In the elections of 1932, 1936 and 1940, Democrats won on the New Deal platform.

BIBLIOGRAPHY.—For descriptive material *see* bibliographies in *Bulletins* No. 177 and 301 of the United States Geological Survey; the *Annual Reports* and especially the *Final Report* of the New Jersey Geological Survey; and the *Annual Reports of the New Jersey State Museum*. For population, occupations, etc., *see* the volumes of the *Sixteenth U.S. Census;* the biennial *Census of Manufactures;* and the *Year Book* of the U.S. department of agriculture. For administration *see* Fitzgerald's *Legislative Manual* and the *Reports* of the various State departments, boards and commissions, especially the *Annual Report* of the department of public instruction.

*History.*—The most important sources are: *Documents Relating to the Colonial History of the State of New Jersey* (Archives of the State of New Jersey, 1st. series), edit. by W. A. Whitehead, F. W. Ricardo and W. Nelson (26 vol., 1880–1903); *Documents Relating to the Revolutionary History of the State of New Jersey* (Archives of the State of New Jersey, 2nd series); 5 vol., 1901–17; *Acts of the General Assembly of New Jersey* from 1703–1761, reprinted by A. Leaming and J. Spicer (1881); and *Minutes of the Provincial Congress and the Council of Safety of the State of New Jersey* (1879).

For the period of the Dutch rule, *see* L. B. O'Callaghan's *History of New Netherland* (1846); John Romeyn Brodhead's *History of the State of New York* (2nd vol., 1853, 1871); E. P. Tanner, *The Province of New Jersey* (1908), the most thorough study of the period from 1664 to 1738; Edgar J. Fisher, *New Jersey as a Royal Province 1738 to 1776* (1911), an excellent account of the closing years of the colonial period; Samuel Smith's *History of the Colony of Nova Caesarea, or New Jersey* (1765; 2nd ed., 1877), still one of the best accounts of the colonial period, and particularly valuable on account of its copious extracts from the sources, many of which are no longer accessible; *see,* also, William W. Whitehead's "The English in East and West Jersey, 1664–1689" (in vol. iii. of Justin Winsor's *Narrative and Critical History of America*), and Sydney G. Fisher, *The Quaker Colonies; a Chronicle of the Proprietors of the Delaware* (1919). Other useful contributions are A. D. Mellick, *Story of an Old Farm;* or, *Life in New Jersey in the 18th Century* (Somerville, N.J., 1889), full of interesting details; F. B. Lee and others, *New Jersey as a Colony and as a State* (4 vol., with an additional biographical volume, rather unevenly proportioned, and inaccurate as to details); C. R. Erdman, *The New Jersey Constitution of 1779* (1929), a critical study; I. S. Mulford, *Civil and Political History of New Jersey* (1851); W. A. Whitehead, *East Jersey under the Proprietary Governments* (New Jersey Historical Society *Collections,* vol. 1., 1875); W. R. Fee, *Transition From Aristocracy to Democracy in New Jersey from 1789–1829* (Somerville, 1933); W. E. Sackett, *Modern Battles of Trenton* (2 vol., 1895–1914), a political history of New Jersey from 1868 to 1913; H. E. Halford, *Woodrow Wilson and New Jersey made over* (1912); *New Jersey Politics During the Period of the Civil War and Reconstruction* (1924). *See* also the *Collections* and other publications of the New Jersey Historical society and *New Jersey* (1939) in the American Guide series, prepared by the Federal Writers' Project of WPA. (W. R. CK.)

**NEW JERSEY TEA** (*Ceanothus americanus*), a North American shrub of the buckthorn family (Rhamnaceae), called also red-root, native to dry open woods and gravelly banks from Maine to Manitoba and southward to Florida and Texas. Its low, branching stems, 1 to 3 ft. high, which spring from a dark red root, bear ovate, three-ribbed, somewhat downy, toothed leaves and attractive white flowers in umbel-like clusters. During the Revolutionary War the leaves were used as tea. (*See* CEANOTHUS.)

**NEW JERUSALEM CHURCH** or NEW CHURCH, the community founded by the followers of Emmanuel Swedenborg (*q.v.*). Swedenborg himself took no steps to found a church, but having given a new interpretation of Scripture, it was inevitable that those who accepted his doctrine should separate themselves and organize a society in accordance therewith. Those who received them fully during Swedenborg's lifetime were few and scattered, but courageously undertook the task of dissemination, and gave themselves to translating and distributing their master's writings. Two Anglican clergymen were conspicuous in this work: Thomas Hartley (d. 1784), rector of Winwick, and John Clowes (1743–1831), vicar of St. John's, Manchester. Hartley translated *Heaven and Hell* (1778) and *True Christian Religion* (1781); Clowes, who taught New Church doctrine in the existing churches and was opposed to the forming of new organizations, translated 17 volumes, including the *Arcana Coelestia,* and published over 50 volumes of exposition and defence. Through his influence Lancashire became the stronghold of the Swedenborgians.

The first organised congregation of Swedenborgians met in a church in Great Eastcheap in January 1788; and in April 1789 a General Conference of British Swedenborgians was held in Great Eastcheap Church, followed by another and by the publication of a journal, the *New Jerusalem Magazine,* in 1790. In the provinces the first church was at Birmingham (1791), followed by one at Manchester and another at Liverpool (1793). The Accrington church, the largest in Great Britain, was founded in 1802. Many of the early converts to the New Church were among the most fervent advocates of the abolition of slavery, one was the medical officer of the first batch of convicts sent to Botany Bay.

In 1815 the Conference took up the question of home missionary work, and its agents were able to found many branches of the church. In 1813 the Manchester and Salford (now the North of England) Missionary Society was founded, chiefly to provide preachers for the smaller churches in its area; in 1857 a National Missionary Institution was founded and endowed, to which most of the local ones have been affiliated. Other denominational agencies have been concerned with the printing and circulation of Swedenborgian literature, a training college for the ministry (founded in 1852), and a Ministers' Aid Fund (1854), and an Orphanage (1881). The constitution of the New Church is of the Independent Congregational type; the Conference may advise and counsel, but cannot compel the obedience of the societies. Returns for 1928 showed 70 societies with about 6,300 members.

*The New Church in Europe.*—In Sweden the Philanthropic Exegetic Society was formed by C. F. Nordenskiold in 1786 to collect documents about Swedenborg and to publish his writings. The introduction of alchemy and mesmerism led to its dissolution in 1789, but its work was continued by the society "Pro fide et charitate," which existed from 1796 to 1820. For many years the works of Swedenborg and his followers were proscribed, and receivers of his writings fined or deprived of office, but in 1866, when religious liberty had made progress, the cause was again taken up; in 1875 the society of "Confessors of the New Church" was formed in Stockholm, and propaganda has been carried on in most of the towns of Sweden, as also in Norway and Denmark. In Germany the great name is that of Immanuel Tafel (d. 1863), librarian of Tübingen, who not only edited, translated and published, but in 1848 founded a "Union of the New Church in Germany and Switzerland" which held quarterly meetings. In Switzerland, on the contrary, there is an organized body of the New Church. In France about 1838 J. F. E. Le Boys de Guays began his masterly translation of all Swedenborg's theological works; and nearly every European country has some known adherents.

*In America.*—About 1784 James Glen, a London Scot, delivered lectures in Philadelphia and Boston and circulated some of Swedenborg's works. Francis Bailey, state printer of Pennsylvania, was attracted by them and became active in their promulgation. During the next ten years a number of prominent men gave their support to the teaching, which spread inland and southward.

*In Australia, etc.*—The formation of societies in Australia began at Adelaide in 1844. Melbourne and Sydney followed in 1854, Brisbane in 1865. New Zealand has a church at Auckland (1883). Mission churches have been established in Japan, the Philippine Islands and British Guiana; and in 1910 David W. Mooki organized a Church for the natives of South Africa.

*See* L. P. Mercer, *The New Jerusalem in the World's Religious Congresses of 1893; Minutes of the General Conference of the New Church* (annual); *Journal of the Annual Session of the General Convention of the New Jerusalem in the United States of America.*

**NEW KENSINGTON,** a third-class city of Westmoreland county, Pennsylvania, U.S.A., on the Allegheny river and the Pennsylvania railroad, 18 mi. N.E. of Pittsburgh. Pop. 11,987 in 1920 (24% foreign-born white); in 1940 it had increased to 24,055. It is a coal-mining centre, and has important manufactures (including aluminium, glass, malleable iron and car springs,

conduits, plastics) with an output in 1940 valued at $35,000,000. The borough was founded in 1891, incorporated in 1892 and took on a city status in 1930.

**NEW LONDON,** a city of southeastern Connecticut, U.S.A., on the west bank of the Thames river, 3 mi. from Long Island sound; a port of entry and one of the county seats of New London county. It is on federal highway 1 and is served by the Central Vermont and the New York, New Haven and Hartford railways and by steamship lines. Pop. (1920) 25,688 (23% foreign-born white); (1940 federal census) 30,456. The city, facing southeast, lies on sloping ground which commands wide views of the sound and the surrounding country from its higher points. The fine natural harbour is a U.S. submarine base, and on Fisher's island (8 mi. S.E.) is Ft. H. G. Wright, headquarters of the Long Island sound harbour defences. At the entrance to the harbour, on either side of the river, stand Ft. Trumbull and Ft. Griswold (no longer in use). New London is a summer resort and a station of several yacht clubs. The annual boat races between Harvard and Yale are rowed on the river near the city. Among the points of special interest are the town mill (1650); the Hempstead mansion (1678); the old cemetery northeast of the city, laid out in 1653; a schoolhouse in which Nathan Hale taught; and a courthouse built in 1785. At Ft. Trumbull is the U.S. coast guard section base. The academy is in New London. The Connecticut college for women (chartered 1911) occupies 350 ac. within the city limits. Two endowed high schools and an endowed industrial school are included in the public-school system. The traffic of the harbour (which has a 1,000-ft. pier built by the state in 1917) is large and consists mainly of general merchandise. Foreign trade is represented by imports of lumber and exports of automobiles.

The city has varied manufactures.

New London was founded in 1646 by John Winthrop the younger. In 1658 the present name was substituted for the Indian "Nameaug" and the river Monhegin became the Thames.

The city was incorporated in 1784. In the 18th century New London had a large trade with the West Indies, Gibraltar and the Barbary States, but this declined after the War of 1812. It was also an important whaling and sealing port.

During the Revolution it was a rendezvous for privateers. The first naval expedition was organized in its harbour in 1776.

**NEW LONDON,** a city of Wisconsin, U.S.A., on the Wolf river, in Outagamie and Waupaca counties. It is on federal highway 45 and is served by the Chicago and North Western and the Green Bay and Western railways. Pop. (1940), 4,825. It is a dairying region and has various manufacturing industries.

**NEW MADRID,** a city and the county seat of New Madrid county, Mo., U.S.A., on the right bank of the Mississippi river, about 35 mi. S. by W. of Cairo, Ill. Pop. (1930) 2,309; (1940) 2,450. It is served by the St. Louis Southwestern railway and by river barges. The city is a shipping point for a rich grain, cotton, livestock and lumber region. Among its manufactures are lumber, staves and hoops. The municipality owns its waterworks. Owing to the encroachments of the Mississippi river, the site of the first permanent settlement of New Madrid is said to lie now about 1½ mi. from the east bank of the river, in Kentucky. This settlement was made in 1788, on an elaborately laid out townsite, and was named New Madrid by its founder, Col. George Morgan (1742–1810), who, late in 1787, had received a grant of a large tract of land on the right bank of the Mississippi river from Don Diego de Gardoqui, Spanish minister to the United States. The tract lay within the province of "Louisiana," and the grant to Morgan was a part of Gardoqui's plan to annex to that province the western American settlements. Earthquake shocks in 1811 and 1812 caused a general emigration.

New Madrid was occupied by Confederate troops under Gen. Gideon J. Pillow, on July 28, 1861, and after the surrender of Ft. Donelson (Feb. 16, 1862) the troops previously at Columbus, forming the Confederate left flank, were withdrawn to New Madrid and Island No. 10 (in the Mississippi about 10 m. S.). Early in March, Major-General John Pope and Commodore A. H. Foote proceeded against the positions on the left bank; New Madrid, then in command of Gen. John P. McGown, was evacuated on the 14th; (Admiral) Henry Walke (1808–96), commanding the "Carondelet," ran past the batteries of Island No. 10 and the shore batteries on April 4, and Lieutenant-Commander Egbert Thompson, commanding the "Pittsburgh," on the 7th; meanwhile the Federals under the direction of Col. Josiah W. Bissell (b. 1818), of the engineer corps, had, with great difficulty, constructed an artificial channel to New Madrid across the peninsula (swamp land) formed by a great loop of the Mississippi; troops were conveyed by transports through this channel below the island, Federal batteries having been established on the right bank of the river; the retreat of the Confederates down stream was effectually blocked; they evacuated the island on April 7, and on the 8th the garrison and the forces stationed in the shore batteries, a total of about 7,000, under Gen. W. W. Mackall, was surrendered at Tiptonville.

**NEWMAN, FRANCIS WILLIAM** (1805–1897), English scholar and miscellaneous writer, younger brother of Cardinal Newman, was born in London on June 27, 1805. He was educated at Ealing, and at Oxford, where he was elected fellow of Balliol in 1826. Conscientious scruples respecting the ceremony of infant baptism led him to resign his fellowship in 1830, and he went to Baghdad as assistant in the mission of the Rev. A. N. Groves. In 1833 he returned to England on behalf of the mission, but finding himself suspected of heterodoxy, he became classical tutor in an unsectarian college at Bristol. In 1846 he became professor in University college, London, where he remained until 1869. In 1847 he published anonymously a *History of the Hebrew Monarchy.* In 1849 appeared *The Soul, her Sorrows and Aspirations,* and in 1850, *Phases of Faith, or Passages from the History of my Creed*—the former a tender but searching analysis of the relations of the spirit of man with the Creator; the latter a religious autobiography detailing the author's passage from Calvinism to pure theism. It is on these two books that Prof. Newman's fame rests, though he was a versatile writer on many subjects. His last publication, *Contributions chiefly to the Early History of Cardinal Newman* (1891), was severely criticised. He died at Weston-super-Mare on Oct. 7, 1897. *See* T. G. Sieveking, *Memoir and Letters of Francis W. Newman* (1909).

**NEWMAN, JOHN HENRY** (1801–1890), English cardinal and leader of the Tractarian movement, was born in London on Feb. 21, 1801, the eldest son of John Newman, banker, of the firm of Ramsbottom, Newman and company. At the age of seven Newman was sent to a private school conducted by Dr. Nicholas at Ealing. At the age of 15 he was conscious of an "inward conversion," an incident which throughout life remains "more certain than that he had hands or feet." In 1816 he matriculated at Trinity college, Oxford. After graduation in 1821 he took pupils and read for a fellowship at Oriel, to which he was elected in 1822. Two years later he was ordained in the Anglican ministry and became curate of St. Clement's, Oxford. For a year he was vice-principal of the St. Alban's hall, but in 1826 he became tutor at Oriel. In 1827 he was appointed vicar of St. Mary's (to which was attached the chapelry of Littlemore) and in 1831–32 was select preacher before the university. In 1832 a difference with Hawkins, provost of Oriel, on the "substantially religious nature" of a tutorship, led to his resignation from that post. He then went for a tour on the Mediterranean with R. H. Froude, but at that time was still strongly Protestant in his views, as his comments on his stay in Rome show. During this tour he wrote many of the poems in the *Lyra Apostolica,* and "Lead, Kindly Light."

**Tractarian Movement.**—He was at home again in Oxford on July 9, 1833, and on the 14th Keble preached at St. Mary's an assize sermon on "National Apostasy," which Newman afterwards regarded as the inauguration of the Oxford movement. In the words of Dean Church, it was "Keble who inspired, Froude who gave the impetus and Newman who took up the work"; but the first organization of it was due to H. J. Rose, editor of the *British Magazine,* who has been styled "the Cambridge originator of the Oxford movement." It was in his rectory house at Hadleigh, Suffolk, that a meeting of High Church clergymen was held, July 25–29 (Newman was not present), at which it was resolved

to fight for "the apostolical succession and the integrity of the Prayer-Book." A few weeks later, Newman started, apparently on his own initiative, the *Tracts for the Times,* from which the movement was subsequently named "Tractarian." Its aim was to secure for the Church of England a definite basis of doctrine and discipline, in case either of disestablishment or of a determination of High Churchmen to quit the establishment. The teaching of the tracts was supplemented by Newman's Sunday afternoon sermons at St. Mary's, the influence of which was very great during the next eight years. In 1835 Pusey joined the movement, which, so far as concerned ritual observances, was later called "Puseyite"; and in 1836 its supporters secured further coherence by their united opposition to the appointment of Hampden as regius professor of divinity. His Bampton lectures (in the preparation of which Blanco White had assisted him) were suspected of heresy, and this suspicion was accentuated by a pamphlet put forth by Newman, *Elucidations of Dr. Hampden's Theological Statements.*

At this date Newman became editor of the *British Critic,* and he also gave courses of lectures in a side chapel of St. Mary's in defense of the *via media* of the Anglican Church as between "Romanism" and popular Protestantism. His influence in Oxford was supreme about the year 1839, when, however, his study of the monophysite heresy first raised in his mind a doubt as to whether the Anglican position was really tenable on those principles of ecclesiastical authority which he had accepted; and this doubt returned when he read, in Wiseman's article in the *Dublin Review* on "The Anglican Claim," the words of St. Augustine against the Donatists, *securus iudicat orbis terrarum,* words which suggested a simpler authoritative rule than that of the teaching of antiquity. He continued his work, however, as a High Anglican controversialist until he had published, in 1841, *Tract 90,* the last of the series, in which he put forth, as a kind of proof charge, to test the tenability of all Catholic doctrine within the Church of England, a detailed examination of the XXXIX Articles, suggesting that their negations were not directed against the authorized creed of Roman Catholics, but only against popular errors and exaggeration. This theory, though not altogether new, aroused much indignation in Oxford, and, at the request of the bishop of Oxford, the publication of the *Tracts* came to an end. At this date Newman also resigned the editorship of the *British Critic,* and was thenceforth, as he himself later described it, "on his deathbed as regards membership with the Anglican Church." He now concluded that the position of Anglicans was similar to that of the semi-Arians in the Arian controversy; and the arrangement made at this time that an Anglican bishopric should be established in Jerusalem, the appointment to lie alternately with the British and Prussian governments, was to him further evidence of the nonapostolical character of the Church of England. In 1842 he withdrew to Littlemore, and lived there under monastic conditions with a small band of followers, their life being one of great physical austerity as well as of intense reflection and prayer. To his disciples there he assigned the task of writing lives of the English saints, while his own time was largely devoted to the completion of an essay on the development of Christian doctrine, by which principle he sought to establish the identity of the teachings of the Christian Church throughout the centuries with those of the Roman Catholic Church. In Feb. 1843 he published, as an advertisement in the *Oxford Conservative Journal,* an anonymous but otherwise formal retractation of all the hard things he had said against Rome; and in September, after the secession of one of the inmates of the house, he preached his last Anglican sermon at Littlemore and resigned the living of St Mary's.

**Reception into the Catholic Church.**—But still an interval of two years elapsed before he was formally received into the Roman Catholic Church (Oct. 9, 1845) by Father Dominic, an Italian Passionist. In Feb. 1846 he left Oxford for Oscott, where Bishop Wiseman, then vicar-apostolic of the Midland district, resided; and in October he proceeded to Rome, where he was ordained priest. Four years later, he was given the degree of D.D. by the pope, *honoris causa.* At the close of 1847 he returned to England as an Oratorian, and resided first at Maryvale (near Oscott); then at St. Wilfrid's college, Cheadle; then at St. Ann's, Alcester street, Birmingham; and finally at Edgbaston, where spacious premises were built for the community, and where (except for four years in Ireland) he lived a secluded life for nearly 40 years. Before the house at Edgbaston was occupied he had established the London Oratory, with Father Faber as its superior. In 1850, at the Corn exchange in Birmingham, he delivered a course of lectures on "The Present Position of Catholics in England," in the fifth of which he protested against the anti-Catholic utterances of Dr. Achilli, an ex-Dominican friar, whom he accused in detail of numerous acts of immorality. Popular Protestant feeling ran very high at the time, partly in consequence of the recent establishment of a Roman Catholic diocesan hierarchy by Pius IX, and criminal proceedings against Newman for libel resulted in an acknowledged gross miscarriage of justice. He was found guilty, and was sentenced to pay a fine of £100, while his expenses as defendant amounted to about £14,000, a sum that was at once raised by public subscription, a surplus being spent on the purchase of Rednall, a small property on the Lickey hills, with a chapel and cemetery, where Newman is buried.

In 1854, at the request of the Irish bishops, Newman went to Dublin as rector of the newly-established Catholic university there. But conditions were not favourable and complications became so great that after four years he retired, the happy outcome of his stay there being a volume of lectures entitled *Idea of a University,* containing some of his most effective writing. In 1858 he projected a branch house of the Oratory at Oxford; but this was opposed by Manning and others, as likely to induce Catholics to send their sons to that university, and the scheme was abandoned. In 1859 he established, in connection with the Birmingham Oratory, a school for the education of the sons of gentlemen on lines similar to those of the English public schools, an important work in which he never ceased to take the greatest interest. But all this time (since 1841) Newman had been under a cloud, so far as concerned the great mass of cultivated Englishmen, and he was now awaiting an opportunity to vindicate his career. In 1862 he began to prepare memoranda for the purpose.

**Works.**—The occasion came when, in Jan. 1864, Charles Kingsley, reviewing Froude's *History of England* in *Macmillan's Magazine,* incidentally asserted that "Father Newman informs us that truth for its own sake need not be, and on the whole ought not to be, a virtue of the Roman clergy." After some preliminary sparring between the two, Newman published, in weekly parts, his *Apologia pro vita sua,* a religious autobiography of unsurpassed interest, the simple confidential tone of which "revolutionized the popular estimate of its author," establishing the strength and sincerity of the convictions which had led him into the Roman Catholic Church.

In 1870 he put forth his *Grammar of Assent,* the most closely reasoned of his works, in which the case for religious belief is maintained by arguments differing somewhat from those commonly used by Catholic theologians; and in 1877, in the republication of his Anglican works, he added to the two volumes containing his defense of the *via media* a long preface and numerous notes in which he criticized and replied to sundry anti-Catholic arguments of his own in the original issues. At the time of the Vatican Council (1869–70) he thought the time inopportune for a definition of Papal infallibility, and in a private letter to his bishop (Ullathorne), surreptitiously published, he denounced the "insolent and aggressive faction" that had pushed the matter forward. But he made no sign of disapproval when the doctrine was defined, and subsequently, in a letter nominally addressed to the duke of Norfolk on the occasion of Mr. Gladstone's accusing the Roman Church of having "equally repudiated modern thought and ancient history," Newman affirmed that he had always believed the doctrine, and had only feared the deterrent effect of its definition on conversions on account of acknowledged historical difficulties.

In 1878 his old college (Trinity), to his great delight, elected him an honorary fellow, and he revisited Oxford after an interval of 32 years. At the same date died Pius IX. His scholarly suc-

cessor and illustrious patron of education, Leo XIII, was encouraged by the duke of Norfolk and other distinguished Roman Catholic laymen to make Newman a cardinal, the distinction being a marked one, because he was a simple priest and not resident in Rome. The offer was made in Feb. 1879, and the announcement of it was received with universal applause throughout the English-speaking world. The "creation" took place on May 12, with the title of St. George in Velabro, Newman taking occasion while in Rome to insist on the lifelong consistency of his opposition to "liberalism in religion." After an illness that excited apprehension he returned to England, and thenceforward resided at the Oratory until his death, Aug. 11, 1890, making occasional visits to London, and chiefly to his old friend, R. W. Church, dean of St. Paul's, who as proctor had vetoed the condemnation of *Tract 90* in 1841.

Newman's influence as controversialist and preacher was very great. Some hundreds of clergymen, influenced by the Tractarian movement of which for 10 or 12 years he was the acknowledged leader, made their submission to the Church of Rome. And the influence continued to be felt. Practically all English converts since 1845 partly attribute their conversion to Newman. Newman's works were translated into several European languages. The accompanying schools of thought, the "Credo in Newmanum," were especially characteristic of France and Germany before Sept., 1939. The attempts of the "Modernists" to make a protagonist of Newman failed, as is evident from Pius X's letter to Bishop O'Dwyer and from the tribute paid to Newman by Pius XI. Many anthologies from his writings appeared, especially in the United States, where, too, a large number of societies, etc., were named in his honour. Several of his works were edited for collegiate study, and similarly his sermons as homiletical models. Passages from his devotional writings were adapted to the form of petition and published as Newman prayerbooks. A movement was started to promote his being declared "Venerable," the first process towards canonization. Newman had a vivid sense of man's personal relationship with God. As he expressed it . . . "alone with the Alone," two beings in all creation, God and himself. All else was a reflection of the Supreme Being. His sincerity of purpose was acknowledged by the English people slowly but in the end generously, in their happiness over his being chosen a cardinal. He was a man of magnetic personality, with an intense belief in the apostleship of his own career; and his character may be described as strong, with an almost feminine sensitiveness to impressions. As a poet he had inspiration and genuine power. "The Dream of Gerontius" is generally recognized as a masterpiece. His prose style is fresh and vigorous.

There is at Oxford a bust of Newman by Woolner. His portrait by Ouless is at the Birmingham Oratory, and his portrait by Millais is in the possession of the duke of Norfolk, a replica being at the London Oratory. Outside the latter building, facing Brompton road, is a marble statue of Newman as cardinal.

BIBLIOGRAPHY.—The early authorities for Newman's life are his *Apologia* and the *Letters and Correspondence* edited by Miss Mozley. The letters and memoranda dealing with the years 1845–90 were entrusted by Newman to the Rev. W. Neville as literary executor. These were used in the authoritative work, *The Life of John Henry Cardinal Newman,* 2 vol. (1912; 3rd ed., 1927), by W. P. Ward. T. Mozley, *Reminiscences chiefly of Oriel College, and the Oxford Movement,* 2 vol. (1882); R. W. Church, *The Oxford Movement, Twelve Years, 1833–1845* (1891); and R. H. Hutton, *Cardinal Newman* (1891), should be consulted. *See* also *Cardinal Newman's Works,* 40 vol. (with index by J. Rickaby, 1874–1921); P. Thureau-Dangin, *La Renaissance Catholique en Angleterre au XIX^e siècle,* 3 pt. (1899–1906; trans. and rev. by W. Wilberforce, 2 vol., 1914); L. Félix Faure, *Newman, Sa vie et ses oeuvres* (1901); G. Grappe, *J. H. Newman, Essai de psychologie religieuse* (1902); C. J. Blennerhasset, *John Henry Kardinal Newman* (1904); W. Barry, *Cardinal Newman* (1904; rev. ed., 1927); H. Brémond, *Newman,* 3 vol. (1905–06); J. J. Toohey, *An Indexed Synopsis of the Grammar of Assent* (1906); E. Przywara, *Einführung in Newmans Wesen und Werk.* Vol. IV of *Christentum* (1922); N. J. D. White, *John Henry Newman* (1925); B. Newman, *Cardinal Newman* (1925); J. J. Reilly, *Newman as a Man of Letters* (1925); J. D. Folghera, *Newman Apologiste* (1927); trans. by P. Hereford as *Newman's Apologetic* (1929); F. J. Friedel, *The Mariology of Cardinal Newman* (1928); S. P. Juergens, *Newman on the Psychology of Faith in the Individual* (1928); J. L. May, *Cardinal Newman* (1929); W. Meynell, *Cardinal Newman* (1930); C. Dawson, *The Spirit of the Oxford Movement* (1933); J. E. Ross, *John Henry Newman* (1933); J. A. Elbert, *The Evolution of Newman's Concept of Faith Prior to 1845; a Genetic Presentation and Synthesis* (1933); J. M. Flood, *Cardinal Newman and Oxford* (1933); W. F. P. Stockley, *Newman, Education and Ireland* (1933); H. Tristram, *Newman and His Friends* (1933); S. Dark, *Newman* (Great Lives Series, 1934); W. R. Lamm, *The Spiritual Legacy of Newman* (Religion and Culture Series, 1934); T. Corcoran, *Newman: Selected Discourses on Liberal Knowledge, with an Introduction* (1935); F. R. Cronin, *Cardinal Newman: his Theory of Knowledge* (1935); D. P. Sobry, *Newman en zijn "Idea of a University"* (1935); F. Tardivel, *La personnalité littéraire de Newman* (1937); S. Leslie, "Cardinal Newman," in *Great Catholics,* ed. C. C. H. Williamson (1938); C. F. Harrold (ed.), *A Newman Treasury* (1943). Adverse criticism will be found in the writings of E. A. Abbott (*e.g., The Anglican Career of Cardinal Newman,* 1892).

(A. W. HU.; D. OL.)

**NEWMARKET,** a market town 13½ mi. N.E. of Cambridge, England, on the Bury branch of the L.N.E.R. Pop. of urban district (1938) 9,207, and of rural district (1938) 18,820. Area of former, 8.6 sq.mi. For administrative and parliamentary purposes the town and urban district are in West Suffolk, though the rural district is in Cambridgeshire. Newmarket has been celebrated for its horse races from the time of James I, though at that time there was more coursing and hawking. Charles I instituted the first cup race there. The racecourse, which lies S.W. of the town, has a full extent of 4 mi., but is divided into different lengths to suit various races. It intersects the Devil's Ditch or Dyke (sometimes also known as St. Edmund's Dyke), an earthwork consisting of a ditch and mound about 7½ mi. long. It starts southeast of the Swaffham-Burwell road, and the ditch has a depth of 15 ft., the slope from the top of the dyke to the bottom of the ditch measures 62 ft., while the over-all breadth of dyke and ditch is 37 yards. It is surmised that it belongs to the Iron age, and that the builders were the Iceni. Roman remains have been found in the neighbourhood, and in later times the dyke formed part of the boundary of East Anglia. (*See* C. Fox, *Archaeology of the Cambridge Region,* 1923.)

**NEW MEXICO,** popularly known as the "Sunshine" state, is situated in the southwestern part of the United States between 31° 20′ and 37° N. lat., and 103° and 109° W. longitude. It is bounded north by Colorado; east by Oklahoma and Texas; south by Texas and the republic of Mexico; and west by Arizona. It has an extreme length north and south of 400 mi., and extreme width east and west of 358 mi. and a total area of 121,666 sq.mi., of which 155 sq.mi. are water surface.

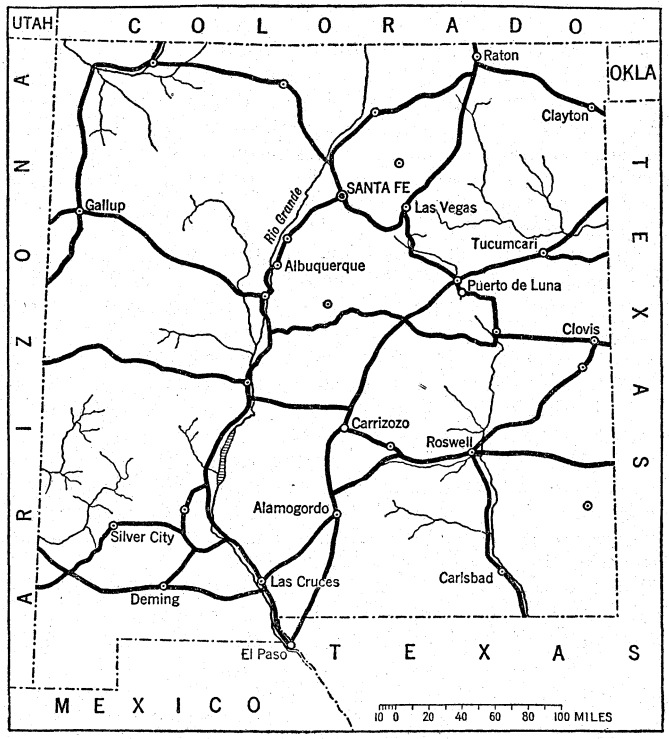
**Physical Features.**—The borders of the state are characterized by high plateaus cut by deep canyons, while in the central part faulted mountains surround comparatively level areas filled with alluvial deposits. Between the Rio Grande and the Pecos valley the mountains form a more continuous range than on the west side of the river where the elevated areas form the main continental divide. The Sangre de Cristo mass is a part of the Colorado mountains which extend into New Mexico slightly east of the north central part of the state and east of the Rio Grande. South of this northern mass two series of ridges extend to the southern boundary: the one near the Rio Grande, called in places from north to south the Sandía, the Manzano, the San Andrés, the Oscura and the Organ mountains; while the eastern group consists of the Hills of Pedernal, the White, the Sacramento and the Guadalupe mountains.

On the west side of the Rio Grande the San Juan mountains dominate the country north of the Chama river. A second somewhat smaller mass lies between the Chama and the Jemez river, the Jemez mountains. Across the Puerco the Mount Taylor mountains carry the main divide in a southwestern direction to the Zuñi mountains, which are continued farther south in one of the largest mountain masses of the state, the Mogollons, with the San Mateo and the Magdalena as outlying ridges in the direction of the Rio Grande, and the Black Range forming the southeastern part. In the extreme southwestern part of the state the western mountains terminate in several parallel ridges; the Burro, the Pyramid, the Big Hatchet and the Peloncillo mountains.

The major divides following the tops of the ranges and high plateaus run generally north and south. Of the most important

there may be mentioned the divides between the Pecos and the Canadian valleys; between the Pecos and Tularosa valleys; between the Tularosa and the Rio Grande; and between the Rio Grande and the San Juan, Little Colorado and Gila valleys.

The rivers are the only important bodies of water that make up a part of the physiography of the State. In the north-eastern part of the State, in Union county, two of the branches of the




MAP SHOWING THE MAIN ROADS IN NEW MEXICO

Arkansas river have their sources. These are the Cimarron and the North Canadian rivers. A third branch of the Arkansas, the Canadian, flows through Colfax, Mora, San Miguel and Quay counties. As the Canadian drains the eastern part of the Sangre de Cristo Range, so the Pecos river receives the water from the southern part of the range and flows in a southerly direction across the State. The Rio Grande is the only important river in New Mexico that does not have its source within the State. It enters New Mexico in a deep canyon a short distance to the east of the 106 meridian, and flows south through the centre of the State. On the western side of the continental divide the principal rivers are the San Juan, Little Colorado and Gila, tributaries of the Colorado which flows to the Gulf of California.

The principal characteristics of the soils of New Mexico are: a large amount of mineral matter; a small amount of organic matter; deep soils; and a marked degree of productivity when irrigated.

**Climate.**—The winter rainy season is created by comparatively dry westerly winds blowing from the Pacific, coming into New Mexico from the north-east and north-west. In the summer the place of these winds is taken by a monsoon wind from the south, south-west or south-east. When they reach the mountainous districts of New Mexico they are cooled. This results in giving New Mexico a summer period of sub-tropical monsoon rains. The average rainfall for the State is about 15 in. annually. On some sections of the southern plains it is as low as 6 in. while in the mountain districts of the north it rises to 25 or 30 inches. The skies are generally clear and sunshine is abundant; the days are warm but the nights are cool. At Santa Fe, where the mountains and plains meet, the mean annual temperature is 48·8° F; the mean for the winter is 30·9° and for the summer 67°; and the highest and lowest temperatures ever were 97° and −13°.

**Flora and Fauna.**—The physiographical conditions of New Mexico determine, in a measure, the distribution of plants and animals. Six life zones are represented in the State, due to variation in altitude which is a striking characteristic of mountainous areas. The Lower Sonoran is the zone of mesquite, occupying the valleys of the southern part of the State. For agricultural purposes it is the most important of the zones, due to the long growing period and the high temperatures. The woody plants of this region include the creosote bush, the Spanish bayonet, the screw bean, the desert willow, and valley cottonwood. Cactuses in a variety of species are a part of the flora of this zone.

Among the mammals there are a number of species of rats, mice, squirrels, rabbits, skunks and bats. There are also the jaguar, the New Mexico desert fox, the Mearns coyote, the Mexican badger and the New Mexico weasel. The birds are numerous.

The Upper Sonoran, the largest of the zones, ranks first in economic wealth. It embraces the grazing lands that include about three-fourths of the State, or 92,000 square miles. The grasses that give this zone its value are the grama, the galleta, buffalo and porcupine. Several species of deer, coyotes, antelopes, wolves, prairie dogs and mountain sheep are common to the area.

The Transition zone, covering about 10,000 sq.m., is the section of the State important for timber. Very little agriculture is carried on, but there is good range for stock. The Merriam elk, Rocky mountain lion, Mexican mountain lion, the mountain bobcat, mountain coyote, Mexican wolf, black bear, grizzly bear, otter and mink are found in this zone.

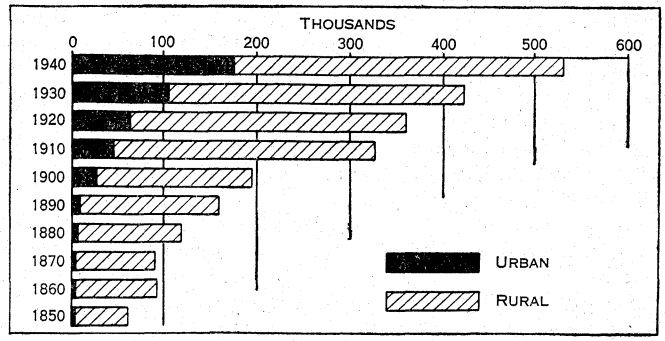
The Canadian zone is about one-fifth the size of the Transition. Its importance lies in the water-supply that it stores for the regions of lower altitude. Its lowest parts on the cold slopes are at an altitude of 8,500 feet. The trees found are the Bristol cone pine, the western white pine, Douglas spruce and the balsam.

The Hudsonian is a very narrow zone along the timber line on the upper slopes of the high mountains with an area of 300 square miles. The trees and shrubs include the Siberian juniper, Englemann's fir, Parry's fir, several species of currants and sedges. The mammals are few, being mountain sheep, Rocky Mountain woodchuck, the grey and dusky rock cony.

The Arctic-Alpine is the smallest of the life zones represented in New Mexico. The area is above the timber line, at about 12,500 feet. Among the plants are the Colorado poppy, several species of saxifrages, sedges and rushes, the dwarfed closed gentian, alpine larkspur, alpine sagebrush. Few mammals enter the region.

**Population.**—The population of New Mexico in 1850 was 61,547; in 1880, 119,565; in 1910, 327,301; and in 1940, 531,818. This last figure represents an increase of 25·6% over the population in 1930.

The population per square mile was 4·4, as compared with 44·2 for the United States as a whole. Of the 1940 population, 176,401, or 33·2%, lived in urban places, that is, in cities, towns and villages of 2,500 or more. The number of occupied dwelling units




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF NEW MEXICO, 1850–1940

returned in the housing census of 1940 was 129,504, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 4·3 in 1930 to 4·1 in 1940.

The white population of New Mexico formed 92·5% of the total in 1940, as compared with 92·4% in 1930, practically all the nonwhite population being Indians.

The number of males per 100 females in the entire population

of the state was 105, though there was a slight excess of females in the urban population, the sex ratio being 98·8 for the urban population and 108·2 for the rural. The population of the state and of its principal cities is summarized for recent censuses in the following table:

| Area | Population | | | Percent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 531,818 | 423,317 | 360,350 | 25·6 | 17·5 |
| Urban | 176,401 | 106,816 | 64,960 | 65·1 | 64·4 |
| Rural | 355,417 | 316,501 | 295,390 | 12·3 | 7·1 |
| Percent urban | 33·2 | 25·2 | 18·0 | .. | .. |
| Principal cities: | | | | | |
| Albuquerque | 35,449 | 26,570 | 15,157 | 33·4 | 75·3 |
| Santa Fe | 20,325 | 11,176 | 7,236 | 81·9 | 54·4 |

The Indians of New Mexico constitute an interesting part of the population. They consist of two types: the nomadic Indians who have been settled on reservations by the U.S. Government; and the Pueblo Indians, who live a communal life which was well established long before the Spanish came to the New World. There are 18 subdivisions of the latter group living mainly in the Rio Grande valley.

**Government.**—With slight amendments the constitution adopted in 1911 remains the basis of the state government. Amendments may be proposed by a majority of the members in each house and must then be voted upon by the people at the next general election or a special election called not less than six months after adjournment of the legislature.

The state legislature is composed of a senate and house of representatives having 24 and 49 members respectively. Regular sessions are held in odd-numbered years, beginning the second Tuesday in January. By constitutional amendment in 1939 the legislature meets in two 30-day sessions with an intersession of 30 days. Special sessions not to last over 30 days may be called by the governor but must confine their business to specific matters mentioned in the governor's proclamation. Representatives are elected for two years and senators for four years, the latter, contrary to the practice in most states, being all elected at one time. The governor possesses a veto power which can be overridden by a two-thirds vote of the legislative members present and voting in each house. The people of New Mexico possess the referendum privilege.

A direct primary system was established in 1938. In the national congress the state is represented by two senators and by two representatives under the 1940 reapportionment.

The constitution provides for 11 elective administrative officers, namely, governor, lieutenant governor, secretary of state, auditor, treasurer, attorney-general, commissioner of public lands, superintendent of public instruction and three corporation commissioners, all serving two years. They may succeed themselves for one term but are not afterwards eligible for re-election until a two-year period has elapsed, except the lieutenant governor who may succeed himself indefinitely. State boards and commissions number about 75.

More recent bodies include a labour and industrial commission, 1931; state police, 1933; tourist bureau, 1935; department of public welfare, 1937.

A supreme court holds one session a year, which lasts as long as the justices think proper, trying cases appealed from the lower courts.

There are five supreme court justices elected one at a time for terms of eight years each. There are nine district courts (but ten judges) holding two regular sessions each year at the county seat. The district judge is elected for six years. There are probate courts in each county and justices of the peace in each precinct.

**Finance.**—The cost of state government more than doubled in the decade 1928 to 1938, expenditures increasing from $9,654,057, to $22,300,354; state and local expenditures totalled $35,785,968.

The assessed value of property subject to taxation was about the same after a mid-decade decline, $316,468,567 in 1928 and $312,442,485 in 1938.

The adoption of a constitutional amendment limiting property taxation to 20 mills made necessary a sales tax in 1935, a severance tax in 1937, and a compensating tax in 1939.

In 1938 the state debt was $6,942,880 (chiefly highway debentures) and the total revenue receipts were $22,971,399, including $4,506,493 from the gasoline tax, $3,649,569 sales tax, $3,484,633 federal road aid and $3,522,619 lands income.

In the year 1940 there were 41 banks in the state (22 of them national banks) with total deposits of $60,148,000.

**Education.**—Previous to 1891 when the general public school system of New Mexico was established, education was carried on mainly by private and religious agencies which established mission schools and academies. Progress in the public school system was slow from 1891 until 1911 when statehood was granted, but has been rapid since, as is shown by the increase in expenditures for public schools.

The governing authority of the public school system is the state board of education consisting of the governor, the superintendent of public instruction, who is elected for two years, and five members, who are appointed by the governor. During the period 1928–29 to 1937–38, enrolment increased from 98,752 to 129,877; expenditures from $7,497,762 to $9,001,045; and property valuation from $11,903,744 to $15,635,022. There were, in 1937–38, 1,280 schools; 988 school buses were operated at a cost of $864,626. Free basal elementary textbooks were introduced in 1931, and there has been increased emphasis on vocational training and on art and music. Teachers must have a minimum of one year college work; their average annual salary is $842 in the rural schools and $1,244 in the city.

The University of New Mexico, with its distinctive buildings in the Indian Pueblo type of architecture, is situated on a mesa about a mile from and overlooking the city of Albuquerque. Its attendance increased from 235 in 1915 to 1,700 in 1940, its faculty members from 21 to 110 and its buildings from 8 to 18 in number. The State School of Mines, located at Socorro, had an enrolment of 170 students and a teaching staff of 13 members in 1939. The College of Agriculture and Mechanic Arts near Las Cruces, in the fertile Mesilla valley, had a staff of 96 members and an enrolment of 900 students. The New Mexico agricultural experiment station is a part of the institution. The New Mexico Military institute at Roswell, a school of high rating, is also supported in part by state funds. It offers a course of work covering the four years of high school and first two years of college. The New Mexico Normal university at Las Vegas contains a training school, a high school department and a four year normal department. Similar in organization is the New Mexico Teachers' college at Silver City.

At El Rito is a Spanish-American normal school designed to instruct teachers for the Spanish districts. The Eastern New Mexico Normal was established at Portales in 1934.

**Charities and Corrections.**—The state supports a penitentiary, established at Santa Fe in 1884, and a prison farm of 2,000 ac. acquired in 1939 for outdoor rehabilitation; a hospital for the insane at Las Vegas, established in 1889; a school for the blind, Alamogordo, 1903; a school for the deaf, Santa Fe, 1903; a miners' hospital at Raton, 1903; an industrial school for boys, originally established at El Rito in 1903 and moved to Springer in 1909; a girls' welfare home, Albuquerque, 1919; a school for mental defectives, Los Lunas, 1925; and the Carrie Tingley Crippled Children's hospital, Hot Springs, 1937.

**Agriculture and Livestock.**—The area east of the Rio Grande valley contains about four-fifths of the crop land harvested in the state. The valley and region to the west has an acreage of about 330,827, principally in the middle Rio Grande valley and Catron county northward.

In Curry, Roosevelt, Quay, Harding, Union and Colfax counties an average rainfall of 14·3 in. (1914–34) permits of considerable dry farming, while over the rest of the state crops are dependent almost entirely upon irrigation and confined to those river valleys where it is practicable: the Rio Grande, Pecos, San Juan, Gila, Canadian and their tributaries.

The total farm land (stock and crop) increased from 30,822,034 ac. in 1930 to 38,860,427 ac. in 1940. About 37% of the crop land is farmed by owners, and about 26% by tenants. The value of all farm land and buildings decreased during the decade from $207,859,492 to $187,525,814.

The estimated value of the major crops in 1940 was $19,470,000; the total crop land, including minor crops, was 1,372,200 ac. For the period from 1929 to 1938 the average acreage for leading crops was: grain sorghums, 314,000; wheat, 260,000; corn, 207,000; dry beans, 153,000; cotton, 114,000. The average annual production: grain sorghums, 3,348,000 bu. or 10·3 bu. per acre; wheat, 2,921,000, and 9·9; corn, 2,847,000 and 13·6; dry beans, 542,000 bags and 343 lb. per acre; and cotton, 99,000 bales, 420 lb. per acre.

The leading cash crop is cotton; in 1940 it was valued at $5,966,000 in lint and $1,238,000 in cottonseed. For the same year tame hay was valued at $2,848,000; dry beans, $1,589,000; grain sorghums, $1,544,000; corn, $1,473,000; and wheat, $1,118,000, a severe drop from the previous year, when 3,782,000 bu. were harvested at a value of $2,647,000. Minor crops were: potatoes, $365,000; oats, $254,000; and barley, $140,000. Apples to the amount of 700,000 bu. were raised; peaches, 120,000 bu. and 1,270 tons of grapes.

The chief farm animals in New Mexico are horses, mules, cattle, sheep and hogs. Their total average value for the years 1929 to 1938 was $52,945,000, and in 1940, $66,170,000. The number of horses and mules declined steadily during the period; they averaged respectively 146,000 and 20,000 head, but in 1940 numbered only 125,000 and 14,000. The average number of cattle for the period was 1,252,000, at an average value of $26.71 per head; in 1940 the number was 1,276,000, worth $45,085,000. Sheep averaged 2,608,000 at $5.10 per head; in 1940 2,433,000 were worth $14,025,000. Hogs averaged 68,000 at $8.02, but were estimated at 110,000 in 1940 (a record number) worth $765,000.

Milk cows and heifers increased from 71,000 in 1931 to 79,000 in 1940, valued at $3,476,000. The major portion of the cattle are still raised on large ranches for beef purposes. Ranches average from 60 to 80 sections in size but very little of the land (10% to 25%) is owned by the rancher himself. About half is leased from the National Forest service, from private owners (often homesteaders who have failed), or from the railways or the state. In the southwestern counties about 25% is public domain, and in the south-central counties about 40%. Sheep and cattle are raised all over the state with cattle more evenly distributed.

Five counties, San Juan, McKinley, Lincoln, Chaves and Lea, have more than 100,000 sheep.

The cash farm income for 1940 was $14,217,000 from crops and $40,723,000 from livestock and products, a total of $54,940,000; $4,652,000 in government payments made a grand total income of $59,592,000.

**Mining.**—Though New Mexico was once an important silver-producing state, the 20th century brought an increased demand for the baser metals, especially copper, zinc and lead, and capital was drawn to their production. Showing a steady increase in output and value after the depression of 1921 copper became the leading mineral in 1925, its production amounting, four years later, to 97,717,262 lb. valued at $17,198,238, then declining in 1938 to 40,878,000 lb. worth $4,006,044. About 99% of the copper is mined in Grant and Hidalgo, chiefly from the Chino Copper company's operations in the Central district and from the 85 mines in the Lordsburg district. Zinc production increased from 228,000 lb. valued at $11,400 in 1921 to 68,910,000 lb., worth $4,548,060 in 1929, then declined to 56,472,000 lb. valued at $2,710,656 in 1938. Lead production varied from 20,000,000 to 22,000,000 lb. from 1929 to 1933, then declined in 1938 to 9,898,000 lb. worth $455,308. The silver and gold mined in 1938 amounted in value to $795,061 and $1,506,750 respectively.

Coal production declined steadily from 3,709,000 tons in 1913 to 1,263,000 tons in 1932, then rose to 1,715,000 tons in 1937. The greatest advance was in petroleum production, because of the discovery of oil fields in Lea county.

New Mexico ranked 17th among oil-producing states in 1929, but ranked sixth in 1934, dropping to seventh place in 1939. Peak production was attained in 1937, with 38,854,000 bbl.

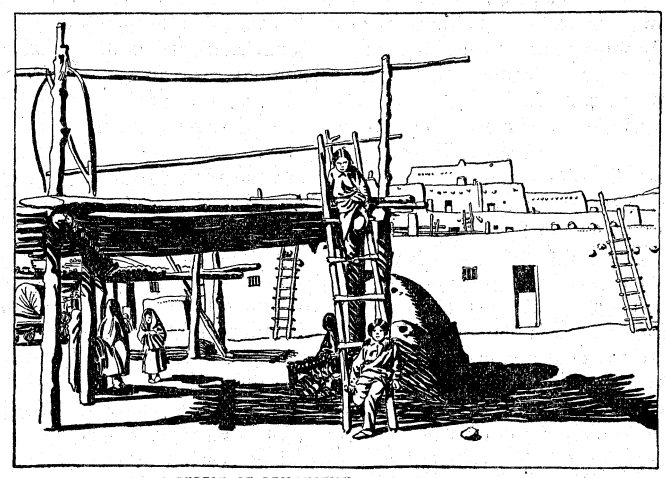
**Manufactures.**—As New Mexico is primarily a mining and stock-raising region, its manufacturing industries, though growing, are still of comparatively little importance. The value of the products of manufacturing establishments increased from $19,459,000 in 1925 to $21,697,000 in 1929, or 11%, but dropped to $9,580,000 in 1933 as a result of the world-wide economic depression. Of the latter figure $4,737,000 was added by the manufacturing process. There were in 1939, 272 establishments paying $2,912,993 in wages to 3,250 wage earners, and using $16,411,877 worth of materials, fuel and purchased electric energy.

The chief industries in 1939 were lumber and timber products, $3,665,658; petroleum refining, $3,538,753; printing and publishing, $1,703,930; and cottonseed products, $1,164,676.

**Transportation.**—Six railroads operate in New Mexico; the most important is the Atchison, Topeka and Santa Fe. Commercial air transportation is provided by one transcontinental and one north-south line (Albuquerque is the junction airport). Improved surface highways increased from about 2,100 mi. in 1929 to 7,200 mi. in 1938. A motorized state police was established in 1933 and a state driver's licence has been required since 1937. The ports of entry, established to collect the commercial mileage tax instituted in 1933, were placed under the state police and called registration stations.

**History.**—In the period 1525–43 explorations extending from Florida to the California coast paved the way for the later colonization of Florida and New Mexico in the latter part of the 16th century, Texas in the early part of the 18th and California in the latter part of that century. The first of the expeditions was that of Narváez. The treasurer of this expedition, Cabeza de Vaca, wandered across the continent to New Spain in the years 1528–36.

The appointment of Antonio de Mendoza as first viceroy of New Spain in 1535 marked the beginning of a period of improved organization in the continental possessions of Spain. Early in 1539 Friar Marcos de Niza was chosen by the viceroy to investigate the land north of Culiacán and inaugurate a new policy in Indian affairs. When Friar Marcos left Culiacán, March 1539, he was accompanied by Estevánico, as guide, who was one of the four survivors of the Narváez expedition. The party reached the vicinity of the Zuñi pueblos, in the western part of New



BY COURTESY OF THE BUREAU OF RECLAMATION

EXTERIOR VIEW OF TAOS, SHOWING ONE OF THE TWO SIX-STOREYED PUEBLOS AND THE LADDERS BY WHICH IT IS ENTERED

Mexico. In the following year the well equipped expedition of 270 soldiers under Coronado arrived by the same trail. The Zuñi pueblos were conquered and the expedition established winter headquarters near the present town of Bernalillo. The Grand Canyon of the Colorado was discovered and other parties explored the Rio Grande valley and the country as far east as the present state of Kansas.

An expedition was organized by the Franciscan friar, Augustín

Rodríguez in the summer of 1581 for the purpose of converting the Indians of the lands to the north of Mexico. A year later Antonio de Espejo led an expedition to rescue the friars of the Rodríguez party, who had remained in New Mexico without protection after the return of their military escort to Mexico. (The name New Mexico seems to have been applied to the Pueblos of the Rio Grande valley in the summer of 1582, although the name applied by the members of the Rodríguez expedition, San Felipe, and the name given by Espejo, Nueva Andalucía, were probably sometimes used.) Near the close of the century a contract was made with Juan de Oñate for the colonization of New Mexico. The expedition was assembled in the vicinity of Santa Bárbara in August 1597, and after several delays proceeded up the Rio Grande. The first settlement was made at San Juan de los Caballeros in the Chama river valley, July 11, 1598. The construction of the first church in New Mexico was completed and mass was celebrated on Sept. 9, 1598. The present capital of New Mexico, Santa Fe, was founded in 1609.

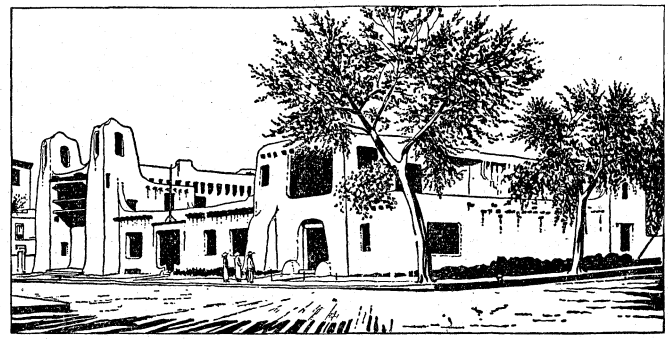
New Mexico remained a frontier mission field during the 17th century. Twenty friars were serving by 1624; the churches numbered 43; and the number of Christian Indians 34,000. The total Spanish population at the end of the century was only 2,000, which shows that the colony had not become an important source of wealth. The differences between the Indian culture and the Spanish-European manner of life were the principal causes of the revolt of the Pueblos in 1680. The Pueblo Indians were willing to accept the God of the Christians as an additional protecting power, but they could not give up their own beliefs concerning the spirits of the universe without completely destroying their organized tribal life, because every phase of their existence is affected by their conceptions of the relation of the tribe to the world. The Spanish settlers abandoned their holdings and retreated southward to El Paso. Diego de Vargas effected a reconquest of the province between 1692 and 1696. Albuquerque was founded in 1706 and by 1799 had a population of 4,020. The total population of the province at the close of the 18th century was about 30,000; 20,000 Spanish and 10,000 Indians.

The internal affairs of New Mexico prior to 1821 were not affected to any great degree by the revolutionary developments which took place during this period in Spain and Mexico. New Mexico became a political subdivision of the Mexican Republic; granted independence from Spain by the Treaty of Córdoba, Aug. 24, 1821. Trade with the American settlements in the Missouri valley, which had been discouraged during the Spanish régime, was legalized in 1821. An annual caravan set out from Missouri in the spring of the year. The value of the merchandise carried on the outward journey increased from $15,000 in 1822 to $450,000 in 1843. The Santa Fe trade was a success because merchandise could be freighted across the plains to the markets of New Mexico and sold for a lower price than goods could be brought from Vera Cruz by way of Chihuahua.

The Republic of Texas claimed the Rio Grande as its western boundary. The prosperous Santa Fe trade, which would be a rich source of taxation, encouraged Texas to assert this claim. An expedition was organized in 1841 which arrived in New Mexico in a disorganized condition and surrendered to Governor Armijo at Anton Chico. A second expedition in 1843 also failed.

Upon the outbreak of war with Mexico the army of the West under command of Col. Stephen Watts Kearny, occupied Las Vegas Aug. 15, 1846 and took formal possession of the country. The capital was occupied three days later and a military government was established which ruled the territory for five years. The civil government was retained for two years during which period a rebellion broke out resulting in the assassination of Governor Bent at Taos, on Jan. 19, 1847. The Territory of New Mexico was created by act of Congress, Sept. 9, 1850, extending from the 103 meridian of longitude on the east to the Territory of California on the west. The present boundaries were fixed by 1863 with the formation of the Territory of Arizona from the western half, and the Territory of Colorado from a northern portion two years earlier.

At the outbreak of the Civil War the Territory was invaded by a Confederate force, under command of Brig.-gen. H. H. Sibley, which marched up the Rio Grande valley and occupied the capital. The Union army under command of Col. E. R. S. Canby, with reinforcements from Colorado, won the decisive battle of the campaign at Apache canyon, on March 28, 1862. The period following the American occupation was marked by the solution



BY COURTESY OF THE ATCHISON, TOPEKA AND SANTA FE RAILROAD

THE STATE ART MUSEUM AT SANTA FE

of the nomadic Indian problem and the economic development of the territory. A reservation was established in 1868 for the Navajo Indians in the north-western part of the Territory; the Mescalero Apache were settled in the southern part of the Territory in 1873; and the Jicarilla Apache in the northern part in 1880. The legal status of the Pueblo Indian was complicated by the Treaty of Guadalupe Hidalgo and later decisions of the U.S. Supreme Court.

The building of railways into the West, the increasing population, and the quieting of the Indians resulted in a great increase in cattle and sheep. The overflowing cattle herds of Texas were used to stock the ranges in New Mexico and the States to the north. The Goodnight-Chisom trail up the Pecos valley was followed by the overland drives to the ranges in Colorado and Wyoming; and to the railway shipping points in Kansas. Conflicts occurred between the cattle and sheep raisers over water and the use of the open range. The most bitter of these was the Lincoln county war which started in 1877 and lasted about three years. The Atchison, Topeka and Santa Fe railway was extended to Albuquerque in 1880. A year later connection was made with the Southern Pacific railway at Deming, which placed the Territory on a transcontinental line. With the advent of the railways mining and irrigation developed; the population increased and a public school system was established in 1891.

The Spanish and Mexican land grants in New Mexico have constituted one of the most difficult land problems in the history of the State. The Treaty of Guadalupe Hidalgo confirmed the grants but lack of accurate documents made difficult the settlement of conflicting claims.

Constant efforts were made to secure Statehood. The Enabling Act was passed by Congress on June 20, 1910, a constitution was drafted and approved, and on Jan. 6, 1912, the State was formally admitted to the Union. In politics New Mexico has maintained a fairly even balance between the major parties, voting predominantly Democratic in 1916, '22, '24, '30, '32, '34, '36 and '40, and generally Republican in 1918, '20, '26 and '28.

BIBLIOGRAPHY.—J. Gregg, *Commerce of the Prairies* (1845); H. H. Bancroft, *Arizona and New Mexico* (1889); F. W. Blackmar, *Spanish Institutions of the South-west* (1891); C. F. Lummis, *The Land of Poco Tiempo* (1893); S. Wallace, *The Land of the Pueblos* (1895); W. M. Nicholl, *Observations of a Ranchwoman in New Mexico* (1898); G. B. Anderson, *History of New Mexico* (1907); F. A. Jones, *Epitome of the Economic Geology of New Mexico* (1908); O. H. Lipps, *The Navajos* (1909); Lingren, Graton and Gordon, *Ore Deposits of New Mexico* (1910); F. M. Hanley, *The Dated Pre-history of Chetro Ketl* (1930); R. E. Twitchell, *Leading Facts in New Mexican History* (1911–12); *Spanish Archives of New Mexico* (1914); *Military Occupation of New Mexico* (1909), *Old Santa Fe* (1925); L. B. Prince, *A Concise History of New Mexico* (1912), *Spanish Mission Churches of New Mexico* (1915); P. E. Goddard, *Indians of the South-west* (1913); H. E. Gregory, *The Navajo Country* (1916); A. F. Bandelier, *The Delight Makers* (1918); G. W. James, *New Mexico the Land of the Delight Makers* (1920); H. E. Bolton, *Spanish Exploration in the South-west*

(1916); *The Spanish Borderland* (1921); G. P. Hammond, *Don Juan de Oñate and The Founding of New Mexico* (1927); Mary Hunter Austin, *The Land of Journey's Ending* (1924); B. C. Grant, *Taos Indians* (1925), *Taos Today* (1925); C. F. Coan, *A History of New Mexico* (1925); J. H. Vaughan, *History and Government of New Mexico* (1925); E. C. Parsons, *The Pueblo of Jemez* (1925); W. N. Burns, *The Saga of Billy the Kid* (1926); J. S. Ligon, *Wild Life of New Mexico* (1927); *New Mexico Historical Review* (1926 *et seq.*); *Southwestern Historical Quarterly* (1897 *et seq.*); A. B. Thomas, *Forgotten Frontiers* (1932); *Journal of American Folk-Lore* (1888 *et seq.*); the *Annual Reports* of the Bureau of American Ethnology (1879 *et seq.*); *Publications* of the New Mexico Historical Society (1882 *et seq.*); *New Mexico* (American Guide Series, WPA, 1940).

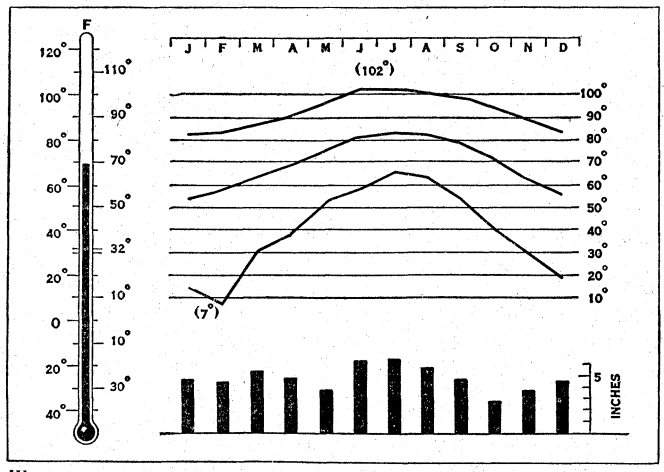
(F. D. R.)

**NEWNAN,** a city of western Georgia, U.S.A., the county seat of Coweta county; on Federal highway 29, 40 m. S.W. of Atlanta. It is served by the Atlanta and West Point and the Central of Georgia railways. Pop. 6,386 in 1930; 7,182 in 1940. It is a shipping point for agricultural products.

**NEW ORLEANS,** a city of Louisiana, U.S.A., situated on the east bank of the Mississippi river about 107 m. from its mouth. It was originally on a bend in the river and from that fact its popular name, "Crescent City," was derived.

**Physical Features.**—The soil is an alluvial deposit from the river and, therefore, has its greatest elevation at the river bank, where the ground behind the levees is from 10 to 15 ft. above the mean level of the Gulf of Mexico; but the lower parts of the city are below gulf level. Built on the narrow ridge of land at the river bank, the growing city first expanded along the river front and later, the cypress swamps between the river and Lake Pontchartrain having been cleared and drained, covered a distance of from 4·5 to 7·3 miles. The river approaches New Orleans flowing eastward, turns rather abruptly to the south at the upper municipal limits, then eastward as it passes the modern city, and finally northward in one of the sharpest bends to be found in the lower river, near the site of the original city, or *vieux carré.*

The difficulties involved in building a city on such a site as that of New Orleans were great. Drainage, sanitation and a satisfactory water supply were realized nearly two centuries after the establishment of the first settlement, and in the interim yellow fever and cholera took frightful tolls. Modern engineering




WEATHER GRAPH OF NEW ORLEANS. THE THERMOMETER INDICATES THE NORMAL ANNUAL MEAN TEMPERATURE. THE MIDDLE CURVE SHOWS THE NORMAL MONTHLY MEAN TEMPERATURE; THE CURVES ABOVE AND BELOW, THE HIGHEST AND LOWEST EVER RECORDED IN EACH MONTH. THE COLUMNS INDICATE THE NORMAL MONTHLY PRECIPITATION

and sanitation finally triumphed, and to-day New Orleans is one of the healthiest cities of the world.

The boundaries of the parish of Orleans and the city of New Orleans are the same, with a land area of 199.4 sq. miles. The boundary line is very irregular, but may be given approximately as Lake Pontchartrain on the north, the Rigolets and Lake Borgne on the east, the parish of St. Bernard and the Mississippi river on the south, and Jefferson parish on the west. The city gradually expanded by spreading along the higher lands near the river bank.

New Orleans is noted for its mild and balmy winters; the summers are uniformly warm but extreme heat is unknown, and the highest temperature recorded by the weather bureau is 102° F, while a temperature of 100° F is seldom reached, owing to the cool breezes from the Gulf of Mexico. Mean temperature is:—

| | | | |
|---|---|---|---|
| January | 54·5° | July | 82·4° |
| February | 57·2 | August | 82·3 |
| March | 63·0 | September | 79·4 |
| April | 68·9 | October | 70·4 |
| May | 75·2 | November | 61·9 |
| June | 80·9 | December | 55·7 |
| Yearly average | | | 69·3 |

The rainfall averages 56·77 in., well distributed through the year.

**Population.**—The population of New Orleans was 339,075 in 1910, 387,219 in 1920, 458,762 in 1930, and 494,537 in 1940. The increase in the decade 1930–40 was 7·3%; 1920–30, 18·5%; 14·2% in 1910–20. Every country in Europe is represented in the inhabitants. The Italians are the most numerous; other nationalities of great numerical strength are Irish, Germans, English and French. The French, because of the creole element, feel perfectly at home, speaking their own language, and living among sympathetic surroundings. The creoles are the descendants of the French and Spanish settlers of Louisiana. When the city passed under the American flag the Americans built up a quarter for themselves, up stream from the *vieux carré,* the upper boundary of which was Canal street. The line is not as strictly drawn now as in earlier years, as many creoles have settled in the newer portions of the city and some Americans have moved to the French quarter. This change was more pronounced in the third decade of the 20th century during which time a lively interest in the old quarter developed into a movement to preserve those buildings and other historical sites of the city.

**Water Supply, Drainage and Sewerage.**—The entire city, except for its levees, is below the river high water mark while a large portion of it is below that of Lake Pontchartrain. Combined with these difficulties New Orleans has heavy rainfall; occasionally over 3 in. in one hour, 7 in. in 5 hours and 9 in. in 12 hours, having been experienced. As a result of the occasional excessive rainfalls, it has been necessary to provide large canal systems to convey the water to and from the pumping plants, and eight pumping stations for the removal of storm water have been built. The average annual rainfall is more than 56 in.; the topography is such that the runoff must be removed by pumping. The capacity of the drainage pumps is 27,000 cu.ft. per sec.; this is sufficient to remove the water from a lake 10 sq.mi. in area and 8·6 ft. deep in 24 hours.

Some drainage water is pumped more than once; altogether this is the greatest aggregation of drainage pumps to be found anywhere in the world.

The sewage of the city is collected separately from the drainage and is finally discharged into the Mississippi, where the dilution is so great that it is not noticeable further down stream. Like the drainage, the sewage has to be pumped, much of it through two or more lifts, and this is accomplished by electric pumping stations operating automatically.

In the early days of the colony the turbid water from the Mississippi was carried from the river and settled in large earthen jars. Wells were used to supply water for household purposes but not for human consumption. In 1810, a first attempt was made to establish waterworks. In 1833 the Commercial Bank was organized for the purpose of establishing waterworks in New Orleans and iron pipes replaced the early wooden ones. In 1869 the city bought the system from the company, issuing bonds for that purpose; but lack of funds and bad management obliged the city in 1877 to give a monopoly to the New Orleans Water-Works company. The river water was too muddy to be useful for most purposes and cisterns were preferred, although a time of drought often caused scant supply. To solve the problems involved and to study the methods of treatment for purification of the river water, an experimental plant was established in 1900, and a process adopted for softening by the use of lime and small amounts of sulphate of iron, producing a coagulation whereby the fine clay particles are brought together into large masses that will settle out in a few hours, or which are large enough to be

completely removed by the filters. By this process, first put into operation in 1909, New Orleans has had continuously an abundant supply of clear, pure water of the highest quality. Recent additions to the water purification plant have increased its capacity to a normal production of 112,000,000 gallons per day and to a maximum of 160,000,000 gallons if necessary.

**Streets, Bridges and Parks.**—The streets of the *vieux carré*, or old French city, are narrow, but in the newer portions there are many wide avenues and boulevards, some of which were originally canals. Some of the avenues, such as St. Charles, Esplanade, Claiborne and others, were originally laid out with sufficient width for a street on each side, accommodating traffic in both directions and with a "neutral ground" between, which has been used for street car tracks and planted with trees.

New Orleans is situated on the Old Spanish Trail which extends from San Diego, Calif., to St. Augustine, Fla. It is at the southern end of the Jefferson highway which runs to Winnipeg, and the Colonial highway which leads to New York. The Jackson and Mississippi Valley highways lead to points in the middle west and the Mississippi valley. Early in the year 1928 the New Orleans-Pontchartrain bridge was opened to traffic. This concrete structure, nearly 25,000 ft. in length, was built by a private corporation at a cost of $5,500,000.

A more direct line to the Gulf coast was created shortly after by building bridges across Chef Menteur and the Rigolets by the Louisiana Highway commission.

New Orleans is well supplied with parks. Audubon park, with 234 ac., is situated in the upper portion of the city and contains a statue of Audubon. The original area of City park was about 1,400 ac. This park has been developed and beautified largely through the efforts of WPA. The area has been added to by hydraulic dredging on the lake shore front between West End and beyond Bayou St. John on the east. A large municipal yacht harbour has been constructed at West End. Many miles of boulevards and driveways, with parks and bathing beaches, are also being developed as residential areas. This has also become the location of the training school for naval aviators and the army bombing airport, navy bombing airport, as well as La Garde hospital. The New Orleans airport, completed in 1933, which is farther east on the lake, is the terminal for the Eastern air lines, Chicago and Southern and National air lines.

Three additional lines await certificates to fly to Central America.

**Gas and Electricity.**—Electric cars were first used in New Orleans in 1893. At that time there were several independent competing lines which were later consolidated into a modern, efficient system. The New Orleans public service supplies electricity for power and lighting, and supplies natural gas to power plants and for domestic use.

**Port.**—New Orleans is one of the largest North American ports, accommodating between 90 and 100 steamship lines; 2,595 vessels with a total gross tonnage of 12,665,816 tons and goods worth $900,000,000 entered the port in 1940. The limits of the Port of New Orleans include the parish of Orleans and a part of the parishes of Jefferson and St. Bernard bordering on the Mississippi, with a frontage of 41·4 mi. on both sides of the river. About 7 mi. of river front is equipped with publicly owned wharves, steel sheds, cotton warehouses, grain elevators, coal tipples and other modern facilities. The Inner Harbour navigation canal extends for 5 mi. from the river to Lake Pontchartrain. Recent development of South West pass with an available depth of 35 ft., has made the port available to the largest ships.

**Transportation.**—Twelve railroad lines enter New Orleans: the Gulf Coast lines, Illinois Central, Yazoo and Mississippi Valley, Louisiana Railway and Navigation company, Louisiana Southern, Louisville and Nashville, Missouri Pacific, New Orleans Great Northern, New Orleans and Lower Coast, Southern Pacific, Southern Railway and the Texas Pacific. New Orleans owns and operates a Public Belt railroad, extending the length of the docks. The Federal Barge line supplies freight service to points on the Mississippi and Warrior rivers.

**Commerce and Industry.**—In 1937 there were 584 business establishments producing products valued at $126,508,215. Property valuation of the city in 1939 was $500,318,415; bank debits in 1940 were $2,724,441,000.

**Education.**—The New Orleans public school system consisted in 1940 of 90 kindergarten and elementary schools, 11 high schools, one vocational school, 3 schools for graduates, 20 evening schools, with a day enrolment of 70,000 and an evening enrolment of 5,000. Negroes are educated in separate schools and more in the evening than whites. Educational receipts for 1939–40 totalled $5,066,535, of which $2,861,869 was raised from local taxes, $1,697,648 from state appropriations on the per educable basis. Of the expenses, $4,637,899 were for current needs. There were several private schools at the high school level in 1940; the Catholic Church and Lutherans had systems of parochial schools throughout the city at elementary and high school levels. Uniform textbooks purchased by the state department of education were supplied through the Orleans parish school board to private, parochial and public schools, and classes were taught under a curriculum approved by the state department of education. Among the preparatory schools were Rugby academy, New Orleans academy, Newman school, Holy Cross college and Christian Brothers college. The Delgado trades school was opened near City park in 1921. Newman school was founded in 1903 and is coeducational.

*Tulane University.*—The history of Tulane university dates back to the foundation of the medical college in 1834. It was chartered in 1835 and in the following year issued the first degree in medicine conferred in the southwest. The constitution of 1845 provided for the establishment of a university in New Orleans, embracing the medical college to which law and academic departments were to be added.

In 1882 Paul Tulane, for many years a merchant in New Orleans, gave liberally for the higher education of "the white young persons in the city of New Orleans." His entire donations reached the sum of $1,050,000. He died at Princeton, N.J., in 1887. In 1884 the board of administrators of the Tulane educational fund received from the legislature complete and perpetual control of the University of Louisiana. This act was ratified in 1888 and again in the constitutions of 1898, 1913 and 1921.

H. Sophie Newcomb Memorial college is the women's department of Tulane university. Tulane university had a total enrolment of 4,370 in all departments during the session of 1939–40, exclusive of the summer school, which numbered 872 more. Its endowment is $11,106,896.

*Loyola University.*—In 1904, the Jesuit Fathers opened a school opposite Audubon park. A collegiate course was added and in 1912 the legislature granted them power to confer "degrees in arts and sciences and all the learned professions, such as are granted by other universities in the United States."

**Monuments, Public Institutions and Customs.**—The Delgado Art museum in City park was established by a gift from Isaac M. Delgado in 1911. There is a nucleus of an art collection containing many works of great merit. The annual exhibition of the Art Association is an important event. The Cabildo houses an important historical museum containing much of interest and value pertaining to the history of Louisiana and New Orleans. The Presbytery, facing Jackson square on the side of the Cathedral of St. Louis, contains a valuable museum of natural history, principally relating to Louisiana. The Confederate Memorial hall contains relics of the Civil War. It is located on Camp street. The Tulane university museum occupies the entire third floor of Gibson hall; it contains petrological, palaeontological, zoological and anthropological sections. New Orleans has become one of the cultural centres of the United States and the mecca for writers, painters, sculptors and artists in all fields. Several galleries exhibiting contemporary art are to be found in the *vieux carré*. A civic symphony has been established and the Philharmonic society brings the great contemporary musicians and concerts to the city. The Metropolitan opera comes annually, thus reviving interest in French opera which was originally heard in New Orleans long before it was heard in New York. The Middle American research institute, created in 1924 as a department of Tulane university, has a museum and library,

field work and publications as its primary activities. The library of 40,000 items and the museum contain manuscripts, documents and other material relating to Mexico and Central America from expeditions and purchases which are being constantly increased. The institute has a permanent endowment of $300,000. The New Orleans spring fiesta was organized in 1937 and has created tourist interest in art, architecture, gardens and local traditions. New Orleans has been enriched by the liberal planting of azaleas and camellias, resulting in increased interest in gardening and landscaping.

New Orleans has a number of excellent hospitals: the Baptist; Charity; City (for mental diseases); Eye, Ear, Nose and Throat; Hôtel Dieu; Soniat Memorial-Mercy hospital; the Flint-Goodrich hospital of Dillard university for Negroes; and the U.S. marine and U.S. Veterans' hospitals, the St. Rita Surgical and Touro infirmaries. Practically all the charitable institutions of New Orleans receive contributions from a community chest. In 1935 these amounted to $590,976.

Over 50 newspapers and periodicals are published in New Orleans, including two morning and two afternoon papers. The *New Orleans Picayune* was founded in 1837, the *Daily Times* in 1863, the *Daily Democrat* in 1875. The two latter formed the *Times-Democrat* in 1881 and this and the *Picayune* became the *Times-Picayune* in 1914. The *Daily Item* began publication in 1877, later becoming the *New Orleans Item* and in 1924 publishing the *Morning-Tribune* and the *Sunday Item-Tribune*, suspended in 1941. The *Daily States*, started in 1880, was purchased by the Times-Picayune Publishing company in 1933 as an afternoon and combined Sunday publication.

There are some 300 churches in New Orleans, representing different denominations. Roman Catholic churches are the most numerous.

The French opera house, designed by Gallier, was erected in 1859 at the corner of Bourbon and Toulouse streets. It was a distinctive and widely known centre of artistic and social life in New Orleans for many years. The Mardi Gras balls were held there until the building was destroyed by fire in 1919.

The carnival season extends from Twelfth Night to Lent, and its climax is reached in the festivities of Mardi Gras, the eve of Ash Wednesday. The ancient custom of celebrating the carnival was brought to New Orleans by the Latin peoples, and especially by the young creoles who studied in Paris and returned to live in New Orleans. Beginning with Twelfth Night there is a series of brilliant balls, and during the last week the balls of Momus, Proteus and Comus, preceded by gorgeous pageants, bring the season of mirth to a conclusion. On Mardi Gras, Rex parades the streets and at night the final parade is that of Comus.

Among writers and historians of note associated closely with New Orleans should be mentioned: John James Audubon, C. E. A. Gayarré, Alcée Fortier, Grace King, Mary Ashley Townsend, Lafcadio Hearn, George W. Cable, Mollie Moore Davis and Lyle Saxon.

**Government.**—The city government was at first carried out by a mayor and administrators, seven in number. Finally, in 1912, by act of the legislature, the commission form of government was adopted; the mayor became commissioner of public affairs. Four other commissioners have charge of public finances, public safety, public utilities and public property. At the first regular meeting after the election, the commission council by a majority vote assigns one of the councilmen to each of the above named departments.

**History.**—The city of La Nouvelle Orleans was founded by a French governor of Louisiana, Jean Baptiste Le Moyne, Sieur de Bienville, and was named in honour of the Regent, the Duc d'Orléans. The island of Orleans was chosen for the site, on an elevation along the east bank of the river and about 107 m. from its mouth, between the head of Bayou St. John and the river. Among the advantages of this site were the higher land, accessibility by two main waterways (the Mississippi and the lakes), and by Bayou St. John for the small craft of that day. On the other side of the river it was not far to Bayou Barataria, which later was destined to become the rendezvous of the famous pirates, Jean and Pierre Lafitte, and which offered access to the gulf without stemming the current of the Mississippi.

There is some doubt as to the exact date of the founding of New Orleans, but it is generally given as 1718. It was then proposed that John Law's famous company, which had obtained charter for the territory from France, should move its headquarters from the barren coast country to the new site. New Orleans thus became the capital of the Colony in 1722. At this time the city had but 100 houses and 500 inhabitants. It was laid out in approximately a parallelogram, 4,000 ft. long on the river by 1,800 ft. in depth, divided into regular squares 300 ft. on each side. In 1724 the streets were named. The houses were rude cabins of split cypress boards, roofed with cypress bark. They were separated from one another by willow copses and weed-grown ponds swarming with reptiles. Two squares on the river front near the centre of the city were set apart for military and ecclesiastical uses. The front was the Place d'Armes, now Jackson square; the rear one was early occupied by a church. In 1726 a monastery was erected to the east of the church for the Capuchin monks, who had arrived two years earlier. A company of Ursuline nuns came to New Orleans in 1727. At the same time the Jesuits arrived and received a large tract of land from Bienville, the French governor. This tract, bounded by what is now Common, Tchoupitoulas, Annunciation and Terpsichore streets, was later added to by donation and purchase and extended to Felicity street. Here the Jesuits cultivated myrtle, the wax of which was then a staple article of commerce; the orange, the fig, indigo and probably sugar-cane. These became staple crops. The Order was suppressed for political reasons in 1763 and its great plantation confiscated by the king of Spain.

Many storms and disasters occurred during the early years of the city. In 1719 the river rose to a great height and the site was completely inundated to a depth of a few inches. In 1722 a hurricane destroyed 30 houses and damaged crops. German colonists who had settled on the banks of the Arkansas managed to reach New Orleans and there prayed Bienville to send them back to their homes. He persuaded them to establish themselves along the river above the city, and thus was formed the nucleus of the German settlement, which to this day is called the German coast.

There were few women of good character in the Colony in the early days; and many of the better class of settlers, missing their home life, desired to return to France. It thus became imperative that if the settlement was to survive, the men must have good wives to make homes for them. When Bienville left the Colony in 1724, he promised to send a load of good women as soon as possible. In 1727 the "Casket Girls" (*Filles à la cassette*) arrived and were placed under the care of the Ursuline nuns whose convent had been established in the same year. They were first domiciled in Bienville's former home, but in 1730 their own house on Chartres and Ursuline streets was completed. This is the oldest building in the United States west of the Alleghenies.

In 1763 the Treaty of Paris was concluded between France and England. By this treaty England gained all the territory east of the Mississippi except the Isle of Orleans. On Nov. 3, 1762, Louis XV. had, by the secret treaty of St. Ildefonso, given the Isle of Orleans and all of Louisiana west of the Mississippi to his cousin, Charles III. of Spain. It was not until Oct. 1764 that the French king notified governor Abbadie of the transfer of the Colony, nearly two years previously, to Spain, and ordered him to surrender Louisiana to accredited Spanish commissioners when they should present themselves. There was sorrow and dismay when these tidings were received. In 1783, the Treaty of Paris confirmed Spain in possession of this territory and granted free and open navigation of the Mississippi river to the subjects of Great Britain and the United States. In 1788, and again in 1794, fires destroyed large portions of the city. By the first, 19 squares were devastated, and 856 houses were burned. The second fire destroyed 212 houses and caused a loss estimated at $2,600,000. Rebuilding with brick instead of wood, resulted in a more permanent city.

During this period the Spanish Governor, Almonaster y

Rojas, was the greatest benefactor of New Orleans; he gave freely of his private fortune for many purposes. He rented in perpetuity the squares flanking the Place d'Armes and erected a row of brick buildings to be used as shops and retail stores. These were replaced in 1845 by the Pontalba buildings, which bear the name of their builder, Baroness Pontalba, a daughter of the governor. He rebuilt the Charity hospital, which had been destroyed by a hurricane, and a chapel for the Ursuline nuns. Through his generosity the cathedral was completed in 1794; it was constructed of bricks and had much the same appearance as to-day except in details of the belfry and towers. A town-hall, or hall of the Cabildo, presented to the city in 1795, was used as a meeting place of the Spanish Cabildo. It was here that the formal transfer of Louisiana from France to the United States took place.

Before the cultivation of sugar-cane the staple crop of Louisiana had been indigo; but it did not prove successful. In 1794 Etienne de Boré succeeded in making granulated sugar. His plantation is now within the city limits. By the Treaty of Madrid, signed in Oct. 1795, Spain and the United States agreed that New Orleans should be open to the Americans as a port of deposit for three years; the produce was to be free of duty but a reasonable price for storage was to be paid. The commerce of New Orleans increased greatly, the levee was the scene of noisy, bustling business.

The purchase of Louisiana by the United States in 1803 had a further beneficial effect on trade. The first half of that year showed an increase of 37% in tonnage over that of 1802; exports exceeded $2,000,000 and imports $2,500,000. The flat-boat trade with the upper valley also increased enormously. Above the *vieux carré* commercial houses were erected and this newer portion of the city gradually became a business centre. Above the Terre Commune, Common street, was Madame Gravier's plantation, a part of the former Jesuit grant. Many of the street names are reminders of the first owners or of the first use of the locality. Gravier street bears the name of its original owner; Poydras that of a philanthropist; Magazine was so named because of the great tobacco warehouses on Magazine and Common, and Camp street because of a slave camp between Poydras and Girod. An aristocratic suburb was along the Bayou St. John road. Below the old city the Marigny plantation was settled by the French.

In 1805, New Orleans was incorporated as a city and the people exercised their right of suffrage for the first time in electing aldermen. Between 1803 and 1810 the population more than doubled with the arrival of many whites, mulattoes and slaves from Cuba, Santo Domingo and other islands of the West Indies. The creoles of those islands had much in common with the creoles of Louisiana—many were of French ancestry, they had the same religion, language and political ideas, and had met with the same political misfortunes. The creoles were numerically so strong that they dominated the city.

On Jan. 10, 1812, the "New Orleans," a steam propelled vessel built by Nicholas Roosevelt, arrived on her maiden trip from Pittsburgh.

The War of 1812 found New Orleans without adequate defences; Wilkinson was ordered to occupy that part of Florida west of the Perdido river; the Creek Indians massacred 350 whites at Ft. Mimms, Miss.; drunken Choctaws roamed the streets of New Orleans; Barataria bay was held by the Lafittes and their band of piratical smugglers, who appeared daily in the city. Claiborne had great difficulty in raising the quota of 1,000 men called for by the President, but finally accomplished it. Congress ordered Jackson to proceed to New Orleans for its defence.

Commerce on the Mississippi was greatly stimulated by the advent of steam navigation. In 1817, 1,500 flat-boats and 500 barges brought the produce of the valley to New Orleans. Four years later 287 steamboats, 441 flat-boats and 174 barges moored along the water front of the city. The American section became the market for cotton, tobacco, pork, beef, corn and flour, while the old city retained control of coffee, indigo, sugar, rice, foreign fruits and wine. In the year 1825, the imports and exports of the city were valued at $17,000,000, and by 1835 at more than $53,000,000, a part of the increase being due to the extraordinary rise of prices throughout the country. The population was cosmopolitan. In 1815 it numbered 33,000 and in 1820 had advanced to 41,000. Commerce increased more rapidly than population because of the absence of manufacturing; between 1830 and 1840 trade advanced 75% and the population only 20%.

In 1847–48 the exports of domestic products from New Orleans exceeded those of New York, although the total exports were less than those of the northern city; but imports at New Orleans were far less.

In 1842 receipts from the interior were valued at $45,700,000 and in 1851 they had increased to $107,000,000. One tenth of the arrivals were now steamships. This trade was carried on in spite of the danger from bars on entering the river; in the space of a few weeks, in 1852, 40 ships went aground at the entrance to the river. The terrible yellow fever epidemics of 1853–55 reduced the volume of trade, which was regained, however, and a high-water mark reached in 1857, to be followed by a financial crash which was disastrous to the business houses of New Orleans.

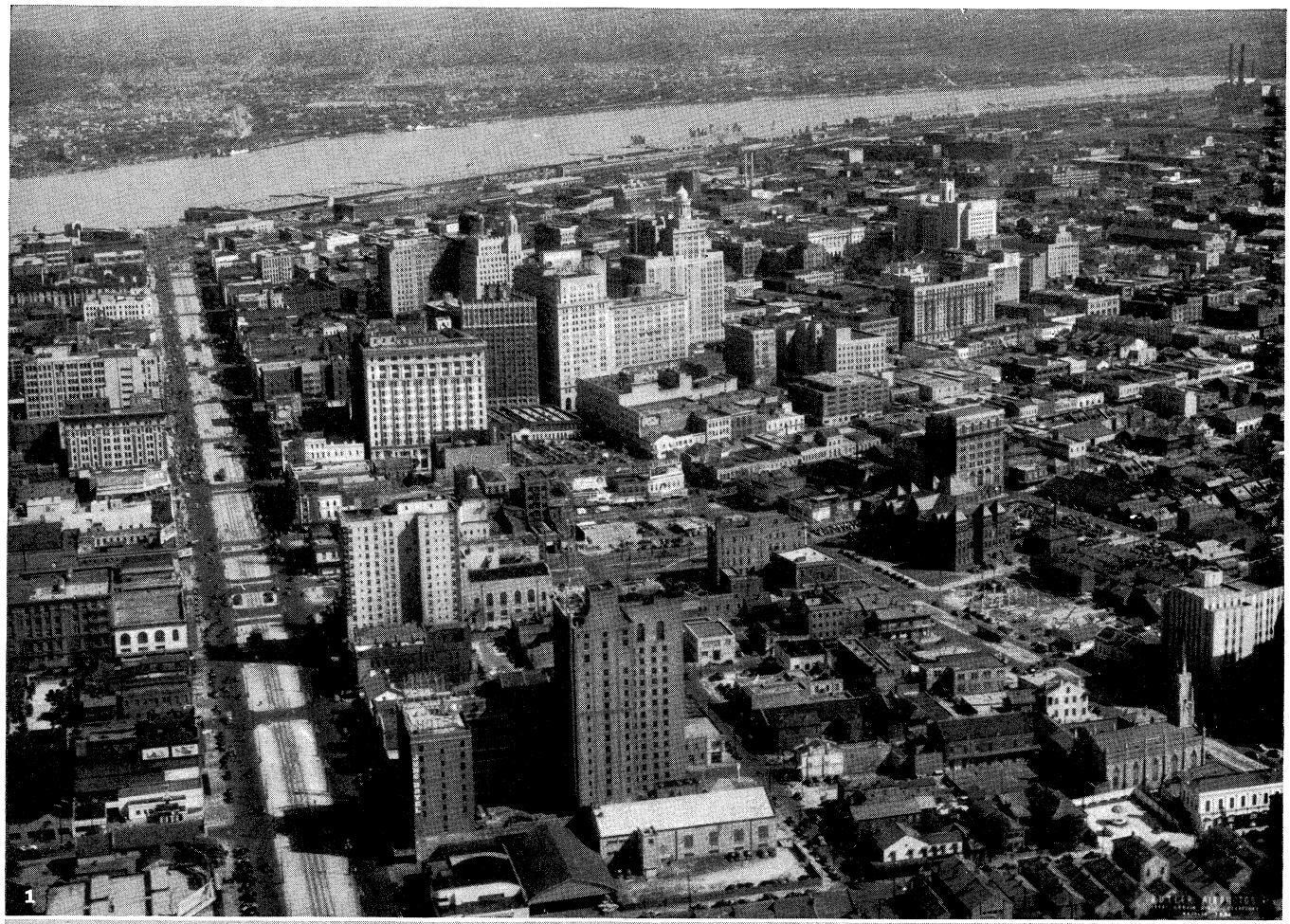
Louisiana seceded from the Union on Jan. 26, 1861. New Orleans was recognized as a strategic point by the authorities at Washington and two expeditions started to secure the Mississippi for the Union: Grant was to descend the river and Farragut and Butler were to ascend it. The city had sent 5,000 soldiers to the defence of the northern line of the Confederacy but the Southern Government seemed oblivious to the importance of holding New Orleans. While Grant was endeavouring to push his way down stream, Farragut was entering the river from the gulf with a fleet of 43 vessels. The assistance asked by Gen. Lovell could not be given by the Confederacy. An attempt was made to obstruct the passage of the Federal fleet by cables put across the river below the city, but New Orleans was captured by Farragut on April 25, 1862 and the city front blazed with the fire from thousands of bales of cotton and hogsheads of sugar and molasses which were burned to prevent their falling into the hands of the Federals.

Gen. Benjamin T. Butler with 15,000 soldiers took charge of the city on May 1, 1862. Mayor Monroe was removed from office and a military commandant appointed in his place. The city council was replaced by the bureau of finance and the bureau of streets and landings. Butler's rule in New Orleans was execrated by the people of the city and he was removed before the year expired.

The Republican Congress decided that the Southern States should be regarded as conquered territory, reconstructed and admitted to the Union. First of all the new freemen were to be secured in the enjoyment of their citizenship and suffrage. The white men of the State were virtually deprived of the ballot by all the restrictions placed upon its exercise. In the wake of the war came a host of undesirables seeking fortunes by easy means. They became known as "carpet baggers," and their Southern friends and associates were known as "scalawags." In New Orleans they gained control of the city government through leadership of the voting population—largely composed of the newly enfranchised negroes. The property of the city disappeared; extravagant expenditures reached $6,961,381 by 1872 and the bonded indebtedness $21,000,000, paying up to 10% interest.

The citizens of New Orleans formed the "White League" for the expulsion of the "carpet-bag" government and for restoring white supremacy. To frustrate their plan an order was issued forbidding a citizen to keep a firearm even in his home. It was rumoured that a ship was to arrive on Sept. 14, 1874, with a cargo of ammunition and the metropolitan police formed at the foot of Canal street with mounted cannon to prevent the citizens from reaching the vessel. The White League formed at Poydras street and moved out to the levee; a skirmish followed in which the metropolitan police were worsted, suffering considerable loss. By gradual successes the White League restored white control.

Improvements made but slow progress during restoration times and for many years after; the city undertook the operation of the water works in 1869; a drainage system was proposed in 1871 but proved too expensive to be carried out; in 1871 the board of park commissioners bought the Upper City park, now Audubon park. The population in 1860 was 168,755 and had



BY COURTESY OF (1) BUTLER AIRPHOTOS, INC., (2) NEW ORLEANS ASSOCIATION OF COMMERCE

## VIEWS OF THE NEW AND OLD CITY OF NEW ORLEANS

1. Air view of New Orleans, showing at the left Canal street, the centre of the retail business district, and the sky-scrapers of the modern city. In the distance is the Mississippi river
2. Historic Jackson Square, formerly the Place d'Armes, in the old French Quarter. On the left side of the St. Louis Cathedral, built in 1794, is the Spanish Cabildo, now part of the Louisiana State Museum, and on the right is the Presbytere, construction on which was started in 1794. On adjoining sides of this Square are the so-called Pontalba apartments built by the Baroness de Pontalba in 1849

increased by 1870 to 191,418. During this decade many freed negroes had come to the city from the country districts. In 1870 the fifth and sixth districts were added by the annexation of the town of Algiers on the opposite bank of the river and of Jefferson City (formerly Lafayette), a town adjoining the fourth district. In 1874 Carrollton was admitted as the seventh municipal district, and New Orleans attained its present limits.

In the spring of 1927, New Orleans was saved from a great Mississippi river flood by blasting the levee at Poydras, about 15 m. below the city, on April 29. This operation sacrificed the adjacent parishes of St. Bernard and Plaquemines at a cost to the city of approximately $5,000,000. To avoid similar danger in the future a spillway has been constructed about 35 m. above the city to remove 250,000 second-feet of water from the river during excessive floods and deliver it into Lake Pontchartrain.

A railway and highway bridge across the river at New Orleans was completed in 1935. An outstanding event in 1940 was the overthrow of the Long political machine and the election of Sam Houston Jones as governor. (W. B. G.)

BIBLIOGRAPHY.—G. E. King, *New Orleans* (1904); J. S. Kendall, *History of New Orleans* (1922); L. Saxon, *Fabulous New Orleans* (1929); F. Tinker, *Old New Orleans* (1931); S. C. Arthur, *Old New Orleans* (1936); J. E. Boyle, *Cotton and the New Orleans Cotton Exchange* (1934); Board of Commissioners of the Port of New Orleans, *Annual Reports* (1897–1937); and New Orleans Association of Commerce, *Publications* (1909–1937).

**The Battle of New Orleans.**—This was the final engagement of the American War of 1812 (*q.v.*), fought on Jan. 8, 1815, between the forces of the United States, under Maj.-gen. Andrew Jackson, and those of Great Britain under Maj.-gen. Sir Edward Pakenham. The abdication of Napoleon in April 1814 made it possible for Great Britain to give more attention to her American antagonist. The Gulf of Mexico region was selected for the attack, and late in 1814 a fleet of 50 vessels and an army of nearly 10,000 veterans were dispatched to the region of the Mississippi river. The British advance was made by way of Lake Borgne and the Villere canal to the bank of the Mississippi where the advance-guard appeared on Dec. 23, 1814. Jackson was wholly surprised by this movement but with a superior force made an immediate (Dec. 24) attack with such effect that the British decided to wait for the main army and their artillery. This gave Jackson time to fortify a dry canal and to receive additional reinforcements.

At last, in the early morning of Jan. 8, 1815, a direct attack was made on the now strongly entrenched line of the defenders at Chalmette, near the Mississippi river. It failed disastrously with a loss of about 2,000 out of 9,000 British troops engaged, among the dead being Pakenham and Maj.-gen. Gibbs. The British attack on the right bank had been successful but Gen. Lambert, Pakenham's successor, was unwilling to take the responsibility of any further fighting. The expedition was soon abandoned, and by the end of the month the troops embarked for England. The American loss proved to be 71, out of a total of about 4,000 engaged on both sides of the river. The battle of New Orleans had no bearing on the outcome of the war as peace had been made at Ghent 15 days before the battle was fought, but news of the battle and the peace reached Washington almost together. (*See* WAR OF 1812.)

**NEW PHILADELPHIA,** a city of eastern Ohio, U.S.A., 75 mi. S. by E. of Cleveland, adjoining Dover, on the Tuscarawas river and federal highway 21, at an altitude of 890 ft.; the county seat of Tuscarawas county. It is served by the Baltimore and Ohio and the Pennsylvania railways. Pop. 10,718 in 1920 (92% native white); (1930) 12,365; (1940) 12,328 by the federal census. Coal and fireclay abound in the immediate vicinity, and the city has important manufactures (including enamelled ware, tin plate, electric and vacuum sweepers, iron castings, steel, trucks, trailers and brick), with an output in 1937 valued at $2,462,253. There were in that year 14 manufacturing establishments employing 593 persons. On May 3, 1772, a company of Christian Indians led by the Moravian missionary, David Zeisberger (1721–1808), came from western Pennsylvania, and three months later John Heckewelder (1743–1823) arrived with 200 more Indians. They laid out the town of Schoenbrunn at the "big spring" a little southeast of the present city of New Philadelphia, built the first church and the first schoolhouse in Ohio and more than 60 dwellings of hewn timber, but were obliged to abandon the settlement in 1777 on account of the hostility of the neighbouring Indians. The site of Schoenbrunn, discovered in 1923, was bought by the Ohio state archaeological and historical society. Other missions were planted in this region at Gnadenhütten (1772), Lichtenau (1776) and Salem (1780). On March 7 and 8, 1782, the 96 peaceful Christian Indians at Gnadenhütten were tricked and brutally massacred by a force of 100 whites sent out from Ft. Pitt under Col. Williamson. At Zoar, 5 mi. N. of New Philadelphia, a settlement was made in 1817 by 225 Germans under the leadership of Joseph Bimeler. In 1824 they organized a communistic society, which lasted until 1898. New Philadelphia was founded in 1804 by John Knisely, from Pennsylvania. It was incorporated as a village in 1815 and chartered as a city in 1896.

**NEW PLYMOUTH,** a municipality and seaport on the west coast of North Island, New Zealand, capital of the provincial district of Taranaki, 258 mi. north-north-west of Wellington by rail. Pop. (1936) 16,653 (18,520 with suburbs). The district is not unjustly termed "the garden of New Zealand." It is highly fertile, cereals and fruits growing well; and it is one of the chief dairy centres of New Zealand. The settlement was founded in 1841 by the Plymouth Company under the auspices of the New Zealand Company, and chiefly consisted of emigrants from Devonshire and Cornwall. On the seashore in the neighbourhood are extensive deposits of ironsand.

**NEWPORT,** a municipal, county and parliamentary borough, seaport and market town of Monmouthshire, England, on the Usk, 5 mi. from its confluence with the Severn, and 133½ mi. from London by the G.W.R. Pop. (1938) 95,910. Area 12.3 sq.mi. It lies chiefly on the right (west) bank of the river, and on the east, north and west it is sheltered by a line of hills.

An ancient mesne borough and castle, it occupied an important position on the Welsh marches. The town, which is not mentioned in Domesday, grew up round the castle built early in the 12th century. Giraldus Cambrensis, writing in 1187, calls it *Novus Burgus,* probably to distinguish it from Caerleon, whose prosperity declined as that of Newport increased. From Robert Fitz Hamon (d. 1107) the lordship passed to the earls of Gloucester and Stafford and the dukes of Buckingham. The town received its first charter in 1227, and Hugh le Despenser, who held the lordship for a short time, obtained in 1323 a charter of liberties for the burgesses, granting them freedom from toll throughout England, Ireland and Aquitaine. The earl of Stafford granted a further charter in 1385, confirmed by his grandson in 1427, which gave the burgesses the right of self-government and of a merchant gild. On the attainder of the duke of Buckingham in 1483 the lordship lapsed to the crown, of whom it was held in the 16th and 17th centuries by the Pembrokes, and in the 19th by the Beauforts. The town was incorporated by James I in 1624. In 1385 the borough obtained a market lasting 15 days from the vigil of St. Lawrence (Aug. 10). The charter of 1624 granted two fairs. Newport was the scene of a serious Chartist riot in 1839. The town became a county borough in 1891 and returns one member to parliament.

The old parish church of St. Woollos (after 1921 the cathedral church of the Anglican diocese of Monmouth) stands on Stow hill. Originally it consisted only of the present nave, a fine specimen of grand, though unadorned, Norman architecture; but a massive square tower (of the time of Henry III) and a chancel were added later; a large western Early English lady-chapel is interposed between the nave and the tower. The castle, founded at the close of the 11th century, was greatly altered in the late Perpendicular period. The old Dominican monastery is entirely rebuilt and occupied as a private residence; but there are a few fragments of a house of White Friars. There is a museum and art gallery. Newport owes a rapid increase in the later 19th century to its situation on a fine tidal river, which renders it

an outlet for the eastern section of the south Wales coalfields.

Of the docks, the Old dock was partially formed in 1842, while the Alexandra was opened in 1875. The administration of the docks is in the hands of the Harbour commissioners. There are the Alexandra, North and South, docks with a quayage of 7,839 and 17,189 ft. respectively, and the Town (Old) dock with a quayage of 4,853 ft. The Alexandra docks enclose the second largest sheet of water in the world (28¾ ac.). The average depth of water in both Alexandra docks is 45 ft. at spring tides and 35 ft. at neap tides. In the Old dock the depths are 30 ft. and 20 ft. respectively. There are two dry docks connected with the Alexandra docks, one owned by the G.W.R. company being 523 ft. long and 74 ft. wide, while the privately owned dry dock is 453 ft. long and 64 ft. wide. There are three other private dry docks, all of them entered from the river. The town grew rapidly during the first quarter of the 20th century under a town planning scheme, and extensive building was carried out at Somerleyton and St. Julien's. It spread over Caerleon. A new bridge over the Usk, 60 ft. wide, forms the main gateway for road traffic from London to south Wales. There is an impounding reservoir at Talybout, Breconshire, with a capacity of 2,500,000,000 gal.

**NEWPORT,** market town, municipal borough and county town of the Isle of Wight, England. Pop. (est. 1938) 19,970. Area, 24.2 sq.mi. It is near the centre of the island, at the head of navigation of the Medina river, 5 mi. S. from its mouth at Cowes. It is the chief centre of the railway system of the island. The church of St. Thomas of Canterbury was rebuilt in 1854 in the Decorated style. The county hall (1938) is a building in modern style. The town hall (1816) was designed by John Nash. There are a corn exchange (1929) and a museum. The grammar school was founded in 1614 and there is a blue-coat school for girls founded in 1761. The Albany barracks and Parkhurst prison lie north of the town. A considerable trade is carried on in timber, malt, wheat and flour, and supplying the barracks and local villages brings much business. Newport (*Neuport*) was probably a Roman settlement, then known as *Medina;* remains of a villa in good preservation were found in 1926. There are no traces of Saxon occupation, and no evidence that Newport became a borough before the reign of Henry II. The first charter was granted by Richard de Redvers between 1177 and 1184, and a second, by Isabel de Fortibus, was confirmed by successive kings. The borough was incorporated by James I in 1608 and the final charter, by which Newport was governed until 1835, was granted by Charles II in 1661. It was represented in parliament in 1295, but no other return was made until 1584, when it regularly sent two members. From 1867 to 1885 it sent one but in 1885 its representation was merged in that of the island. The Saturday market dates from 1184, and there is a Tuesday market. Owing to its facilities for trade, Newport early superseded Carisbrooke as the capital.

**NEWPORT,** a market town and urban district of Shropshire, England, 18 mi. E.N.E. of Shrewsbury, with stations on the G.W.R. and L.M.S.R., and on Shrewsbury canal. Pop. (1938) 3,456. Area, 1.2 sq.mi. Newport is not mentioned in Domesday, but at the Conquest was part of the manor of Edgmond, which William I gave with the rest of Shropshire to Roger, earl of Shrewsbury. Henry I. is thought to have founded the borough, at first called New Borough, after the manor had come into his hands through the forfeiture of Robert de Belesme. The site was probably chosen partly on account of the fisheries which are mentioned in Domesday. Henry II. granted all the liberties, rights and customs which the town enjoyed under Henry I. Henry III. granted the borough with the manor of Edgmond, to Henry de Audley. Confirmation charters were granted by Edward I. in 1287 and Edward II. in 1311. The town was incorporated in 1551 by Edward VI. whose charter was confirmed by James I. in 1604. The governing body consisted of a high steward, deputy steward, two water-bailiffs and 28 burgesses, but the corporation was abolished by the Municipal Corporation Act of 1883, and a Local Board was formed, which, under the Local Government Act, gave place in 1894 to an urban district council. The church of St. Nicholas is Early English and Perpendicular. There is an ancient market cross. Newport possesses a grammar school founded in 1665. To the south of the town are the ruins of Lilleshall abbey.

**NEWPORT,** a city of Campbell county, Kentucky, U.S.A., on the Ohio river, opposite Cincinnati and adjoining Bellevue, Dayton, Southgate and Ft. Thomas and separated from Covington only by the Licking river. It is on federal highway 27 and on state highways 8 and 9, and is served by the Chesapeake and Ohio and the Louisville and Nashville railways, trolley and bus lines and river steamers. Population 1940 census, 30,631. It is a residential suburb of Cincinnati and also an industrial area largely given to metal fabrication with manufactured goods totalling $18,457,000 annually.

Two miles back from Newport is the city of Ft. Thomas (a U.S. military post, established in 1888 to supersede Newport barracks [1804] and a city of the same name); pop., 11,034 in 1940.

Newport was laid out in 1791, incorporated as a town in 1795 and chartered as a city in 1834.

**NEWPORT,** a city of Rhode Island, U.S.A., 30 mi. S. by E. of Providence, occupying the southern end of the island of Rhode Island (or Aquidneck); a port of entry, the county seat of Newport county, a place of great historic interest, and a fashionable summer and autumn resort. Pop. (1930) 27,612; (1940) 30,532, an increase of 10·6%.

From the harbour on the west the city rises to a gently rolling plateau with maximum elevations of about 250 feet. The climate is mild and equable throughout the greater part of the year. The "Old Town," with its narrow streets and 18th century houses, climbs the hill back of the harbour.

At the head of Washington square, or the Parade, stands the old State House (or Colony house, when it was built in 1739), now an historic shrine where Washington, Adams, Monroe and other presidents have been entertained. Near by is the Vernon house (built in 1758, and occupied by Rochambeau during the Revolution), which still has its beautiful mahogany balustrades, panelled chimney pieces and delft-tiled hearths. Rare Chinese murals have been found behind panelling. Trinity church (1725) has a beautiful white spire, tipped with a golden crown. At the head of Touro street (named for Isaac Touro, an early rabbi of Dutch nativity) is the Hebrew cemetery (established in 1677) and farther down the street is a fine synagogue (1763), said to be the oldest in America. The old Friends' meetinghouse, part of which dates from 1699 (the first one built on American soil), is now a recreation centre. In Touro park, near the upper end of Bellevue avenue, is the old stone mill, frequently attributed to the Norsemen but probably erected by Benedict Arnold for a corn mill. Near by is the Redwood library, incorporated in 1747 (a development of the Philosophical society founded in 1730), occupying a building erected in 1750, and named for Abraham Redwood (d. 1788), a Friend who contributed £500 for books. A little farther on is the Casino, and from this point Bellevue avenue, extending south to the ocean, is bordered on both sides with the summer "cottages" of wealthy New Yorkers—palatial structures representing almost every possible style of architecture, set in ancient trees and modern gardens, behind high stone or brick walls or grilled fences. On Conanicut island, west of Newport, is the old town of Jamestown (pop. [1940] 1,744), also a summer resort.

Newport's inner harbour, formed by a deep indentation in the western shore, has a depth of about 18 ft. and is almost landlocked.

It is guarded by Ft. Adams on the point forming its western boundary. On Goat island, lying in the entrance of the harbour, is the U.S. torpedo station; and on Coasters Harbor island, farther north, off which the old frigate "Constellation" is moored, are a training station of the U.S. navy, a naval war college and, near by, a naval hospital. Newport is an important naval base.

Newport was founded in 1639 by John Clarke, William Coddington and other Antinomians, who had been driven out of the Massachusetts Bay colony, but first settled at Portsmouth on the northern end of the island in 1638.

In 1640 Portsmouth and Newport united and elected Codding-

ton as governor. In 1644 the two towns with Providence formed a government under a parliamentary charter. In 1647 Warwick was included but the southern towns formed a separate government in 1651. They were reunited in 1654, and a liberal charter was obtained in 1663 from King Charles II.

The first newspaper was published in 1732 by James Franklin (a brother of Benjamin), whose son James in 1758 established the *Mercury,* still published. Between 1739 and 1760 great fortunes were made in the "triangular trade" with Africa and the Barbados, in which rum from Newport was exchanged for slaves in Africa, who were exchanged for sugar and molasses in the Barbados, which were brought back to Newport to be made into more rum. In 1770 Newport's foreign trade was greater than that of New York, but it was entirely destroyed by the Revolution, when the town was in the hands of the British from Dec. 1776 to Oct. 25, 1779. After the evacuation of the British it was occupied by French troops under Rochambeau, and in 1780–81 it was a station of the French fleet. Newport was chartered as a city in 1784; resumed the town form of government in 1787; was again chartered as a city in 1853; and secured a new charter in 1906. Until 1900 it was one of the capitals of Rhode Island. The influx of wealthy New Yorkers began after the Civil War.

**NEWPORT,** a city of northern Vermont, U.S.A., a port of entry and the county seat of Orleans county; beautifully situated at the southern end of Lake Memphremagog, 6 mi. from the Canadian border. It is on federal highway 5, and is served by the Canadian Pacific and the Quebec Central railways, and in summer by lake steamers. Pop. (1940) 4,902. It is a summer resort, a centre for winter sports, a shipping point for maple sugar and farm products, and has several manufacturing industries. It was founded about 1810 and incorporated as a city in 1918.

**NEWPORT NEWS,** a city and a port of entry of southeastern Virginia, U.S.A., on the north side of Hampton Roads and the James river, opposite Norfolk; in Warwick county, but independent of it. It is on federal highway 60; is the tidewater terminus of the Chesapeake and Ohio railway; and is served also by interurban trolley, motorbus and truck lines, several ferries and numerous steamship lines. Pop. 34,417 in the year 1930; and 37,067 in 1940 (33% Negroes). Newport News is one of the four cities forming the port of Hampton Roads (*q.v.*), the principal coal and tobacco port of the United States. Its harbour, spacious and well protected, is connected with the ocean by a channel 600 ft. wide and 35 ft. deep. Nearly a mile of the water front, at the southern end of the city, is occupied by the great railway terminal, covering 337 ac., and comprising 125 mi. of track, storage space for 5,000 cars, warehouses with 1,725,000 sq.ft. of floor space, and piers specially equipped for handling bunker and cargo coal and other commodities. Farther north on the river are the shipyards (among the largest in the country) which have built many United States battleships, cruisers, gunboats and numerous merchant vessels (including the S.S. "California," of 31,000 tons displacement, completed in 1928), and where in 1922–23 the "Leviathan" was reconditioned. Between these two outstanding features of the city, about the centre of the water front, is a public park, and near by a municipal harbour for small boats. Newport News exported 6,965,049 tons of coal and 143,542,000 lb. of tobacco in 1940. Its total water-borne commerce in 1940 amounted to 7,446,378 tons. The exports are chiefly tobacco, coal, lumber and scrap iron; the imports, largely Turkish tobacco, newsprint and chrome and manganese ores. Shipbuilding and ship repairing are the principal manufacturing industries. The aggregate factory output was valued at $81,132,056 in 1937, as compared with $22,625,547 in 1927. The city operates under a commission-manager form of government. Its assessed valuation for 1940 was $36,096,000 ($44,160,902 in 1928), of which 86% represented real and 14% personal property. The net bonded debt was $5,170,000 in 1940.

A settlement of Irish colonists was planted there in 1621 by Daniel Gookin, and the name was chosen to honour Capt. Christopher Newport, an associate of John Smith, and Sir William Newce, on whose advice the site was selected. It remained a small hamlet until in 1881 it became the eastern terminus of the Chesapeake and Ohio railway. The city was laid out in 1882 and incorporated in 1896. By 1900 it had a population of 19,635.

**NEWQUAY,** a seaport and watering place of Cornwall, England, 14 mi. N. of Truro by rail. Pop. of urban district (est. 1938) 7,820. It is on Newquay bay, sheltered to the west by Towan head. The harbour, artificially constructed, and equipped with a jetty and piers, admits vessels of 200 tons. China stone and china clay are exported and coal is the chief import.

**NEW ROCHELLE,** a city of Westchester county, New York, U.S.A., on Long Island sound and federal highway 1 (the Boston Post road); 16 mi. N.E. of the Grand Central station in New York city. It is served by the New York, New Haven and Hartford and electric railways. Pop. (1920) 36,213 (23% foreign-born white); (1930) 54,000; (1940) 58,408. New Rochelle is primarily a residential suburb of New York, with some fine old colonial dwellings still standing, and many beautiful modern residential districts of park-like contour. It is the seat of the College of New Rochelle (Roman Catholic; 1904). The city has an area of 9.9 sq.mi., 9 mi. of water front, and a rolling surface reaching an altitude of 289 feet. Zoning ordinances are in effect, and there is a city-planning commission. Besides three city parks covering 83 ac., there are within the city limits parks, parkways and bathing beaches (including Glen island) aggregating 385 ac., owned by the county. There is comparatively little manufacturing, except for local consumption. The assessed valuation for 1940 was $187,856,000.

On the landward side the city is fringed by residential suburbs, including Larchmont, Pelham and Pelham Manor. The farm given by the state to Thomas Paine at the close of the Revolution is marked by a monument on the road to White Plains, and the farmhouse is now a museum. On David's island, 2 mi. S.W. of New Rochelle, is Ft. Slocum, a U.S. army post. The first settlement of importance on the site of New Rochelle was made in 1688 by Huguenots, some of whom came from La Rochelle. The village was incorporated in 1847 and in 1899 it became a city.

**NEW ROMNEY,** a municipal borough in the Ashford parliamentary division of Kent, England, and one of the Cinque Ports, 75 mi. E.S.E. of London by the S. Ry. Pop. (1938) 1,934. Area 2.4 sq.mi.

Its harbour was the cause of the early importance of Romney, as it was called before 1562–63, and the annual assembly of the Cinque Ports, called the Brodhull, was held there owing to its central position. At the time of Domesday the archbishop of Canterbury and the bishop of Bayeux were joint lords. Romney owed the maritime service to the king of supplying five ships to serve for 15 days in the year. A confirmation of liberties was granted by John in 1205. The town was incorporated by Edward III and was represented in the parliament of 1265. It returned two members from 1366 to 1832, when it was disfranchised. After Elizabeth's charter of 1562–63 the town was officially New Romney. Important documents relating to the Cinque Ports are in the Guild Hall at New Romney. It lies on Romney marsh, part of a level extending from Winchelsea in the southwest to Hythe in the northeast, which was within historic times in great part covered by an estuarine inlet of the sea. The river Rother, which now has its mouth at Rye harbour, formerly entered the sea here, but had its course wholly changed during a great storm in 1287, and the gradual accretion of land led to the decay, not only of New Romney, but of Winchelsea and Rye as seaports. Romney marsh itself is protected by a seawall, and its guardianship and drainage are in the hands of a special corporation dating from 1462. New Romney, which is now over a mile from the sea, has a large sheep fair in August, but little other trade. Of the five churches mentioned in Domesday only the Norman church of St. Nicholas remains. The Romney, Hythe and Dymchurch railway, of 15 in. gauge, incorporated in 1926, is one of the smallest public railways in existence.

**NEW ROSS,** a town of Co. Wexford, Eire, on the Barrow, 2 mi. below its junction with the Nore, 102 mi. S.S.W. of Dublin by the Great Southern railway. Pop. (1936) 5,056. St. Alban built the abbey of Rossmactreoin, which gave rise to the ancient

city Rossglas. There are remains in Rosbercon of a 13th century Dominican foundation. According to Camden, New Ross was founded by Isabella, daughter of Strongbow and wife of William Marshal, afterwards earl of Pembroke. A charter granted to it by Roger Bigod in the reign of Edward I, was extended by James I and James II. In 1269 the town was surrounded by walls. The fortresses were dismantled by Cromwell, but some remains are extant.

The Barrow is crossed by a swivel bridge. The inland water communications reach to Dublin by means of the Barrow and the Grand canal.

The Nore is navigable to Inistioge. New Ross has breweries and tanyards, a salmon fishery, and exports agricultural produce. The urban district includes Rosbercon.

**NEWRY,** a seaport, urban district and market town of Co. Down, Northern Ireland, on the Newry water and Newry canal at head of Carlingford lough, 45 mi. S. of Belfast by the G.N.R. Pop. (1937) 12,738. Area 1.09 sq.mi. In 1175 an abbey was founded there by Maurice M'Loughlin, king of Ireland. It was converted in 1543 into a collegiate church for secular priests, and was dissolved by Edward VI, who granted it to Sir Nicholas Bagenal, marshal of Ireland. In 1689 Newry was set on fire by the duke of Berwick when in retreat before Schomberg. Charters were granted to the town by James I and James II. Until 1898 a portion of Newry was situated in Co. Armagh. A mile N.E. of the town is a notable rath or enclosure, taking its name of Crown rath from traditional single encounters between native princes in contention for the sovereignty. The L.M.S. railway connects Newry with the deep-water harbour at Greenore; and there is an electric railway to Bessbrook in Co. Armagh. The western part, called Ballybot, is connected with the eastern part, or old town, by bridges over the canal and over the tidal water.

The port admits vessels of 3,000 tons to Victoria basin, 3 mi. from the town.

**NEWS AGENCY.** An agency which supplies news to periodicals, clubs, associations, or private persons, by telegram, in manuscript, proof, by tape machine or duplicated; less frequently by telephone. A news agency does not itself publish news but supplies information privately to its subscribers.

**British News Agencies.**—These may conveniently be divided into four categories:

(1) *Propaganda News Agencies.* These are generally small in size and confine their information to the particular question in which they are interested. Examples are the Labour Press service and the Protestant Press bureau. Information from these bureaus, though sent out in good faith, is necessarily scrutinized more carefully for possible bias by the experienced journalist than information received from other sources. In general these bureaus are not commercially profitable enterprises but are subsidized by political or other organizations.

(2) *Local Agencies.* In a number of middlesized towns there are news or reporting agencies such as the Bradford Press bureau or the Aberystwyth News agency, whose object is not merely to serve the local press with news of every kind but to take in some measure the place of a local correspondent for the lesser London dailies. Agencies of this class and the first frequently send in unsolicited information, to be paid for if and as used. Agencies of the two following classes rarely do so.

(3) *Technical Agencies.* These, such as the Aviation News agency, the Commercial Press Telegram bureau, the Hockey Reporting agency, explain their function by their names. They are mostly situated in London, and they necessarily appeal to a limited clientele; but some, especially the sporting agencies, are very considerable enterprises.

(4) *National Agencies.* Infinitely the most important form of news agency is the national agency, both from the range of its activities, the size of its staff and its powerful and subtle influence in the press. Of these, though the name of the British United Press is occurring more and more frequently in the columns of London dailies, there are but four of prime importance: the Press Association Ltd., which deals only with home affairs, Reuters' Ltd., which deals only with foreign affairs, the Central News Ltd., and the Exchange Telegraph Company Ltd., both of which cover both fields.

All newspapers rely chiefly on the agencies for the receipt of what may be called formal or expected news such as university intelligence, market returns or city quotations. In the same category, to a large extent, fall many ministerial statements, which are often circulated through the Press association or other agencies. Such circulation obviates the calling together of some scores of reporters to hear precisely the same words; moreover, an experienced politician, though he may add in an interview extra details for the papers he desires to favour, will not make his general statement until he is assured that the agency representatives are present, as through them he can speak to the whole British and much of the colonial press.

For general news, the agencies cover a larger area than any one journal could. At any one of the smaller London police courts, for example, an interesting or scandalous case may at any moment come up without warning. No private reporting staff could hope to catch every such case, but an agency man is almost certain to be in attendance. If, again, it is known that a case or a function of unusual interest is expected in a town where the paper concerned has no correspondent, a "special" is ordered from an agency, which details one of its reporters, for that day only, to telegraph an exclusive report to its client.

Agency material, in London, is delivered by telegram, by duplicated sheets delivered by hand, and (in the case of the Central News, Reuters and the Exchange) by tape machines. The largest foreign service is supplied by Reuters, used by the British government during World War I for propaganda purposes and denounced as mendacious by the German press, as in the famous cartoon *Das Reuter Denkmal.* The agencies have been charged with bias in their presentation of news, especially foreign news. The truth or otherwise of this charge must be a matter of opinion, but it can safely be said that there is no authenticated case of the agencies having refused their services to a journal to whose policy they objected. The power of the American Associated Press has no parallel in Britain, nor have the disputes over its exclusiveness and the competition for "A.P. franchises."

The services provided for the provincial press are in some ways even more extensive, as they include "London letters" and often the only reports received of parliamentary proceedings. Even syndicated "leaders" are often sent out, and propaganda agencies supply newspapers (other than dailies) half-printed, with blank pages for local information. The staffs of the agencies are for the most part organized in the National Union of Journalists, and salaries, in comparison with pre-World War I rates, have notably increased. (R. W. P.; X.)

**United States.**—Two rival principles underlie American news agencies. The Associated Press and the Canadian Press represent one principle, that of pure co-operation and mutuality, and the United Press associations and the International News service represent the opposite fundamental in that they are profit-making corporations, collecting and selling service on commercial lines. There is lively competition in the news agency field, both for group domination and for reportorial achievement. In one sense, all of the news services serve a common ideal which is to deliver to their "members" or "clients" the important news by the most rapid means, written true to authenticated or evidential facts without bias, opinion or undue colour.

The development of the American news agency dates back to the struggle of the pioneer press of New York. While individual editors of the colonial press and their successors for 50 years had with interesting enterprise employed the foot courier, the packet, the stagecoach, the pony express, the canal boat and the primitive steam train, the birth of the idea that there might be co-operation among several newspapers in the collection of news which all could share occurred just 100 years ago when the Association of Morning Newspapers was organized in New York for the purpose of maintaining boats to meet ships as they came up the bay bearing news from Europe. The first telegraph line, running from Washington to Baltimore, was not opened until 1843. Fifteen years later the Atlantic cable was opened for

traffic. Other co-operative news agencies, concerned with the business of meeting ships in New York harbour, were later organized and from a merger of these the New York Associated Press, a co-operative news-gathering organization of New York newspapers, was formed. It was mutual in New York, but sold its product to newspapers in other American cities. In various sections of the United States other small, co-operative or privately owned news agencies gradually came into being, such as the New England Associated Press, the Southern Associated Press and the Western Associated Press. The United Press, which is not to be confused with the present United Press Associations, was established as a national rival to the various Associated Press units, then only beginning to co-operate. In 1892 the unified Associated Press took the field as the rival of the old United Press. It obtained contracts for the exclusive use in the United States of the news reports of the leading European agencies—Reuters in Great Britain, Wolff in Germany and Havas in France. These connections had previously been in favour of the United Press and their loss resulted in the failure of the latter organization. To supplant the United Press several agencies were formed by groups of newspapers outside of the Associated Press group. They were the Publishers' Press and the Laffan Service in the eastern States, the Scripps-McRae Press Association in the Middle West, and the Scripps-Blade Service in Pacific coast States. Except for the Laffan Service, which was finally discontinued, these services merged to form the United Press Associations in 1907. The Associated Press was reorganized in 1900 and incorporated under the laws of New York, as a purely co-operative association that could declare no dividends, that elected its membership and shared the cost of operation among members who are individuals representing newspapers, not the newspapers themselves. The International News Service was established by William Randolph Hearst in 1906. Transradio Press Service, Inc., was organized in 1934 to serve news to broadcasting stations. It now has several press clients. The Canadian Associated Press is co-operative, non-profit making, its elected members dividing the costs of operation. It works in close relation to the Associated Press, with an exchange of news reports. The New York City News Association, co-operatively owned and governed by the New York dailies, covers police and other routine local news intensively.

Organizations with a similar purpose are maintained in Chicago and Los Angeles. The Standard News Association reports suburban news for New York papers. (A. T. R.)

**NEW SIBERIAN ISLANDS** are situated off the Arctic coast of Siberia, from 73° to 76° 6′ N., and 135° 30′ to 151° E. The name is loosely applied, covering either the northern group only of these islands, for which the name of New Siberian or Anjou Islands ought properly to be reserved, or the southern group as well, which ought to retain its name of Lyakhov Islands. Some confusion prevails also as to whether the islands Bennett, Jokhov, Vilkitski, Henrietta and Jeannette, ought to be included in the same archipelago, or described separately as the Jeannette or De Long Islands. The first three of these belong geographically, and probably geologically to the New Siberian group, from which they are less than 100 m. distant. Henrietta and Jeannette Islands lie 200 m. north-east of Novaya Sibir Island, in 157° to 159° E. Sannikov Land, reported by J. Sannikov in 1805 to lie north of Kotelni Island, probably does not exist. The islands form part of the Yakutsk Soviet Republic.

The *New Siberian Islands* consist of Kotelni, the largest (116 m. long, 100 m. wide), having the small island Byelkovski near its western shore; Thaddeus (Faddeevski), in the middle; and Novaya Sibir, New Siberia, in the east (90 m. long, 40 m. wide). Kotelni is the largest and reaches an altitude of 1,200 ft. in the volcanic Malakatyn-tas mountain. It is built of Silurian coral limestones (Llandovery division), containing a rich fossil fauna. The same Silurian deposits are widely spread on the mainland as far as the Olenek. Middle Devonian limestones and slates are all faulted north-north-west and south-south-east. Triassic slates appear in the south-east. Diabases pierce to Devonian rocks. The eastern portion of the island, named Bunge's Land, is covered with Post-Tertiary deposits. Novaya Sibir Island attains altitudes of 200 to 300 ft. in its western portion. The so-called Wood Mountains, which were supposed to be accumulations of floating wood, are denudations of Miocene deposits containing layers of brown coal with full stems of trees. These Tertiary deposits are characterized by a rich flora and fauna, testifying to a climate once very much warmer. The only representative of tree vegetation now is a dwarf willow 1 in. high.

The *Lyakhov Islands* consist of Bolshoi, or Blizhni, which is separated by Laptev Strait, 27 m. wide, from Svyatoi Nos of Siberia; Mali, or Dalni; and several smaller islands to the west of Mali. Bolshoi too consists of granite protruding from beneath non-fossiliferous deposits. Along its southern coast Baron Toll found immense layers of fossil ice, 70 ft. thick, evidently relics from the Ice Age, covered by an upper layer of Post-Tertiary deposits containing numbers of perfectly well-preserved mammoth remains, rhinoceros, *Ovibos,* and bones of the horse, reindeer, American stag, antelope, *saiga,* and even the tiger, associated with relics of forest vegetation. A stem of *Alnus fruticosa,* 90 ft. high, was found with all its roots and even fruit. Similar deposits of ground ice occur in Vasilievski Island. Basalts and Tertiary brown coal deposits enter into the composition of the southern extremity of Bennett Island; Vilkitski Island is low (50 ft.) and basaltic. Bennett and Henrietta Islands have a few small glaciers. The New Siberian Islands have none.

The climate of these islands is very severe. In 1886 the winter ended only in June, to begin anew in August (May 21, −5·8° F; Oct. 16, −34·6°). The highest summer temperature was 50°. Flocks of geese and other birds come to the islands in summer. The lemmings are numerous. Reindeer, followed by wolves, come across the ice from Siberia; the fox and polar bear feed on the lemmings. There is much driftwood. The islands have been long known to Siberian hunters who come for furs and fossil ivory.

A Yakutsk Cossack, named Vaghin, wintered on Bolshoi in 1712, but it was a merchant, Lyakhov, who first described the two greater islands of this group in 1770, and three years later reached on sledges the largest island of the New Siberian group, which he named Kotelni. M. Hedenstrom, accompanied by Sannikov, explored the archipelago and published a map of it in 1811. Anjou visited it in 1821–23. A scientific expedition under Dr. A. Bunge (including Baron E. Toll) explored it in 1885–86. Toll revisited it in 1893 with Shileiko, and again in 1900 with F. G. Seeberg in the "Zarya." The Russian hydrographical expedition in "Taimir" and "Vaigach" in 1912 did some surveys in the New Siberian Islands; in 1913 it discovered Vilkitski Island and in 1914, Jokhov Island. The "Maud" in 1924 visited the New Siberian Islands. (*See* ARCTIC REGIONS.)

BIBLIOGRAPHY.—The works of Hedenstrom, F. von Wrangell, and Anjou, Bunge, and Toll in *Beiträge zur Kenntniss des russischen Reichs,* 3te Folge, iii. (1887). Toll in *Memoirs (Zapiski) of the St. Petersburg Academy of Sciences,* 7th series, xxxvii. (1889), xliii. (1895), and 8th series, ix. (1899), with maps. *Geographical Journal,* Dec. 1919; *Geographical Review,* July 1925 and H. U. Sverdrup, *Tre Aari Isen med Maud* (Oslo, 1926). (R. N. R. B.)

**NEW SOUTH WALES,** a state of the Commonwealth of Australia, lying in the south-east, and occupying 309,432 sq.m. or 10·4% of the continent. From the east coast (Point Danger-Cape Howe, 700 miles) to the western boundary which runs for 240 miles along longitude 141° E., the average breadth is *c.* 650 miles. The northern boundary lies along lat. 29° S. and further east, along the Upper Darling (Barwon-Macintyre-Dumaresq) streams and thence along a crooked line of highland divide (Macpherson Range, etc.) to Point Danger. The southern boundary is formed by the middle and upper Murray to the head of the Indi (Forest Hill), thence in a straight line south-east to Cape Howe.

Physiographically four main divisions may be distinguished, corresponding to fairly well-marked climatic and economic areas.

(i.) **Eastern Highlands,** the most striking, as also the most decisive, of the relief features, consists of a belt of plateaux extending from the Macpherson Range on the north to the Australian Alps (*q.v.*) on the south. (*See* AUSTRALIA: *Geomorphology; Queensland.*) In the north the *New England Plateau* (*c.* 200 miles long, 70–80 miles broad, with *c.* 9,000 sq. miles lying above 3,000 ft.) rises in its centre to *c.* 5,000 ft.—Ben Lomond,

5,000 ft.; Mount Capoompeta, 5,100 ft.—sinks at either extremity to *c.* 4,000 ft.; Mount Lindsay (Macpherson Range), 4,064 ft.; Oxley's Peak (Liverpool Range), 4,500 ft.—and has considerable outliers, on the west the volcanic Nandewars (4,000 ft.) and Warrumbungle Range (3,000 ft.), and on the east and south the semi-detached spurs carved out by stream erosion into the likeness of ranges—Hastings, Mount Royal, Liverpool, etc., "Ranges." To the south of these ranges the plateau belt is broken across and the Central Plateau is separated from the more northerly by the remarkable Hunter River valley, the saddle at the head of which (near Cassilis) lies at *c.* 1,500 ft. The *Central Plateau* extends from this gap to the Lake George depression just north of the Federal Capital Territory. In general it repeats the features of the New England Plateau (*cf.* volcanic outliers on the west: Canobolas group, *c.* 3,000 ft.) but it is smaller and lower, few areas rising above 4,000 ft., and altitudes vary considerably. Its north-eastern section, the Blue Mountain Plateau, capped with (Triassic) sandstone, tilts from 4,000 ft. (west) to 700 ft. (east). From the Lake George fault-depression ("Senkungsfeld") to the border extends the *Southern Plateau,* a portion of the Australian Alps, a series of massive flattish-topped blocks diversified by (mainly north to south) down-faulted depressions (Mount Kosciusko, 7,328 ft.). Geologically this highland belt is characterised by its prevailingly ancient rocks (pre-Cambrian granites, folded Palaeozoics, etc.); by the volcanic flows (basalt, trachyte, etc.) which form cappings over considerable areas; by the extensive faulting which has differentiated levels, dislocated former drainage and resulted, in particular, in the abrupt scarps and declivities of the eastern flank; by the flattening by erosion (peneplanation) of the surfaces.

(ii.) **The Coastal Lowlands** belong structurally to the highland belt, being mainly, perhaps, down-faulted portions of it. The coast-line also appears in certain stretches (*e.g.,* in the south) to be fault-determined. Almost everywhere the plateaux behind break away in sharp declivities and form steep backing walls often scarred by deep gorges. The coastal lowlands are mostly narrow (10–20 miles)—often mere deltaic fringes at river-mouths. In three places—around Sydney, Hunter River, Clarence-Richmond-Tweed rivers—they form roomier basins in which later rock-formations (*e.g.,* Triassic) have been preserved. The Hunter-Goulburn Valley is a down-faulted trough worked out by erosion in weak strata and breaks across the highlands, running almost straight south-east to north-west for 120 miles to the Cassilis saddle (*v. sup.*) and is floored in its lower part with deltaic deposits. The structure of the Hunter Valley and of the Sydney Basin accounts for the outcropping of valuable coal seams. The coast-line, backed in many parts by bold heights, consists mainly of a succession of rugged promontories alternating with sandy bays and some inlets. In the central portion, on the other hand, subsidence has produced fine drowned valley harbours (Sydney, Port Stephens, Broken Bay, etc.).

(iii.) **The Western Slopes** are the "ramp" of the eastern plateaux, their uneven but relatively gentle declivity towards the great interior plains. In addition to outliers of the highlands (Mount Exmouth group, Curumbenya Range, etc.) the Cobar (*c.* 300 miles south-east–north-west; 150 miles wide; altitude 500–1,000 ft.) and Wyalong peneplains—worn-down relics of the buckled ancient floor which protrude through the later surface deposits—are the chief irregularities, though the streams have excavated long and broad transverse furrows.

(iv.) **The (Western) Plains** occupy all the remainder (nearly $\frac{2}{3}$) of the State except along the western edge where the Barrier "Range" (*c.* 100 miles north to south; 30 miles east to west; altitude *c.* 1,000 ft. or 500 ft. above the surrounding plains) forms a series of hard etched and scarped ridges and resembles in structure the Cobar "peneplain." The immense plains—substantially the basins of the Upper Darling and a good part of that of the Murray—are floored with recent deposits (probably residuals of an earlier and wetter epoch). The western portions, and the older and higher of these deposits, are prevailingly red and are generally fertile. Black soils are found in the river valleys (*e.g.,* middle Macquarie, Castlereagh, Namoi, etc.) and along the silted-up courses of old streams. The streams, meandering, distributing, and flooding wide over these levels, are continually spreading fresh alluvium. The northern portion (80,000 sq. miles) reaching south-eastwards to Dubbo, falls within the Great Artesian basin, and the south-western parts (Riverina) fall within the Murray-River artesian area. In the former area bores vary from *c.* 90–4,340 ft. (av. *c.* 1,750 ft.), while 380 flowing wells discharge 80,780,000 gals. a day (maximum for single well, 1·5 million gallons).

Of the rivers the coastward-draining are relatively short, the Hunter and Wollondilly, each *c.* 340 mi. are the longest—rapid and constant-flowing streams, and owing to recent (Pleistocene and earlier) uplift, they are vigorously cutting back and excavating deep canyon-like gorges in the plateaux behind (*cf.* upper Macleay gorge, 3,000 ft. deep), creating wild and beautiful scenery and opportunities for the development of water-power. The lower basins are undulating to hilly with rich alluvial flats. Sand-barred mouths are common and also lagoon-like lakes (*e.g.,* Lake Macquarie) due to damming of mouths by marine drift. (*Cf.* south to north current along the coast.) Few are navigable for any great distance and then usually for small craft only (*e.g.,* Hawkesbury, 70 miles; Macleay, 39 miles; Shoalhaven, 22 miles). *See* also RICHMOND RIVER. The inward-flowing streams have been referred to. (*See* AUSTRALIA: *Drainage.*) Of the Murray, 1,200 miles are within New South Wales. Recent measurements have given the following results: Darling, length 1,160 miles, drainage area 221,700 sq. miles; Murrumbidgee, 981 and 10,700; Lachlan, 922 and 10,420; Macquarie, 590 and 10,090; Namoi, 526 and 9,820.

**Climate.**—Situated wholly in the temperate zone, New South Wales has a generally moderate climate. Average temperatures are higher by 5°–7° F in the north than in the south, and the range increases towards the interior, the mean daily range on the coast being *c.* 19° F, in the western plains *c.* 26° F. The transition zone between summer and winter rains passes diagonally (north-west to south-east) through the State. The area south-west of the line Broken Hill-Wagga-Albury receives winter rains mainly from Antarctic depressions ("lows"); the area north-east of a sinuous line running from the north-west corner of the State to Newcastle receives summer rains from tropical (monsoonal) "lows"; the intervening belt receives rain from both quarters and, in the east, from the passage of anticyclones ("highs") also. The east receives much more rain, and more uniformly, than the interior, the isohyetal lines except in the south and south-west running roughly parallel with the coast. The extremes are in the north-east corner (80 in. per ann.) and in the north-west (7 in.). Only 42% of the total area receives an average of over 20 in. per ann.; 15% receives less than 10 in. which is also more or less erratic. Heavy rains cause extensive flooding of the streams resulting often in serious loss; droughts are also a recurrent difficulty, especially in the interior. The rate of evaporation increases from *c.* 40 in. a year on the coast to *c.* 100 in. in the north-west with concomitant seasonal aridity and the drying up of streams. Four main climatic divisions, corresponding to the physiographic, may be distinguished: (i.) *Coast:* relatively high and regular rainfall coming mainly from the sea, with mild and humid conditions. Av. ann. temps., in the north 76°–57° F, in the south 68°–51° F; rainfall 30–80 in. per ann., greater in the north. (*See* LISMORE, NEWCASTLE, SYDNEY.) (ii.) *Tablelands:* cool and bracing climate with cold winters in the south; uniform and reliable rainfall. Average ann. temps.: in the north 70°–45° F; in the south 63°–38° F; av. ann. rainfall, 40 in. in the east to 30 in. in the west. (*See* BATHURST.) (iii.) *Western Slopes:* a drier, sunny and healthy climate with uniformly distributed rainfall. Temperatures are higher in the north, summer: 81°–73° F, winter, 53°–46° F; rainfall (av. ann.): 30 in. in the east, 20 in. in the west. North of the Lachlan the rains come from the north in February–May; the Riverina has light, but fairly reliable, winter showers. (*See* ALBURY.) (iv.) *Western Plains:* a dry climate, invigorating in winter, but liable to suffer from droughts, dust-storms and, more locally, from floods. Temperatures are higher in the north—av. ann.: summer 84°–75°; winter 54°–49° F. Av. ann. rainfall from 7 in. in the north-west; 10–15 in. along the Darling; 20 in.

in the east. (*See* BROKEN HILL.) (*See* AUSTRALIA.)

**Economics.**—The general facts relating to the distribution of minerals, soils and natural vegetation have been given under AUSTRALIA (*q.v.*). The clear physical differentiations indicated above, together with the stage of growth attained, give the economic development of New South Wales a marked regional character. Climate, relief, location of minerals and accessibility (*i.e.*, communications) are dominant factors in the distribution of the population. The following survey therefore proceeds upon the basis of four regions, viz., Western Plains; Central Plains; Tablelands; Coastal Lowlands. The last three occupy belts roughly parallel with the coast line and admit of subdivision into north, central and southern sections.

**Western Plains,** occupying the west and northwest portion (80,312,000 ac.=125,487 sq.mi. or $\frac{2}{5}$ of the state) west of the courses of the Lachlan, Bogan, and Upper Darling (Barwon) rivers, has abundance of good soils but a poor and unreliable rainfall—8–19 in.; under 10 in. over $\frac{1}{3}$ of its area—and suffers occasionally from fierce heats, droughts, floods and always from introduced rabbits. Mining and pastoral pursuits alone have importance. In the northwest is Broken Hill (*q.v.*); the once-famous Cobar-Nymagee copper area, which is just included in the east, has suspended production, and opal mining (White Cliffs, etc., in the northwest; Lightning Ridge field—12,000 acres—in the northeast) is depressed (output 1926: £11,500). It is an area of isolation, "wide open spaces," large long-term leaseholds, over 63% of the total area being occupied by 196 holdings of over 100,000 acres each. The country produces fine-woolled merinos, but its carrying capacity varies greatly with the seasons and is generally low (40–130 sheep per sq.mi. according to season, or $\frac{1}{5}$ of that of the lands further east). The livestock (1939) consisted mainly of 5,966,000 sheep, 63,000 head of cattle and 25,000 horses. The total population was 44,500 (1 person per 3 sq.mi.; without Broken Hill, 1 per 7 sq. miles) or 1.9% of the population of the state, Broken Hill alone accounting for 26,925. Apart from this the settlements consist mainly of collecting and distributing centres for pastoral areas situated on railway lines (Cobar, etc.), on rivers (Wilcannia, Wentworth), or on both (Bourke, population [1933] 1,778; Walgett, Menindee, etc.) besides isolated stations and mining camps. Railways link Bourke, Cobar, Walgett and other towns on or near the eastern boundary—rivers with the eastern parts of the state and with Sydney, and the recently completed line from Sydney to Broken Hill (Condobolin-Ivanhoe-Menindee) traverses the heart of the area (east to west) and should help to develop much territory. Though increasingly tapped by railways the Darling still carries traffic (*e.g.*, wool to South Australia) in good seasons, and for the rest transport is by camel etc., train—increasingly by motor—over rough tracks.

**The Central Plains** form a natural extension of the western, large portions of them being little distinguished as regards relief from the latter. Thus in the northwest they comprise the low flat lands stretching east of the Barwon-Bogan rivers, and in the southeast the broad Riverina plains are only divided from the western plains by the Murrumbidgee and Lachlan rivers. Further east the land slopes gradually up, but, except in the centre (Cobar-Wyalong area) there is little above 1,000 ft. and few rugged features. But its rainfall, though rather scanty and unreliable, is better than that further west (15–24 in., the greater quantity in the north—18–28 in.—being balanced by greater evaporation). The rivers from the highlands further east stream across these lowlands but are of no great service, being irregular in flow, entrenched in places, and liable to flood. Artesian supplies have proved a great boon and have been extensively exploited, especially in the northwest and southwest. The soils, red-brown loams and black soils, are good but the latter are very heavy and have only recently begun to be worked. Of the total area (*c.* 41,420,000 ac. =64,719 sq.mi.) some $\frac{9}{10}$ are occupied, of which 62% has been alienated from the crown, and though holdings of 10,000 acres and upwards account for 19% (89 over 50,000 ac. each), medium to small-sized holdings are common further east and particularly in the Riverina. The area, in fact, forms a climatic and economic transition zone. In the west pastoral pursuits; in the east, mixed agriculture and grazing; in the Riverina and a few other parts agriculture alone, or dairying alone, are practised. The area contains 40% of the agricultural lands of the state; and in the northwest and southwest portions are some of the best sheep-lands. Along the east the fringes of the wheat-belt are included. The 10-in. winter rainfall line (7 months: April-October, the growing season) runs roughly down the middle (north-northeast–south-southwest) of the area, and to this the wheat "frontier" approximates, falling behind it in the northeast but overstepping it to the extent of 5,000,000 acres and pushing forward into rainfall areas of 8–9 in. (April–Oct.) in the centre and particularly in the southwest (Riverina). Thus, while grazing, with a little mixed and other farming, predominates in the north, mixed farming—mainly sheep and wheat—arable farming, fruit-growing (vines, etc.) and dairying increase in importance in the south. A special place, in virtue of its irrigation areas, and its wider range of possibilities, is taken by the Riverina (*q.v.*). The total livestock amounted (1939) to 13,939,000 sheep, 200,000 cattle, 116,000 horses, 9,000 dairy cattle, but the numbers vary greatly according to season (*e.g.*, sheep: 1891, 25,000,000; 1921, 14,000,000; dairy cattle: 1911, 48,000). Similarly the sheep-carrying capacity, though high (266.6 per sq.mi.) varies from 351–205 per sq.mi. With a total population of 115,640, the area had (1926) a density of 1.8 persons per sq.mi. The chief settlements, apart from the pastoral river centres common to this and the Western Plains (Walgett, Hillston, Balranald, etc.), are centres of mixed pastoral and farming areas: Moree (4,355 in 1933), Narrabri—a railway junction town in a sheep, dairy, and fruit area, with butter factories and freezing works—and Coonamble in the north, Nyngan and Condobolin in the centre, and a large number of similar settlements in the Riverina.

**The Western Slopes** consist in the main of gently rolling country which rises from levels of under 1,000 ft. to elevations of over 2,000 ft. and merges into the plateaus to the east. It is essentially the zone of the upper, and fairly roomy, basins of the western rivers, but in the northwest and southwest the narrower head-water valleys and plateau margins are included in the administrative division. The rainfall is abundant and also fairly reliable (19–34 in.—rather more in the north, 24–33 in., more varied in the south where the Australian Alps are approached: 16–40 in.). The outcrops of ancient rocks along these slopes, as also the stream-beds descending over them, have yielded rich stores of minerals, and Forbes, Temora, Wyalong, Grenfell, etc., were once famous mining centres. Some gold-mining is still carried on, tin is obtained at Ardlethan, chrome iron at Gundagai, and a little coal is worked near Gunnedah. But in general mining has been succeeded by agriculture as the value of the red soils for wheat has become known. Out of the total area, 28,164,000 ac. (*c.* 44,000 sq.mi.), $\frac{6}{7}$ is occupied. Wheat, needing dry summers and an optimum growing season (April–Oct.) rainfall of 11–15 in., finds these conditions in a belt *c.* 500 miles long (northwest–southeast), about 100–130 mi. wide, and limited on the east by a line about 120 mi. from the coast, the coastal portions having proved too humid. Within this belt are 53,000,000 ac. of which about 26,000,000 ac. seem capable of cultivation, and of this $\frac{1}{5}$ would normally be used for growing wheat-hay (fodder). The area of possible wheat cultivation has greatly increased, nearly 20,000,000 additional acres having been occupied for this purpose in 1904–22. The total area actually cultivated to wheat (1939) is about 5,000,000 ac., about one-half of which is under wheat at any time. Fruit-growing and dairying are also carried on, and along some of the rivers irrigation also (*e.g.*, Forbes, Dubbo, Ardlethan). Grazing (mainly sheep) is everywhere important. The great bulk of the holdings within the area lie between 100 and 3,000 acres. Livestock total: sheep, 15,670,000 with the very high average density of 389 per sq.mi.; cattle, 361,000; horses, 159,000; dairy cattle, 55,000. In addition to primary production there are butter-factories, freezing works, flour and saw mills, etc., and in certain railway centres (*e.g.*, Junee, Quirindi) are large railway engineering works. The total population (1933) was 243,000 (5.5 per sq.mi.). The towns (Tam-

worth, 9,913 in 1933; Dubbo, 8,344; Forbes, 5,355; Parkes, 5,846; Junee, Cootamundra and Temora, 3,823) are centres for agricultural and pastoral producing areas, adding often the functions of railway junctions, mining, and (on a small scale) industrial centres.

**The Tablelands** extend to the east of the above division and are bounded on the east almost everywhere by abrupt and often rugged and precipitous declivities. They include much level or rolling country capable of cultivation but much, especially in the south (ALPS, AUSTRALIAN, *q.v.*), is too rough for anything but grazing. The climate is also cool or cold and, though bracing, tends to be wet. (Rainfall, 24–53 in.; in the north 30–38 in.; in the south 19–65 in.) Mining, formerly extensive, is still important. The tin resources of the Northern plateau (Tingha, Emmaville) are actively exploited; silver ores of high quality are mined at Yerranderie (Burragorang valley); gold is mined at various places: Bathurst, Uralla, etc.; the iron deposits of Cadia (reserves 10,000,000 tons) and Carcoar are utilized in the industries of Lithgow (*q.v.*) and smaller deposits exist at Goulburn and Queanbeyan, while the most westerly outcrops of the Sydney Basin coal deposits crop out and are worked at Lithgow. Of the total area (26,480,000 ac.=41,375 sq.mi.) about 77% (20,000,000 ac.) is occupied, but less than one-half is alienated from the crown. The climate is, in general, too damp for wheat but such as is grown is also found mainly in the central area. Sheep-grazing is carried on from north to south, though the central parts lead in this also. The highlands favour a different type of sheep from the plains—not so robust but of exceptionally fine and dense wool. The New England wool, being reputed to be one of the best of all spinning wools, and the Southern Tablelands (*e.g.*, Monaro district) are also noted. The area carried (1939) 12,122,000 sheep (292.9 per sq.mi.); 427,000 cattle; 94,000 horses, and 42,000 dairy cattle. Apart from Lithgow (*q.v.*) manufacturing industries (flour milling, tanning, soapmaking, railway engineering, etc.) are confined mainly to the larger towns, but the noted beauty of the scenery and the relative coolness of summer attract numerous visitors and in the areas within easy railway reach of Sydney and Newcastle the tourist industry is important. The towns and settlements are centres for pastoral, agricultural, and mining districts; many are tourist centres as well, while some are also railway-junction towns with a certain industrial activity. In the Northern Plateau, Armidale (*q.v.*: 6,794 in 1933), Glen Innes (5,352) and Tenterfield are on the main northern railway (Sydney to Brisbane) and combine most of these functions, serving as holiday centres especially for Newcastle and the north coast towns. On the highlands west of Sydney (Blue plateau) holiday and tourist resorts are more important—Katoomba (6,445); Goulburn (14,849), also an agricultural centre with some industries—while further west, Bathurst (*q.v.*, 10,413) and Orange (9,634) combine this with the other functions mentioned. Further removed, such towns as Cowra (5,056), Young (4,011), Mudgee (3,993), Wellington (4,320) are rather more agricultural and pastoral (wheat and sheep) centres and belong almost as much to the Western Slopes division. Lithgow (*q.v.*, 13,444) with its iron, steel and other industries stands rather apart as an outlier of the coastal industrial areas.

**Production.**—In 1926 production was: wool, 79,230,000 lb.; wheat, 2,100,000 bu.; butter, 4,136,000 lb.; minerals, £1,322,000; manufactures, £2,687,000. The Federal Capital territory falls within this area (*see* CANBERRA) and was formerly mainly devoted to grazing (sheep). On the edges of the southern tableland (west of Yass) is the famous Burrinjuck dam, the headworks of an important Riverina (*q.v.*) irrigation scheme.

**The Coastal Lowlands,** irregular, broken and detached patches or mere strips scattered and stretched along the eastern margins, are yet economically and in general social respects perhaps the most important regional element in the state. Relatively small in extent (22,237,000 ac.=34,745 sq.mi.) they contained about 1,770,000 persons (75.7% of the total pop., 1926; 43.4 per sq.mi.); the great majority of large towns, including the capital; nearly all the coal fields and manufacturing areas; all the sugar-growing, the bulk of the dairying and maize-growing areas, besides all the seaports, with the financial and commercial nerve-centres of the state. The largest, and also the most important, individual areas are the Sydney and Hunter river lowlands in the centre, the Clarence-Richmond-Tweed basins in the north, and the Illawarra district in the south. These are described separately (*see* SYDNEY, SINGLETON, RICHMOND, WOLLONGONG) and a general survey alone is given here. The climate is mild and humid, and distinctly warmer in the north (rainfall: 30–62 in.; 35–76 in. in the north, 27–61 in. in the south). Apart from river bottoms and some coastal flats, the terrain is hilly or broken and the cultivable area is small, and of this area less than a quarter was cultivated in 1925–26. The broken lands—tableland scarps, valleys, foothills, etc.—are valuable for mining (*e.g.*, Clarence valley) and the intersection and laying bare of coal-seams by river action and coastal faulting is a fact of importance. The extensive timber resources have been greatly depleted, though some timber is still cut in the Northern and Hunter valleys. In many parts the topography and climate offer facilities for water-power development (*cf.* Nymboida-Clarence scheme), while the rougher interior country is also used for cattle. Wheat and sheep are virtually excluded by the dampness of the climate, but 95% of the holdings used for dairying are in this area. All the sugar grown in the state is cultivated in the northern corner (1938: 21,000 ac.). Considerable quantities of fruit are grown—tropical fruits in the north, vines, oranges, etc., in the (northeast) Hunter valley and in the Sydney Basin—and mixed agriculture is practised (maize, lucerne, potatoes in the north and centre). Livestock (1939): cattle, 695,000; dairy cattle, 962,000; horses, 154,000; sheep, 1,342,000. The holdings are comparatively small: 400–500 acres. The outcropping of coal in convenient positions has given rise to a coal-mining and coal-exporting industry (*see* BULLI, MAITLAND)—in 1938 very depressed—and more recently to growing manufacturing industries centred chiefly in or near Newcastle, Sydney, Port Kembla (*q.v.*). Here is the chief and growing industrial "hub" of the commonwealth. Here, also, are the financial and commercial headquarters—the central banking, wool-broking, railway and shipping, political and social organizations—of the state. Of ports, Sydney and Newcastle—the former good, the latter indifferent as a harbour—are the most important, but Grafton (a river port), Coff's Harbour and Byron Bay in the north have actual importance or possibilities as outlets for local trade and the same applies to Port Stephens as a possible outlet for the lower Hunter district. Jervis bay is the destined site for the port of the federal capital. Associated with the coasts are also fishing (mainly in the northern estuaries and lakes; 1938: £620,000), and the tourist and holiday-resort industries. Of the total population of the area (*v. sup.*) Sydney alone accounts for 1,235,267 (1933), and about 200,000 more inhabit the Sydney basin (Cumberland county). The lower Hunter valley and coasts immediately north of it (*i.e.*, substantially the Newcastle [*q.v.*]-Maitland [*q.v.*] district) count a further 280,000. Of northern towns Lismore (*q.v.*, 11,762 in 1933), Grafton (6,411), Casino (5,287) are important centres, while in the south Nowra, Wollongong, Kiama are local exporting centres and health resorts.

**Statistical Summary.** *Area*—excluding Federal Capital Territory; including 176 sq.mi. of harbours—309,432 sq.mi., 10.40% of total area of Australia.

*Population* (June 1933): 2,600,847; 8.4 per sq.mi.; *c.* 48% of commonwealth; rate of increase (1926), natural 1.34%, natural+immigration 2.14%; metropolitan 45.6%; 99% of area contained (1926) only 655,300 inhabitants.

*Occupations* (Census 1933: total population 2,600,847; main classes only); *Breadwinners:* 46.5%; *Primary Producers:* 14.3% (agricultural with pastoral and dairying, 9.9%; mining, 3.8%). *Industrial,* 39.3%. *Commercial and Transport,* 26.7%.

*Production* (1938–39): Total, £165,165,000. *Primary Industries:* £74,899,000 (pastoral, £24,894,000; agricultural, £18,459,000; dairying—including pigs, bees, poultry—£16,359,000; mining, *c.* £11,700,000; forests, fisheries, etc., £3,485,000). *Manufacturing Industries:* £90,266,000. Production per head of population: *Primary:* £27.7.11 (pastoral, *c.* £9; agricultural, £7; dairy-

ing, £6.0; mining, £4.5.7). *Manufacturing:* £33.0.4. *Total:* £60.8.3.

*Pastoral Industry* (1939): *Sheep,* 48,877,000 (highest was in 1891, 61,831,000) including 40,861,000 merino; Wool, 437,000,000 lb.=£20,679,000 (at Sydney); average weight of clip, 7.8-8.8 lb. *Cattle:* 2,811,000 (including 1,068,000 dairy cattle). *Horses:* 548,000. *Milk:* 311,000,000 gal. *Butter:* 119,000,000 lb. *Cheese c.* 7,500,000 lb.

*Agriculture:* Area under cultivation (1939): *c.* 10,200,000 ac. (crops alone, 7,050,000 ac.). Wheat, 4,650,000 ac.; 59,898,000 bu.; £6,695,000=36.3% of total agric. produce. Hay, 973,000 ac.; 1,200,000 tons; £4,252,420=23%. Maize, 120,000–166,000 ac.; 3,280,000–4,600,000 bu.; £630,000–894,000=2–4%.

*Mining:* Total value of all minerals produced to end of 1938=*c.* £513,000,000. Total output (1939), £12,000,000; (silver-lead, £3,520,000; zinc, £1,360,000); coal, £6,768,659 (northern fields, 7,000,000 tons; southern and western, etc., 3,800,000 tons).

*Manufacturing Industries* (1911 and 1939–40): Factories: (1911) 5,000; (1939–40) 9,458. Employees: 66,000 and 239,000. Raw materials and fuel: £15,600,000 and £134,453,000. Value of output: £25,700,000 and £239,000,000. Employees: Metallurgical and machinery, 184,000; clothing and textiles, 137,000; food, drink, etc., 87,000.

*Communications—Railways:* Total mileage open 1939 (including Federal and private lines), 6,210 miles (4 ft. 8½ in. gauge, 6,141)=1 mi. railway per 400 inhabitants or per 50 sq.mi. Av. ann. increase of mileage, 155.38 miles. Total capital expended (1939), £149,238,000. Net earnings: £6,108,000=4.10% interest on capital invested.

*Trade:* Total (1935–39), £78,000,000–£112,000,000. (Imports £40,000,000–£63,000,000; Exports £37,000,000–£57,000,000.) Per head of population: £29–£41 (Imports: £15–£23; exports: £14–£21).

*Exports:* Wool: £17,000,000–£27,000,000=45–55% of total exports.

*Wheat and Flour:* £4,000,000–£7,000,000=10–14%. *Meat, hides, leather,* etc.: £5,500,000–£6,700,000=12–13%. *Butter: c.* £2,000,000=3–4%. *Coal:* £350,000 (falling)=1.0%. *Other Minerals: c.* £3,000,000=5–6.5%. Total staple products £25,700,000=61% of total overseas exports.

*Shipping* (all classes): *c.* 3,300 vessels; 11,000,000 registered tonnage, discharging 6,100,000 tons and shipping 5,400,000 tons cargo.

*Social Conditions:* Hospitals: private: 549 (beds: 5,224); public, 207 (13,792). Total (government) expenditure on charitable relief (1938–39): £7,898,000=£2.17.9 per head of population. (Maternity allowances: £167,000; State wards [children]: £760,000; Hospitals, asylums, etc.: £1,150,000; pensions: £6,400,000). State advances for building homes (1926): £1,620,000. Parks, recreation grounds, etc.: 240,000 ac.

*Education:* Schools (1938): public, 3,283; private, 746. Pupils: public, 367,052; private, 100,720=92% of those requiring instruction. (O. H. T. R.; G. Tr.)

## HISTORY

**Early History.**—New South Wales was discovered by Captain Cook on April 28, 1770 (*see* Australia). On Jan. 20, 1788, the "Sirius," commanded by Captain Arthur Phillip, R.N., reached Botany bay with an armed trader, three store-ships and six transports. The persons on board the fleet included 40 women, 202 marines of various ranks under Major Ross, five doctors, a few mechanics, and 756 convicts. The livestock consisted of one bull and four cows, a stallion and three mares, some sheep, goats, pigs and a large number of fowls. The expedition was well provided with seeds of all descriptions. As Botany bay was found unsuitable, the settlement was transferred to Port Jackson, to the present site of Circular quay. Later, other convict-ships arrived; and, in 1793, came the first free settlers, who were presented with grants of land. By 1800 the population was 5,000.

In 1809 Captain Macquarie became governor, and, during his administration, New South Wales was transformed from a penal settlement to a colony. Schools and churches had already been erected, a newspaper, the *Sydney Gazette and New South Wales Advertiser,* had been started, and attempts made to acclimatize the drama. Macquarie was the first governor to open up the country. He formed roads and built bridges in the districts along the coast, and commenced a track across the Blue mountains. Attracted by the success of Captain John Macarthur with merino sheep, more free settlers began to arrive in 1817; but not until the governorship of Sir Richard Bourke (1831–37) did they obtain trial by jury, free press, a legislature with very limited representation, free grants of land, and religious equality. Settlement had progressed at a rapid rate. Parramatta, Richmond and Windsor were founded before 1798, and Newcastle, Maitland and Morpeth early in the 19th century; but the towns of the interior, Goulburn, Bathurst, and others were not begun till about 1835. Then, again, the explorations which followed the passage of the Blue mountains opened up a large portion of southeastern Australia. By 1840, owing to the formation of other colonies, New South Wales, which originally signified the mainland of Australia and the islands in the South Pacific, comprised only the three eastern states of today. Sale by auction of the public lands was now substituted for free grants; and squatters were allowed to occupy sparse areas on payment of a small annual licence. In 1851, when Victoria became a separate colony, the population of New South Wales had risen from the 76,793 of 1837 to 187,243, and the annual exports amounted to £2,399,580. In 1851 also, gold was discovered near Bathurst by E. H. Hargraves, and transportation was at last abolished.

The New Constitution bill was passed in 1853, and two years later, approved by the British parliament. The bill provided for an elected assembly and a nominated council; vote by ballot was introduced; the number of members in the assembly was increased to 80, and the franchise was granted to every adult male after six months' residence. The census of 1857 gave the population of Sydney and suburbs as 81,327. In 1859 Queensland was constituted a separate colony.

**From 1861 to 1888.**—After 1861 the land policy was entirely revised. Sir John Robertson, in his Land bill, introduced the principle of deferred payments for the purchase of crown lands. Residence and cultivation were considered more important than a sufficient price. After much opposition the measure was passed and the other colonies adopted similar legislation. The distinction between the descendants of convicts and the descendants of free settlers was now finally abandoned. In 1862 a large force, military and police, was despatched to Lambing Flat, in order to protect the Chinamen from ill-treatment by the miners. Bushranging became frequent, and only with great difficulty was stamped out.

H.R.H. the duke of Edinburgh visited the colony in 1868. An attempt was made upon his life by a man named O'Farrell, who was subsequently hanged. A census taken in 1871 showed that the population was 503,981, and the exports £11,245,032. During the governorship of Sir Hercules Robinson (1872–79) the Fiji Islands were annexed; telegraphic communication with England and mail communication with the United States were established, and a coalition between Sir Henry Parkes (premier and colonial secretary) and Sir John Robertson at length made it possible to develop some continuous policy. The census of 1880 gave the population of the colony as 751,468, of whom 411,149 were males and 340,319 females. In this year the railway to Melbourne was completed, and in 1883 valuable deposits of silver were discovered at Broken Hill. In 1885 the British government accepted the offer of a contingent from New South Wales to aid the imperial troops in the Sudan. The railway to Queensland was opened in 1888 by the new governor, Lord Carrington. In the same year the government prevented the landing of some Chinese passengers and passed laws practically prohibiting the immigration of Chinamen.

**Federation.**—In 1889, the premier, Sir Henry Parkes, gave his support to the movement for Australasian federation, and New South Wales was represented at the first conference held in Melbourne at the beginning of 1890 (*see* Australia). Early in 1891 the great strike, which at one time had threatened to paralyse the trade of the colony, came to an end. A board of arbitration and conciliation to hear and determine labour questions and disputes

was formed, and by later legislation its powers were strengthened. (For labour legislation *see* AUSTRALIA.) The census of 1891 showed that the population was 1,134,207, of whom the aborigines numbered 7,705 and the Chinese 12,781. In 1893 a financial crisis resulted in the suspension of ten banks; but with two exceptions they were reconstructed, and by the following year the effects of the depression had passed away. In 1896 a conference of Australian premiers was held at Sydney to consider the question of federation. The then premier, G. H. Reid, was rather lukewarm, as he considered that the free-trade policy of New South Wales would be overridden by its protectionist neighbours. But his hand was to a great extent forced by a People's Federation convention held at Bathurst, and, ultimately, a considerable majority in favour of federation was obtained.

**From 1899 On.**—During the South African War (1899–1902) New South Wales sent 314 officers and 5,796 men, more than one-third of the total number raised by Australia. In spite of the great drought of 1902, the state made progress, and during the period 1901–14 the cultivated area was almost doubled. Scientific breeding of wheat and dry-farming were important factors in this increase.

The protectionist policy of the Federal government helped the manufacturers, and the change from free trade did not appear to injure the prosperity of the country.

The influence of the Labour party was manifested in the adoption of laws extending the arbitration system, and from 1906 "assisted immigration" became its accepted policy. In 1912 fruit-growing began in the irrigation area of the Murrumbidgee. After 1918 a policy of closer settlement for ex-service men was initiated and further encouragement given to immigration from Great Britain.

The railway strike of 1917 had far-reaching effects: it raised legal and constitutional questions of importance and caused, ten years later, the downfall of the labour ministry. In 1925, John T. Lang, the Labour premier, had instructed the railway commissioners to reduce in rank the men who had not taken part in the strike. The arbitration court forbade the commissioners to carry out the premier's instruction. Thereupon Mr. Lang introduced his Railway bill to annul the decision of the court. This was passed in the assembly but rejected by the legislative council. As the council is a nominated body, Mr. Lang recommended to the governor that 25 new members (all pledged to support the bill) should be added to its number. The recommendation was, after some demur, accepted, but, when a further bill was brought forward to abolish the council, some of the new councillors refused to die for the party and the bill was rejected by 47 to 41.

During the earlier part of this period there was a great deal of activity in railway circles. In 1926 the first section of the Underground in Sydney was opened; and in 1932 the great bridge over the harbour, which had been started in 1925, was ready for traffic. In 1930 two important lines were opened, *i.e.*, in the far west to Broken Hill, which had previously been reached via Adelaide, and the Kyogle-Brisbane railway. By this route Brisbane was linked to Sydney and Albury by a complete standard-gauge railway in 1932, when the large bridge over the Clarence river was ready for use. In 1930 Kingsford Smith flew from England to Australia in less than 11 days, and in 1934 the air-mail to England was inaugurated.

In 1933 there was a record wheat harvest, and the evils of the depression began to lessen. The decennial census was taken on June 30. In the same year the great Hume dam across the Murray river near Albury was completed. The year 1938 was the 150th anniversary of the foundation of Australia, and widespread celebrations took place, especially in Parramatta. In 1939 the Arbitration court adopted 44 hours as the standard working week. Baron Wakehurst became governor of the state in 1937, while in the state parliament A. Mair was premier in 1939, but gave place to Hon. William John McKell in 1941.

(H. D. N.; G. TR.)

**NEWSPAPERS** (*see* also COPYRIGHT, LIBEL, CONTEMPT OF COURT). For legal definition of newspapers in the strict sense reference should be made to the article on PRESS LAWS, but for the purpose of this article the term comprises daily or weekly publications mainly concerned with the reporting, illustrating and commenting upon current events. (For magazines and the like *see* PERIODICAL.)

**Early History.**—In the days before printing the earliest equivalent of the modern newspaper was the series of public announcements called *Acta Diurna* issued during the Roman empire and posted up in the same way as the French postal *affiches* of to-day and copied by scribes for dispatch to provincial subscribers. A like series of official reports was made in China as early as the 7th century, but in a general sense right up to the invention of printing (*q.v.*) the dissemination of news in all countries was by the slow process of word of mouth and by private letter. After the discovery of printing pamphlets or single sheets announcing some item of news were often issued.

It is now generally supposed that the first of them to be published regularly was a German publication the *Avisa Relation oder Zeitung,* first printed in 1609. Then came the Antwerp *Nieuwe Tijdingen* in 1616, and in May 1622 appeared what is now conceded to be the first English newspaper proper, *The Weekly Newes from Italy, Germany, etc.,* London, published by Nicholas Bourne and Thomas Archer. These enterprising editor-publishers, however, had a formidable competitor in Nathaniel Butter, a freeman of the Stationers' Company, who in June 1605 had momentarily satisfied the public demand for sensation, as greedy then as it is now, by reports of two dramatic murder trials in Yorkshire, one of which was the Calverley case. Butter had published *Newes from Spain* in 1611, and when the *Weekly Newes* appeared he almost immediately brought out a rival quarto sheet named *Newes from Most Parts of Christendom,* and its success was so great that a Butter-Archer fusion followed. Their joint production was called the *Newes of the Present Week.* It must not be assumed that during the whole period this journal was published regularly every week, but it is the earliest continuous English newspaper, so far as known to historians. In 1638 Charles I. gave Butter the right of publishing foreign news on payment of £10 a year towards the repair of St. Paul's cathedral, but in the following year he fell under the displeasure of the licenser of the press. Despite the latter's decree of suppression Butter brought out his paper all the same, and he lived to a great age, dying in 1664. Archer had died in 1634.

## I. BRITISH NEWSPAPERS[1]

In the reign of Queen Elizabeth the news writer was well established. Formerly he did not fulfil an independent calling but was a retainer in the service of some great noble whom he kept equipped with such intelligence as his master required, but the gradual spread of learning led to a demand, especially in districts remote from London, for a regular supply of news. For a long period the purveyors of these letters, who must be regarded as journalists, syndicated (to use an expression familiar to modern journalism) their information in manuscript form, and there was more than one organisation for the interchange of letters between London and the provinces. Of these early news-letters good examples are in the *Paston Letters* and the *Sydney Papers.*

**First Newspapers.**—It was at one time believed that the earliest regular English newspaper was an *English Mercurie* of 1588, said to have been printed in the year of the Spanish Armada. Copies are in the British Museum, but it was afterwards proved that these early copies in mss. and print were forgeries.

There is in the British Museum a *Mercurius Gallobelgicus,* the work of D. M. Janson, of Cologne. A fairly thick octavo book, giving a Latin chronicle of events from 1587 to 1594, it is really a sort of annual register. It was continued down to 1635. The *Mercurius Gallobelgicus* is chiefly interesting because, by circulating in England, it started the idea of a periodical supplying foreign news, and apparently became to English contemporaries a type of the newfangled news-summaries; and the title *Mercurius* or Mercury—as representing the messenger of the gods—thus became a common one for English periodicals. On June 1st, 1619, Ralph Rounthwaite entered at Stationers' Hall *A Relation of all matters done in Bohemia, Austria, Poland, Sletia, France, etc., that is worthy of relating, since the 2nd of March 1618* (1619 N.S.) *until the 4th of May.* Again at the beginning of November 1621 Bartholomew Downes and another entered in like manner *The certaine and true newes from all parts*

[1]In the following section have been incorporated certain sections of the articles by E. Edwards in the 9th edition and by H. Chisholm in the later editions of the *Encyclopædia Britannica.*

*of Germany and Poland, to this present 20 of October 1621.* No copy of either of these papers is now known to exist. But in May 1622 we arrive at a regular weekly newspaper which may still be seen in the British Museum, the *Weekly Newes* of Archer and Bourne referred to above.

**Freeing the Press.**—The first periodical with a title was a *Mercurius Britannicus* published by Archer (1625; the earliest copy in existence being No. 16, April 7), which probably lasted till the end of 1627. But the activity of the newspapermen was checked by the Star Chamber edict in 1632 against the printing of news from foreign parts. The next step in the evolution of the newspaper was due to the abolition of the Star Chamber in 1641, and the consequent freeing of the press; and at last we come to the English periodical with domestic news. In November 1641 begins *The Head of severall proceedings in the present parliament* (outside title) or *Diurnal Occurrences* (inside title), the latter being the title under which it was soon known as a weekly; and on Jan. 31, 1642 appeared *A Perfect Diurnal of the Passages in Parliament.* These were printed for William Cooke, and were written apparently by Samuel Pecke, "the first of the patriarchs of English domestic journalism" (J. B. Williams). The weekly *Diurnals* were on the side of the parliament until in Jan. 1643 appeared at Oxford the first Royalist diurnal, named *Mercurius Aulicus, a Diurnal communicating the intelligence and affaires of the Court to the rest of the Kingdome* (continued till Sept. 1645, and soon succeeded by *Mercurius Academicus*), which struck a higher literary note. It was conducted by Sir John Berkenhead, a Fellow of All Souls, whose style is said to reflect that of the Parliamentary oratory of his day. He afterwards became master of requests. *Mercurius Civicus,* the first regularly illustrated periodical in London, was started by the parliamentarian Richard Collings on May 11, 1643 (continued to Dec. 1646); Collings had also started earlier in the year the *Kingdome's Weekly Intelligencer,* which lasted till Oct. 1649. In September 1643 appeared another Puritan opponent of *M. Aulicus* in the later *Mercurius Britannicus* of Captain Thomas Audley, which in September 1644 was taken over and continued for nearly two years by Marchamont (or Marchmont) Nedham. Nedham was a master of invective and one of the earliest to change sides when it suited him. From Oct. 1649 to June 1650, by a new act of parliament, the licensed press itself was entirely suppressed, and in 1649 two official journals were issued, *A Brief Relation* (up to Oct. 1650) and *Severall Proceedings in Parliament* (till Sept. 1655), a third licensed periodical, *A Perfect Diurnall* (till Sept. 1655), being added later in the year, and a fourth, *Mercurius Politicus* (of which Milton was the editor for a year or so and Nedham one of the principal writers), starting on June 13, 1650 (continuing till April 12, 1660). After the middle of 1650 there was a revival of some of the older licensed news-books; but the *Weekly Intelligence of the Commonwealth* (July 1650 to Sept. 1655), by R. Collings, was the only important newcomer up to September 1655, when Cromwell suppressed all such publications with the exception of *Mercurius Politicus* and the *Publick Intelligencer* (Oct. 1655 to April 1660), both being official and conducted by Nedham.

Till Cromwell's death (Sept. 3rd, 1658) Nedham reigned alone in the press, but in 1659 a rival appeared in Henry Muddiman (a great writer also of "news-letters"), whose *Parliamentary Intelligencer,* renamed the *Kingdom's Intelligencer* (till Aug. 1663), was supported by General Monk. Nedham's journalistic career came finally to an end (he died in 1678) at the hand of Monk's council of state in April 1660. His successor, Muddiman, was supplanted in 1663 by Sir Roger L'Estrange, formerly a Royalist cavalry officer who narrowly escaped execution during the commonwealth; he was appointed "surveyor of the press." On him was conferred by royal grant—as it proved, for only a short period—"all the sole privilege of writing, printing and publishing all narratives, advertisements, mercuries, intelligencers, diurnals and other books of public intelligence; . . . with power to search for and seize the unlicensed and treasonable schismatical and scandalous books and papers." L'Estrange discontinued *Mercurius Politicus* and *Kingdom's Intelligencer* and substituted two papers, the *Intelligencer* (Aug. 1) and the *Newes* (Sept. 3) at a halfpenny, the former on Mondays and the latter on Thursdays; they were continued till Jan. 29, 1666, but from the beginning of 1664 the *Intelligencer* was made consecutive with the *Newes,* numbered and paged as one.

**The London Gazette.**—The first number of the bi-weekly *Oxford Gazette,* licensed by Lord Arlington and written by Muddiman, was published on Nov. 16, 1665. It was a "paper" of news, of the same size and shape as Muddiman's news-letters. With the publication of the 24th number (Monday, Feb. 5, 1666 O.S.) the *Oxford Gazette* became the *London Gazette,* which has appeared twice a week, on Tuesdays and Fridays, ever since as the official organ of Government. After the Revolution of 1688 the press censorship was relaxed, being finally abandoned in 1693, and a number of newspapers came into being, including the *Universal Intelligence, English Courant, London Courant, London Mercury, London Intelligence, Orange Gazette, Flying Post, Post-Boy,* a daily which lasted only four days, and the *Lincoln, Rutland,* and *Stamford Mercury,* now the oldest of the provincial papers. In 1699 appeared the *Edinburgh Gazette,* a bi-weekly, and in 1702 the *Daily Courant,* the first English daily, a small sheet printed on one side only, the editor-printer of which confined himself to news and not views.

**Defoe and Lloyd.**—It is Daniel Defoe who is the first English journalistic writer of national importance. In Feb. 1704 he began his weekly, *The Review,* which eventually was printed three times a week and was a forerunner of the *Tatler* (started by Steele in 1709) and the *Spectator* (started by Steele and Addison in 1711). Defoe's *Review* came to an end in 1713, and between 1716 and 1720 he published a monthly with an old title, *Mercurius Politicus.* By some authorities Defoe is considered the originator of the serial story.

The *Examiner,* which was started in 1710 as the chief Tory organ, enjoyed as its most influential contributor Swift, the father of the leading article. Edited by Dr. William King, afterwards principal of St. Mary's hall, Oxford, this political journal had brilliant contributors in Bolingbroke, Prior, Atterbury and Arbuthnot. Swift had control of the journal for 33 numbers between November, 1710, and June, 1711, but on becoming dean of St. Patrick's he gave up regular journalistic work. There followed a number of other political journals, such as the *Craftsman,* the *Whig Examiner,* and the *Medley.*

In 1696 Edward Lloyd—the virtual founder of the famous "Lloyd's" of commerce—started a thrice-a-week paper, *Lloyd's News,* which had but a brief existence in its first shape, but was the precursor of the *Lloyd's List* of the present day. No. 76 of the original paper contained a paragraph referring to the House of Lords, for the appearance of which a public apology must, the publisher was told, be made. He preferred to discontinue his publication (February 1697). Nearly thirty years afterwards he in part revived it, under the title of *Lloyd's List*—published at first weekly, afterwards twice a week (*see* F. Martin, *History of Lloyds,* 66–77 and 107–120). This dates from 1726. It is now a daily.

**Stamp Tax of 1712.**—The increasing popularity and influence of the newspaper press could not fail to be distasteful to the government of the day. The paper which seems to contain the first germ of the newspaper tax is still preserved amongst the treasury papers, and probably belongs to the year 1711. "There are published weekly," says the writer, "about 44,000 newspapers, viz., *Daily Courant, London Post, English Post, London Gazette, Postman, Postboy, Flying Post, Review* and *Observator.*" ("A Proposition to Increase the Revenue of the Stamp-Office," Redington, *Calendar of Treasury Papers, 1708–1714,* p. 235.) The duty eventually imposed (1712) was a halfpenny on papers of half a sheet or less, and a penny on such as ranged from half a sheet to a single sheet (10 Anne, c. xix. § 101).

Swift's doubt expressed in his *Journal to Stella* (Aug. 7, 1712) as to the ability of the *Spectator* to hold out against the tax was justified by its discontinuance in Dec. 1712, Steele starting the *Guardian* in 1713, which only ran for six months. But some of the worst journals that were already in existence kept their ground, and the number of such ere long increased. An enumeration of the

London papers of 1714 comprises the *Daily Courant*, the *Examiner*, the *British Merchant*, the *Lover*, the *Patriot*, the *Monitor*, the *Flying Post*, the *Postboy*, *Mercator*, the *Weekly Pacquet* and *Dunton's Ghost*. Another enumeration in 1733 includes the *Daily Courant*, the *Craftsman*, *Fog's Journal*, *Mist's Journal*, the *London Journal*, the *Free Briton*, the *Grub Street Journal*, the *Weekly Register*, the *Universal Spectator*, the *Auditor*, the *Weekly Miscellany*, the *London Crier*, *Read's Journal*, *Oedipus or the Postman Remounted*, the *St. James's Post*, the *London Evening Post* and the *London Daily Post*, which afterwards became better known as the *Public Advertiser*. Part of this increase may fairly be ascribed to political corruption. Later towards the middle of the same century the provisions and the penalties of the Stamp Act were made more stringent. Yet the number of newspapers continued to rise. In 1753 the aggregate number of copies of newspapers annually sold in England, on an average of three years, amounted to 7,411,757. In 1760 it had risen to 9,464,790, and in 1767 to 11,300,980. In 1776 the number of newspapers published in London alone had increased to fifty-three.

**18th Century Journalists.**—Thus the 18th century saw the gradual development of the purely political journal side by side with those papers which were primarily devoted to news, domestic and foreign, and commerce. It was left to Steele and Addison (*q.v.*) to develop the social side of journalism in their journals named above which have found a permanent place in English literature. Nor must we omit Dr. Johnson's 2d. bi-weekly, the *Rambler*, started in 1750, and his weekly, the *Idler* (1758). In 1761 the *North Briton* came out and it was largely due to Wilkes' determined fight for the liberty of the press (*see* WILKES, JOHN) that at length the last shackles on free expression of opinion in Britain were cut away, and by 1772 the right to publish parliamentary reports had been established.

The outstanding daily paper in the middle of the 18th century was the *Public Advertiser*, which for some 25 years had been called the *General Advertiser* (and for some time the *London Daily Post*). It was published with notable success by Henry Woodfall and his son Henry Samson Woodfall, and it was in this paper that appeared the famous Letters of Junius (*q.v.*), which have been attributed to Philip Francis. These papers led to a marked increase in its circulation, the monthly sale in Dec. 1771 being close on 84,000 as compared with 47,500 seven years previously. But in 1798 it was merged in the *Public Ledger*.

**Early 19th Century.**—In 1769 William Woodfall started the *Morning Chronicle*, whose daily circulation in 1819 reached 4,000, and in 1843, at a time when Dickens was a contributor, 6,000. But in another six years the circulation had fallen to 3,000. For some five years it became the property of the duke of Newcastle, Mr. Gladstone, and others, but finally ended insolvent, after a life of over ninety years. Another longlived daily paper, whose top circulation was about 6,000, was the *Morning Herald* (1781–1869). Two other important dailies were started in the 18th century which still exist, the *Morning Post* and *The Times;* these are dealt with later, together with the *Morning Advertiser*, founded in 1794. It was William Cobbett (*q.v.*) who first attempted to reach the masses by his pen, and reduced the price of his *Weekly Political Register* from 1s.–0½d. to twopence in his endeavour to appeal to the working classes for support of those principles of parliamentary reform dear to his heart. In 1808 Leigh Hunt brought out the *Examiner* whose frank criticism of the prince regent landed him and a brother in gaol. This weekly journal had quite a long lease of life and excelled in dramatic criticism, besides giving an excellent review of the events of the week in all branches of public affairs.

**Abolition of Taxes on Knowledge.**—The development of the press was enormously assisted by the gradual abolition of the "taxes on knowledge," and also by the introduction of a cheap postal system. In 1756 an additional halfpenny was added to the tax of 1712. In 1765 and in 1773 various restrictive regulations were imposed. In 1789 the three-halfpence was increased to twopence, in 1798 to twopence-halfpenny, in 1804 to threepence-halfpenny, and in 1815 to fourpence, less a discount of 20%. As prosecutions multiplied, and the penalties became more serious, revolutionary tendencies increased in a still greater ratio. Blasphemy was added to sedition. Penny and halfpenny journals were established which dealt exclusively with narratives of gross vice and crime. Between 1831 and 1835 hundreds of unstamped newspapers made their appearance. The political tone of most of them was fiercely revolutionary. Prosecution followed prosecution; but all failed to suppress the obnoxious publications.

To Bulwer Lytton, the novelist and politician (Lord Lytton, *q.v.*), and subsequently to Milner Gibson and Richard Cobden, is chiefly due the credit of grappling with this question in the House of Commons in a manner which secured first the reduction of the tax to a penny in 1836, and then its total abolition in 1855. The number of newspapers established from the early part of 1855, when the repeal of the duty had become a certainty, and continuing in existence at the beginning of 1857, amounted to 107; 26 were metropolitan and 81 provincial. The duties on paper itself were finally abolished in 1861.

The abolition of the stamp taxes brought about such reductions in the prices of newspapers that they speedily began to reach the many instead of the few. Some idea of the extent of the tax on knowledge imposed in the early 19th century may be gathered from the fact that the number of stamps issued in 1820 was close on 29,400,000, and the incidence of the advertisement tax, fixed at 3s. 6d. in 1804, made it impossible for the newspaper owner to pass on the stamp tax to the advertiser, as is done nowadays with regard to all commodities of popular consumption. In 1828 the proprietors of *The Times* had to pay the State over £68,000 in stamp and advertisement taxes and paper duty. But after the reduction of the stamp tax in 1836 from 4d. to 1d. the circulation of English newspapers, based on the stamp returns, rose from 39,000,000 to 122,000,000 in 1854.

Lord Northcliffe, or Alfred Harmsworth as he then was, was the pioneer of the half-penny daily newspaper towards the end of the century. He wrote an article for the 11th edition of the *Encyclopædia Britannica*, in which after sketching the development of the British press he pointed out that "the development—and indeed the possibility—of the cheap daily paper was due to a number of causes operating together during the latter half of the 19th century. Among these, the first place must undoubtedly be given to the cheapening of paper, through the introduction of wood pulp and the perfecting of the machinery used in the manufacture. From 1875 to 1885 paper cheapened rapidly, and it has been estimated that the introduction of wood pulp trebled the circulation of newspapers in England. Keen competition in the paper trade also did much to lower prices. At the same time the prime cost of newspaper production was increased by the introduction of improved machinery into the printing office. The growth of advertisements must also be taken into account in considering the evolution of the halfpenny journal. The income from this source alone made it possible to embark upon journalistic enterprises which would otherwise have been simply to court disaster. The popular journal of the present day does not, however, owe its existence and success merely to questions of diminished cost and improved methods of production. A change has come over the public mind. The modern reader likes his news in a brief, handy form, so that he can see at a glance the main facts without the task of reading through wordy articles. This is especially the case with the man of business, who desires to master the news of the past 24 hours as he travels to his office in the morning. It is to economize time rather than money that the modern reader would often prefer a halfpenny paper; while the man of leisure, who likes to peruse leading articles and full descriptive accounts, finds what he needs in the more highly priced journals. The halfpenny paper in England has not had to contend with the opposition that the penny newspaper met from its threepenny contemporaries in the 'fifties and 'sixties. This is largely due to the fact that in most cases the contributors, paper, printing and general arrangement of the cheaper journal do not leave much room for criticism. G. A. Sala once complained that the reporters of the older papers objected to work side by side with him when he represented the first penny London daily (the *Daily Telegraph*), through fear of losing caste, but this does not now

apply, for in the United Kingdom, France and the United States the cheap journals, owing to their vast circulation, are able to offer the best rates of remuneration, and can thus command the services of some of the best men in all the various departments of journalism."

**Newspaper Expansion.**—The history of journalism in the 19th century has been divided by a well-known writer on the press, H. R. Fox Bourne, roughly into four stages: (1) persecution; (2) liberation, 1830–1855; (3) cheapening, 1855–1875; (4) widening, since 1875. The first three stages have already been outlined, but the widening process, which has gone on ever since, must be traced to the wonderful progress in the technique of newspaper production and the vast increase in the reading public resulting from the development in State education. Perhaps the most notable event at the beginning of the cheapening stage was the foundation of the *Daily Telegraph and Courier* in June 1855 at 2d., which was reduced to 1d. in ten weeks, with the result that in six months it had the then remarkable circulation of 27,000 a day. Julius Reuter founded in Paris in 1849 the great foreign news agency which still bears his name though it is now controlled by the Press Association, an organization for the gathering and dissemination of domestic news which was founded in 1865. This was preceded in 1863 by the Central Press and followed in 1870 by the Central News and next the Exchange Telegraph with their ticker machines.

It is appropriate at this stage to sketch the history of the great English newspapers.

## THE LONDON PRESS

**The Times,** which occupies the premier position among English newspapers, was started by John Walter on Jan. 1, 1785 under the name of the *Daily Universal Register.* Then, as now, it was printed in Printing House square, Blackfriars. The founder promised the readers of the new journal that it would contain nothing to wound anyone's delicacy or corrupt the mind, that it would abstain from unfair partisanship and scandalous scurrility, and that it would be a faithful recorder of legitimate intelligence. On Jan. 1, 1788 its title was changed to *The Times,* and this great newspaper has ever since been the pre-eminent national journal and daily historical record. It came into existence when a new wave of democratic thought was spreading over Europe, and the French revolution was already brewing. Free expression of opinion in the press was still a thing of the future, and within a few years of the establishment of his paper Walter had several sojourns in Newgate and had to pay several fines for criticisms of the authorities. One of his offences was the statement that the then prince of Wales and other royal princes had by their misconduct incurred the just disapprobation of George III.

John Walter the second practically took over the reins in 1803, and he also had to encounter the active opposition of governments whom he had occasion to criticise, including that of William Pitt. He introduced a better system of news transmission and steam printing (1814) with the result that he was able to make the proud announcement that 1,100 sheets had been impressed in one hour. In view of the newspaper and advertisement tax and other disabilities, it was a considerable achievement when in 1815, the year of Waterloo, the daily circulation reached 5,000. In twenty years this was doubled, in 1851 it had reached 40,000, and three years later it was over 50,000, when its most circulated rival, the *Morning Advertiser,* had a sale of less than 8,000 copies. When John Walter the second assumed control *The Times* was a small four-page sheet. When he gave up control in 1847 it consisted of twelve large pages. Sir John Stoddart, later governor of Malta, was the editor for several years up to 1816. He was succeeded by Thomas Barnes, and when the latter's health began to fail much of the editorial work devolved upon Captain Edward Sterling, whose pontifical and sometimes explosive style caused Carlyle to say: "he more than any other man was *The Times,* and thundered through it to the shaking of the spheres." Carlyle also called him "Captain Whirlwind," and the popular title of "the Thunderer" often given to *The Times* dated from his time. In those days the most powerful writer in its columns on foreign affairs was Crabb Robinson; his place was taken at a later date by Henry Reeve.

In 1841 on the death of Barnes the editorial chair was taken by quite a young man, John Thaddeus Delane, whose brilliant career in this capacity lasted until 1877. His place was taken by Dr. Thomas Chenery, who died in 1884 and was succeeded by George Earle Buckle, who since his retirement in 1912 has won a niche in English literature by his life of Disraeli. Meanwhile since 1848 John Walter the third had been in command. He died in 1894, and was succeeded by Arthur Walter.

About the beginning of the 20th century *The Times* had begun to feel the influence of the more go-ahead methods of the popular press, and there was a loss of circulation and revenue which became a grave source of anxiety to its owners. It was a period when another great London daily paper, the *Standard,* was *in extremis.* Finally in 1908 Lord Northcliffe realised his ambition of long years and acquired the chief control of the "Thunderer," with A. Walter as chairman of the company which was created to carry it on, and Moberly Bell as managing director. It cannot be said that Lord Northcliffe's administration was consistently successful but he thoroughly remodelled the organisation and increased its efficiency in all departments. There is no doubt that by the introduction of sound business methods he laid a solid foundation upon which the present remarkable prosperity of the paper is largely based. Under his rule the price of *The Times* at different periods was threepence, twopence, and a penny. At earlier dates the price had been: 1796, 4½d.; 1799, 6d.; 1809, 6½d.; 1815, 7d.; 1836, 5d.; 1855, 4d.; and 1861 (on the abolition of the newspaper tax) 3d., at which it remained right up to the end of the 19th century. It is now (1929) 2d. On his retirement Buckle was succeeded as editor by Geoffrey Dawson, then a young man, formerly private secretary of Lord Milner and editor of the *Johannesburg Star.* In 1919, just after the war, he retired from the editorship owing to a difference of opinion with Lord Northcliffe and his place was taken by Wickham Steed. In 1923, when, following the death of Lord Northcliffe, Major J. J. Astor, M.P., became its chairman and chief proprietor, Geoffrey Dawson again became editor. Major Astor secured the future independence of the paper by a deed establishing a body of trustees consisting of holders of various public offices whose consent would be required to validate any future transfer of ownership.

*The Times* excels in every department, mainly by employing experts in particular subjects. It is the only newspaper whose law reports are recognised by the courts as authentic, these reports being done day by day by skilled barrister reporters. Similarly *The Times* specialises in its presentation of foreign affairs and has maintained for nearly a century in the chief capitals of the world an able staff of foreign correspondents, of whom one of the most famous was de Blowitz, who among his many "scoops," secured for *The Times* the privilege of being able to publish exclusively the text of the Berlin Treaty of 1878 on the very day that it was signed.

The principal adjuncts to *The Times* are the literary supplement, which surveys the whole field of new literature every Thursday, the weekly edition, first published in 1877, containing a summary of the week's news, *The Times* law reports (mentioned above), the educational supplement and the trade and engineering supplement, which are weekly publications, and the index, an invaluable record of the events of the day recorded in the newspaper, which is published quarterly. In addition *The Times* issues at intervals handsome supplements to its readers without any extra charge.

The publishing department of *The Times* has invaded several new fields of enterprise. *The Times Atlas* was first published in 1895, and this publication was supplemented by that of *The Times* (previously Longmans') *Gazetteer.* A much larger and more important venture was the issue in 1898 of a reprint of the ninth edition of the *Encyclopædia Britannica* at less than half the original price, on a new system of terms (known as *The Times* system) that enabled the purchaser to receive the whole work at once and to pay for it by a series of equal monthly payments. This was followed by a similar sale of the *Century Dictionary* and of a reprint of the first 50 years of *Punch;* and 11 new vol-

umes of the *Encyclopædia Britannica,* supplementing the ninth edition, and forming with it the tenth edition, were issued by *The Times* in 1902 on similar terms (*see* ENCYCLOPAEDIA). There was also *The Times History of the War in South Africa* of 1899–1902.

**The Daily Telegraph,** another great national daily, first published as the *Daily Telegraph and Courier,* was published on June 29, 1855, as a twopenny newspaper. It was owned by Colonel Sleigh who transferred the ownership to Joseph Moses Levy in the following September. Levy produced it as the first penny newspaper in London, the name *Courier* being subsequently dropped. His son Edward Lawson (later the first Baron Burnham, soon became editor, which post he continued to hold till 1885. A long list of distinguished members of the staff included Sir Edwin Arnold, George Augustus Sala, for many years the uncrowned king of Fleet St., Professor E. Dicey, Sir J. M. Le Sage, Bennet Burleigh, the war correspondent, J. L. Garvin, and H. D. Traill; and among dramatic and literary critics Clement Scott and W. L. Courtney. After 1890 the Hon. Harry Lawson, the eldest son of the owner (later Viscount Burnham), assisted in the general control. The *Daily Telegraph* became the especial organ of the middle classes and shortly before the advent of the halfpenny daily newspaper had achieved so remarkable a success that it could claim the largest circulation in the world. It was consistently Liberal up to 1878 when it opposed Gladstone's foreign policy, and at the Irish Home Rule split in 1886 it became Unionist. Its enterprises included the financing of an important archaeological exploration in Nineveh resulting in the discovery of a number of fragments of the cuneiform narrative of the deluge, and the despatch, in co-operation with the New York *Herald,* of Sir H. M. Stanley, on a successful exploration into darkest Africa. The *Daily Telegraph* successfully weathered the World War, increasing its price to 2d. at which it (1929) remains. On the death of Sir J. Le Sage a few years ago he was succeeded in the editorial chair by J. Miller, who died after a short tenure, his place being taken by A. E. Watson, the present (1929) editor. In December 1927 Lord Burnham and his family sold the *Daily Telegraph* to Sir William and Sir Gomer Berry and Sir Edward Iliffe under whose control it has continued its same policy.

**The Morning Post** is the oldest of London daily newspapers extant. It was founded in 1772 as the *Morning Post and Daily Advertising Pamphlet,* a paper of eight pages, 12 inches long by 8. It was mostly an advertising sheet including State lotteries, which were legal and popular at that time. It developed into a national newspaper under the ownership of Peter and Daniel Stuart after 1795, and attracted a wonderful galaxy of writers, including Sir James Mackintosh, Samuel Taylor Coleridge, Southey, Arthur Young, the poet Moore, Wordsworth, and Charles Lamb. It has always maintained a tradition of vigorous and unblenching criticism, and Nicholas Byrne, the editor-owner who succeeded Daniel Stuart, was murdered in his office as the result of an article which had given offence. At the beginning of the 19th century the circulation was about 4,000 a day. In 1850 the paper came under the control of Peter Borthwick, who had sat for a long period as M.P. for Evesham, and on his death in 1852 he was succeeded by his son, Algernon, who had been a brilliant Paris correspondent for the *Morning Post.* Under his régime the paper settled down to a prolonged prosperity as a Conservative journal and before long became the leading society paper, whose fashionable characteristics often made it the butt of Thackeray's satirical pen. During Lord Palmerston's tenure of the Foreign Office the *Morning Post* was always regarded as his especial organ, and even in those early days it was distinguished for its robust imperialism in foreign affairs. In 1877 Borthwick became sole owner, and four years later he reduced the price from 3d. to 1d. at which it stood till the World War, when the price was raised to 2d. Borthwick became a knight, then a baronet, and was raised to the peerage as Lord Glenesk in 1895. When Lord Glenesk died in 1908 the ownership passed to his only surviving child, Countess Bathurst, who carried on the traditions of the paper (which was consistently Protectionist) until she disposed of it in 1923 to a group headed by the duke of Northumberland. Among the editors of the *Morning Post* have been Sir William Hardman, J. Nicol Dunn, Sir Fabian Ware, and H. A. Gwynne, the present (1929) editor. The price of the paper was reduced to 1d. in 1927.

**The Daily News & Westminster Gazette** (the *Daily News* absorbed the *Westminster Gazette* in Feb. 1928) is the oldest Liberal newspaper published in London. It was founded in 1846 under the editorship of Charles Dickens who retired after a few weeks, being succeeded for a year or so by John Forster, later his biographer. The original staff included Mark Lemon, afterwards editor of *Punch,* and Douglas Jerrold. The *Daily News* has a consistent record as the champion of Liberalism; it led British public opinion in sympathizing with the North in the American Civil War, in supporting the war of freedom in Italy, and the emancipation of Bulgaria and the Armenians. The price of the paper was reduced to 1d. in 1868. Under the control of Sir John Robinson it attained a high reputation for its foreign correspondence, beginning with the celebrated Archibald Forbes in the Franco-German war 1870.

On a change in ownership after the retirement of Sir John Robinson, Sir E. T. Cook, who had been editor of the *Westminster Gazette,* became editor of the *Daily News* from 1896. He resigned in 1901 in consequence of another change in ownership. Cook was a Liberal Imperialist and the paper had passed under the control of D. Lloyd George and his friends; and afterwards passed under that of the Cadbury family. After an interregnum A. G. Gardiner was the next editor. In 1904 the price of the paper was reduced to a halfpenny. Gardiner resigned the editorship after the World War and was succeeded by Stuart Hodgson as editor; Tom Clarke joined the paper in 1926 as managing editor. The *Daily News* absorbed the *Morning Leader* and acquired the *Star* in 1909, and has maintained that journal as a lively and independent exponent of Liberalism. In 1930 the *Daily News* and the *Daily Chronicle* were amalgamated, and the paper has since then been published as the *News-Chronicle.*

**The Daily Chronicle,** unlike the *Daily News* which was started under distinguished auspices, was the outgrowth of a London local daily, the *Clerkenwell News,* and was established in 1877. It consisted almost entirely of small advertisements and Edward Lloyd, the founder of *Lloyd's Weekly News* turned it into a general morning London newspaper. During the Home Rule controversies of the '80s it was Liberal Unionist, but under the editorship of A. E. Fletcher (1895) it became Gladstonian Liberal. Fletcher was an idealist who sympathized with Labour and had a passion for literature. During his editorship literature was developed in the newspaper as a regular feature. Fletcher was succeeded by H. W. Massingham who, while maintaining the literary features, made the paper a more robust political organ. Massingham was a Radical; and had formerly been editor of the *Star.* He lost his position on the *Chronicle* because of his opposition to the Boer War. He was succeeded by W. J. Fisher and the paper pursued a humdrum career and was a declining property when in 1904 Robert Donald was appointed editor, with the object of revitalising the paper. The price was reduced to halfpenny and at once the paper entered upon a new era of prosperity and prestige which reached its height during the World War. During the long Liberal régime from 1906 to the year of 1915, the *Chronicle* was regarded as the chief supporter of the Left Wing of the Government. The *Chronicle* was a pioneer in the introduction of illustrations by leading artists, those contributing to the *Chronicle* including Burne Jones, Joseph Pennell, who was art editor, and Linley Sambourne. It made a high reputation for its foreign correspondence, and took a leading part in exposing public abuses.

The paper was sold to D. Lloyd George and his friends in the autumn of 1918, when Sir Robert Donald retired from his position as editor and as managing director of the company. It has since been edited by Ernest A. Perris, who joined it as news editor in 1904. In 1927 it was sold to two Indian merchants, Sir David Yule and Sir Thomas Catto, Lloyd George retaining a minority interest. Lord Reading was appointed chairman. The chairman has changed six times in ten years. Sir David Yule died in July 1928, and William Harrison, who (1929) is chairman, on behalf of the Inveresk Paper Company, Limited, acquired a

controlling interest. In 1930 the *Daily Chronicle* amalgamated with the *Daily News* to form the *News-Chronicle*.

**The Daily Mail** started by Alfred and Harold Harmsworth in 1896 as a halfpenny daily newspaper is one of the miracles of journalism. It was a phenomenal success from the first number. At the dawn of the present century it had already reached the million mark, and it has never looked back. In 1904 Sir Alfred Harmsworth (by that time a baronet) started the *Continental Daily Mail* in Paris, now the property of Lord Rothermere. The *Daily Mail* publishes an edition in Manchester and an Atlantic edition on the chief transatlantic steamships.

From the first the *Daily Mail* broke away from the traditional conception that a daily newspaper should espouse or reflect a particular political policy. The *Daily Mail* has been sternly independent and sometimes embarrassing to Governments and politicians but it generally registered the majority public opinion. Lord Northcliffe (as he became later) was not only a brilliant organiser but a keen journalist imbuing by personal contact all members of the able staff which he gathered around him with some of his own dynamic enthusiasm. The *Daily Mail* has been the pioneer in many enterprises in journalism and in national interests, including the invaluable help which it gave to aviation. Lord Northcliffe and his associates also deserve credit for offering inducements hitherto unequalled for special correspondents. It has brought into the profession men and women of high literary standing and has led to an increase in professional remuneration of journalists of all classes.

For many years the editor-in-chief was Thomas Marlowe, who retired two or three years after the death of Lord Northcliffe, and was succeeded by W. G. Fish.

Since it came under the control of Lord Rothermere on the death of his brother its phenomenal success has continued both in regard to increase in sales and in profit making. The annual profit of the *Daily Mail* alone is understood to exceed £1,000,000. Its daily net sale in 1928 reached 2,000,000.

**The Daily Express,** which was founded as a half-penny newspaper in 1900 by the late Sir C. Arthur Pearson, is second only to the *Daily Mail* in circulation. In its first issue it published a message of good will from the Kaiser William, and announced: "Our policy is patriotism, our party is the British empire."

It struck a new note, since imitated by other papers, of publishing its principal news on the first page, which became, so to speak, the shop-window. In 1902 R. D. Blumenfeld joined the staff; he became editor in 1904, and in 1912, when Sir Arthur Pearson lost his sight, formed a syndicate which acquired control. Lord Beaverbrook began to take an interest in the paper while it was financially in low water and during the war obtained complete control. Blumenfeld remained the managing editor. Immediately after the War the *Daily Express* showed increased vitality. Lord Beaverbrook spent prodigious sums out of revenue in developing the paper. To a large extent it is his personal organ—and expresses his views on political and other affairs.

The *Daily Express* is printed simultaneously in London, Manchester and Glasgow.

**The Daily Herald** (price 1d.), the official organ of the Trades Union Congress, after passing through severe financial difficulties has now definitely taken its place among London dailies. It occupies a unique position in the press as the only daily newspaper exclusively devoted to the interests of the Labour party. In 1930 the financial management was undertaken by Messrs. Odhams Ltd., and the *Daily Herald* became one of the leading newspapers.

A notable addition to Labour journalism took place in April, 1929, when the Co-operative Societies affiliated with Labour acquired *Reynolds' Newspaper,* which was established over 80 years ago and has been consistently conducted on democratic lines.

**Other Dailies.**—There is only one sporting daily newspaper in London, the *Sporting Life* (started in 1859) with which was amalgamated after the World War the *Sportsman* (founded 1865). The famous old sporting newspaper *Bell's Life* was absorbed by the *Sporting Life* in 1886. Finance is represented by the *Financial News* (founded in 1884) and the *Financial Times* (1888) which absorbed the *Financier,* now each 2d.

**London Evening Newspapers.**—There are only three London evening newspapers surviving, each published at 1d. The oldest of these is the *Evening Standard,* first published as an evening edition of the *Standard,* which was founded in 1827. It has absorbed in turn the *St. James's Gazette,* the *Globe* and the *Pall Mall Gazette.* It is now the property of the Beaverbrook group.

The *Evening News* was founded in 1881, and after many vicissitudes of fortune when in low water was acquired in 1895 by Alfred and Harold Harmsworth and Kennedy Jones. It was the Harmsworths' first incursion into daily journalism, and made a rich experimental field for the *Daily Mail.* The *Evening News* is one of the Associated Newspaper group and has the largest circulation of any of the evening papers in the country.

The *Star,* the only Liberal evening paper in London, was started by T. P. O'Connor in 1888 as a halfpenny journal in support of Gladstone. In 1909 it was acquired by the *Daily News.*

**Great Papers of the Past.**—Fleet street is crowded with the ghosts of journals which in their time have filled important places in the life of the country. There was the *Morning Chronicle* which began its career in the 18th century and had among its contributors Sheridan, Sir J. Mackintosh, John Campbell (afterwards Lord Chancellor), Campbell, the poet, Thomas Moore, Lord Brougham, Byron, William Hazlitt, John Stuart Mill, Charles Lamb and Thackeray. John Black, its most famous editor used to say that one of the paper's parliamentary reporters, Charles Dickens, was the best shorthand writer he had ever known. After a notable career the *Morning Chronicle* died in 1862.

The *Standard* was established as an evening paper in the Tory interest (as the express organ of the opponents of the measure for removing Roman Catholic disabilities) in 1827, its first editor being Stanley Lees Giffard, father of the first earl of Halsbury. In the '50s it was purchased by James Johnstone, who brought out the *Standard* as a morning paper (June 29, 1857), increased its size from four to eight pages, and reduced the price from fourpence to twopence. In Feb. 1858 Johnstone again reduced the price, this time to a penny. One of its contributors in the 'sixties was Lord Robert Cecil, later Lord Salisbury, the prime minister. In the early '60s it engaged William Heseltine Mudford. He was sent as special correspondent to Jamaica in 1865 to report upon the troubles which involved the recall of Governor Eyre; a further period in the gallery of the House of Commons followed, and in 1876 Mudford became editor. Johnstone, the proprietor to whose energy and perspicacity the paper owed so much, died in 1878, and under his will Mudford was appointed editor and manager for life, or until resignation. Already a great property, the *Standard* in Mudford's hands entered upon a very successful period. Alfred Austin, T. H. S. Escott, Miss Frances Power Cobbe and Professor Palmer were all writing for the paper at the same time. It had many famous war correspondents, foremost among whom were G. A. Henty, the famous author of boys' books; John A. Cameron, who was killed at Abu Klea; and William Maxwell. In January 1900 Mudford retired, and was succeeded in the editorship by G. Byron Curtis (d. 1907). In November 1904 the *Standard,* which had at that time taken rather a strong line in deprecating the tariff reform movement within the Unionist party, was sold to (Sir) C. Arthur Pearson, who was chairman of the Tariff Reform League, and H. A. Gwynne became editor. In 1910 it passed into the control of Davison Dalziel (the late Lord Dalziel) and disappeared during the war.

A disastrous experiment in newspaper production was the *Tribune,* founded by Franklin Thomasson in 1906 as a solid penny daily. After gathering a brilliant staff and expending very large sums he found it necessary to discontinue the paper in 1908. The unhappy enterprise is described in Sir Philip Gibb's novel "The Street of Adventure." The *Echo* was established by Cassells in 1868 and afterwards owned in turn by Albert Grant, the company promoter, Passmore Edwards, Andrew Carnegie, and the late Sam Storey. The *Echo* perished in 1905.

The *Globe* was founded in 1803, and after many years as a leading Whig organ it turned Conservative in 1866 when it became the property of a syndicate which included Sir Stafford Northcote

(Lord Iddesleigh). Two years later it assumed the deep pink hue which it kept until its demise after the World War. The first number of the *Pall Mall Gazette* (the name being borrowed from the incident in which Thackeray describes Captain Shandon in the Marshalsea prison drafting the prospectus of the *Pall Mall Gazette* as a paper "written by gentlemen for gentlemen") appeared in February 1865. Its first editor was Frederick Greenwood, who gathered round him a brilliant array of talent in Sir Henry Maine, Sir J. Fitzjames Stephen, Anthony Trollope, Charles Reade, George Henry Lewes, George Eliot, Matthew Arnold, and Richard Jefferies. In 1875 Greenwood was able to convey to Disraeli news of the French bid to secure control of the Suez Canal, thereby enabling Britain to get in first. It had been a consistent supporter of Disraeli, and when on changing hands it became Liberal John Morley became editor, with W. T. Stead as assistant editor. In 1882 its price was reduced from 2d. to 1d.

When Morley exchanged journalism for politics in 1883, he was succeeded by W. T. Stead (*q.v.*), with Alfred Milner, afterwards Lord Milner, as his assistant. Stead's adventurous career as the editor came to an end in 1889, in consequence of his publishing a series of articles called "The Maiden Tribute of Modern Babylon," purporting to further the Criminal Law Amendment Bill. He was succeeded by E. T. Cook. The *Pall Mall Gazette* was now steadily Liberal and a strong advocate of Irish Home Rule. It had two distinguished editors at a later date in Sir Douglas Straight and J. L. Garvin, and finally passed through several hands before its decease.

Founded in 1880 by H. Hucks Gibbs (afterwards Lord Aldenham), for Frederick Greenwood to edit when he had left the *Pall Mall*, the *St. James's Gazette* represented the more intellectual and literary side of Tory journalism in opposition to the new Liberalism of Mr. Greenwood's former organ. In 1888 the paper having then been sold, Greenwood retired and was succeeded as editor (1888–1897) by (Sir) Sidney Low, who in his turn was succeeded by Hugh Chisholm (1897–1900). Among the contributors were Rudyard Kipling, Sir James Barrie and G. S. Street.

Towards the end of the 19th century it assumed a more popular style and shape, and for a year or two before its acquisition by (Sir) C. Arthur Pearson in 1903 and its final merging in the *Evening Standard* it was edited by Ronald MacNeill (Lord Cushendun).

When the *Pall Mall Gazette* was sold to Lord Astor in 1892 and converted into a Conservative organ, E. T. Cook, the editor, and most of his staff resigned; in 1893 they came together again on the *Westminster Gazette*, newly started for the purpose by Sir G. Newnes (who had made a fortune out of *Tit-bits* and other popular papers) as a penny Liberal evening paper. It was printed on green paper. The paper was conducted on the lines of the old *Pall Mall*, and it had the advantage of a brilliant political cartoonist in F. Carruthers Gould. In 1895 Cook was appointed editor of the *Daily News*, and his place was ably filled by J. Alfred Spender, who had been his assistant-editor, F. C. Gould (who was knighted in 1906) being his chief assistant. Apart from Sir F. C. Gould's cartoons, the *Westminster* became conspicuous in London evening journalism for its high standard of judicious political and literary criticism. It gradually became the chief organ of Liberal thought in London. In 1908 a change of proprietorship took place, the paper being sold by Sir G. Newnes (d. 1910) to a group of Liberal capitalists including the late Lord Cowdray and Lord Melchett (then Mr. A. Mond), but without affecting the *personnel* or policy of the paper. How the famous green *Westminster* finally vanished after the war to be replaced by the daily newspaper of the same name, which was merged in the *Daily News* in 1928, has already been stated.

### BRITISH PROVINCIAL PRESS

The first provincial paper in England was the weekly *Worcester Postman*, 1690, now *Berrow's Worcester Journal*. In the first twenty years of the 18th century a number of other journals sprang up in country towns, practically all of them being weekly journals. Among them were the *Stamford Mercury* begun in 1713 and the *Northampton Mercury* begun in 1720. At the beginning of the 19th century the provincial press consisted of less than a hundred journals, as compared with many thousands at the present day. They were at that time practically without influence and presented a minimum of local news without expressing any views. Benjamin Flower, printer of the *Cambridge Intelligencer*, who in 1799 was haled before the House of Lords for breach of privilege in commenting upon some action by a bishop, fined £100 and sent to Newgate for six months, was the first to introduce the leading article in the provincial press. *The Leeds Mercury*, founded in 1717, under the control of Edward Baines (1801) became the most important and influential of the north country papers in the first half of the 19th century. For many years it admitted neither theatrical nor racing matter to its columns until the sentiment of its readers in Lancashire and Yorkshire underwent a change in regard to these forms of amusement. After the Reform Act of 1830 and the contemporaneous spread of self-education and establishment of reading circles and newspaper clubs, the country newspapers developed in importance and usefulness, being forced to assuage the public thirst for information and instruction. It was not however till the final removal of the taxes on knowledge, already described, that the provincial press came into its own, and from being strictly local organs began to show almost as large an interest in affairs of national importance as their London contemporaries.

Within ten years of the abolition of the paper duty penny morning newspapers had taken up commanding positions in Edinburgh, Glasgow, Dundee and Aberdeen; in Liverpool, Manchester, Leeds, Bradford, Newcastle and Sheffield; in Birmingham and Nottingham; in Bristol, Cardiff and Plymouth; and across St. George's Channel in Dublin, Cork, Belfast and Waterford. But any real importance as organs of opinion was still confined to only a few of the great penny provincial dailies, notably the *Yorkshire Post, Manchester Guardian, Birmingham Post* (1857), *Sheffield Telegraph* (associated with Sir W. Leng), *Liverpool Daily Post, Leeds Mercury* and *Western Morning News;* others too numerous to mention here were at the same time cradling journalists who were to become famous in a larger sphere, such as the *Darlington Northern Echo*, on which W. T. Stead made his début, while Joseph Cowen for some years made the Newcastle *Daily Chronicle* a powerful force.

In the early 'seventies such a thing as a full telegraphic report in a provincial morning newspaper of parliamentary proceedings, or of a speech by a leading statesman, was almost unheard of. The Press Association had not then covered the country with its organization. Reuter's foreign news service very briefly reported important events. Between 1870 and 1880 a complete revolution was effected, as the result of social and educational changes. Newspapers that had been content to fill their columns with local news and clippings from London and distant provincial papers put such matter aside. Telegraphic news crushed it out. When in Feb. 1870 the government took over the telegraph system, and gave special terms for press messages, English and Irish newspapers, following Scotland's lead, began to open offices in London with special wires. The Press Association spread its news-collecting organization over the whole country, and was stimulated to activity by the rising opposition of the Central News. The universal use of news agency messages tended to a uniformity from which the more enterprising journals saved themselves by special London letters, parliamentary sketches and other exclusive contributions. In 1881 the reporters' gallery in the House of Commons was opened to some provincial newspapers. The first syndicate to send out war correspondents was formed by the *Glasgow News*, the *Liverpool Daily Post, Manchester Courier, Birmingham Gazette* and *Western Morning News*, who despatched two correspondents to Egypt. The Central News also sent out war correspondents to Egypt and the Sudan. During the South African War (1899–1902) the leading provincial newspapers, however, all formed syndicates amongst themselves to secure war telegrams, and in many cases made arrangements for the simultaneous publication of the letters and telegrams of leading London journals.

**Leading Provincial Newspapers.**—The leading English provincial daily papers in 1929 were:

The *Manchester Guardian,* price 2d., founded in 1821 as a weekly Whig organ and for the last fifty years the chief exponent of Liberalism outside London. During the greater part of this period it was edited by C. P. Scott, and maintained a standard of excellence in all its branches that gave it a world-wide reputation. Apart from its vigorous politics it enjoys an unrivalled literary prestige, and a dignity of expression and presentation, unsullied by recourse to the methods of self-advertisement which seem necessary to those more popular newspapers that seek huge circulations. It became a penny paper in 1857, two years after it had been turned into a daily journal. Prominent names associated with it have been C. E. Montague (who died in 1928), C. P. Scott's son-in-law, L. T. Hobhouse, Andrew Lang, Richard Jefferies, Richard Whiteing (who died in June 1928), Sir Claude Phillips, George Saintsbury, Laurence Housman, G. W. E. Russell, and Spenser Wilkinson. In its book reviewing, its dramatic criticism, and its foreign correspondence alone the *Manchester Guardian* exercises an unparalleled influence in provincial journalism, and is usually regarded as a national organ.

*The Yorkshire Post,* price 2d., started in 1866 as a Conservative paper and now ranks as the principal Conservative newspaper outside London, enjoying a national prestige extending far beyond the borders of Yorkshire. In its early years it devoted especial attention to racing, which was neglected by most local papers in the county in those days, and under the control of the Beckett family it rapidly attained a solid prosperity which it still maintains. It has had talented editors in H. J. Palmer, J. S. R. Phillips, and Arthur H. Mann (its present—1929—editor).

The *Birmingham Daily Post,* price 1d., founded in 1857 by J. F. Feeney and John Jaffray (afterwards made a baronet) and now controlled by Sir Charles Hyde, Bart. It holds a position in the midlands analogous to that of the *Yorkshire Post* in the north, and is edited by G. W. Hubbard.

The *Liverpool Daily Post and Mercury,* price 1d., founded in 1853 as a Liberal paper, and for many years possessing as its editor the outstanding personality of Sir Edward Russell. In 1904 it absorbed the *Liverpool Mercury* (founded in 1811), and it holds a pre-eminent place in the life of the great seaport.

**Scotland, Wales and Ireland.**—In Scotland the leading newspapers are the *Scotsman* and the *Glasgow Herald,* each 2d. The former was started as a biweekly in 1817 and became a daily in 1855. It was Liberal until the Home Rule split in 1886 when it adopted the Unionist cause. Alexander Russell was its most famous editor in the 19th century (1848–1876) and for many years it has been the only Edinburgh morning newspaper.

The *Glasgow Herald* dates from 1783, when it first came out with the extra name "and Advertiser" tacked on. It has a great literary reputation, well maintained under Sir Robert Bruce's present editorship. He follows an illustrious line of editors, including Samuel Hunter, George Outram, Dr. Russell, and Dr. Wallace. The *Glasgow Herald* has a high reputation as a commercial organ and is credited with having a larger sale than any newspaper published at 2d. outside London.

The daily newspapers of Scotland, which for the latter part of the 19th century were predominantly Liberal, are now Conservative, except the *Edinburgh Evening News.*

The chief newspaper in Wales is the *Western Mail,* Cardiff, which has recently absorbed the *South Wales Daily News,* and thus becomes the only morning paper in the Principality.

The only important newspaper town in Northern Ireland is Belfast, which has two historic newspapers: the *Belfast News Letter,* which has been in existence about 200 years, and the *Northern Whig,* which celebrated its centenary some years ago.

### THE PICTORIAL PRESS

The earliest attempts in England at the pictorial portrayal of news took the shape of "broadsides," one of which, published in 1587, the year before the Armada, recounted the "Valiant Exploits of Sir Francis Drake." These early pictorial "broadsides" illustrate the hold which murders and tragedies have always had upon the imagination of people. A picture appeared portraying the execution of Strafford in 1641, and later the execution of Charles I. was similarly illustrated. Several woodcuts appeared after the Restoration depicting the executions of the regicides. In the *Grub Street Journal* in 1731 was published an illustration of the Lord Mayor's Show, and in 1740 the *Daily Post* came out with a picture illustrating Admiral Vernon's attack on Porto Bello. Copper plates were used by the *English Magazine,* the *Thespian Magazine,* and other such publications in the 18th century. Occasional pictures of important events were published in the early days of the *Observer* (1791), including a portrait of Abraham Thornton, who in 1818 on being charged with murder invoked the ancient procedure of wager of battle, with the result that a special bill had to be passed abolishing a practically obsolete form of trial. The *Observer* also published pictures of the coronation of Queen Victoria and of the fire in 1841 which destroyed the armoury at the Tower of London. In 1834 the *Sunday Times* gave a picture of the ruins of the old House of Commons after it had been burnt down, and a journal called the *Magnet* in 1840 illustrated the removal of Napoleon's body from St. Helena.

Herbert Ingram conceived the idea of "all the news in pictures" and he brought out the first number of the *Illustrated London News* on May 14, 1842, price 6d., a weekly paper containing 16 printed pages and 32 woodcuts, one of which depicted the great fire at Hamburg in which a hundred people lost their lives. The chief engravings, by Sir John Gilbert, illustrated the first bal masqué given by Queen Victoria at Buckingham Palace. From that time onwards the *Illustrated London News* has given a faithful representation of the events of the week, and in its files can be traced the evolution of the wood engraving to the half-tone, which owing to the development of photography and modern engraving processes by the end of the 19th century had extinguished the skilled handiwork of the wood engraver. In 1860 Ingram was drowned with his eldest son in the disaster in Lake Michigan in North America which overtook the steamer Lady Elgin. The control of the paper passed to another son, afterwards Sir William Ingram. Its editors included Charles Mackay (1848–1859), John Lash Latey (1859–1890), the late Clement K. Shorter (1890–1899), and Bruce Ingram, grandson of the founder, the present (1929) editor. It virtually held the field alone in weekly illustrated journalism until in 1861 the first penny popular paper was started by the same proprietor, the *Penny Illustrated Paper,* edited by John Latey junior, who afterwards for a period was editor of the *Illustrated London News.* In 1869 the first serious rival of the *Illustrated London News* was published, the *Graphic,* produced by W. L. Thomas. *Black and White,* a paper of the same class as the *Illustrated London News* followed in 1891; and in 1892 the *Sketch* was started by the late Sir William Ingram, under the editorship of Shorter, as a social and theatrical illustrated weekly. Clement K. Shorter founded the *Sphere* in 1899. It became a serious rival of the existing picture papers, absorbed *Black and White,* and started the *Tatler,* which competed for public favour with the *Sketch.* A similar type of paper was the *Bystander,* issued by the *Graphic.* Ingram also owned a fashion paper, the *Ladies' Pictorial,* and the *Illustrated Sporting and Dramatic News.* Sir John Ellerman acquired all these papers except the *Graphic* and the *Bystander* and they were brought under one proprietary in 1926 by William Harrison of the Inveresk Paper Company, who promoted Illustrated Newspapers Ltd., acquiring at the same time the *Graphic* and *Bystander* which had passed into the hands of Messrs. Berry. Harrison promoted in 1928 another weekly newspaper on somewhat different lines. The Illustrated Newspapers Ltd. therefore own the *Sphere,* the *Illustrated London News,* the *Graphic, Sketch, Tatler, Bystander, Eve,* which is an amalgamation of several fashion papers including the *Ladies' Pictorial,* while the same company publish the *Illustrated Sporting and Dramatic News.*

### WEEKLY NEWSPAPERS AND REVIEWS

The weekly reviews, beginning with the *Examiner,* which was founded in 1808 and ceased in 1881, have changed little in character but occupy a much less important position in journalism

owing to the prodigious advance in the daily and Sunday newspapers. The weeklies were formerly looked to for guidance in political opinion and for literary criticism. They have been displaced in both spheres. The world moves too quickly and unless a weekly review has a particular standpoint and makes a special appeal to a class it carries little weight in contemporary journalism. The weekly which shows the greatest vitality is the historic *Spectator* which celebrated its centenary in November 1928. It was founded by Robert Stephen Rintoul and exercised great influence as an exponent of moderate Liberalism, thoughtful criticism, particularly in the discussion of religious problems. In 1861 it passed under the control of R. H. Hutton and Meredith Townsend. In 1897 it was acquired by J. St. Loe Strachey who maintained its high character and literary reputation. It was outspoken in its political opinions, and while Conservative Unionist in most subjects, it was a strong exponent of Free Trade. It was acquired in 1926 by Evelyn Wrench under whom new features were introduced and more modern methods adopted. It is by far the most widely circulated of the weekly reviews. The proprietor made arrangements in 1928 to safeguard the policy of the *Spectator* in the future by adopting the same system that has been embodied in the constitution of the *Times*. The historic *Saturday Review* has passed through many hands and still survives. The great literary weekly, the *Athenaeum*, which was started in Jan. 1828, was absorbed in the *Nation*, the literary weekly review which grew out of the *Speaker*, founded by Sir Wemyss Reid in 1898. The name was changed when H. W. Massingham became editor in 1907. Another distinctive weekly is the *New Statesman* which is a moderate exponent of Socialist politics. The other weeklies are of minor importance. With the exception of the *Spectator* the weeklies, while their literary characteristics are maintained, are reduced in size. Weekly reviews of literature, art, drama and topical problems of the day including politics, are being largely displaced by the Sunday newspapers, particularly the *Observer* and the *Sunday Times*, each of which at one-third of the price, give two-thirds more reading matter exclusive of news. They command writers of the highest reputation while they sell many more thousand copies than the weekly reviews sell hundreds. One unique weekly remains and keeps up its reputation. That is *Truth* which was founded by Henry Labouchere. It is a many sided journal and is chiefly renowned for its fearless criticism and its extremely independent attitude towards men's affairs.

Besides *Truth*, specialist weekly journals form a distinctive feature of British journalism. Religious weeklies which show vitality include the *Church Times*, the *British Weekly*, the *Christian World*, the *Tablet*, and the *Methodist Recorder*. The *Field*, as the country gentleman's paper, edited by Brian Vesey-Fitz-Gerald, holds its position unchallenged. *Punch*, edited by E. V. Knox, is Britain's supreme humorous journal which is more national than ever it was. In the world of economics and finance two weekly papers stand out—the *Economist* and the *Statist*. In the medical world the *Lancet* and the *British Medical World* are without competitors. *Country Life* is one of the most attractive of the weekly journals.

### SUNDAY NEWSPAPERS

The rise of the Sunday newspapers in the last twelve years is alluded to elsewhere. Here it may be noted that the historic Sunday newspapers, unlike some of the historic daily newspapers, show great vitality.

The *Observer*, which is the most powerful political organ of the Sunday newspapers, first saw the light in the year 1791, a period when France had entered upon a revolution which was to shake the foundations of Europe and change the course of history. The *Observer* reported the battle of Trafalgar, 1805, without headlines and ten years later Wellington's dispatch on the Battle of Waterloo as if it were the heading of a parliamentary Blue Book. The *Observer* kept on its respectable but somewhat sombre career until it was acquired by Lord Astor and edited by J. L. Garvin, when it assumed a distinctive character, a virile independence in its political outlook while it made a strong feature of foreign correspondence, literature, the drama, etc.

The *Sunday Times*, another historic Sunday newspaper which was founded in 1822, is parallel with the *Observer* except that it is more moderate and consistent in its political outlook, but there is not much to choose between the two newspapers in regard to their general features. The *Sunday Times* is notable in respect that it laid the foundations of the Berry family in the newspaper world. It was the first general newspaper acquired by Sir William Berry, who bought it in 1915. He has exercised a particular control over it. The editor is (1929) Leonard Rees.

Another old Sunday newspaper is *Lloyd's Weekly News*, now known as the *Sunday News*, started by Edward Lloyd in 1842. A year later the *News of the World* was founded. During the last 20 years it has become the most widely circulated of all newspapers. *Reynolds Illustrated Newspaper*, a democratic organ, was started in 1850, and the *People* (Conservative), in 1881.

The two Sunday picture papers are the *Sunday Pictorial* and the *Sunday Graphic*. The other Sunday papers vary in the degree to which they cater for the masses by sensational news, crime stories, prizes, competitions, coupons, etc. The *Sunday Dispatch* (formerly the *Weekly Dispatch*) and the *Sunday Express* are somewhat similar in type and less popular in their appeal than other journals which exceed them in sale, headed by the *News of the World*, which has a sale of nearly four millions, the *People*, the *Empire News*. Other most widely circulated Sunday papers are the *Sunday Chronicle* and the *Sunday News*. A development since the war has been provincial Sunday newspapers outside Manchester, the home of the *Sunday Chronicle* and the *Empire News*, such as the *Sunday Sun*, Newcastle, the *Sunday Post*, Glasgow, the *Sunday Mercury*, Birmingham, and the *Sunday Sentinel*, Stafford. The aggregate sale of all the Sunday newspapers is estimated to be 16,000,000.

### DEVELOPMENT OF THE MODERN NEWSPAPER

It was the last quarter of the 19th century that witnessed the beginning of changes in journalism which moulded the present character of the British newspapers. The first sign of change was struck by W. T. Stead in the *Pall Mall Gazette*, over 40 years ago. He popularised the interview, and humanised political journalism. He was cramped in his activities, as he edited an afternoon review rather than a newspaper. The influence which the *Pall Mall Gazette* exercised under Frederick Greenwood, John Morley, W. T. Stead, and E. T. Cook was indirect. It had no popular appeal.

The first break in old traditions and appeal to democracy through the press came when the late T. P. O'Connor founded the *Star* in Jan. 1888. With the *Star* began a new type of popular journal. Human interest was its daily fare, and though small in size its scope was as wide and diversified as life. Politics and crime, special and personal news, finance and serial stories, books and fashions, labour, art, music, were all popularised by O'Connor. He had on his staff seven men who were afterwards editors of London newspapers, and the men who began their careers on the *Star* and gained fame in their own spheres in later years include George Bernard Shaw, A. B. Walkley, the greatest dramatic critic of his time, and that wayward genius Joseph Pennell.

As already mentioned the big advance in the new journalism was left to Alfred Harmsworth, the late Lord Northcliffe (*q.v.*). Newspapers were the second stage of his meteoric career. He began with *Answers* and other periodicals, following the lead of Sir George Newnes with his *Tit-Bits*, and soon surpassed him. After his success in this sphere of journalism, Lord Northcliffe and his brother, Harold Harmsworth (now Lord Rothermere), acquired the London *Evening News*, and on this founded their phenomenal success in halfpenny morning journalism.

**The 20th Century.**—The introduction of half-tone pictures to illustrate the news of the day was another new element in extending the sphere of the daily press and in popularising it. Encouraged by the support which he received from women readers of the *Daily Mail* and of his many weekly variety papers, Lord Northcliffe issued a newspaper which was to be edited by women for women. He produced the *Daily Mirror*, intended to be a higher type of paper than the *Daily Mail* and to appeal more to the

interests of serious-minded women. It was still-born. It was Lord Northcliffe's greatest failure. But it was a lucky failure. The paper which was intended to be the women's *Times* was transformed into the first illustrated halfpenny daily newspaper. The *Daily Mirror* was bought by Lord Rothermere, and became as great a financial success as the *Daily Mail*.

The *Daily Sketch* was the next halfpenny daily picture paper to be published. The *Daily Graphic* had existed for many years as a penny daily illustrated paper, but never attained great success nor won popular favour. All newspapers began, one after the other, to introduce a page of half-tone pictures and to publish other pictures in their news columns, the *Times* and the *Daily Telegraph* being among the last to adopt this feature.

Meanwhile other newspapers had been compelled by the success of the *Daily Mail,* followed by the *Daily Express,* to come down to a halfpenny and similarly to make their appeal to the masses. Leading articles became shorter, feature pages were introduced, and a magazine page with short articles and items of the tit-bit character, though it must not be assumed that this abbreviated style carried with it any real degeneration of journalism.

The World War brought more changes. At first, like all other industries, except those concerned with the production of munitions or in some way associated with catering for the forces, the press was disorganized. The Government recognised that the press was an essential element in national effort, and facilities were granted to newspapers, both in regard to obtaining materials and in retaining man power. For the first time also, war correspondents became more than camp followers, were granted uniforms and became officially attached to armies.

No industry has undergone such dramatic changes since the World War as the press. The late Kennedy Jones, who was associated with the Harmsworths in founding the *Daily Mail,* said to the late Lord Morley: "You found journalism a profession, we have made it a branch of trade." It has now become also a branch of finance.

### THE ERA OF AMALGAMATIONS

The great change from the private proprietorial system to limited liability companies was initiated by Lord Northcliffe in promoting limited liability companies to take over Harmsworth Bros., the most successful periodical business, and afterwards *The Evening News.* Amalgamations and groupings of papers followed. Referring to this phase of newspaper development Sir Robert Donald, in an address at York, as president of the Institute of Journalists, in 1913, said: "Combination has been the chief characteristic of industry all over the world, and the press could not remain outside this tendency. One company sometimes owns or controls a series of newspapers. There have been absorptions, amalgamations and alliances, with the result that vast aggregations of capital have been built up in which thousands of shareholders are interested. These agglomerations, piling up power and wealth, are controlled by the same forces which operate in other fields of industrial activity." He also predicted that the future would see combinations increase; there would be fewer newspapers, and "colossal circulations would continue to grow." The newspaper run as a luxury and for a mission, and not as a business enterprise, would be squeezed out of existence. There would therefore be fewer newspapers, but the total circulations would be greater.

These predictions, made a year before the World War, have been fulfilled, but no one foresaw that the press combinations would reach such gigantic proportions, or become so immensely profitable. The war facilitated and expedited the rise of the press syndicates. One has only to look at the Stock Exchange quotations to realise the influence of finance on the Press and the power of the press in finance.

There has however been a decrease in the number of newspapers. In 1928 there were in Great Britain, Northern Ireland, and the Irish Free State, 2,150 newspapers, distributed as follows: London 992, of which 21 were morning, including specialist papers (*Jewish Express,* in Hebrew, *Jewish Times, Lloyd's List,* and *Lloyd's Daily Index*), and 3 evening dailies (and the *Jewish Evening News,* published in Whitechapel). The newspapers in the English provinces and Wales, including localised issues, numbered 1,363, of which 35 were morning and 80 evening dailies; Scotland, 228, including 6 morning and 10 evening dailies; Ireland, 161, including 8 morning and 5 evening dailies; the British Isles, 16, of which 5 were dailies.

Twenty years previously there were nearly 200 more newspapers than in 1928, although the population greatly increased during these two decades.

The rise of the newspaper combination has dethroned all the old newspaper dynasties. The Walters of *The Times* are no longer in control of that great national newspaper. The Borthwicks of *The Morning Post,* the Lloyds of the *Daily Chronicle* and *Lloyds News,* the Hultons of the *Manchester Daily Dispatch,* etc.; the Ingrams of the *Illustrated London News;* Cox of the *Field;* and, in the provinces, Byles of the *Bradford Observer,* Baynes of the *Leeds Mercury,* Cowen of the *Newcastle Chronicle,* and others have been displaced. The last of the monarchs of Fleet Street to give up their splendid isolation were the Lawsons of the *Daily Telegraph.* It was a shock to the newspaper world when, in December 1927, the second Lord Burnham sold the paper which his grandfather founded and his father—a newspaper genius—installed in the first place in British journalism.

**Owners of the Press.**—New magnates assumed power. No longer were newspapers the personal properties of the Borthwicks, Lawsons and the Walters; they belonged to shareholders who entrusted their money to a directorate. Greatest of the new barons of the press were the Harmsworths, headed by Viscount Rothermere (1868–1940). The Berrys, newest monarchs in the newspaper world, were still young in their generation, and Lord Beaverbrook—a Canadian by birth— had been in England only a few years when he bought the *Daily Express.*

The most spectacular financial newspaper deal was that involved in the creation of the *Daily Mail* Trust, Limited. It was incorporated on Sept. 27, 1922 and purchased the 400,000 deferred (controlling) shares in Associated Newspapers, Ltd., as sanctioned by the court on the death of Lord Northcliffe. The price paid was £1,600,000, which was met by an issue of 7 per cent first mortgage debentures. Early in 1923 the trust purchased 49 per cent in the *London Express* Newspaper, Ltd. A little later it purchased the large newspaper business of E. Hulton and Company, Ltd., and paid for it by a second issue of £8,000,000 7 per cent debentures, liquidating out of the proceeds the former issue of £1,600,000 debentures. At the same time the trust retained 49 per cent. interest in *The Evening Standard,* which had been included in the Hulton group but was transferred to Lord Beaverbrook. In the same year the trust sold the greater portion of the Hulton press to the Berry brothers for more than the original purchase price, while retaining possession of *The Daily Sketch, The Sunday Herald* and new printing works; these three assets being subsequently promoted and sold for £1,600,000 under control of Lord Rothermere. The trust paid £4 for the deferred shares in Associated Newspapers, Ltd. They appreciated almost as much again. The trust in two years discharged a debenture obligation of £9,000,000.

**The Rothermere Group.**—The most powerful newspaper group in Great Britain is that of the late Lord Rothermere, not because of the number of newspapers combined or associated, but on account of their predominantly national character and the immense financial resources behind them. Lord Rothermere only occasionally contributed articles to his newspapers, and then only on subjects upon which he held strong personal views. The chief Rothermere groups are:—

*The Associated Newspapers, Ltd.,* owning the *Daily Mail, Evening News, Sunday Dispatch, Overseas Mail.*

| Capital: | £ |
|---|---|
| 5% Cumulative Preference shares | 500,000 |
| 7% Cumulative Ordinary shares | 600,000 |
| Deferred shares | 2,250,000 |
| Total | £3,350,000 |

*Daily Mirror Newspaper, Ltd.*

| Capital: | £ |
|---|---|
| 8% Cumulative Preference shares | 800,000 |
| Ordinary shares | 1,400,000 |
| Total | £2,200,000 |

In the spring of 1928 the ordinary shares of the Daily Mirror and Associated Newspaper Companies were converted each into four shares of a nominal value of 5s. The value of these shares in the summer of 1928 was in the case of the Associated Newspapers 24s., and in the case of the *Daily Mirror* 35s.

*Sunday Pictorial, Ltd.*

| Capital: | £ |
|---|---|
| 8% Cumulative Preference shares | 500,000 |
| £1 Ordinary shares | 1,500,000 |
| Total. | £2,000,000 |

These companies are shareholders in the Daily Mail trust, controlled by Lord Rothermere, already referred to. The financial strength of the Rothermere newspapers is not indicated by the amount of dividends which they distribute, as they build up great reserves and have no prior debenture or other charges.

In Feb. 1928, Lord Rothermere also promoted *Northcliffe Newspapers,* Ltd. (share capital £2,500,000; loan capital £3,000,000, 5½ per cent. guaranteed debenture stock), primarily for establishing or acquiring "in selected centres of large population throughout the country evening newspapers which, by reason of possessing the advantages of extensive organization and large resources, will be the most up to date in the country."

It was stated in the prospectus that the surplus assets of Associated Newspapers and of the Daily Mirror were respectively £5,129,000 and £2,500,000—excluding good will and all liabilities.

The debenture stock was guaranteed by the Associated Newspapers, Ltd., and the *Daily Mirror* Newspapers, Ltd. The 5 per cent. debenture stock was very much oversubscribed. The share capital was divided into £2,400,000, £1 ordinary shares and £100,000 £1 management shares. Two shillings was paid on all the management shares and on £1,400,000 ordinary shares, so that the company started with capital in cash amounting to £3,150,000, with £2,260,000 uncalled share capital.

During the summer of 1928 Northcliffe Newspapers, Ltd., acquired several prominent newspapers and made arrangements to start new evening newspapers in selected centres as announced in the prospectus. The *Daily Mirror* Company, acting independently or in association with Northcliffe Newspapers, acquired several well-established evening newspapers and founded a regional Sunday paper at Stafford.

The capital of the various Rothermere companies does not by any means indicate their financial strength and great earning capacity. They possess a complete dual organization between the Associated Newspapers and the *Daily Mirror,* and are building up a third national organization in the Northcliffe Newspapers. All these newspapers are safeguarded in regard to the supply of paper; they control mills in Newfoundland, Canada and England. The following table shows the capitalisation of their paper making companies:—

*Anglo-Newfoundland Development Co., Ltd.*

*Capital issued* { $6,439,585, Ordinary Shares. / $2,426,010, 8% Cumulative Preference Shares. / $1,594,255, Second Preference Shares.

As at 31.8.27 { £ 280,625, 5% Debentures. / £1,118,650, 6% Second Mortgage Bonds.

The Associated Newspapers Limited hold a majority of the Ordinary Shares.

*A. E. Reed & Company Limited*

*Capital:* £293,970, 6% First Mortgage Debenture.
£240,000, 6½% Cumulative Preference Shares.
£225,000, Ordinary Shares.

Daily Mirror Newspapers Ltd., hold a majority of the Ordinary Shares.

*Bowaters Paper Mills Limited*

*Capital:* £275,000, 7½% Cumulative Participating Preference Shares.
£295,600, 6½% First Mortgage Debentures.
£193,000, Ordinary Shares.

Majority of Ordinary Shares held by W. V. Bowater & Sons Ltd., which is in turn controlled by "Daily Mirror Newspapers Ltd."

*The Empire Paper Mills (1922) Ltd.*

*Capital:* £400,000. Ordinary Shares of £1 each.
All the shares are held by Associated Newspapers Ltd.

*Anglo-Canadian Pulp & Paper Mills Ltd.*

*Capital:* $8,000,000, 7% Preference Shares. (Cumulative from October, 1929.)
£3,000,000, 6½% Mortgage Debentures.
135,000 Shares of Common Stock of no par value.

**The Berry Group.**—The largest newspaper proprietary in Great Britain and in the world is that controlled by Lord Camrose (formerly Sir William Berry) and his brother, Sir Gomer Berry, whose rise in the newspaper business has been as romantic as their success has been phenomenal. Their vast interests are the creation of little more than ten years' activities.

The founder of the business, William E. Berry, like Alfred Harmsworth before him, served an apprenticeship in the humble spheres of journalism, beginning on the *Merthyr Times.* He went to London in 1898 as sub-editor on the *Investors' Guardian,* and though he quickly showed a special *penchant* for financial journalism, he worked on the staffs of several papers before launching out as a newspaper proprietor. In 1901 he started the *Advertising World,* the first production of the kind in the United Kingdom, and in the same year was joined by his brother Gomer. Together they started and owned various weekly and monthly papers, and when in 1915 they acquired the *Sunday Times* and introduced a new vitality into that old established newspaper they were already recognised as important newcomers to the press industry. In quick succession they acquired the *Graphic,* the *Daily Graphic,* the *Bystander,* the *Financier,* the *Financial Times,* the old established house of Cassells, with its periodicals and big publishing business, and Weldon's Fashion Journals. In 1923 they bought *Kelly's Directories* including the famous *London Post Office Directory.* Later an alliance was formed between the company owning Kelly's directories and Iliffe and Sons who own a leading group of trade and technical journals. Large printing works went with these two concerns. While the foregoing were big transactions from the financial point of view the Berrys were not firmly established in the newspaper world until 1924 when they bought most of the publications of Edward Hulton Ltd. which had been acquired by Lord Rothermere and Lord Beaverbrook, and formed the Allied Newspapers Ltd., which included the *Sunday Times.* The group contained widely circulated and popular newspapers, including the *Manchester Daily Dispatch,* the *Manchester Evening Chronicle,* the *Sunday Chronicle,* the *Empire News,* the *Sporting Chronicle,* and sundry other publications. About the same time they took over the control of another important newspaper property, the *Sheffield Daily Telegraph* and *Evening Telegraph,* with a number of popular periodicals. Another big milestone in their progress was reached in the following year when they bought all the newspapers in Newcastle except one, namely the *North Mail,* the *Newcastle Evening Chronicle,* the *Sunday Sun,* etc., and simultaneously acquired the *Glasgow Daily Record,* the *Glasgow Evening News,* and *Sunday Mail.* To this group was added in 1926 the *North Eastern Daily Gazette* of Middlesbrough, and the Allied Northern Newspapers Co. Ltd. formed with a capital, including debentures, of four million pounds. Very soon afterwards the Berrys purchased from Lord Rothermere the two papers which he had retained from the Hulton group, namely, the *Daily Sketch* and the *Sunday Graphic,* which were formed into a separate company. Towards the end of 1927 Sir William and Sir Gomer Berry—both having been made baronets in recognition of their public services, Sir William in 1922 and Sir Gomer in 1927—startled the newspaper world by acquiring the *Daily Telegraph* from Lord Burnham and his family. Sir Edward Iliffe was a partner in this transaction. The new owners immediately began to put new life into this sound and sedate organ of the English commercial and middle classes. Important paper making works went with the newspaper. The capital involved in this transaction has not been made public.

It is probable that the Berrys would have been content to have consolidated their properties but in 1928 a new newspaper war was started and they took up the challenge. They bought the *Derby Express,* the *Bristol Times and Mirror,* the *Bristol Evening Times, the Aberdeen Press & Journal* and the *Aberdeen Evening Express.*

For several years the Berry family have had control of the *Western Mail* and *Evening Express,* Cardiff, and in August 1928 bought the *South Wales Daily News* and *South Wales Echo*—the other papers in Cardiff.

While the foregoing list of newspaper properties controlled by the Berry companies are a formidable combination they do not by any means complete the wide range of their interests in the publishing business. In 1927 they bought the Amalgamated Press Ltd., the business founded by the late Lord Northcliffe and his brother Lord Rothermere. It was largely in the hands of the trustees of the Northcliffe estate and the Berrys were the successful bidders. It is the largest periodical business in the world and publishes over 120 weekly and monthly publications. Its capital was £3,000,000. The Berrys paid £9,000,000 and have paid dividends on the increased capital.

Lord Camrose and Sir Gomer Berry carry on their vast and varied interests in a commercial spirit without bringing their personalities before their many millions of readers.

Like all big combinations the Berrys proceeded to safeguard themselves regarding the supply of raw material. They acquired with the Amalgamated Press the Imperial Paper Mills and in 1927 bought the famous Edward Lloyd Paper Mills, the biggest single concern of the kind in the world, so that they became the biggest paper manufacturers in Great Britain, as well as the largest newspaper and periodical owners.

The issued loan and share capital of the various Berry enterprises belonging to public companies was, in the summer of 1928, as follows:

| | £ |
|---|---|
| Allied Newspapers Ltd. | 8,250,000 |
| Allied Northern Newspapers Ltd. | 4,000,000 |
| *Daily Sketch* and *Sunday Graphic* Ltd. | 2,584,096 |
| *Financial Times* Ltd. | 1,500,000 |
| Kelly's *Directories* Ltd. | 1,131,372 |
| Weldon's Publications Ltd. | 385,000 |
| Amalgamated Press Ltd. | 9,200,000 |
| *Bristol Times and Mirror* Ltd. | 138,337 |
| Aberdeen Newspapers Ltd. | 188,310 |
| Edward Lloyd Investment Co. Ltd. | 4,500,000 |

The capitalization of the Cardiff newspapers and the one in Derby has not yet been published, but will probably be £1½ million.

The Berry press "trusts" have not provoked the same criticism among public men or fears from journalists as has been the case with other newspaper combinations because they have not used their powers to push themselves or to run particular policies. They have maintained the character of the publications acquired, retaining local management and giving their editors considerable latitude. They have not over-centralized. So far as the reading public of the different papers are concerned they do not notice marked changes in the appearance and character of the publications. The centralized control is mainly commercial and financial. All the Berry companies are financially successful. Their progress has been steady and while their loan capital is heavy their earning capacity has up to now increased and the ordinary shares stand at a premium.

Apart from periodicals which number about 200 the Berry combinations control in London three daily newspapers and two Sunday newspapers; in the provinces, eight morning, eight evening, three Sunday newspapers; fourteen weekly newspapers; in Scotland two morning, two evening, and two weekly newspapers and one Sunday newspaper.

**The Beaverbrook Group.**—An arresting personality in the British Press is Lord Beaverbrook. He went into the newspaper business during the World War and it was not long before he showed striking gifts for the particular kind of journalism which he took up. He has the news and the political sense highly developed and if he frequently annoys he always interests. The Beaverbrook group, in which Lord Rothermere has a minority interest, consists of *The Daily Express, The Sunday Express,* owned by London *Express* Newspapers, Ltd. (capital £539,439), and *The Evening Standard.* The policy of Lord Beaverbrook has not been to distribute dividends on the ordinary shares, but to extend plant and building, reduce capital and organise a future impregnable position.

The commercial possibilities of Lord Beaverbrook's newspapers have not yet been tested. Judged by the rapid expansion which they have made in recent years and the volume of advertising which they carry it is a fair assumption that if the intensive development policy were discontinued these journals would be next to the Associated Newspapers in earning capacity.

**Daily Chronicle Group.**—The *Daily Chronicle* Investment Corporation Trust was formed in July 1927 to take over the properties of the United Newspapers (1918) Ltd., with a capital of £3,050,000 consisting of £800,000 7% first cumulative preference shares, £700,000 8% second cumulative preference shares, £1,400,000 ordinary shares, £1 each, and 3,000,000 deferred shares of 1/– each. The corporation owns the *Daily Chronicle,* the *Sunday News,* the *Edinburgh Evening News,* the *Yorkshire Evening News,* and the *Doncaster Gazette.*

In July 1928 after the death of Sir David Yule and the retirement of Sir Thomas Catto, their interests were acquired by Mr. William Harrison on behalf of the Inveresk Paper Co., Ltd., of which he was chairman. Mr. Harrison had previously entered the newspaper field by acquiring the *Lancashire Daily Post,* Preston, and an interest in the *Hull Daily Mail* and *Grimsby Telegraph.* Besides his interests in daily newspapers, Mr. Harrison, as already mentioned, is chairman of Illustrated Newspapers, Ltd., which own nearly a dozen illustrated and trade papers. Mr. Harrison also controls most of the paper-making mills in Great Britain outside of newsprint mills.

**The Starmer Group.**—This is an association of 32 provincial newspapers with London headquarters at Newspaper house. The founders were the Rowntree family and Sir Charles Starmer, who began his newspaper career on the *Northern Echo* (Darlington). With the Rowntrees and Lord Cowdray, he built up this group, which includes the *Northern Echo, Sheffield Independent, Sheffield Mail, Nottingham Evening News, Nottingham Journal, Birmingham Gazette, Yorkshire Observer, Yorkshire Gazette, Bradford Telegraph and Argus, Birmingham Evening Dispatch, Lincolnshire Chronicle,* and a number of weeklies. The *Westminster Gazette* (morning paper) belonged to this group until its merging with the *Daily News* in Feb. 1928.

**Other Combinations.**—A financial group was promoted in July 1928 comprising the *Financial News,* the *Investors' Chronicle,* half interest in the *Economist,* the *Banker,* and the *Liverpool Journal of Commerce,* with a share capital of £550,000. One condition was that the editorship of the *Economist* should always be independent. The promoters of the issue were the printing firm of Messrs. Eyre and Spottiswoode.

Among the largest combinations of newspaper properties outside the big combines may be mentioned:

*The Liverpool Daily Post and Echo* Ltd., which owns the *Daily Post, Liverpool Echo, Liverpool Courier and Express*—all the newspapers in the city and neighbourhood.

The Consolidated Newspapers, Ltd., belonging to Sir Leicester Harmsworth, owns the *Western Morning News,* the *Mercury,* and the *Evening Herald,* Plymouth—the only morning and evening papers in that town—an evening paper in Exeter, and one in Torquay. In the summer of 1928 Sir Leicester Harmsworth acquired the *Field,* the *Queen,* and the *Law Times.*

The *Glasgow Herald* (Outram & Co.) Ltd., of Glasgow, with the *Bulletin* (an illustrated morning paper), the *Evening Times,* and the *Citizen.*

D. C. Thomson & Co., Ltd., own all newspapers and publications in Dundee, including the only morning and the only evening paper in that city, a Sunday newspaper, and a large number of weeklies.

The Yorkshire Conservative Newspaper Co., Ltd., are the proprietors of the *Yorkshire Post,* including *Yorkshire Evening Post,* and *Leeds Mercury.*

Anglo-Foreign Newspapers, Ltd., formed in Jan. 1929, has acquired interests in various newspapers and trade journals.

**Organisations.**—A net-work of organisations exists for employers and workers. In the newspaper business collective bargaining is the rule. On the employers' side, there is the Newspaper Proprietors' Association, which represents the London press, the Newspaper Society for the provincial press, the Scottish Newspaper Proprietors' Association, and the Irish Newspaper Society. There is also the British Trade and Technical Trade Journals Organisation.

Since 1913 the position of the working journalist has been vastly improved by the continued activities of the Institute of Journalists, incorporated by royal charter in 1890, and more especially by the influence exercised by the National Union of Journalists, founded in 1907, which is a trade union and has been the means of raising the standard among working journalists and of establishing the principle of minimum salaries.

At first competitive, the two bodies now show a tendency to become mutually complementary, the institute specialising in the professional, cultural and benevolent interests of the journalist, and the union concerning itself primarily with questions of salaries, hours and working conditions. The institute gives full membership to all bona fide journalists; the union restricts voting membership to journalists who cannot exercise the powers of an employer; thus, generally, editors, managing editors, and director-journalists are not eligible for full membership of the Union, and favour membership of the chartered body.

On the side of the manual workers there is also a complete net-work of organisations. The chief federated societies are the Typographical Association, representing compositors throughout the country; the London Society of Compositors; the National Society of Operative Printers and Assistants and Printing Machine Managers. Press telegraphists; correctors of the press; electrotypers and stereotypers; pressmen; paper-makers and others engaged in connection with newspapers, all have their unions. Beyond the federated societies is a large number of affiliated federations covering Great Britain.

Advertisers have organisations also, including advertising managers, circulation managers, and, indeed, every one associated with the production and distribution side of the press. Newsagents combine chiefly in the Federation of Wholesale Newsagents and the National Federation of Retail Newsagents.

**The General Strike and the Press.**—A development of the coal dispute in England, which came to a head at the end of April 1926, was a general strike organised by the General Council of the Trades Union Congress. An important preliminary incident was a stoppage of work which occurred in the office of the *Daily Mail.* (*See* GENERAL STRIKE.)

After the first few days certain newspapers began to re-appear in the first instance mostly by photographic processes, in two or four diminutive pages, which were gradually increased in size as voluntary labour was obtained. The Government by voluntary labour issued from the office of the *Morning Post* the *British Gazette,* which was under the control of Winston Churchill. It soon attained a very large circulation. The Trades Union Congress retaliated by producing the *British Worker* by trade-union labour. The newspaper and periodical business probably suffered more by the strike than any other industry, as a considerable proportion of the staff had to be retained and heavy general expenses incurred. The general strike was called off on Thursday, May 13, and after negotiations the newspapers resumed normal production on Tuesday the 18th.

After the strike an agreement was entered into between all organizations representing employers and employed which defines the functions of both parties. The agreement between the Newspaper Proprietors' Association and the respective unions, which was a notable landmark in collective bargaining, is as follows:—

1. There shall be not interference with the contents of newspapers owned by members of this Association.
2. There shall be no interference with, or victimisation of, any members of the staff who worked or returned to work during the strike, either in their own or in any other office. Nor shall there be any victimisation by the employers.
3. There shall be no interference by members of the unions with the management of businesses, or with the right of the management to employ, promote, or discharge members of the staffs. Nor shall it be necessary for private secretaries or managers of departments not engaged in production to be members of a union.
4. No chapel meetings shall be held during working hours.
5. The strict observance of agreements in the newspaper trades shall be regarded as a matter of honour affecting each individual employer or employee.

**Empire Press Union.**—An organization which represents not only the Press of Great Britain but of the Dominions is the Empire Press Union, which was the outcome of the first Imperial Press Conference held in 1909. It represents newspapers, either by proprietors or responsible members of the staff. It has branch sections in the overseas dominions and keeps a permanent supervision over such questions affecting cable services and charges, and matters of common interest to the press as a whole. The second Imperial Press Conference was held in Canada in 1920, and the third in Australia in 1925. The first president of the Empire Press Union was the first Lord Burnham, and he was succeeded by his son, the present Lord Burnham. The chairman of the Council from 1915–26 was Sir Robert Donald, who was succeeded by J. L. Garvin, and was followed by Major the Hon. J. J. Astor. The Empire Press Union has insisted continuously on better and cheaper communications with the overseas dominions and has devoted particular attention to the promotion of empire wireless.

**Page Fellowship.**—American newspaper fellowships in memory of Walter Hines Page, the great ambassador, were established by the English Speaking Union of the United States in 1926 for the purpose of promoting more understanding among other English-speaking people through the medium of the press. Fellowships are awarded to British journalists who spend a year in the United States actually at work on newspapers and in the study of public questions. A British committee in co-operation with the English Speaking Union of the British empire selects the fellows, the first of whom was J. A. Spender, who spent three months in America in 1927.

**International Press Conference.**—The first international conference of newspaper experts held under the auspices of the League of Nations was held at Geneva in August, 1927. It was attended by editors and newspaper men from all over the world. Lord Burnham, then president of the English Newspaper Proprietors' Association and the Empire Press Union, presided. A series of resolutions were passed dealing with tariffs for telegraphs, telephones and wireless and improvement in communications, transport of newspapers, professional facilities for journalists, which have been referred to the League's organization for communications and transit for study and report. Other resolutions referring to postal subscriptions to newspapers, protection of news, censorship in peace time and facilities for travel tours, scholarships, railway fares, repressive measures, etc., will be considered by the Council of the League.

**Cheaper Communications.**—Cheaper and quicker means of communication and distribution of news is always in process of evolution. What are known as "loaded cables" have been laid down, increasing enormously the capacity and speed by which messages can be transmitted by cable, the advantages of which newspapers will share. In the address to the Institute of Journalists in 1913, to which reference has already been made, Sir Robert Donald visualized a time when news would be collected by wireless telephone and the reporter would always have a portable telephone with him, with which to communicate with his paper without the trouble of going to the telephone office, or writing out a message. The competitor, he said, to the national newspaper would not be another national newspaper, but

a method of circulating news by means of some scientific mechanism for transmitting the spoken word. He predicted that all the news of the day would be laid on to houses and offices, just like gas and water. During the years 1924 and 1925 the development of broadcasting brought this vision within the region of realisation. Newspapers look on this development with a watchful eye, lest it should, in addition to supplementing their functions, arrest their progress.

A revolution has taken place in long distance communication. New inventions have quadrupled the carrying capacity and speed of submarine cables and simultaneously short wave or beam wireless has more than caught up with the cables. On the main world routes where the two systems have come into competition the cables have suffered. This development in wireless, which was due to Senatore Marconi, has definitely established wireless as the cheapest and quickest means of communication over long distances and has therefore rendered a valuable service to the press. Cables are, however, more efficient in direct communication and have greater accuracy. On the other hand wireless can reach all parts of the world and will link up vast territories which will never be connected by telegraph. In fact it is doubtful whether more cables will be constructed except in association with wireless. The services should be complementary.

The interest of the press in these developments is to get the advantage of cheaper and quicker means of communication. In contracts proposed for wireless services to the British Government and in resolutions passed by Imperial Press Conferences, it was always assumed that the tariff for wireless would be one-third less than cable rates. When the beam and short-wave system came into operation in 1927, it was proved that wireless could operate profitably at these reduced rates. As this competition was threatening the existence of cables, the British Government called an Imperial Conference in 1927, which sought a solution of the problem in the interest of empire communication, by endorsing a merger of all cable and wireless undertakings within the British empire. It was assumed that under unified control the users, including the newspapers, would get better service at lower rates.

More revolutionary than long distance wireless was the introduction of receiving illustrations by wire. The chief London newspapers began in 1928 reproducing wireless pictures of events which took place thousands of miles away and it is expected that this development will become a regular feature of the press in a few years' time. The use of wireless telephony will also become more general. The effect of all these developments will be to widen the scope of newspapers and bring the people of the world closer together.

**The Future of British Newspapers.**—The revolution which took place in English journalism immediately preceding, during, and after the World War was characterised not by improvements in the traditional features of newspapers, but by the introduction of extraneous elements. These extraneous elements and methods were intended to force sales by making people buy more than one paper and several copies of the same paper. They were also intended to keep readers once secured by non-journalistic attractions and thus permanently increase and stabilise sales. As sales were made the basis of advertising rates, after Lord Northcliffe had set the example of issuing sales certificates, it became imperative to maintain a ratio between sales and advertising rates.

The chief feature adopted to capture new readers and attach them to a newspaper was insurance. Newspaper insurance, beginning modestly both as regards the accidents covered and the amounts recoverable, increased enormously until many subjects besides accidents to registered readers were covered, and the payments reached £12,500 on death by a railway accident. By the middle of 1928 the *Daily Mail* had paid over £1,000,000 under its insurance scheme. From the readers' point of view newspaper insurance is a good investment. No premium beyond the price of the paper is necessary. The system suits newsagents too, as they add to their list of permanent purchasers. Some newspapers carry their own insurance, while others pay premiums to insurance companies in proportion to their sales. In every case insurance companies investigate and settle claims. It does not seem that newspaper insurance has been inimical to normal insurance business. It is supplementary, not competitive.

Newspaper insurance has become a tremendous factor in the life of the people. Every year it is extended through its adoption by more newspapers and through the increase in payments. The newspaper which possesses the greatest financial resources will always lead in insurance. Heavy expenditure is incurred in the attempts to make insurance pay. An army of canvassers are employed, going from house to house in order to secure new readers; and poster and other advertising campaigns are carried on regardless of expense.

Newspaper insurance differs from company insurance. A company takes premiums from clients, but hopes that they may escape accidents and prolong their lives. Newspapers on the other hand seem to rejoice—in headlines—over fatal accidents which befall their readers and boast about the amount of money they pay out. One reader killed in a railway accident brings a hundred new readers into the net. Newspaper insurance has come to stay.

In addition to insurance many newspapers resort to a variety of competitions to capture readers. These competitions, some of which require little skill or knowledge, carry big prizes. The coupon system, which usually accompanies prize competitions, induced readers to buy many copies of the same issue for the sake of the coupon, as entries are not limited. This kind of coupon competition was declared by the High Court in October 1928 to be illegal and was stopped. There are many other competitions, including beauty contests and competitions referring to all kinds of sport. The cross-word puzzle competition has become almost universal and handsome prizes are offered for correct results. This is a competition which requires a certain amount of knowledge to solve. The general knowledge examination which has been adopted by all kinds of newspapers and periodicals demands greater intelligence, but in this case few prizes are offered.

The same comment applies to all competitions carrying prizes as to insurance—success depends on the amount of money spent in pushing schemes, and not so much on the merits of the schemes.

Other extraneous features have been introduced into journalism in the race for sales, or to stimulate advertisements, including devices by which readers may receive presents of various articles or beneficial considerations,—free trips, free entertainments, etc., —State events are organized and exhibitions held. Newspapers which do not resort to these expedients to foster business find themselves at a disadvantage. There are examples of newspapers which contain more news and better reading matter than their contemporaries, but which, because they decline to adopt insurance, or competitions, or puzzles,—as undignified or incompatible with their conception of the mission of the press,—fall behind, become unprofitable, and unless subsidized for political reasons, cease to exist.

The modern newspaper caters for all classes. It is severely sectionalised, and while the interests touched upon are more comprehensive than they were twenty years ago, the space devoted to general news of the day is very much less. Except in the case of a few newspapers, speeches are not reported at any length, and politics is treated as a subject of minor interest. Newspapers have become more or less imitative, and no journal is permitted to get more than a day ahead with a new feature or a new development. While minor changes are numerous, there has been no revolutionary change in the characteristics of daily journalism since the days of Lord Northcliffe. The popular cross-word puzzle, the general knowledge questions, and the comic strips which have been almost universally adopted, are importations from America.

The widening of interest in the contents of newspapers, colossal sales, amalgamations, and local monopolies do not fully explain the phenomenal financial success of newspapers since 1918. As compared with pre-war times newspapers have doubled their selling price and quadrupled their charges for advertisements, but there has not been a commensurate rise in the cost of raw materials, of labour, or of transport.

The chief factor in making for newspaper prosperity has been the increase in advertising. Newspaper advertising has become a vital factor in national industry and salesmanship. There has

been a quickening of the business sense, a determination to open up new markets, to increase consumption. Simultaneously there took place in England a revolution in the methods and style of advertising. The advertising agent, instead of being a mere conduit pipe, has become a highly scientific expert. More firms have been induced to advertise, and the experience of scientific publicity has been followed by larger allocations for this branch of salesmanship. The newspapers have reaped the benefit of the originality, resource, thought and enterprise which the advertising consultants apply to their business.

All these factors in recent newspaper development have made the newspaper business more and more dependent on finance. The consolidation of the press has continued without a break since 1918,—amalgamations, syndicates, trusts have followed upon each other. The impetus given to advertising enabled companies which were over-capitalised when promoted to return handsome profits. The only break in the movement towards trustification came in 1928, when Lord Rothermere launched his scheme for competitive evening newspapers in the provinces. How that scheme, which was welcomed by advertisers and journalists, will develop remains to be seen. Only a man with powerful financial resources behind him could undertake such an enterprise. Few new newspapers will be started, because the syndicated press is firmly entrenched and can exhaust the resources of any ordinary competitor.

The future of the British newspaper, therefore, becomes a question of finance. It is estimated that three-fourths of the newspapers in England and Scotland, and a greater proportion of newspaper sales are controlled by large corporations or by local monopolistic companies. These big corporations are not going to dissolve, and local monopolies will not be challenged except by a corporation.

Multiple ownership of newspapers possesses all the commercial and financial advantages of other big businesses, but mass production and centralised control destroy individuality. As members of a big combine newspapers lose character: they tend towards a standardised type. They may be better productions than is possible under isolated ownership, but the old conceptions of a newspaper as an institution with a soul of its own, which could not be measured by ordinary commercial standards, is gone.

The paramount interest of press trusts is to earn dividends for shareholders. It may be that four or five corporations with several hundred thousand shareholders will compete vigorously, but fights for supremacy usually end in understandings, in division of territory, in agreements and amalgamations. It is quite probable that the whole press of England may fall under the control of two or three trustified ownerships acting in co-operation.

BIBLIOGRAPHY.—*Mitchell's Newspaper Press Directory* (1910–28); *The Newspaper World;* H. Simonis, *Street of Ink* (1917); Robert Donald, *The Parliament of the Press and the Work of the Empire Press* (1920); W. H. Mills, *The Manchester Guardian. A Century of History* (1921); J. Saxon Mills, *The Press and Communications of the Empire* (1924); *The Romance of the Daily Mirror 1903–24* (1925); *Printers and Stationers Year Book and Diary* (1926). *See* also *Willing's Press Guide* (annual); *Sell's Dictionary of the World's Press* (irregular); T. B. Brown, *The Advertisers A.B.C.* (annual); J. B. W. Williams, *Hist. of British Journalism to the Foundation of the Gazette* (1908); H. R. Fox-Bourne, *English Newspapers* (1877); "The Newspaper Press," *Quarterly Review*, cl. 498–537 (October, 1880); *Progress of British Newspapers in the 19th Century* (1901; published by Simpkin, Marshall & Co.); Andrews, *History of British Journalism* (2 vols., 1860); Hunt, *The Fourth Estate;* Grant, *The Newspaper Press* (3 vols., 1871–73); Mason Jackson, *The Pictorial Press;* James D. Symon, *The Press and its Story;* Sir Alfred Robbins, *The Press.*

## II. THE BRITISH DOMINIONS

**Irish Free State.**—Newspapers in the Irish Free State are settling down to dominion conditions, but it cannot be said that the new political freedom has stimulated newspaper enterprises. The Dublin morning papers are now *The Irish Times* and *The Irish Independent,* and the evening papers, *The Herald* and *The Dublin Evening Mail.* In 1910 there were four morning papers and three evening papers in the Irish capital. The historic *Freeman's Journal* passed through many vicissitudes, and finally disappeared in 1923, after 160 years of existence. There is one morning paper and one evening paper in Cork. British newspapers, daily and weekly, have a considerable sale in the Irish Free State.

**Canada.**—There are no more independent newspapers than those published in the British overseas dominions. They are comparatively free from Government influences, and are not subject to the domination of syndicates or trusts. The press of each dominion has its own characteristics. Canadian newspapers not unnaturally reflect the style and appearance of American newspapers, while retaining some of the more sedate qualities of English journalism.

There are few Sunday newspapers in Canada, although American Sunday newspapers are sold at railway stations and at hotels throughout the dominion. Such papers as *The Montreal Star* and *The Toronto Globe* have very large sales and are second to none in enterprise.

The Canadian press publishes a great deal of British news and carries American magazine features.

There are no national newspapers in Canada, as the Dominion is too vast for papers to circulate beyond one province. There are several papers of national reputation and wide influence, as *The Manitoba Free Press, The Montreal Gazette, The Montreal Star, The Toronto Globe, The Vancouver Daily Province, The Halifax Chronicle, The Halifax Herald.* Such newspapers stand high, and Canadian journalists are continually being tempted to cross the border to fill important posts on the American press, and in recent years have been drawn in greater numbers to London. In some towns, such as Ottawa, the same papers have morning and evening issues. There are no big newspaper trusts in Canada. There is a chain under the same ownership including newspapers in Hamilton, Ontario, Ottawa, Regina and Vancouver City, but otherwise the combines are local. There is a healthy French press in the Quebec province. *La Presse* of Montreal claims to have the largest sale of any newspaper in Canada, French or English. Every town in Canada, even if its population does not exceed 5,000, has a daily newspaper, as is the case in most communities in other British dominions. The trade and technical press of Canada compares well with similar papers in other countries. Monthly publications are at a disadvantage because of competition from the excellent cheap magazines and Sunday supplements from the United States, which regard the dominion as a dependency for periodical literature.

The small town of St. John's, population 38,645, in the large island dominion of Newfoundland, prides itself on having one morning and three evening newspapers.

**Australia.**—Australian newspapers are dignified in appearance and possess solid qualities. As the number of newspapers is comparatively few for a growing community, they are almost without exception highly prosperous and very efficiently equipped. In Melbourne, which with its suburbs has over a million inhabitants, there are only two general morning newspapers—*The Age* and *The Argus,* and a pictorial paper—and one evening paper, the *Herald.* Many attempts have been made at competition with the *Herald,* but all have failed.

The chief newspaper centre in Australia is Sydney, which has seven daily newspapers—four morning, two evening, and one commercial. The *Melbourne Age* and the *Sydney Morning Herald,* occupy a first position among empire newspapers. The *Daily Guardian* most resembles the popular newspaper in England.

With regard to the capitals of the other States of the Commonwealth, Brisbane has two morning and two evening dailies, Adelaide two morning and one evening, Perth one morning and one evening paper. Hobart, the capital of Tasmania, has only one paper. In several of the cities a daily commercial news-sheet is issued and a very large number of weeklies. The weekly newspaper occupies a very important place in Australian journalism as it covers a large number of smaller towns few of which have daily newspapers. An exception is Rockhampton, in Queensland, which although it has only a population of 31,000, boasts of one morning and one evening paper. Launceston, in Tasmania, which has only a population of 35,000 in the city and suburbs, contains one morning and one evening paper.

The Australian newspapers comprise numerous trade journals,

general weekly papers, and also humorous journals. The Sydney *Bulletin, Truth* and *Smith's Weekly* have the largest sale among weekly papers.

**New Zealand.**—With a total population of about 1,500,000 New Zealand has a very healthy newspaper press, in style and characteristics similar to the Australian newspapers. Wellington, the capital, with a population of 93,000, has one morning and one evening paper. Christchurch, which has 40,000 more population, has two morning and two evening papers; Dunedin one morning and one evening. Invercargill, with a population of only 22,000 has one morning newspaper and one evening. New Plymouth, with a population of 16,000, has one morning and one evening.

**South Africa.**—With a white population of less than a million and a half divided between the British and the Dutch, the Union of South Africa makes a good show in the matter of the press. The more important newspapers are in the English language. They include *The Cape Times, The Cape Argus* and *The Johannesburg Star,* which are first-class papers. Newspapers are sometimes printed in the dual languages. In Bloemfontein and Pretoria there are one Dutch and one English paper; in Durban, two morning newspapers in English. Johannesburg has fewer newspapers than one would expect from a city of its population and commercial importance: there is only one morning and one evening newspaper in English.

Newspapers in South Africa are divided into associated groups, and there are also combinations of news agencies, advertising and distributing agencies, all of which tends to handicap enterprise and limit the number of newspapers. The leading Dutch papers are *Die Burger* and *Ons Land* of Cape Town, and the *Volkstem* of Pretoria.

**India.**—Up to the removal (*see* PRESS LAWS) of the rigid newspaper licensing system in British India in 1835 under the inspiration of Macaulay there were very few British or vernacular newspapers. At the Mutiny in 1857 the restrictions were partly restored, and though the Indian press has grown tremendously in volume it is still subject to severe Government regulations. Apart from obscure native sheets there are about 200 newspapers and periodicals published in British India. The part played by English newspapers in India cannot be measured by the copies which they sell. In Calcutta, with a population of nearly 1,500,000, is published the oldest newspaper in India, *The Englishman* (1821), and also the most popular, *The Statesman. The Times of India* (Bombay), *The Madras Mail, The Pioneer* of Allahabad, *The Civil and Military Gazette* of Lahore, are the best-known papers and organs of opinion. There is quite a number of official journals in India. The vernacular papers are growing in number and in influence, and some of the Nationalist organs are published in English—as, for instance, the *Amrita Bazar Patrika* of Calcutta. Some papers are published in two languages, in English and vernacular.

### III. NEWSPAPERS IN CONTINENTAL COUNTRIES

Freedom of the press in Continental countries has not kept pace with the development of political constitutions. Since the reconstruction of Europe after the World War there has been an increase of newspapers and particularly of organs of political opinion. In France, Germany, Belgium, Austria and Hungary, press conditions are somewhat the same as in pre-war days. In Russia there is practically no freedom of the press, and the same may be said with regard to Italy. In the new States of Czecho-Slovakia, Rumania and Yugo-Slavia, censorship and suppression of newspapers are carried on to as great an extent as before the war. In Poland there has been a revival of newspapers, but here again in regions inhabited by minority races the press is only tolerated. In all these new countries journalism is a hazardous profession, and has not gained in strength or dignity. In every country the extreme political Left is represented by propagandist newspapers, and while these journals are occasionally suppressed in the countries in which they are published, they are allowed to circulate in neighbouring countries.

**Newspapers of France.**—In no other country is the political influence of the press so great, or its literary merits so high, as in France. In France journalism is literature and literature is journalism. Some of the greatest literary men of France have been created by the press; and the greatest literary critics have contributed to it. Journalism is also inextricably intermixed with politics. It was so in the time of Cardinal Richelieu, at the inception of the press, and in the time of Napoleon. Napoleon had great respect for the press. While he censored and suppressed journals he was always ready to use them to his advantage. There have been presidents of the republic, prime ministers, ministers, colonial governors, academicians and others who attain high positions in national life, who graduated through the press. When they retire, they return to their muttons. The most famous journalistic statesman was Georges Clemenceau, the great war premier. He retired a year after the treaty of peace was signed, and at the age of 80 was an unsuccessful candidate for the presidency. He did not profess disappointment at his failure, but consoled himself with the observation: "What matter? with good pen and paper one could be king of the world."

The outstanding features of French newspapers are the signed article, dramatic and literary criticism, the short story, and the small items known as *chronique.* The collection and presentation of news, as will be shown, was a late development in the history of the French press. Not many decades since it was said that French newspapers were dated to-morrow and contained the news of the day before yesterday. While the literary reputation of the French press stands high, its commercial and political morality is not on the whole quite so commendable. Many newspapers are run for, or by, ambitious politicians, or in some interest, and nearly all of them accept inspiration from the Foreign Office. Ministers change frequently but the system remains. It is like part of the constitution.

The annals of French journalism begin with the *Gazette* (afterwards called the *Gazette de France*), established in 1631 under the patronage and with the active co-operation of Cardinal Richelieu. The first editor and printer was Théophraste Renaudot. The first weekly number apparently appeared in May 1631. So much, at least, may be inferred from the date (4th July 1631) of the sixth number, which was the first dated publication. Each number of the paper, which cost 6 centimes, consisted of a single sheet (eight pages) in small quarto, and was divided into two parts—the first simply entitled *Gazette,* the second *Nouvelles ordinaires de divers endroits.* It commonly began with foreign and ended with home news. Much of its earliest foreign news came direct from the minister, and not seldom in his own hand. Louis XIII. took a keen interest in the progress of the infant *Gazette,* and was a frequent contributor, now and then taking his little paragraphs to the printing office himself, and seeing them put into type. In Oct. 1631 Renaudot obtained letters patent to himself and his heirs, conferring the exclusive privilege of printing and selling, where and how they might please, "the gazettes, news and narratives of all that has passed or may pass within and without the kingdom." At his death in Oct. 1653 Renaudot left the *Gazette* to his sons in flourishing circumstances. Its place is now filled by the *Journal Officiel.*

In 1672 the *Mercure galant* was established by Donneau de Vizé. Its title was later changed to *Nouveau Mercure,* and in 1728 to *Mercure de France,* a designation retained, with slight modification, until 1853, when the paper finally ceased. It had many prominent contributors. In 1790 its circulation rose very rapidly and reached for a time 13,000 copies. Mirabeau styled it in debate "the most able of the newspapers." Great pains were taken in the collection of statistics and state papers, the absence of which from the French newspaper press had helped to depress its credit as compared with the political journalism of England and to some extent of Germany.

Under Napoleon the organ of official information was the *Moniteur* (*Gazette nationale, ou le moniteur universel*), founded in 1789 under the same general management with the *Mercure.* The *Moniteur* kept step with the majority of the assembly, the *Mercure* with the minority. So marked a contrast between two journals with one proprietor gave too favourable a leverage to the republican wits not to be turned to good account. Camille Des-

moulins depicted him as Janus—one face radiant at the blessings of coming liberty, the other plunged in grief for the epoch that was rapidly disappearing.

The only other newspaper of a date anterior to the Revolution which need be noticed here is the first French daily, the *Journal de Paris*, which was started on New Year's Day of 1777 and lived till 1819. Its period of highest prosperity may be dated about 1792, when its circulation is said to have exceeded 20,000. The *Journal des Débats*, which still flourishes, was founded in 1789 by Baudouin.

The cheap journalism of Paris began in 1836 (1st July) with the journal of Girardin, *La Presse*, followed instantly by *Le Siècle*, under the management of Dutacq, to whom, it is said—not incredibly—the original idea was really due. The first-named journal attained a circulation of 10,000 copies within three months of its commencement and soon doubled that number. The *Siècle* prospered even more strikingly, and in a few years had reached a circulation (then without precedent in France) of 38,000 copies.

The rapid growth of the newspaper press of Paris under Louis-Philippe will be best appreciated from the fact that, while in 1828 the number of stamps issued was 28 millions, in 1836, 1843, 1845 and 1846 the figures were 42, 61, 65 and 79 millions respectively. At the last-mentioned date the papers with a circulation of upwards of 10,000 were (besides the *Moniteur*, of which the circulation was chiefly official and gratuitous) as follows: *Le Siècle*, 31,000; *La Presse* and *Le Constitutionnel*, between 20,000 and 25,000; *Journal des Débats* and *L'Epoque*, 10,000 to 15,000.

The impulse given to the growth of advertisements in the days which followed July 1830 became, as the years rolled on, sufficiently developed to induce the formation of a company—in which one of the Laffittes took part—to farm them, or rather to farm a certain conspicuous page of each newspaper, at a yearly rent of £12,000 sterling (300,000 francs), so far (at first) as regarded the four leading journals (*Débats, Constitutionnel, Siècle, Presse*), to which were afterwards added two others (*Le Pays* and *La Patrie*). The combination greatly embarrassed advertisers, first, since its great aim was to force them either to advertise in all, whether addressing the classes to be canvassed or not, or else to pay for each advertisement in a selected newspaper the price of many proffered advertisements in all the papers collectively, and, secondly, because by many repetitions in certain newspapers no additional publicity was really gained, two or three of the favoured journals circulating for the main amongst the same class of buyers.

On July 16, 1850, the assembly passed what is called the *"loi Tinguy"* (from the name of the otherwise obscure deputy who proposed it), by which the author of every newspaper article on any subject, political, philosophical or religious, was bound to affix his name to it, on penalty of a fine of 500 francs for the first offence, and of 1,000 francs for its repetition. Every false or feigned signature was to be punished by a fine of 1,000 francs, "together with six months' imprisonment, both for the author and the editor." The practical working of this law lay in the creation of a new functionary in the more important newspaper offices, who was called *secrétaire de la rédaction*, and was, in fact, the scapegoat *ex officio*. The *"loi Tinguy,"* though now long repealed, has had a permanent influence on French journalism in the continued prevalence of signed articles, and the consequent prominence of individual writers as compared with the same class of work in other countries.

In 1858 the order of the six leading Parisian papers in point of circulation was—(1) *Siècle*, (2) *Presse*, (3) *Constitutionnel*, (4) *Patrie*, (5) *Débats*, (6) *Assemblée*. The number of provincial papers exceeded five hundred. "Newspapers, nowadays," wrote a keenly observant publicist in that year, "are almanacs, bulletins, advertising mediums, rather than the guides and the centres of opinion." In 1866 the change had become more marked still. The monetary success of Girardin's many commercial speculations in this branch of commerce greatly increased the number of Parisian journals, whilst lowering the status and circulation of those of established rank. In 1872 the circulation of *Le Petit Journal* (founded 1863), the pioneer of the French halfpenny press, was 212,500, and it went on rapidly increasing. In 1874 an elaborate return showed that in the 35 principal towns of France, comprising a population of 2,566,000 their respective journals had an aggregate weekly issue of 2,800,000 copies. In 1878 the total number of journals of all kinds published in France was 2,200. Of these 150 were political, strictly speaking, of which Paris published 49. Of Parisian journals other than political there were 1,141 (including 71 religious, 104 legal, 153 commercial, 134 technological, 98 scientific and medical, 59 artistic). At that date *Le Figaro* had a circulation of about 70,000, *Le Petit Journal* (at a halfpenny) one of about 650,000.

The law concerning the liberty of the press, of July 29, 1881, abolished suretyship for newspapers, decentralised their registration, and took away the former discretionary power, lodged in the home office, of interdicting the circulation in France of foreign journals. The home minister might still prohibit a single number of a newspaper; only the whole council of ministers, duly convened, could prohibit the circulation of a foreign newspaper absolutely.

The newspapers of Paris, and similarly of France, practically doubled in number between 1880 and 1900. In 1880 there were about 120 Paris newspapers, in 1890 about 160, and in 1900 about 240. The total number of newspapers, as distinguished from periodicals, published in France during 1900 was in round numbers 2,400, of which about 2,160 appeared in 540 provincial towns.

The history of the French press during the last twenty years of the 19th century followed very closely that of the country itself, Boulangist and anti-Boulangist, Dreyfusist or anti-Dreyfusist, Republican or Nationalist; finally it became either Moderate Republican or Radical Socialist, with a sprinkling of Nationalist organs and a small minority of Royalist and Bonapartist sheets.

The French papers, of whatever party, took an increased interest during this period in foreign matters and much improved their organisation for collecting news. *L'Eclair* gave less attention to the discussion of political questions from the party point of view than to the collection of news, and was followed by the *Echo de Paris* (1884) and *Le Matin*, which also dates from 1884, and which by an arrangement with the London *Times* gave every day a translation of most of the telegrams published in that newspaper. The *journal d'information*, as these papers were called, took its place beside the journal properly so-called, more perhaps as a rival than as a complement. The natural result followed, and the more old-type newspapers took steps to provide their readers with news as well as with leading articles, current and literary topics, society gossip, dramatic criticism and law reports. Nothing perhaps was so striking after 1890 as the demand of the French public for foreign and colonial news, or the readiness of the papers to supply it by means of special representatives independent of the news agencies. An enlargement of the individual newspapers followed, accompanied by a reduction of price.

In home matters the French press made greater progress still in the rapid and accurate collection of news, and in this respect the provincial press showed more enterprise and more ability than that of Paris. Its development was remarkable, for whereas in 1880 the inhabitants of the departments had to await the arrival of the Parisian papers for their news, they now had the advantage of being supplied every morning with local newspapers inferior to none of the best organs of Paris. Among the best provincial papers may be mentioned *La Gironde* and *La Petite Gironde* of Bordeaux, *La Dépêche* of Toulouse, *Le Lyon Républicain, L'Echo du Nord* of Lille, *Le Journal de Rouen*, all having a staff in Paris engaged in collecting news, reporting parliamentary proceedings and law cases, telegraphed or telephoned during the night and published early the next morning in their respective localities. Being perfectly independent of purely Parisian opinion or even bias, the decentralisation of the French provincial press became complete; it became also more independent politically than the Paris press. Several journals had and still have national reputations: the *Dépêche* of Toulouse, with its 12 editions daily, the *Progrès* of Lyons, *Le Petit Marseillais, La Petite Gironde* of Bordeaux. The small local press exercises an independent influence during elections.

The French Press has been little changed by the World War. During the War many newspapers temporarily disappeared, owing to the lack of staff, or of means, or shortage of paper. All papers were under a severe censorship and, more than ever, were the servants of the Government.

In 1928 there were 337 journals published in Paris, of which two were official dailies. There were 127 sporting newspapers, of which five were dailies. The number of newspapers published in the provinces was 3,100, including publications of all descriptions.

France was the first country to have national newspapers with sales of over 1,000,000. The sale was stimulated more by two serial stories run by each paper than by news, but since the war news has become more conspicuous in such widely circulated papers as the *Petit Parisien* (1,200,000), *Le Petit Journal* (1,000,000), *Le Matin* (900,000), and the *Journal* (800,000), which may be described as the "Big Four of the Paris Press." Following upon these in point of sales comes the *Echo de Paris* (800,000). The better-known political papers are *Le Temps,* the venerable *Journal des Débats* (founded in 1789 by Baudouin), *La Liberté, L'Oeuvre, L'Humanité* and the *Ère Nouvelle.* The *Figaro* (begun 1854, but a daily from 1866) maintains its unique position. Characteristics of all the popular Press are still signed articles and serial stories. There is a popular daily illustrated paper, *Excelsior,* established 1910, and numerous dailies devoted to sport, finance, the drama, motoring, etc. Every phase of politics is represented in the Paris press, from Legitimist to Communist, and every trade and interest has its organ.

Improvements have taken place in the mechanical equipment of the French press in recent years, and there has been a marked increase in illustrated weeklies and monthlies. The best known weeklies are the dignified *Illustration* and the gay *Vie Parisienne,* which flourished during the war, the literary *Annales Politiques et Littéraires,* and a light variety paper *Nos Loisirs.* The *Revue des Deux Mondes,* the *Mercure de France* and the *Revue Hebdomadaire* are the best known monthlies. The sale of the French press is pushed all over Europe. The chief news agency, Havas, has official support. There is also a universal wireless service which broadcasts news and propaganda. It is a subsidiary of the wireless company, which holds a concession from the State.

English journalism in France was for nearly a century mainly associated with *Galignani's Messenger* (1814–1904), which was killed by the competition of the Paris edition of the *New York Herald.* It had been preceded by Sampson Perry's *Argus* (1809), a Napoleonic organ. In May 1905 a new era of English journalism on the Continent began by the institution of the Paris edition of the London *Daily Mail.* There are three other papers printed in English: the *Chicago Tribune,* the *New York Herald-Tribune* and the *Paris Times* (evening).

**Newspapers in Germany.**—Under the old German empire there was liberty of the press within reason, but certain papers were exploited or influenced by the Government for its own purposes. Before 1914 German journalists had begun to conquer positions in the political world, and the press was gaining in independence. To-day the German press has complete freedom. It is the most serious press in Europe. There are few sensational newspapers. Newspapers do not sell because of sport or "stunts." Journals which cater for the special interests of the working classes discuss economic and industrial problems, and do not merely confine themselves to news. Literature, the drama, art, music and economics occupy a greater proportion of space in German newspapers than in the press of any other country.

Printed newspapers in Germany begin with the *Avisa Relation oder Zeitung* (1609), followed by the *Frankfurter Journal,* in 1615 of Egenolph Emmel. The following year saw the foundation of the *Frankfurter Oberpostamtszeitung*—continued until the year 1866 as *Frankfurter Postzeitung.* Fulda appears to have been the next German town to possess a newspaper, then Hildesheim (1619) and Herford (1630). In the course of the century almost all German cities of the first rank possessed their respective journals. The earliest in Leipzig bears the date 1660. The *Rostocker Zeitung* was founded in 1710. The *Hamburgischer Correspondent* (1714) was originally published under the name of *Holsteinische Zeitungs-Correspondenz,* two years earlier, and was almost the only German newspaper which really drew its foreign news from "our own correspondent." Berlin had in the 18th century two papers, those of Voss (the *Vossische Zeitung,* 1722) and of J. K. P. Spener (1749–1827; the *Spener'sche Zeitung,* or *Berlinische Nachrichten,* 1772). Some half-dozen papers which glimmered in the surrounding darkness were the reservoirs whence the rest replenished their little lamps. On the whole, it may be said that the German newspapers were of very small account until after the outbreak of the French Revolution. Meanwhile the ms. news-letters, as in earlier days, continued to enjoy a large circulation in Germany. Many came from London. The correspondence, for instance, known under the name of "Mary Pinearis"—that, apparently, of a French refugee settled in London—had a great German circulation between 1725 and 1735. Another series was edited by the Cologne gazetteer, Jean Ignace de Rodérique, also a French refugee, and remembered as the subject of a characteristic despatch from Frederick II. of Prussia to his envoy in that city, enclosing 100 ducats to be expended in hiring a stout fellow with a cudgel to give a beating to the gazetteer as the punishment for an offensive paragraph. The money, it seems, was earned, for Rodérique was well-nigh killed. At Berlin itself, Franz Hermann Ortgies carried on a brisk trade in these news-letters (1728–1735), until he too came under displeasure on account of them, was kept in prison several months, and then exiled for life. Nor, indeed, can any journal of a high order be mentioned of prior appearance to the *Allgemeine Zeitung,* founded at Leipzig by the bookseller Cotta (at first under the title of *Neueste Weltkunde*) in 1798. Its articles gave offence to the Austrian court, and the paper had to change both its title and its place of publication. It had been commenced at Tübingen, and removed to Stuttgart; it was then transferred to Ulm, and again to Augsburg. It was Cotta's aim to make this the organ of statesmen and publicists, to reach the public through the thinkers, to hold an even balance between the rival parties of the day, and to provide a trustworthy magazine of materials for the historians to come; and, in the course of time, his plan was so worked out as to raise the *Allgemeine Zeitung* into European fame. Cotta was also the founder, at various periods, of the *Morgenblatt,* which became famous for its critical ability and tact, of *Vesperus,* of *Das Inland,* of *Nemesis,* of the *Oppositionsblatt* of Weimar (for a time edited by Bertuch), and even of the *Archives Parisiennes.*

Whilst French influence was dominant in Germany, the German papers were naturally little more than echoes of the Parisian press. But amidst the excitements of the "war of liberation" a crowd of new journals appeared. Some of these journals lasted but two or three years. Most of the survivors fell victims to that resolution of the diet (Sept. 20, 1819) which subjected the newspaper press, even of countries where the censorship had been formally abolished, to police superintendence.

A similar crop of new papers of revolutionary tendency followed the upheavals of 1830 and 1848. These were equally short-lived, but it is nevertheless undeniable that a marked improvement in the ability and energy of the German political press may be dated from this period.

In Prince Bismarck's days the press bureau of the Prussian Ministry of the Interior, and a similar organization in the Imperial Home Office, used to furnish hundreds of petty local newspapers known as *Kreis-blätter* with whole articles gratis, so that the policy of the government might be advocated in every nook and corner of the country. The numerous journals in which these communications used to appear simultaneously and in an identical form were the government organs to which the Radical and Socialist opposition more particularly applied the term "reptile press." Later this practice of wholesale inspiration was abandoned, but there remained many channels, public and private, through which almost every department of the government could communicate information to newspapers in all parts of Germany.

At the beginning of the 20th century the position and influence of the German press were passing through a period of change. The Germans had become a newspaper-reading people. Indeed, with the remarkable growth of the commercial spirit in Germany

there had simultaneously been a change in the intellectual attitude and habits of the mass of the nation. The German of "the great period" of 1866 and 1870 derived his knowledge of his own and other countries to a very great extent from the more or less intelligent study of books, pamphlets and magazines. The busy German of the opening years of the 20th century had become almost as much the slave of his newspaper as the average American. Berlin in 1900 had 45 dailies, Leipzig 8, Munich 12, Hamburg 11, Stuttgart 8, Strassburg 6. In the domains both of home and of foreign politics the result was often a chaos of crude opinions and impulses, the strata of which were only differentiated by certain permanent tendencies of German political thought based upon tradition, class feeling, material interests, or distinctions of religious creed. In these circumstances it was still possible for the government, as in the days of Prince Bismarck and Dr. Moritz Busch, to bring its superior knowledge to bear upon the anarchy of public sentiment through the medium of the inspired (or as it used to be called, the "reptile") press, but this operation had now to be performed with greater delicacy and skill. The press had begun to feel its power. It was at least able to drive a bargain with those who would officially control it, and it was conscious in its relations with the authorities that the advantage no longer rested exclusively on the side of the latter. It would be instructive to compare, with the aid of Dr. Busch's "Secret Pages" of the history of Prince Bismarck, the methods by which the first chancellor used to create and control a movement of public opinion with the devices by which, for instance, count von Bülow and his subordinates endeavoured to manage the press of a later day. The journalists who placed themselves at the disposal of Prince Bismarck were mostly treated as his menials; as he himself said, "Decent people do not write for me." Count von Bülow's methods, and to a certain extent those of his predecessor, Prince Hohenlohe, moved on somewhat different lines. These methods might be characterized as the psychological treatment of the individual journalist, the endeavour to appeal to his personal vanity or to his legitimate ambition, and only in a minor degree to his fear of the *dossier,* the public prosecutor and the official boycott.

The journalistic characteristics of the German press—apart from the greater freedom which it now enjoys—have not changed since the World War. The former national organs occupy relatively the same positions, but there has been a shifting of ownership, not due to the political revolution but to the effects of inflation. During this period of inflation many of the old family newspaper owners, particularly in the provinces, were unable to survive and sold to industrialists. Hugo Stinnes, the industrial magnate, was able to create a great newspaper trust, which was, however, broken up after his death.

The most remarkable figure in German journalism is Dr. Alfred Hugenberg, a leader of the Nationalist party and the head of one of the most complete publicity organizations in the world. Dr. Hugenberg formerly held an important post in the Prussian Ministry of Finance, and was later, from 1909 till 1918, president of the directorate of Krupp's. In 1916 the Scherl press, an important undertaking which owned among other papers the Conservative *Lokalanzeiger,* became involved in financial difficulties and finally passed under the control of Dr. Hugenberg and other Ruhr industrialists. In the following year a company was formed for the rehabilitation of needy nationalist or monarchist newspapers, and through its operations Herr Hugenberg obtained control over a number of newspapers. He next formed a company for supplying provincial papers with news in stereotype form. This company was called the *Wirtschaftsberatung der Provinzpresse,* or *Wipro* for short. Later he acquired control of the *Telegraphen Union,* next to the Wolff Telegraph Bureau the most important news agency in the country, and of the joint advertising concern of Ala-Haasenstein and Vogler-Daube. A more remarkable and significant venture was his control of the *Universum Film Aktiengesellschaft,* or *Ufa,* which owns 150 cinema theatres and produces three-fourths of the German films. Hugenberg thus owns (1929) a most powerful and complete machine for influencing public opinion not only in Germany but in the world.

So far as is known the German Government has no longer an interest in newspapers as in the days of the Kaiser, when the Foreign Office directed or swayed the policy of several political journals. Its connection with the press is now confined to its participation in Wolff's agency, which is parallel to the Havas agency in France. For eight months in 1926, however, it secretly held a controlling interest in the *Deutsche Allgemeine Zeitung,* an independent Conservative paper with a leaning towards Nationalism. This newspaper was originally owned by the Stinnes concern, but in Aug. 1925, when the concern was being wound up, the newspaper and printing works were bought by the Prussian Government. The newspaper, of which the Prussian Government had no need, was afterwards sold to two private persons. In Nov. 1926, however, it was rumoured that the real purchaser had been the Government of the Reich, which had also paid the subsequent losses on the paper. On the 22nd of the same month Dr. Stresemann admitted before the foreign affairs committee that the paper had been subsidized by the Reich Government since the previous April, and in the debate on the question in the budget committee of the *Reichstag* on the 30th he stated that the controlling interest in the newspaper had been purchased by the Government of the Reich in the preceding April out of the secret funds placed at the disposal of the chancellor and foreign minister. The Reich Government had acquired 75% of the shares, while the remaining 25% had remained in private hands. It was not disclosed what price had been paid by the Reich Government, nor what proportions of the sum were furnished respectively by the chancellor's and foreign minister's funds.

Meanwhile the publishers, editorial staff, and board of management had severally issued statements that neither the publishers nor the editorial staff had been aware of the connection between the paper and the Reich Government, and that no attempt had been made to encroach on editorial independence. There had in fact been no perceptible change in the policy of the paper; and while it had continued to be produced at cost at the printing works, which were still in the possession of the Prussian Government, it had on occasions been severely critical of the Prussian Government. A condition of sale had apparently been imposed by the Prussian Government that it should not be subjected to malicious attacks by the paper, but this undertaking the board of management refused to give on the ground that malicious attacks had never been practised by the paper, and that a special undertaking was therefore unnecessary.

On Feb. 3 the board of management, the publishers and the editorial staff of the paper announced that the controlling interest held by the Government of the Reich had been sold to a group representing industrial, commercial and shipping interests. The announcement added that all participation, direct or indirect, of the Reich Government or of any other official department had ceased with the transaction. The identity of the new owners was not revealed. The status of the paper during that period and the intentions of the Government are still obscure.

While the nationalist newspapers are controlled largely by industrialists, the organs of the Centre or Roman Catholic party are under strict party control and owned by party men. The Centre represents about 40% of the population of Germany, but its press, although vigorous, consists of papers which have not big circulations. The most influential were the *Germania* of Berlin, and the *Volkszeitung* of Cologne which amalgamated at the end of 1927. Another group of papers which has increased in prestige since the war is the Democratic and Social Democratic press, powerful factors in political life.

Among the most independent and influential papers in Germany are the provincial organs, *Frankfurter Zeitung* and the *Kölnische Zeitung* known throughout the political world as the *Frankfurter* and the *Kölnische.* The chief papers in Berlin are the *Börsen Zeitung* (non-party), the *Lokal Anzeiger* and *Der Tag* (Nationalist), the *Berliner Tageblatt* and *Vossische Zeitung* (Democratic), *Deutsche Allgemeine Zeitung* (People's Party), *Deutsche Tageszeitung* (National and Agrarian), the *Morgenpost* (Democratic) and the *Vorwärts* (Social Democratic) and a Communist paper, *Die Rote Fahne* or *Red Flag* (sale, 65,000).

*The new tydings out of Italie are not yet com.*

*Out of Weenen, the 6 November.*

THe French Ambaſſadour hath cauſed the Earle of Dampier to be buried ſtately at Preſburg In the meane vvhile hath Bethlem Gabor cited all the Hungeriſh States , to com together at Preſburg the 5. of this preſent , to diſcourſe aboute the Crovvning & other cauſes concerning the ſame Kingdom.

The Hungarians continue vvith roveing againſt theſe Lands. In like manner thoſe of Moravia , vvhich are fallen uppon the Coſackes yeſter night by Hollеyn, ſet them on fire , and ſlaine many dead , the reſt vvill revenge the ſame.

Heere is certaine nevves com , that the Crabats , as alſo the Lord Budean, are fallen unto Betlem Gabor.

The Emperour ſends the Earle of Altheim as Ambaſſadour to Crackovv in Polen, to appeare upon the ſame meeting-day.

Novv comes tidings, that Betlem Gabor is at Thurna, there doe gather to gether great ſtore of States.

The Emper. Maj. hath appoynted heere a meeting-day upon the 1. of Decemb. thereupon ſhould are the 4 Proclaimed States. The appoyneed taxing ſhall bring up a great ſom of money.

*Out of Prage, the 5 of November.*

Three dayes agone are paſſed by, 2 mile from this Cittie 6000 Hungarians (choſen out Soldiers) under the General Rediſerens, vvhich are gon to our Head-camp, & the Enimie lieth yet near unto ours by Rackonits , though the crie goeth, that the enimie cauſed all his might to com togither, to com this vvayes againſt Prage, if that comes to paſſe, it ſhall not run of vvithout blovves, the vvhich might be revealed vvith in fevv dayes.

It coutinues, that in the Satſer Crais are gathered togither 10000 Countrie-men, moſt high-dutch-men againſt Meiſſen, & no Bohemians , they vvill help the King to drive the enimie out of the Land In like manner ſom certaine 1000 Countrie-men rebel in the Leutmaritſcher Crais, but it is feared that thoſe Countrie-men are ſtarred up , through practiſe of the Adverſarie , that the enimie in the meane vvhile might com to Prage. Wee underſtand, that Bucquoy hath not been in the Camp, but by the Duke of Saxen ſom certaine dayes , therefore vve are to looke to our ſelves, for feare of Trecherie. And it is thonght that the Emperour vvill leave Auſtria to the Hungorians, & ſee to effect his intention only uppon Praghe.

*Out of Ceuln, the 21. Novemb.*

Writing from Marpurg in Heſſen , that the Earle of the ſame Land, doth cauſe the foreſaid Cittie to be ſtrongly fortified , there on doe vvorke many 100 men dayly , and there is muſtered in the Earleſhip Zigenheym not long ſince 1. Govvernement of foote-men , & 6. Cornets of horſe-men , the foote-men are ſent to Marpurg & Rijnfels. But the horſe-men are lodged in the Villages about the Cittie , & thereafter are alſo muſtered the Duke of Saxen Lauvvenburgs Govvernement in Tries-Zigenheym, novv further vvhere they ſhall be laid & uſed, is yet unknovvn. The ſames Brothers Govvernement, there quarter is laid by Caſſel , the Souldiers vvhich are taken on about Hamburg, Lubeck, in the Dukeſhip of Hollſteen , & Meckelenburg, ſhould alſo be muſtered about Caſſel , & be uſed vvhere neede ſhall require.

Since the laſt vve cannot enquire, that there is any thing of any importaunce paſſed betvvixt the Marquis Spinola & the United Princes. We underſtand that the foreſaid Spinola vvil lay his Souldiers in Garniſſon vvith the firſt , & deale them unto divers places, on part to Oppenheym, Alтzey, Ingelheym & Cruiſtnach, the other part at Summeren & Bacharache , the ſpeech goeth that there ſhalbe layed vvith in Ments a good Company in Garniſſon.

The Biſhop at Halberſtadt, Duke Chriſtiaen at Bruynſvvyck, doth cauſe to be taken on 2000 Muſquetters, to ſend to the United Princes.

Heere is tydings , that betvveen the King of Bohemia & the Emperours folke hath beene a great Battel about Prage , but becauſe there is different vvriting & ſpeaking thereuppon , ſo cannot for this time any certainety thereof be vvritten, but muſt vvayte for the next Poſt. As alſo of the Cittie Pilſen , vvhich the Earle of Manſvelt (ſo the ſpeech goeth) ſhould have delivered into the Emperours hands.

*From Cadan in Bohemia , 4 mile from Racouits, the 12. November.*

From Solts is certaine adviſe that the Emperours folk have made them ſelves vvith all theire might out of theire Camp, & taken their vvay to vvards Praghe, like as they vveare then com to the long mile , but as the King underſtand ſuch , he is broken up vvith his armey, and com to the 10g mile beforen the enimie, vvhere they have had a very ſtrong Battelle & on both ſides more then 6000 men ſlaine, though moſt on the Kings ſide , alſo hath the enimie gotten of the King ſom peeces of Ordenuance and vvaggens vvith amunitie, ſo that the King muſt retire back to Praghe , and the enimie to the Weiſſenberg , there he lies yet and roves from thence to the Leut Maritſcher Crais unto Brix,



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

REPRODUCTION

Two-page newspaper printed in Amsterdam, December 2, 162

hath taken in Trebnits Pielan & Dux alſo laid folk upon Leutmaritcher Slamer, and Launer paſſages, that the Paſſage upon Prage is vvholy taken avvay, and this day is com heere in a certain Perſon that brings tydinghs unto our Magiſtrat, that betvvixt Sonnevveid and Patronit, vvhere the enimie hath lien are found ſom certaine 1000 dead Bodies, & on the other ſide there King lay alſo ſom certaine 1000. dead bodies, vvhat is com to paſſe betvvixt both vve ſhal ſhortly heare.

*Out of Amberghe, in the Vpper-Pallatine, the 17. ditto.*

Here hath beene a greate crie, that the Duke of Beyeren ſhould have taken in Praghe, and beaten our King out of the fielde, but is not certaine, for the Carle of Solms vvrites out of Waltſaxen of the 14 of this preſent, that the Duke of Beyeren vvas broken up with his camp very ſtil, & marched in al haſt to Prage, though they had left ſom 100 men vvhich lay in theire quarter ſoom houres, vvhich made fires there in, that on vvoulde not have thought but that the vvhole Armay had layen there ſtill, but as ours underſtood that they vveregon followed they them preſently, though the Beyerens vverd com to Weiſſenberge before but the 8 of this preſent have ours ſett upon the Beyerens by force, and fought the vvhole day togither, that on both ſides are ſlaine aboute 8000 men, and very many ſhould be hurt. Our King vvith the Lord General the Earle of Hohenlo, alſo the vvhole army are vvith in Prage, & the Duke of Beyeren uppon the Weyſſenbergh & Srern; vve hoope that they ſhall ſhortly be driven from thence. What further is done betvvixt them, vve look for every houre to enquire further thereof, & it ſeemes none can com from Prage, becauſe the paſſages are every vvhere ſhut.

*Out of Ceulen, the 24 of November.*

Letters out of Neurenburghe of the 20 of this preſent, make mention, that they had advife from the Borders of Bohemia, that there had beene a very great Battel by Prage, betvveen the King & the Duke of Beyeren, & many 1000. ſlaine on both ſides, but that the Duke of Beyeren ſhould have any folke vvith in Prage, is yet uncertaine, there uppon under the Merchants vvith in Neurenberge are laid many 100. Florins that the Emperour, nor the Duke of Beyeren have no folke vvith in Prage. The cauſe that here comes no certainty thereof, is this; That all paſſages are ſo beſet, & ſo dangerous to travaile, that it is to vvondered at, & not enough to be vvritte of, vvhat roveing, ſpoyling and killing is done dayly uppon all vvayes.

Vppon the Schanſe Prieſts cap is ſtrongly builded, & buy dayly much vvood lime & ſtone, to make houſes there upon, and ſo provide them ſelves for the vvhole vvinter. And are not long ſince in the night 500 Souldiers paſſed by Durs out of Gulik, ſo the ſpeech goeth, there meaning ſhould be to build a nievv Sch. nſe by Flamerſheym, to take avvay the paſſage from the Marquis Spinola.

---

*Imprinted at Amſterdam by George Veſeler, A. 1620. The 2. of Decemember.*

And are to be ſoulde by Petrus Keerius, dvvelling in the Calverſtreete, in the uncertaine time.

BRITISH MUSEUM NO 1900 INSPECTED



NEWSPAPERS

PLATE

OF AN EARLY NEWSPAPER

20, by George Veseler. One of the first newspapers to be printed in English

The *Tägliche Rundschau,* which spoke authoritatively on foreign affairs, ceased publication on June 30, 1928. The more popular papers in Berlin have sales exceeding 250,000. Among the most widely circulated papers outside Berlin are the *Düsseldorfer Nachrichten* (Independent-National), which reaches the same figure, the *Frankfurter General-Anzeiger,* 115,000, the *Hamburger Anzeiger,* 110,000, the *Leipziger Neueste Nachrichten* (Patriotic), 175,000, the *Münchner Neueste Nachrichten* (National), 145,000, the Dortmund *General Anzeiger* (non-party), 122,000, and the *Dresdener Neueste Nachrichten* (People's Party), over 100,000. There are a number of Communist journals, including, besides the Berlin *Rote Fahne,* papers in the following cities: Breslau, the *Arbeiterzeitung,* sale 15,000; Chemnitz, *Der Kämpfer,* 75,000; Bochum, the *Westfälische Arbeiter Zeitung,* 22,000; Essen, the *Ruhr Echo,* 47,000; Hamburg, the *Volkszeitung,* 25,000; Leipzig, the *Sächsische Arbeiterzeitung,* 30,000.

There are several newspapers which occupy a status and exercise an influence in German journalism and public life which cannot be measured by sales. The *Frankfurter Zeitung,* already mentioned, is perhaps the most powerful. It has 19 issues a week—morning and afternoon. Of a similar type is the *Kölnische Zeitung,* which was founded in 1848, and of which Bismarck once said that it was "worth an army corps on the Rhine"; and the *Hamburger Nachrichten,* founded in 1792. The *Jenaische Zeitung* has been in the same family since it was founded in 1674. A still older paper, the *Königsberger Hartungsche Zeitung,* dating from 1640, keeps its flag flying in the Eastern outpost on the Baltic. Papers published in districts which are inhabited by Germans, although not now under the German flag, are intensely Nationalist, such as the *Saarbrücker Zeitung,* papers in Polish Upper Silesia, Danzig and other territories formerly in the Empire.

In Germany, no general newspapers are published on Monday, except two or three in Berlin. Sunday is a day of rest to newspaper workers. The provincial morning papers in Germany issue three editions during the day, the contents varying more or less. In Berlin, two editions are issued. There are few afternoon papers in Germany.

The external form and arrangement of German newspapers is puzzling at first sight to an English reader. The outside sheet contains the editorial articles and news, while the middle of the paper is taken up by supplements which can be added to indefinitely. The quantity of extraneous matter, such as articles on literary, social and technical subjects, is enormous, and even the most serious political journals invariably publish a novel in serial form, as well as numerous novelettes and sketches. The local news in Berlin and other large cities is written with the minuteness and the familiarity of style of a village chronicle, and gives the impression that every one is occupied in observing the doings of his neighbour. The signed article is very much in vogue, and most writers and salaried correspondents have at least a cypher or initial by which they are distinguished.

According to the *Politischer Almanach* there are over 100 important newspapers in Germany, and 38 serious political journals, representing all shades of political opinion. There are 24 large news agencies in Berlin, with branches in the chief cities. All the political parties have their Press agencies.

Among the best-known German reviews are the *Preussische Jahrbücher, Deutsche Rundschau, Neue Rundschau, Deutsche Stimme, Süddeutsche Monatshefte* and the *Neue Zeit.* The *Reichsanzeiger* corresponds to the *London Gazette.*

**Austria.**—Austria with its diminished population, now between 6 and 7 million, has naturally many fewer newspapers than formerly, although the leading journals, such as the *Neue Freie Presse* and the *Neues Wiener Journal,* circulate amongst the German-speaking population throughout the territory of the old Austro-Hungarian monarchy. Vienna has a vigorous local press representing all political parties, including the Communists. There is freedom of the press in Austria.

**Hungary.**—With regard to Hungary the position is different. Hungary has now a population of 8 million, but journals in the Magyar language do not circulate outside the diminished area of Hungary, as the authorities in the Succession States prohibit them. This restriction has had an unfortunate effect on Hungarian journalism. There are still ten daily newspapers in Budapest, but very few in the provinces, and it is stated that not more than three newspapers in Budapest, owing to the restriction of the area of circulation, are now commercial successes. The *Pester Lloyd,* published in German in Budapest, is a newspaper of international reputation and celebrated its 70th anniversary in 1928. Papers published in the Magyar language to serve the Hungarian minorities in Czechoslovakia, Rumania and Yugoslavia have a precarious existence. The most widely-circulated newspaper in Budapest is the *Pesti Hirlap,* which is followed by the *Az Est.* The other best known Hungarian newspapers are the *Magyarorszag* (Hungary) and *Magyarság* (Hungarian People).

**Czechoslovakia.**—The newly-won freedom in Czechoslovakia led to a great increase in the number of newspapers. It is a country with many political parties, and each party has its organ. There are many daily papers in Prague and the other chief cities in the republic. Unfortunately while the constitution of Czechoslovakia guarantees freedom of the press, this provision is not observed. Ever since the republic was established there has been press censorship,—originally preventive, but latterly censorious, and in some cases it has taken the form of suppression. This action applies to newspapers in all languages—Slovak, German and Hungarian,—but as regards Czech it is applied only to Communist journals. A very close supervision of newspapers is exercised by the Ministry of Justice through the police; no reasons are given for suppressing newspapers, and no compensation paid for the loss incurred by the newspaper proprietors.

While the police suppress newspapers, the Government uses the press for its own propagandist purposes. Several papers may be regarded as the official organs of the different parties in power. The Czech Foreign Office has an organ in the German language, the *Prager Presse,* and weekly journals in French and English, while a number of newspapers in the Czech language may be regarded as official.

**Italy.**—Before the advent of Mussolini's Fascist regime, the Italian Press laws were based on a royal decree of 1848. In Italy now newspapers are only permitted to exist by favour of the Government. The independence of the press has almost disappeared under the Mussolini regime. In 1924 a decree was issued which made newspapers liable to suppression and editors to punishment if they published "tendencious news" which might embarrass the Government in foreign or domestic affairs. This policy developed so that by 1926 the freedom of the press in Italy had ceased to exist. Journalists' organizations are also under the control of the Government.

Where the press was not muzzled there was a forced change of proprietorship in harmony with Fascist policy. This was the case with the well-known *Corriere della Sera* of Milan, for some years the most powerful organ in Italy. The *Stampa* of Turin, although never strongly anti-Fascist, was tamed; the same fate overtook the influential journal in the south, the *Mattino* of Naples. The complexion of the best-known papers in Rome has been changed. The only journals which enjoy a certain restrained independence are the semi-official organs of the Vatican. A number of newspapers have ceased to exist, and the journalists' associations have been placed under the control of Government commissioners. There are fewer papers in proportion to the population in Italy than in any other country in Europe except Russia.

**Russia.**—Freedom of the press has been completely suppressed in Soviet Russia. In Tsarist Russia censorship was severe, but a measure of toleration existed. In Soviet Russia censorship is applied before the matter is printed, which has to be submitted to an official editorial board known as the Gosizdat. There is a further check on the publication of news and expression of opinion, as newspapers are only published under the auspices of the governing authorities and are thus practically all official organs.

In 1914 there were 17 dailies in the capital, some of them of international reputation, such as the *Novoe Vrèmja,* and the *Retch,* and five in Moscow. In 1910 there were 52 daily newspapers in Russia, of which 13 were in St. Petersburg (Leningrad), and four in Moscow, exclusive of papers in Finland and

Polish Russia. In 1926 almost all the press was concentrated in Moscow. There were 11 morning and evening papers in Moscow, but only two of any importance, the *Izvestia* and the *Pravda*. In Leningrad there were only two morning papers, the *Pravda* and the *Krasnaya Gazeta*. The number of daily newspapers in Russia in 1928 did not exceed twenty. Scope, it is claimed, is given to what are called "worker correspondents" in the industrial centres, and a feature is the widespread interest in "wall" newspapers. Some papers appeal technically and otherwise to the peasant class.

**Belgium.**—Belgium possesses a vigorous press, published in French and in Flemish. Although the chief Paris papers circulate all over Belgium, the Belgian press nevertheless enjoys a large sale, and the popular journals are highly prosperous. There are 17 daily papers published in Brussels and nine in Antwerp. There are several Socialist journals, the chief organ of the party being *Le Peuple*. The success of the Socialist press is due largely to its association with the co-operative movement. *La Libre Belgique*, which appeared regularly during the War in occupied Belgium in spite of the vigilance of the Germans, now exists as a daily newspaper. In Belgium, the press laws have not been changed for many years and the press enjoys almost unlimited freedom.

**The Netherlands.**—The Netherlands, with a population of over 7,000,000, possess a healthy press, including journals which enjoy a high reputation for their literary merits and as organs of opinion. The chief among these are the *Nieuwe Rotterdamsche Courant, De Telegraaf* and the *Algemeen Handelsblad*, of Amsterdam. There are eight daily papers in Amsterdam, seven in The Hague and five in Rotterdam, and these circulate throughout the country.

**Spain and Portugal.**—There is little progress to record in the Spanish press, and circulations are small. The illustrated *A.B.C.* is the most popular paper. The *Heraldo* and the *Liberal* are Madrid journals. *El Sol* was founded in 1917 by the Spanish Paper Trust. There are 20 daily papers in Madrid and 17 in Barcelona, and about 200 dailies of sorts in Spain. The principal Portuguese papers are the *Diario de Noticias* (founded 1820) and the *Jornal do Comercio*, both published in Lisbon.

**Switzerland.**—Switzerland, owing perhaps to its small population, has few papers known outside the country. In 1926 there were 38 daily newspapers published in German, 19 in French and two in Italian. The best known are the *Journal de Genève*, read in France, the *Neue Zürcher Zeitung* and the *Zürcher Post*, which have a considerable circulation in Germany. (R. Don.)

## IV. UNITED STATES

Among the professional writers of news-letters towards the close of the reign of Elizabeth and the beginning of that of James I., to whom reference has already been made in the discussion of the cradle days of English journalism the three most important were John Chamberlain, Thomas Locke and John Pory. The last of these three, when he was secretary of the Virginia Colony, sent news letters from "James Citty" as early as 1619 to his "good and gracious lord" in London for whom he had previously worked as a professional correspondent. The evolution of the newspaper in the United States, therefore, technically starts with John Pory. But he was not the only writer of news-letters. John Campbell, postmaster at Boston, wrote with some degree of regularity letters of news to the various colonial governors in New England. Later he printed his news-letters and thus established, in April 1704, the first American newspaper—*The Boston News-Letter*. As in other countries there had been stray sheets of news printed at various times, so in this country. Mention may be made of *The Present State of the New-English Affairs* (1689) and *Publick Occurrences* (1690). Both of these sheets were printed in Boston and the latter, brought out by Benjamin Harris, might technically be called a newspaper except for the fact that it had only one issue. Regularity in publication and continuity in the news are demanded by the term newspaper. Harris intended regularity of publication but because his sheet was thought to contain "reflections of a very high nature" it was suppressed by local authorities. Before the close of the century its publisher returned to England to become the publisher of *The London Post*.

**Colonial Period.**—Mortality of pioneer papers in the United States has been usually high. But *The Boston News-Letter* under various publishers survived until the declaration of independence by the 13 original Colonies. The honour of being the second newspaper is practically divided between *The Boston Gazette* (Dec. 1719), started by William Brooker when he succeeded Campbell as postmaster of Boston, and *The American Weekly Mercury* (Dec. 1719), brought out by Andrew Bradford, the local postmaster in Philadelphia. While technically there was a difference of one day, both papers are said to have been mailed to subscribers on the same day. The fourth paper, *The New England Courant*, started in Boston by James Franklin in Aug. 1721, was a flaming organ of dissent carried on by a group of contributors called by the Rev. Increase Mather "the Hell-Fire club." So radical was it in expression of opinion that an order was issued that James Franklin no longer print the newspaper. The situation was met by having a younger brother, Benjamin, become the publisher in name if not in fact. After a quarrel between the two brothers, Benjamin went to Philadelphia where he later purchased (1729) an interest in *The Pennsylvania Gazette*, started by Samuel Keimer (Dec. 1728). Franklin made this paper one of the most influential of all those that appeared in the colonial period. New York did not have a paper until Nov. 1725, when William Bradford started *The New York Gazette*. As "Printer to the Crown," Bradford was unable to record opposition to government measures and in this way provided for the appearance in Nov. 1733 of *The New York Weekly Journal*. The latter paper, nominally published by John P. Zenger, was really edited by the leaders of the opposition. Freedom in expression of popular rights brought a famous libel suit against Zenger that did much to establish the freedom of the press in America. The jury, in freeing Zenger, decided that it had the sole right to judge both the law and the facts and reversed the old tradition, "The greater the truth the greater the libel."

The first newspaper in the ten remaining Colonies of the original 13 was a gazette with the name of the Colony before it, with the single exception of *The Wilmington Chronicle* (1762) in Delaware. These gazettes appeared as follows: Annapolis, Maryland (1727); Charleston, South Carolina (1732); Newport, Rhode Island (1732); Williamsburg, Virginia (1736); New Haven, Connecticut (1755); New Bern, North Carolina (1755); Portsmouth, New Hampshire (1756); Wilmington, Delaware (1762); Savannah, Georgia (1763); and Burlington, New Jersey (1777). These pioneer papers were important because in their plants were trained the printers who went forth to establish others, either in the 13 original Colonies or along the frontier farther west. Colonial printers, often forced to accept wheat, wood, butter, corn, etc., in payment for subscriptions, continually faced censors who, clothed by the law with authority, annoyed publishers bold enough to print the critical debate going on in the community. Setting aside a little corner for original poetry and opening their columns to letters from contributors who furnished essays, they provided a means of literary expression that contributed no small part to the founding of American letters. Of the papers of this period special mention should be made of *The Boston Gazette* (1755), the third paper of that name in Boston and distinguished from the other two as being the "pet of the patriots." Among those who contributed to its columns were such political leaders as Samuel Adams, Joseph Warren, Thomas Cushing, etc. *The Massachusetts Spy* (1770), published first at Boston and then at Worcester, Mass., was a dynamic force under the able editorship of Isaiah Thomas, famous for his history of printing. Toward the close of the colonial period *The Pennsylvania Journal* (1742), under the editorship of William Bradford III., disputed supremacy in Philadelphia with Franklin's *Gazette*.

**Early Political Organs.**—After independence from Great Britain had been secured, papers became political organs of which *The Gazette of the United States* (1789), edited by John Fenno, and *The National Gazette* (1791), edited by Philip Freneau, were possibly the most important because the former was really controlled by Alexander Hamilton, the leader of the Federal Party.

and the latter by Thomas Jefferson, the leader of the then Republican Party—now the Democratic. So vitriolic and so vituperative were the papers that the era is known as one of black journalism. So bitter, for example, was the fight between the two *Gazettes* already mentioned that Washington had to request his two secretaries to put a stop to their bickerings in the interests of the struggling republic. Politics so promoted publication of papers that the number increased from 37 in 1776 to 359 in 1810.

**Dailies.**—As the cities on the Atlantic coast increased in size their papers began to appear more frequently: first semi-weekly, later tri-weekly and finally daily except Sunday. The first daily newspaper was an outgrowth of such a tri-weekly—*The Pennsylvania Packet and General Advertiser* which first appeared in Philadelphia in Sept. 1784. Just as the colonial weekly adopted *Gazette* as a part of its title so the daily seized upon the word *Advertiser*. The second daily, the outgrowth of a semi-weekly at Charleston, S.C., first appeared in Dec. 1784. New York city did not have a daily until March 1785, when Francis Childs started *The New York Daily Advertiser*. The New York daily beginning an independent existence faced a more difficult struggle to secure financial support both in circulation and in advertising. From the start the daily paper was more of an advertising sheet than it was a purveyor of news. Such news as was inserted was chiefly of a commercial character, such as the arrival and departure of vessels, quotations on produce, the transactions in real estate, etc. The paper itself went to the counting room instead of to the home. The oldest daily newspaper in the United States without change in name and with continuous publication is (1929) *The New York Evening Post* (Nov. 1801) which started as a Hamiltonian organ under the editorship of William Coleman. The oldest newspaper that has appeared regularly without suspension since its establishment is *The Hartford Courant* which began as *The Connecticut Courant* (Oct. 1764)—a weekly which did not become a daily until long after *The New York Evening Post* was started. Two men of letters are associated with these two papers: Charles Dudley Warner with *The Courant* and William Cullen Bryant with *The Post*. By 1812 New York had seven dailies but not one of them exceeded 2,000 in circulation.

**News Gathering.**—The weekly and daily newspapers in the United States showed nothing of that enterprise so characteristic of American journalism until Henry Ingram Blake, employed on *The Palladium* of Boston, stopped waiting for news to come to the office and went out in person after such items. At first he went to the coffee houses for such accounts of foreign events as sea captains might bring there. Still later he had his own skiff and rode out to meet incoming vessels to get the news. From this modest beginning came many innovations to facilitate quick publication. In New York the little rowboat soon gave way to the fast clipper ship owned and chartered by a newspaper. *The Journal of Commerce* (Sept. 1827), founded as a semi-religious newspaper by Arthur Tappan, not only had the fastest ships but even built a semaphore at Sandy Hook to relay the news from its own boat to Staten Island from which it was taken promptly to the publication office. In gathering the news on land *The Baltimore Sun* (May 1837), co-operating with other papers, established a pony express to facilitate the collection of news. But the American who really put the news in the newspaper was Prof. Samuel F. B. Morse of New York university, the inventor of the telegraph, who stretched a wire directly from news centres straight to the newspaper office. But other wires soon came through leases directly under the control of such organizations as the Associated Press, the United Press, etc. (*q.v.*).

While better facilities for collecting news were going on, the mulepack, the dugout and the prairie schooner were carrying presses and types farther and farther west to establish *The Kentucky Gazette* (1787) at Lexington; *The Mississippi Gazette* (1800) at Natchez; *The Indiana Gazette* (1804) at Vincennes; *The Missouri Gazette* (1808) at St. Louis; *The Arkansas Gazette* (1819) at Port Arkansas; *The Texas Gazette* (1820) at San Felipe—to mention the gazettes that were the first papers in various States. Among the last to have newspapers were Minnesota, *The Pioneer* (1849) at St. Paul; Utah, *The Deseret News* (1850), at Salt Lake; Colorado, *The Rocky Mountain News* (1859), at Denver; Wyoming, *The Leader* (1867), at Cheyenne; and North Dakota, the latest with its newspaper, *The Tribune* (1873), at Bismarck.

**The Penny Press.**—The daily newspapers which immediately followed the pioneers in this field soon developed to such size that they came to be called blanket sheets. Commercial in character, they had only limited circulation and usually sold at six cents per copy. For $30 a year a business man might not only have the paper for himself but also a square of advertising for his business. Early in the second quarter of the 19th century a new type of daily appeared, cheaper in price and smaller in size—the so-called penny press. The forerunner of this new journalism was *The Daily Evening Transcript* which Lynde M. Walter began in Boston, July 24, 1830, at the low subscription price of four dollars per annum. While the first daily to sell for a penny was *The Cent* (1830) started by Dr. Christopher Columbus Conwell, the first successful publisher and therefore the founder of penny journalism was Benjamin H. Day, whose *Sun* first rose in New York, Sept. 3, 1833, although Horace Greeley had made an unsuccessful attempt the first of the same year in New York to market *The Morning Post* at two cents. *The Sun* immediately met with remarkable success because it gave in condensed form to the mechanics and to the servant girls the tittle-tattle and the backstair gossip of the city; it gave more attention to the assault and battery cases of the police courts than to the attacks of President Jackson on the U.S. Bank. But *The Sun* was soon followed by other penny dailies not only in New York but also in other important cities, such as Philadelphia, Baltimore, Boston, etc. Similar both in size and in subject matter to *The Sun*, they were called penny trash by the sixpenny sheets. The latter in turn were spoken of by the penny papers as "our bedquilt contemporaries." A bitter war arose between the two types of dailies, but it was the penny press that met with popular favour and prospered financially, because it contained the heart throb and the human interest. In all its columns it stressed not what was important but what was interesting. Not until Charles Anderson Dana purchased *The Sun* in 1868 did that paper change its character and become one with a class appeal under his editorship.

**Bennett and Greeley.**—Possibly the man who most influenced American journalism at this period was James Gordon Bennett, who with $500, two wooden chairs and an old dry-goods box began *The New York Herald* in a cellar on May 6, 1835. Bennett was editor, publisher, advertising director, circulation manager and everything else down to the printer's devil. He reported the proceedings of the police court with a freedom that shocked his sixpenny contemporaries and soon found that scandal sold papers on the streets. To him nothing was sacred, not even the church or his own personal affairs. Often assaulted on the street, he reported the affair in his own paper in detail and announced his own engagement in what is considered one of the most interesting specimens of newspaper literature. Though full of malicious squibs and furious diatribes, *The Herald* was in some other respects conducted with remarkable skill and enterprise in being the first to print the news. To his son of the same name Bennett left one of the greatest money-making newspapers in the history of American journalism. The son continued many of the father's policies, but on a larger scale. Expense was not considered when he sent Stanley to Africa to find Livingstone and fitted out an Arctic expedition that had a most unfortunate outcome. In case of distress in any particular country he was among the first through his *Herald* to start a subscription campaign. He began that for the relief of the suffering in Ireland with a gift from *The Herald* of $100,000. Often regarded as eccentric and peculiar, he exerted a tremendous influence upon American journalism because of the emphasis which he placed upon international news without neglecting that which was local in character. He also set the style in the mode of treatment of news and in many ways established the yardstick by which it is measured.

After the arrival of the penny press there came many changes in the manufacture and in the marketing of newspapers. To secure speed in production Robert Hoe took the type from a flat bed

and put it on a revolving cylinder turned by steam. News boys, in addition to distributing papers among regular patrons, were given additional copies to sell in the streets. The printing of larger and larger editions brought many improvements in the manufacture of both presses and paper. The introduction of compulsory education contributed to an interest in the news.

Though starting as a penny paper in April 1841, as a Whig organ, *The New York Tribune* began its second volume in April 1842, at two cents a copy. Horace Greeley, one of the most picturesque figures in American journalism, was its editor and one of its proprietors down to shortly before his death after his defeat in 1872 for the presidency. Upon the completion of its 20th year (1861) it announced its circulation as 287,000. But this figure included both the daily and the weekly: the former was later given as slightly in excess of 55,000. In the same year *The Herald* had a daily distribution of over 75,000 copies—possibly the largest at that time in the world and about 25,000 in excess of *The Times* of London. The circulation of *The Sun* was about midway between that of *The Herald* and that of *The Tribune,* while *The Evening Post,* which from the start had addressed itself to a more cultured audience, had only 18,000. Greeley made his paper not only an organ of Whig politics, but also a purveyor of novel and new ideas in both social and political economy. Among the editorial contributors in the latter field was Albert Brisbane, father of Arthur Brisbane of the present day. In the Franco-Prussian war, *The Tribune* achieved considerable fame through the publication of dispatches sent by cable at enormous expense. In a way *The Tribune* was a sort of school of journalism in which the following distinguished journalists and publicists received their first training: Henry Jarvis Raymond, Charles Anderson Dana, George William Curtis, Carl Schurz, John Hay, Whitelaw Reid, Henry James, William Dean Howells, Bayard Taylor, George Ripley, Margaret Fuller, Edmund Clarence Stedman, Richard Grant White, Richard Hildreth, John Russell Young and Sidney Howard Gay—all of whom later held important positions in New York journalism.

**The Times and The World.**—The final success of *The Tribune* led Henry Jarvis Raymond to establish *The New York Times* on Sept. 18, 1851, but under different conditions than existed when Bennett started *The Herald.* For a mechanical equipment Raymond had to pay at least $50,000 and to his assistants he had to give much larger salaries than he received when he worked for Greeley. Over $100,000 was spent before the paper showed a profit. It was after Raymond's death, however, that *The Times* came into great prominence through its bold exposure of the robberies and frauds committed by the Tweed ring in the municipal government of New York.

In the three decades that followed the establishment of the penny press of New York some 30 daily newspapers were established but their names must remain blank except for one, which has had a most remarkable history, *The New York World.* Started as a religious daily newspaper on June 1, 1860, it was published at a heavy loss until a year later, when it merged with the *Courier-Enquirer,* practically defunct, though at one time, under the ownership of James Watson Webb, a powerful political organ. As a worldly *World* it passed through various ownerships until its purchase (May 1883) by Joseph Pulitzer, the penniless son of a Jewish father and a Catholic mother, who coming to America from Hungary in 1864, was already the owner of *The St. Louis Post Dispatch.* Under his control he transformed *The World* to one of the most fearless, dynamic campaign sheets in the United States. The Civil War brought about an increase in subscription price. In the North the customary price for a sheet of eight or more pages was four cents and farther west five cents. In the South newspapers sold much higher, were reduced in size and even in rare instances appeared printed on wallpaper. The daily demand for news brought forth the Sunday newspaper as that term is now understood.

**Personalities in American Journalism.**—Until several decades after the Civil War, newspapers not only in New York but in other large cities were closely associated with the names of those responsible for their management. In Springfield, Mass., Samuel Bowles was the personification of *The Republican* which his father, with the help of a small hand press, had started on Sept. 8, 1824, and which 20 years later, became a daily. In Philadelphia, *The Record,* started as a one cent daily (June 1877), was the outgrowth of *The Public Record,* founded seven years earlier: the latter paper was a losing venture until William M. Singerly purchased its Associated Press franchise for his new paper. *The Evening Bulletin,* founded in 1847 by Alexander Cummings, had a vicarious existence until it became the property of William L. McLean. The first number of *The News* appeared in Indianapolis, Ind., on Dec. 7, 1869. *The Evening Star,* which first shone in Washington, Dec. 16, 1852, has had a growth contemporaneous with that of the city in which it is published. Its contemporary, *The Post,* was established in the U.S. capital, Dec. 1877, by Stilson Hutchins. *The San Francisco Chronicle* was begun June 1865, by Charles de Young, as a playbill distributed free in theatres and in other places. On March 4, 1887, U.S. Senator George Hearst turned *The San Francisco Examiner,* which he had taken as a part of a bad debt, over to his son William Randolph Hearst, who used it as a starter for a famous chain of papers stretching across the country from San Francisco to New York. In Detroit, in Aug. 1873, James E. Scripps started his *Evening News* which became a rival of *The Free Press* (1831). Milwaukee saw *The Sentinel* established in June 1837, and *The Evening Wisconsin* in June 1847. Louisville, Ky., witnessed (Nov. 1830) the first appearance of *The Journal* under the editorship of George D. Prentice and had laid at its doorstep in Nov. 1868 a united sheet—*The Courier-Journal,* controlled by Col. Henry Watterson. In Chicago passing mention may be made that *The Daily News,* which made its first appearance in Dec. 1875, was started by Melville E. Stone, who later achieved distinction as general manager of the Associated Press; that *The Herald* first appeared March 1881; that *The Tribune,* the first edition of which (June 1847) was 400 copies printed on a hand press, passed, in 1855, into the control of Joseph Medill, whose editorials rivalled those of Horace Greeley. William Rockhill Nelson, a most picturesque figure among the makers of American newspapers, first let his *Star* shine in Kansas City, Mo., Sept. 1880, and Harrison Gray Otis, that dynamic editor, became owner, on Aug. 1, 1882, of *The Los Angeles Times,* a paper then only a year old. To supplement what has been written about the press in Boston, it may be added that *The Post* was started as a Democratic daily on Nov. 9, 1831, but only became a power in Boston journalism when it was purchased by E. A. Grozier, a protégé of Joseph Pulitzer; that *The Herald* came into existence on the afternoon of Aug. 31, 1846, with an edition of 2,000; that *The Globe* was started March 1872, to grace the breakfast table just as *The Transcript* adorned the tea table, and that its builder was Charles H. Taylor, who joined its staff in August of that year.

A catalogue of papers and their editors during the period when personalities were closely linked with papers would resemble the catalogue of ships in Homer's *Iliad* and would make about as interesting reading. But mention must in justice be made of Murat Halstead, of *The Commercial Gazette,* John R. McLean, of *The Inquirer* and Charles P. Taft, of *The Times-Star* in Cincinnati, Ohio; Edwin Cowles, of *The Leader,* William W. Armstrong and L. E. Holden, of *The Plain Dealer,* in Cleveland, Ohio; General J. M. Comley, of *The Commercial Telegram,* in Toledo, Ohio; W. D. Bickham, of *The Journal,* in Dayton, Ohio; J. S. Clarkson, of *The Register,* and John Watts, of *The Leader,* in Des Moines, Iowa; John Arkins, of *The Rocky Mountain News,* in Denver, Colorado; A. H. Belo, of *The News,* in Galveston, Texas; John H. Holliday, of *The News,* John C. New, of *The Journal,* and W. J. Craig, of *The Sentinel,* in Indianapolis, Indiana; J. M. Keating, of *The Appeal,* in Memphis, Tennessee; W. E. Haskell, of *The Tribune,* and J. S. McLain, of *The Journal,* in Minneapolis, Minnesota; A. S. Colyar, of *The American,* in Nashville, Tennessee; H. L. Pittock, of *The Oregonian,* in Portland, Oregon; O. H. Rothaker, of *The Republican,* in Omaha, Nebraska; William Hyde, of *The Republic,* and Joseph B. McCullagh, of *The Globe-Democrat,* in St. Louis, Missouri; J. A. Wheelock, of *The Pioneer-Press* and Lewis Baker, of *The Globe,* in St. Paul,

Minnesota. Sins of omission, if any, may be pardoned, for journalism in the United States, unlike that of England which revolves around London, has many centres in America.

To pass from personalities to statistics, it should be said that figures relating to journalism in the United States until after the census of 1880 are open to question; but the reports of the census for 1850, 1860, 1870 and 1880 still remain, however, the most authoritative information as to the increase in the number of newspapers. According to their tables there were in the United States 254 dailies in 1850, 387 in 1860, 574 in 1870, 971 in 1880; 31 semi-weeklies in 1850, 79 in 1860, 115 in 1870, 133 in 1880; 1,902 weeklies in 1850, 3,173 in 1860, 4,295 in 1870, 8,633 in 1880. Of all these classes, there were in 1850, 2,526; in 1860, 4,051; in 1870, 5,871; in 1880, 11,314.

**Yellow Journalism.**—Around 1880 the more important daily newspapers underwent great economic change as the result of small stores consolidating into huge department stores which took liberal space in the papers to advertise their so-called bargains. As store and other display advertising increased in amount, newspapers were continually forced to increase their size. This increase was possible without raising subscription rates because of the substitution of wood pulp paper for rag and a constant lowering in the price of the pulp stock. The newspaper became, consequently, a complicated economic product with two things for sale: to the reader it sold news, editorials and other interesting reading matter; to the advertiser it offered white space at so much per inch. Complications came from the fact that these two joint products had to be marketed in the same container—the white paper on which the news was printed and on which the advertising was displayed. More and more the advertiser paid the heavier burden in the cost of production. Because advertising rates were based on the number of papers distributed, there resulted a wild race for circulation. The rural weeklies remained about the same but the city dailies underwent a social change. In small communities where the editor knows personally many of his subscribers, the paper is forced to omit news that is unkindly or reflects upon the character of prominent citizens and to leave such news to circulate by word of mouth. In the larger cities where the next door neighbour is practically a stranger, exciting and emotional news does not circulate by gossip and the paper that prints it sells well on the streets. Recognition of this fact caused a wave of sensational—sometimes called yellow—journalism to sweep over the United States. Bennett had earlier discovered this fact but it remained for Joseph Pulitzer and William Randolph Hearst to run a race to see which could carry sensational journalism to its extreme. Hearst, who already owned *The San Francisco Examiner,* coming to New York in 1896, purchased *The New York Journal* which had been started by Albert, a brother of Joseph Pulitzer. According to the gossip of Park Row, the Fleet street of New York, Hearst "broke into New York with all the discreet secrecy of a wooden legged burglar having a fit on a tin roof." He brought with him the circulation schemes which he had found successful for his *Examiner* in San Francisco, and adopted many new ones furnished to him by newspaper men whom he won over from Pulitzer through larger salaries. He later called the morning edition of *The Journal, The American,* a favourite name with him for other papers of his chain, and in charge of *The Evening Journal* he placed Arthur Brisbane who by still more sensational methods rapidly advanced the circulation of the latter paper. The result of the Hearst influence was a change in character of news content for many papers and a more spectacular display of headlines that stretched across the page.

**Welfare Activities.**—In striking contrast with the sensational activities of certain newspapers was the adoption of extramural activities by the press in the interests of the public welfare. Among the earliest of these was the movement of *The New York Herald,* begun on May 29, 1892, to furnish free ice for the relief of mothers and babies in the tenement house districts of New York. Somewhat similar was the Fresh Air Fund, started by *The New York Evening Post* but later taken over by *The New York Tribune,* to provide outings for city children in homes and camps supported by the fund and in private homes offering to receive the children of the poor for periods ranging from one to two weeks. In Pittsburgh, Pa., *The Press* raised $40,000 with which to build a home for newsboys. In Chicago, *The Tribune* started two reforms that developed into national movements: one, a campaign for a "Sane Fourth of July"; and the other, a "Good Fellow Club" which aimed to give the children of the poor more than a bowing acquaintance with Santa Claus at Christmas time. *The News* of Indianapolis, Indiana, went out into the country and erected a Fresh Air village for the benefit of sick women and children. In San Francisco, *The Examiner* built the Little Jim Hospital for Incurables and the Free Eye and Ear infirmary for the treatment of unfortunate poor children. The One Hundred Neediest Cases of *The New York Times* was designed to relieve just that number but each year has seen a substantial increase in the number of persons helped. *The New York World,* to use another example, started a movement to supply radio without cost to "shut-ins." Smaller papers throughout the United States have followed the examples set by metropolitan dailies in this matter of service and aid to the community.

Practically simultaneous with the arrival of Hearst in New York was that of Adolph S. Ochs who assumed control of *The New York Times,* Aug. 1896. In spite of a proud past, *The Times* for various reasons had lost in circulation until it reached below 10,000 and its mechanical equipment had so deteriorated that it was only worth what it would bring for junk. Reorganized on a sound financial basis by Mr. Ochs, *The Times* quietly and unostentatiously began its campaign of appeal to thoughtful readers under a slogan, "All the News That's Fit to Print." Slowly but surely *The Times* gained momentum until its growth constituted an outstanding chapter in the annals of American journalism. Its remarkable achievements in reporting so fully the news of the World War were simply the culmination of a far-seeing campaign that had progressed steadily under the management of Mr. Ochs who, disclaiming all glory for personal achievement, says that his paper is simply a vindication of his judgment of newspaper readers in New York.

**Consolidations.**—But since 1900 the trend in journalism in the United States has been towards consolidations and extensions of chain newspapers. Those under publishers like Ochs of *The Times,* Nelson of *The Kansas City Star,* Lawson of *The Chicago Daily News,* etc., were simply the exceptions to the general tendency. Space does not permit mention of the amalgamations of smaller papers but some of the more important changes in metropolitan fields may be noted. Frank A. Munsey was sometimes called a dealer in dailies. In 1891 he purchased *The New York Star,* a daily established on Sept. 22, 1825, and on Feb. 1, 1891, changing the name of his paper he gave New York its first tabloid, *The Daily Continent,* which though it attracted favourable attention was not successful financially and so was discontinued on June 30. Before his death in 1925 he merged *The Press* with *The Sun* in 1916. Later, in 1920, he purchased *The New York Herald* and *The Evening Telegram.* Discontinuing *The Morning Sun,* he transferred it to *The Evening Sun* with which, in 1923, he merged *The Globe,* then the oldest newspaper in New York city—established Dec. 9, 1793, as *The Minerva,* and edited by Noah Webster, the lexicographer. Then Munsey purchased *The Evening Mail* with which he consolidated *The Evening Telegram* (later sold to form *The World-Telegram*). He then sold (1924) *The Herald* to *The New York Tribune,* both published under a joint title. In Boston *The Herald* (morning) took over (1912) *The Traveler* (evening) and continued it as its evening edition. Later (1917) *The Herald* absorbed *The Journal* (morning). In Kansas City W. S. Dickey bought (1921) *The Journal* (morning) and (1922) *The Post* (evening). He continued *The Journal* as a morning paper and *The Post* as an afternoon, with joint publication on Sunday, with a flat subscription price for both papers. In this he followed the example of *The Star* which since 1901 has been printing *The Times* as its morning issue, with both papers going to the same subscribers.

In Philadelphia Cyrus H. K. Curtis became on Jan. 1, 1913, the publisher of *The Public Ledger* which he purchased from Adolph S. Ochs. On Sept. 14, 1914, he started *The Evening Pub-*

*lic Ledger* with which he united (1918) *The Evening Telegraph.* In 1920 he purchased *The Press* to unite with *The Public Ledger* and in 1925 he did the same with *The Philadelphia North American.* In Chicago *The Record-Herald* purchased (1913) *The Inter-Ocean* and appeared as *The Herald* which later was purchased by W. R. Hearst and united with his Chicago *Examiner.* In Cleveland *The Plain Dealer* absorbed *The Leader* and in St. Louis *The Globe-Democrat* purchased *The Republic.* After 1930 the pace of these consolidations accelerated even more. (J. M. Le.)

**Newspaper Chain Groups.**—Of the group-owned newspapers in the United States, the Hearst and Scripps-Howard chains are the most important. In 1937 Hearst, who had experienced considerable financial difficulties, began pruning his group until it was reduced from 25 newspapers in 17 cities to 18 newspapers in 14 cities, not including four Sunday papers with separate titles published in conjunction with dailies. In 1939 the Hearst chain included the following: *New York Journal-American, New York Mirror, Albany Times-Union, Syracuse Journal, Boston Record, Boston American, Baltimore News-Post, Pittsburgh Sun-Telegraph, Chicago Herald-American, Milwaukee News Sentinel, Detroit Times, San Francisco Examiner, San Francisco Call-Bulletin, Oakland Post-Enquirer, Los Angeles Examiner, Los Angeles Herald-Express, San Antonio Light,* and *Seattle Post-Intelligencer.*

In the same year the Scripps-Howard chain published 21 newspapers in 20 cities, as follows: *New York World-Telegram, Cleveland Press, Pittsburgh Press, Cincinnati Post, Columbus Citizen, San Francisco News, Washington News, Indianapolis Times, Oklahoma City News, Knoxville News-Sentinel, Memphis Press-Scimitar, Memphis Commercial Appeal, Birmingham Post, Houston Press, Fort Worth Press, El Paso Herald-Post, Albuquerque Tribune, San Diego Sun, Covington Kentucky Post, Denver Rocky Mountain News,* and *Evansville Press.*

The Frank E. Gannett chain publishes (1939) 16 newspapers in New York and New Jersey, also *The Hartford* (Conn.) *Times* and *The Danville* (Ill.) *Commercial-News.* Among the more important are *The Rochester Times-Union* and *Democrat & Chronicle, The Albany Knickerbocker News,* and *The Utica Observer-Dispatch* and *Press.* Groups with fewer newspapers but large circulation include the Paul Block Newspapers (*Newark Star-Eagle, Pittsburgh Post-Gazette, Toledo Blade, Toledo Times*), the J. David Stern Newspapers (*New York Post, Philadelphia Record, Camden Evening Courier, Camden Morning Post*), and the Scripps League of Newspapers, which has 10 dailies, mostly in the north-west. The Lee Syndicate publishes 10 newspapers in the midwest, including *Davenport Times, Davenport Democrat & Leader, Madison State Journal* and *Lincoln Star.* I. C. Copley controls 4 dailies in Illinois and 12 in California.

A marked tendency in chain publishing, especially after 1925, was the establishment of groups with newspapers in small or medium-sized towns. Among the principal chains in this classification are the H. C. Ogden Newspapers (West Virginia and North Carolina) and the Booth Newspapers (Michigan).

**Conservative Tendencies.**—Among the conservative newspapers published in the United States is *The Christian Science Monitor* (Nov. 1908), published in Boston by the Christian Science Publishing Society. An international daily, with special Atlantic coast, Pacific coast, and midwest editions, this newspaper publishes significant and constructive news from all over the world, but omits anything of a sensational or questionable character. It has established its own standard of news.

**Weekly Reviews.**—Though the Sunday newspapers and the Saturday editions of evening papers devote many pages to weekly reviews of literature, art, music, drama, politics, and current events, they have never superseded the weekly journals specializing in these fields. *The Nation* (1865) and *The New Republic* (1914), both with Leftist editorial tendencies, give pungent articles on current events in the United States and other countries, and review outstanding books. *Time* (1923) and *Newsweek* (1933) present the important news of the week in abbreviated form. *The Literary Digest,* which suspended publication in 1937 after 47 years, formerly presented both sides of controversial topics of the day, quoted from leading newspapers, and carried special departments on letters, art, religion, science, and finances. *The Saturday Review of Literature* (1924) is the leading weekly devoted solely to that subject. *Judge* (1881) is a national humorous weekly, as was the old *Life* (1883-1936). *The New Yorker* (1925) is a sophisticated weekly devoted largely to satirical articles and reviews of plays and books. *The Saturday Evening Post,* which traces its editorial ancestry back to Benjamin Franklin (1728), *Collier's* (1888), and *Liberty* (1924) are more properly included with magazines, though they feature articles on current events. The new *Life,* established in 1936 by the publishers of *Time,* set a fashion in pictorial journalism by devoting almost its entire space to illustrations and news photographs. It was followed by *Look* (1937), a pictorial fortnightly, *Pic* (1937), also a fortnightly, *Click* (1938), a monthly, and others.

**Pictorial Press.**—In 1919 the first daily "tabloid" picture newspaper appeared in the U.S. in New York—*The Illustrated Daily News,* patterned after *The Daily Mirror* of London. Later this paper abbreviated its title to *The Daily News.* By 1939 it had a sworn daily circulation of 1,783,341 and a Sunday circulation of 3,122,720—the largest in the United States. Other tabloids followed, including the *Mirror* (1924) in New York city, and by 1939 there were 73 tabloid-size newspapers published in the United States. Chicago's first such paper was the *Daily Times,* established in 1929, which later added a Sunday edition.

A notable event in pictorial journalism took place in 1914, when *The New York Times* added a rotogravure section to its Sunday edition. Four years later there were nearly 50 papers in the United States with rotogravure sections, and by 1925 the number exceeded 70. Shortly, however, consolidations and suspensions of publication affected the number, and by 1939 it had dropped to 52.

The introduction of wirephoto and radiophoto transmission of photographs provided another fillip to pictorial journalism, and by 1937 most of the large metropolitan dailies were printing photographs of notable news events of the day the world over.

**The American Newspaper Guild.**—In 1936 the first attempt was made to unionize editorial workers, when the American Newspaper Guild obtained a charter from the American Federation of Labor. The next year the Guild voted to switch its affiliation to the C.I.O. and within two years it had signed contracts with 40 newspapers and claimed a membership of about 11,000.

**Circulation Statistics.**—According to N. W. Ayer & Son's directory of newspapers and periodicals for 1939, there were in that year 2,056 daily newspapers, of which probably 200 could properly be classed as of the first rank. Of the dailies, 444 were morning papers, with an estimated total average circulation of 15,925,200, while the 1,583 evening papers had an average aggregate circulation of 24,753,900. Circulation of all dailies (including 29 published all day) was 40,679,100. There were 593 Sunday papers with a combined circulation average of 31,750,000.

Bibliography.—Histories of individual newspapers include: E. Davis, *History of the New York Times, 1851–1921* (1921); J. L. Heaton, *The Story of a Page* (N.Y. World) (1913); F. M. O'Brien, *The Story of the New York Sun 1833–1918* (1918); A. Nevins, *The Evening Post* (New York, 1922); J. M. Lee, *The New York Globe;* and R. Hooker, *The Story of an Independent Newspaper* (Springfield Republican, 1924). Among the books on newspaper editing and making are: G. C. Bastian, *Editing the Day's News;* W. G. Bleyer, *Newspaper Writing and Editing* (1923); J. Rogers, *Newspaper Building* (1918); N. J. Radder, *Newspaper Makeup and Headlines* (1924); M. L. Spencer, *News Writing* (1917); O. G. Villard, *Some Newspapers and Newspaper Men,* offers a critical survey of some of the leading American newspapers; L. N. Flint, *The Conscience of the Newspaper* (1925), and N. A. Crawford, *Ethics of Journalism,* make notable contributions to the field of ethics. *The New York Times* publishes in book form an annual index for that newspaper and a monthly index bound in paper. *See* also C. L. Canon, *Journalism—A List of References in English;* J. M. Lee, *Instruction in Journalism in Institutions of Higher Education* (U.S. Dept. of Education, 1918). Annual review of *Editor and Publisher;* directory of N. W. Ayer & Sons.

## V. LATIN AMERICA

To South America, rather than to its sister continent, belongs the honour of printing and circulating the first printed news sheets of the Western Hemisphere.

**Early News Sheets.**—The first printed sheet of news to appear in South America was issued in 1594 at Lima, Peru, and de-

scribed the capture, off the Peruvian coast, of Richard Hawkins, the free-booter, and of his ship, "The Dainty." Like the earlier sheets of continental Europe, this *Relación* had a long descriptive title. But it was not until 1620 that one meets printed sheets dealing with more than one item of news. After that year their occasional appearance gives the title, Father of South American Journalism, to their printer, Jerónimo de Contreras, who had come to Lima from Seville, Spain. In 1641 José de Contreras succeeded his father as head of the printing house which remained in the family until about the beginning of the second quarter of the 18th century. The most successful of this family of printers was the grandson, José, who obtained the appointment of royal printer to the Spanish Crown in the colonies, and who gave special attention to the editing of news sheets which appeared with approximate regularity of about one a month.

After 1640, *Diario* was commonly used as a title of news sheets, although *La Relación* and *Noticia* appeared. For the most part, these news sheets from the Contreras's press consisted of four pages in small type. *Diario* was especially appropriate as the news was frequently printed in the form of a diary—day by day. After the press of de Contreras had suspended, there was a cessation of news sheets of regular publication. In 1744 there appeared, however, a newspaper with a definite title with consecutive numbers for successive issues. The first issue of this new paper bore the title *Gaceta de Lima, desde primero de diciembre de 1743 hasta 18 de enero de 1744.* This first number is particularly interesting because it prints the traditional origin of the word "gazette" and mentions the names of contemporaneous news sheets in Europe.

**Colombia and Venezuela.**—The first printing office in Colombia, then Nueva Granada, was established at Bogotá in 1737. At first it printed tracts on religious matters, but in 1785, when an earthquake occurred, it issued what is now considered the first attempt in that country to give the public a news sheet. This ill-printed and rudimentary gazette did not last, for its only aim was to spread abroad the news of the earthquake. In 1791 Don Manuel del Socorro Rodríguez, a Cuban, founded a newspaper, in which he printed mainly his poetical and literary works, its other contents being advertisements for runaway slaves, bits of European news, and essays on morals and religion. This newspaper, named *Papel periódico de la ciudad de Santa Fé de Bogotá* appeared irregularly, but lasted for some years.

Another country where a gazette was the first newspaper was Venezuela. The honour of introducing printing into that country is ascribed to Madeo Gallagher and Jaime Lamb in 1808. *Gaceta de Caracas* had its first issue on Oct. 24, 1808. It appeared when Venezuela was in that period of its history known as the colonial age. The first newspaper of what is known historically as the period of independence was *El Correo del Orinoco.* Its first date of publication was June 27, 1818, in Angostura. These two papers marked the beginning of the newspaper press in Venezuela.

The same year that saw the beginning of journalism in Venezuela marks also the beginning of journalism in Brazil. Obviously, the first printed newspaper in the latter country was in Portuguese but, like that of Venezuela, it was called a gazette.

The first newspapers, in the technical sense of that term, for the countries of Latin America may be listed as follows: Mexico, *Gaceta de México* (1679); Guatemala, *Gaceta de Guatemala* (1729); Peru, *Gaceta de Lima* (1744); Cuba, *La Gaceta de la Habana* (1764); Colombia, *La Gaceta de Santa Fé* (1785); Ecuador, *La Gaceta* (1785); Argentina, *El Telégrafo Mercantil* (1801); Haiti, *La Gaceta del Cabo* (1804); Uruguay, *La Estrella del Sur* (1807); Brazil, *Gazeta do Rio de Janeiro* (1808); Venezuela, *La Gaceta de Caracas* (1808); Chile, *La Aurora de Chile* (1812); Panama, *Miscelánea del Istmo* (1822); Bolivia, *El Condor de Bolivia* (1825); Paraguay, *El Paraguay Independiente* (1845).

**Brazilian Journals.**—The honour of being in 1928 the oldest newspaper in South America belongs to *O. Diario de Pernambuco* which was established in 1825. The next newspaper in point of age, founded two years later, is *Jornal do Commercio* of Río de Janeiro. The latter is an extremely conservative paper of limited circulation, while the most popular in that city is the evening paper *A Noite* established in 1910 and credited at the close of 1927 with a circulation of 85,000. Possibly the most influential paper is *O Estado* (1876) of São Paulo. *Fanfulla* (1892), an Italian daily of the same city, wields considerable power through the State of São Paulo. Other influential morning papers are *O Paiz* (1884), *A Patria* (1920) and *Correio de Manha* (1902), all of which are published in Río de Janeiro. Newspapers in Brazil are often the personal organs of owners to whom they are useful for political purposes. At the fall of the empire Brazilian journals numbered about 600. In 1910 the total exceeded 1,000; since then the increase has been about 100 to a decade.

**Argentina and Chile.**—The two leading newspapers, not only in Argentina, but also in South America, are *La Prensa,* founded on Oct. 18, 1869, by Dr. José C. Paz, and *La Nación,* founded on Jan. 4, 1870 by Gen. Bartolomé Mitre, of Buenos Aires. For 59 years (1929) both papers have remained in the families of their founders. Each compares favourably with any other newspaper in any country. Both specialize in printing foreign news; possibly *La Nación* pays more for cable tolls than any other newspaper in the world. Classified advertisements are usually a safe index as to character of newspapers because they represent local opinion. Judged by such a yardstick, *La Nación* resembles the *New York Times* and *La Prensa* the New York *World.* The editorial page of *La Nación* is always dignified in subject-matter and serious in mode of treatment. Its Sunday supplement contains contributions from the best writers, not only of Argentina but also of Spain. Much material later appears in book form. To campaign for civic righteousness seems to be the editorial policy of *La Prensa.* Its evening competitor, *La Razón* (1905), once spoke of it as being a safe and serene guide in the difficult task of creating a public conscience. *La Prensa* widens its influence through syndicating to some 175 provincial papers a weekly feature supplement for Saturday or Sunday editions. *La Prensa* operates a free clinic, offers free legal advice to the poor, pays for a free industrial and agricultural bureau, opens its library to the public and awards 1,000 pesos annually to the person teaching the largest number of illiterates to read. The oldest evening paper in Buenos Aires is *El Diario* (1881). The oldest of all is the English paper, *The Standard* (1861), which competes with *The Herald* (1876).

Crossing the Andes, one finds the newspapers of Chile next in influence. First comes *El Mercurio* (1827) of Valparaiso, with separate publication in Santiago and Antofagasta. Its chief competitor is *La Unión* (1885), which also publishes a paper of the same name in Santiago. In the last-mentioned city are the rather influential *La Nación* (1916), and *El Diario Ilustrado.* In Peru the three leading papers are *La Crónica* (1912), *La Prensa* (1903) and *El Comercio* (1839), of Lima.

The more influential newspapers in Mexico are practically limited to the capital city and frequently contain features obtained from American syndicates. They include *El Excelsior* (1919), *El Universal* (1916) and *El Universal Gráfico* (1922). Outside the capital city, mention may be made of *El Informador* (1917) of Guadalajara, *La Tribuna* (1926) of Guaymas, *El Correo de la Tarde* (1885) of Mazatlán and *Diaro de Yucatán* (1918) of Mérida.

*See* J. M. Lee, *Historia de la prensa periodística de la América del Sur;* A. Celso, *Historia da imprensa do Brazil;* R. Rojas, *La literatura argentina.* (J. M. Le.)

## VI. OTHER COUNTRIES

**China.**—By no means the least result of the Chinese revolution of 1911 was the amazing expansion of the vernacular press. Actually the movement had begun some years earlier, but after the revolution it developed into a portent. Native newspapers sprang up in all parts of the empire in a night, as it were, and it is not surprising that the Chinese press exhibits most of the undesirable attributes of a mushroom growth. The general quality is poor. Most of the papers are run for political or personal ends, the news supplied by them is untrustworthy and their standard of journalistic ethics is low. This is the more to be regretted as their multitude testifies to the interest which awakened China

takes in affairs and their influence on public opinion is beyond doubt enormous; but little improvement is to be expected until political conditions become more settled. As things are it is only fair to say that, with all its irresponsibility and corruption, the Chinese press is on the whole liberal and patriotic in intention if not always in fact. It may be noted that Chinese periodical publications are on a much higher level than the newspaper press.

Between 20 and 30 European and American newspapers are published in China, more than half of them at Shanghai. The majority are British, including the *North China Daily News* of Shanghai which, founded in 1864, is the oldest foreign daily in China. Other British morning newspapers are: *The Shanghai Times, The Central China Post* (Hankow), *The Peking and Tientsin Times, The Hongkong Daily Press* and *The South China Morning Post* (Hongkong). The principal British evening papers are *The Shanghai Mercury, The North China Daily Mail* (Tientsin), *The Hongkong Telegraph* and *The China Mail* (Hongkong). There are three American morning dailies, *The China Press* (Shanghai); *The Peking Leader* and *The North China Star* (Tientsin)—and three French, *L'Echo de Chine* (Shanghai), *Le Journal de Pékin* and *L'Echo de Tientsin.* There are also a number of Chinese and Japanese-owned journals published in English.

**Japan.**—There has been a very remarkable development in the press of Japan during recent years, owing to the spread of popular education. Public opinion in Japan today is practically shaped by the press and while some old restrictions remain the tendency is towards complete freedom of discussion. There are about a dozen newspapers in Japan whose capital is about a million yen. The two centres of newspaper activity are Tokyo and Osaka. The *Osaka Mainichi* and the *Osaka Asahi,* the biggest newspapers in Japan, have a daily circulation of a million copies. The *Tokyo Nichinichi* and the *Tokyo Asahi* are subsidiaries of these newspapers. The *Tokyo Hochi,* the *Jiji,* the *Chugai* and the *Kokumin* are all important national newspapers and almost all are politically independent. There are a very large number of newspapers of the second class which penetrate into the country districts, and there are a number of first-class local newspapers. The Japanese press is influenced by American journalism and some of the popular newspapers display news in quite modern style. Every up-to-date method is employed. In the news columns there is a close network of correspondents and private long distance telephone lines, television, air transport, and pigeons are in use.

A great deal of capital is required to start new newspapers. Greater attention is being given to sport and a large space is given to foreign news.

The *Kokumin* is famous for its president, Mr. I. Tokutomi, who is one of the pioneers of the newspaper business, and is a great critic and author. Its tone is conservative. One of the present problems is the keen competition between the papers in the big cities and the local newspapers, the same tendency which is observable in England.

Newspapers for the English speaking residents in Japan are the *Japan Chronicle* (British), the *Japan Advertiser* (American), and the *Japan Times* (Japanese).

The organisations for newspapers in Japan are the Nohom Shimbun Kyokwai (The Japanese Press Association), and the Kokusai Kisha Kyokwai (International Pressmen's Association), both established in 1913.

During recent years there has been a surprising increase in magazines in Japan of an educational character. Seventy per cent of these are published by Seiji Noma, who is called the "Magazine King" of Japan. It is claimed that the magazines are read by ten million people. His list includes magazines for young men, for girls of the high-school grade, magazines for women, and others of an educational and entertaining character.

BIBLIOGRAPHY.—*Continental Press: Handbuch Deutscher Zeitungen; Political Handbook of the World* (1928); *Political Almanack;* Lewis S. Benjamin, *Guide to the Foreign Press* (1924); *Annuaire de la Presse française et étrangère et du Monde Politique; Newspaper Press Directory* (Mitchell's); *Press Directories* of different countries.

(R. DON.)

**NEWT,** the name applied to the aquatic members of the family *Salamandridae* which constitute the genus *Molge* (*Triton*). The newts are closely related to the true salamanders, *Salamandra,* from which they differ in the shape of the tail, which is compressed, in relation to their more aquatic habits. They swim with their tails, holding the legs pressed into their sides. A marked sexual dimorphism prevails in most species, the males being more brilliantly coloured and provided with a dorsal crest during the breeding season, lasting through the spring and the early summer. Later in the season the males lose their nuptial ornaments, and the two sexes are more alike; they then retire on land, concealing themselves under stones, logs of wood, or in holes in damp earth, but leaving their retreat at night or in wet weather to search for earth-worms and slugs. In the water they eat tadpoles, insect larvae and crustaceans. Newts regenerate lost parts with facility, including whole limbs. One limb can be regenerated a number of times.

The larvae are provided with three pairs of long, plum-like external gills. The fore limbs are developed before the hind limbs. In a few lakes and ponds, metamorphosis (*q.v.*) does not occur and the newt becomes sexually mature as an enlarged larva.

The genus *Molge* extends over Europe, north-west Africa, south-western Asia, eastern temperate Asia (China and Japan) and most of North America. Over 20 species are distinguished. The British species are the crested newt (*M. cristata*), the common newt (*M. vulgaris*) and the palmated newt (*M. palmata*). The first is the largest, and measures 4 to 6in. The skin is more or less rugose, with granular warts, a strong fold extends across the throat, and the male is provided with a high dentate dorsal crest which is interrupted over the sacral region; the upper parts are dark, with black spots; the sides are speckled with white.

BIBLIOGRAPHY.—P. H. Pope, "Life History of the Common Water Newt," *Ann. of Carnegie Mus.* (1924); H. Gadow, "Amphibia," *Cambridge Natural History.*

**NEW TESTAMENT:** *see* BIBLE.

**NEW THOUGHT,** the general name for idealistic tendencies of thinking which arose in the United States, and especially in New England, about the middle of the 19th Century. These tendencies were akin to the transcendentalism of the Concord school of Emerson, Thoreau, Margaret Fuller and Alcott, and have affinities with Plato, Neoplatonism, and the Vedanta philosophy of India. Beginning with the omnipresence and immanence of the Divine, the followers of this school taught a progressive conquest of human ills by re-establishing harmony between the Divine and the human spirit. *See* R. W. Trine, *In Tune with the Infinite.*

**NEWTON, ALFRED** (1829–1907), English zoologist, was born at Geneva on June 11, 1829. In 1854 he was elected travelling fellow of Magdalene college, Cambridge, and subsequently visited many parts of the world, including Lapland, Iceland, Spitsbergen, the West Indies and North America. In 1866 he became the first professor of zoology and comparative anatomy at Cambridge, a position which he retained till his death on June 7, 1907. His services to ornithology and zoogeography were recognized by the Royal Society in 1900, when it awarded him a Royal medal.

He wrote many books, including *Zoology of Ancient Europe* (1862), *Ootheca Wolleyana* (begun in 1864), *Zoology* (1872), and a *Dictionary of Birds* (1893–96), an amplification of the numerous articles on birds which he contributed to the 9th edition of the *Encyclopædia Britannica.*

**NEWTON, SIR CHARLES THOMAS** (1816–1894), British archaeologist, was born on Sept. 16, 1816, at Bredwardine in Herefordshire, and educated at Shrewsbury Schools and Christ Church, Oxford. He entered the British Museum in 1840 as an assistant in the Antiquities Department. In 1852 Newton left the Museum to become vice-consul at Mitylene, with the object of exploring the coasts and islands of Asia Minor. Aided by funds supplied by Lord Stratford de Redcliffe, then British ambassador at Constantinople, he made in 1852 and 1855 important discoveries of inscriptions at the island of Calymnos, off the coast of Caria; and in 1856–1857 achieved the great archaeological exploit of his life by the discovery of the remains of the mausoleum of Halicarnassus, one of the "seven wonders" of the ancient world. He was greatly assisted by Murdoch Smith, afterwards celebrated

in connection with Persian telegraphs. The results were described by Newton in his *History of Discoveries at Halicarnassus* (1862–1863), written in conjunction with R. P. Pullan, and in his *Travels and Discoveries in the Levant* (1865). These works included particulars of other important discoveries, especially at Branchidae, where he disinterred the statues which had anciently lined the Sacred Way, and at Cnidos, where R. P. Pullan, acting under his direction, found the colossal lion now in the British Museum.

For 25 years, 1860–85, Newton was Keeper of Greek and Roman Antiquities in the British Museum. He was Yates professor of classical archaeology at University college, London, (1880–88). His collected *Essays on Art and Archaeology* were published in 1886. He died at Margate on Nov. 28, 1894.

**NEWTON, SIR ISAAC** (1642–1727), English natural philosopher, was born at Woolsthorpe near Grantham on Dec. 25, 1642. His father had died the previous October and his mother, Hannah, daughter of J. Ayscough of Market Overton, married again in 1645 Barnabas Smith, Rector of North Welham, Leicestershire.

After his mother's second marriage her son had lived with his grandmother Mrs. Ayscough at Woolsthorpe, but on his stepfather's death his mother returned to her former home and her boy rejoined her.

For some two years he had attended the Grammar School at Grantham, then kept by Mr. Stokes. He is said to have made little progress with his books until a successful fight with another boy aroused a spirit of emulation and led to his becoming head of the school.

At the age of fourteen on his mother's return (1656) he was taken from school to assist her on her farm. This, however, was not a success; he occupied himself with mathematics when he ought to have been attending to his work. His uncle Wm. Ayscough, Rector of Burton Coggles, was a member of Trinity College, Cambridge, and in 1660 by his advice Newton was sent back to school to prepare for Cambridge. On June 5, 1661 he was matriculated as a subsizar at Trinity College. Three years later he was elected as scholar and in Jan. 1665 proceeded in due course to the degree of Bachelor of Arts. In 1667 he was elected a Fellow of the College.

In the early part of 1665 he discovered what is now known as the binomial theorem, and a little later came the elements of the differential calculus which he called Fluxions. In May of the following year he writes "I had entrance into the inverse method of Fluxions" (in modern terms the principles of the Integral Calculus and the method for calculating the area of curves or the volume of solids) "and in the same year (1666) I began to think of gravity extending to the orb of the Moon . . . having thereby compared the force requisite to keep the Moon in her orb with the force of gravity at the surface of the Earth and found them to answer pretty nearly. All this was in the two years 1665 and 1666 for in those years I was in the prime of my age." The same period saw the commencement of his work on Optics and Colour.

The account of Newton's colour experiments was sent to the Royal Society in 1672. He had been elected a Fellow on January 11 of that year and soon got into correspondence with Oldenburg, the secretary. "I shall endeavour," he wrote, "to show my gratitude by communicating what my poor and solitary endeavours can effect towards the promoting of philosophical design." His *New Theory about Light and Colours* was read on Feb. 8th.

The experiments he described showed conclusively, he claimed, that "Light consists of Rays differently refrangible"; that "Colours are not qualifications of Light derived from refractions of natural bodies as is generally believed but original and connate properties which in divers Rays are divers . . . to the same degree of refrangibility ever belongs the same colour and to the same colour ever belongs the same degree of refrangibility." During the period covered by this work he had become Lucasian Professor of Mathematics. Barrow resigned in his favour in 1669, and Newton's first course of lectures dealt with Optics; hence his renewed interest in the subject, and the experiments with the prism bought at Stourbridge Fair in 1666, culminating in the Royal Society paper of 1672. But the paper led to controversy. The Royal Society solemnly thanked the author "for his ingenious discourse" and he was to be informed "that the society think very much of it."

Robert Hooke along with Ward, Bishop of Salisbury and Robert Boyle were desired to peruse the discourse and report. Hooke in his *Micrographia* (1664) had described an experiment which was fundamentally the same as Newton's with the prism, but he had made no use of it; the theory of colours he attempted to deduce was valueless; however, while admitting the truth of Newton's observations, he declined to accept any of the conclusions drawn from them. The paper, when published, at once attracted attention, and others abroad joined in the discussion, the most important issue of which was Newton's assertion that the length of the band of colours produced at a given distance from the prisms, was the same for prisms of any substance provided their angles were such that the deviation for the mean ray of the band was the same in all.

In this, as we know now, Newton was wrong; the length of the band, the spectrum, is not proportional to the average or mean deviation; it is possible to have two spectra of the same length in which the deviations are markedly different, thus if two such prisms are mounted with their vertices in opposite directions, the light emerging from the second will be achromatic, largely free from colour, but will be deviated from its original path.

Newton's experiments on colour, made in all probability in order to study a defect of the telescope, led him to the belief that the defect was incurable. By putting a divergence lens behind the converging lens of the object glass the colours could again be combined, but, so he concluded, his rays would all be made parallel to their original direction, and would no longer converge to form a real image, which could be magnified by the eyepiece; the telescope could not be made to give a colourless (achromatic) image. This belief he retained throughout his life, but it was wrong. Dispersion and the separation of the colours, are not proportional to deviation.

Shortly after Newton's death Chester Moor Hall invented an achromatic telescope and by 1733 had made several, and in 1758 Dollond the optician took up the matter and constructed satisfactory achromatic lenses.

But his mistake had important consequences; a real image, one, that is, through which the light actually passes, of a distant object can be formed by reflexion at a concave mirror, and since the laws of reflexion, unlike those of refraction through a transparent medium, are independent of colour, the reflected image is the same colour as the object, the rainbow band is there no longer; chromatic aberration, as it is called, is no more a disturbing factor. This then led Newton to make his reflecting telescope in which a concave mirror takes the place of the object glass; the first telescope was made in 1668; the second was sent by him to the Royal Society in December 1671 shortly before his election as a Fellow.

Discussions as to the Optics paper lasted until 1675. "I was so persecuted" he writes in December of that year "with discussions arising out of my theory of light that I blamed my own imprudence for parting with so substantial a blessing as my quiet to run after a shadow." But they had their advantage. They led him to investigate other effects of colour, to enquire how light was produced and to develop the emission or corpuscular theory of light, according to which light is due to the emission by a luminous body of a host of tiny particles travelling in empty space with a speed of 190,000 miles per second; the laws of reflexion and refraction were developed on mechanical principles, aided only by a supplementary hypothesis as to why, when falling on a transparent surface, some of the particles are reflected—bent back into the medium whence they have come—others are refracted, along a new path inclined to the old, into the medium towards which they are travelling. It is a consequence of this theory that light travels more quickly in a dense medium such as glass than in air. The theory was also applied to explain the colours seen when light is reflected from a thin film, a soap film, or the thin layer of air between a convex lens of large radius and a flat reflecting surface on which it rests; in this case when viewed in reflected light of a definite colour a series of dark and light rings

circling round a central black spot is seen. Newton determined the law connecting the radius of a bright ring and the colour of the light and since the radius depends on the colour, the bright rings for the various colours, when white light is used, will be different and the observer will see a series of coloured rings surrounding the black central spot.

Hooke was again a critic; in his *Micrographia* (1664) he had adopted the wave theory of light, due originally to Huyghens, according to which light is energy transmitted by wave motion through a medium pervading space, the universal ether, and had endeavoured to explain, but without success, rectilinear propagation, reflexion and refraction as well as dispersion and the colours of thin plates. Hooke's arguments were vague and carried no conviction to a mind like Newton's; the latter sought a mechanical explanation for all he observed. Newton in his explanation of the reflection and refraction of the corpuscles of a light centre made use of the idea of a wave in an ethereal medium; he rejected Huyghens' theory and thought little of Hooke's attempts at explanation, and so for a hundred years or more Newton's theory held the field. In 1804 Thomas Young, Professor at the Royal Institution, London, established the principle of interference by which he showed that under certain conditions two parcels of light from identical sources falling on a screen could produce a series of bright and dark bands. Along certain lines on the screen there is a maximum of brightness; along others intermediate between these there is darkness. From this and the brilliant work of the French genius Augustin Fresnel, a few years later, came the explanation on the wave theory of all the phenomena of light as then observed.

"In the fourth place," says Newton, writing in 1675, "I suppose light is neither aether nor its vibrating motion but something of a different kind propagated from lucid bodies. . . . Fifthly it is to be supposed that light and aether mutually act upon one another." Did he here build more truly than he knew? Who can say, but we must revert to other work, to other discoveries on which his fame will rest secure till time shall end.

In 1666, when at Woolsthorpe on account of the plague at Cambridge, he "began to think of gravity extending to the orb of the moon," though of this nothing was published for 18 years.

Discussions went on in London at the Royal Society or in the houses of the members, Wren, Seth Ward, Bishop of Salisbury, Robert Boyle, Hooke, Halley, and the others who were active in the Society, until one Wednesday in January 1684 Halley met Wren and Hooke and the latter declared "that he had demonstrated all the laws of the celestial motions." Halley confessed his ignorance and Sir Christopher "to encourage enquiry said he would give Hooke or me"—the quotation is from a letter of Halley to Newton—"two months to bring him a convincing demonstration." Sir Christopher offered to give "a book of 40 shillings" to the one who first found the solution. He was not convinced of Hooke's assertion that he had done it, but wished to conceal the result "that others trying and failing might know how to value it when he would make it public." So it remained till August, when Halley visited Newton at Cambridge and put the question, what would be the path of a body moving under the action of a central force which varied as the inverse square of the distance from the centre. "I then learned," writes Halley in the same letter, "that you had brought this demonstration to perfection." Newton promised to look for the old proof already mentioned but could not find it, "and not finding it did it again and reduced the work into the proposition," which he sent in November to Halley, who immediately returned to Cambridge and persuaded Newton to put them in form for the Royal Society.

On December 10th, 1684, Halley informed the Society that he had lately seen Mr. Newton at Cambridge who had showed him a curious treatise *De Motu* which, upon Mr. Halley's desire, was sent to the Society to be entered on their Register "and a tract, *Propositiones de Motu*" was registered in February 1685 with the date in the margin, 10 Dec. 1684.

But the early months of 1685 were fertile with a new discovery. Newton was away from Cambridge; hitherto his calculations had proceeded on the assumption that the sun and the planets could each be treated as though they were points, concentrated at their respective centres, through which the various forces were assumed to act; but was this true or was it merely an approximation due to the fact that the planetary distances were so immense that even a great sphere like the sun could in comparison be treated as a point? What will be the force with which the sun attracts an exterior particle?

Newton proceeded to work this out, on the assumption that each particle of the sun attracted the external particle with a force which was proportional to the product of the masses of the two and inversely proportional to the square of the distance between them and found (we know he had no expectation of the result until it emerged from his calculations), that if the sun were of uniform density, or consisted of a series of concentric shells each of uniform density, then the resultant force on the external particle was the same as that which would be exerted by the whole mass of that concentrated at the centre.

It was no approximation, the sun and the planets considered as spherical, really behaved as point centres of force.

In the opinion of Professor Adams it was the difficulty of solving this problem and not the uncertainty as to the moon's distance which caused Newton in 1665 to lay aside his astronomical calculations, which were now resumed with a more correct knowledge of the moon's distance. Newton returned to Cambridge and the writing of the *Principia* was begun in March 1686.

The work is entitled *Philosophiae Naturalis Principia Mathematica.* It is in three books, the first *De Motu Corporum* was finished on April 28, 1686 and exhibited to the Royal Society on that day. On June 20, 1687, Newton wrote that the second book was ready. "The third I now design to suppress. Philosophy is such an impertinently litigious lady that a man had as good be engaged in lawsuits as have to do with her." Halley was able to prevent this, and on Sept. 6, 1687 the third book described as *De Mundi Systemate* was presented; the whole was published about Midsummer 1687.

We owe much to Halley; at the time the Royal Society was in difficulties as to funds he took the whole cost on himself. Hooke, when the first book was presented, claimed that he had forestalled Newton in a great part of it, and in the correspondence which followed Halley did all he could to smooth over the difficulties and persuade Newton to continue his work. Newton's letter quoted above indicates his own feelings and in a letter to Halley of July 14, 1686 he had written, "I have considered how best to compose the present dispute, and I think it may be done by the enclosed scholium to the fourth proposition."

In a corollary to the fourth proposition Newton showed that Kepler's third law was a consequence of the elliptic path of a planet under an inverse square law; the scholium runs:

"The case of the sixth corollary applies to the heavenly bodies as our friends Wren, Hooke and Halley have already inferred and therefore I have decided to develope fully all the consequences of a force decreasing as the inverse square." The great work did this: the *Principia* established Newton's fame; some little time elapsed before it was fully accepted on the Continent but for more than 200 years it reigned supreme, and all theories of cosmogony were based on the principles laid down by Newton. His mechanics guided astronomers and men of science in their search for natural knowledge. And if in these last years Einstein has carried us some steps further, has picked up some few more of the jewels of truth, which Newton sought on the shore, Newton's laws remain, included it may be, in a more comprehensive statement of the truth.

In 1687 James II. tried to force the University to admit as a Master of Arts, Father Alban Francis, a Benedictine monk, without taking the oaths of allegiance and supremacy. Newton was one of those who led the resistance to the royal action, and appeared before Lord Jeffreys to argue the case for Cambridge. In the end the deputies were reprimanded, and Pechell the Vice Chancellor was deprived of his office. Newton's share in the affair led to his being elected member for the University in 1689, retaining the seat till the dissolution next year. He was elected again in 1701, but he never took any prominent part in

politics.

On the dissolution of Parliament in 1690 he returned to Cambridge and continued for a time his mathematical work; this was interrupted in 1692–94 by a serious illness. He was suffering from insomnia and nervous trouble. There was a report that he was going out of his mind. Huyghens in June 1694 wrote to Leibnitz 'I do not know if you are acquainted with the accident to the good Mr. Newton, namely, that he has had an attack of phrenitis which lasted eighteen months and of which they say his friends have cured him by means of remedies and keeping him shut up." For some time his friends had been anxious to obtain for him some recognition of his work; this came in 1695. Wren, his friend Charles Montague, Lord Halifax, a former Fellow of Trinity who was Chancellor of the Exchequer, offered him the post of Warden of the Mint. This he accepted and four years later became Master. In the same year he was elected one of the eight Foreign Associates of the French Academy of Science.

In 1696 John Bernoulli addressed a letter to the mathematicians of Europe challenging them to solve two problems and giving six months for the solution. On January 29, 1697 Newton received from France two copies of the printed paper containing the problems and the following day sent the solution to Montague, then President of the Royal Society. They were transmitted anonymously to Bernoulli, who recognised the author in his disguise "tanquam ex ungue leonem."

As Warden of the Mint Newton had retained his Cambridge offices, but soon after his appointment as Master he named Whiston as Deputy, and in 1701 he resigned his Professorship and the Fellowship at Trinity. Whiston became Lucasian Professor. Newton had moved to London, and continued his duties as Master with marked efficiency until his death in 1727.

The remainder of his life calls for little notice; in 1703 he became President of the Royal Society and was re-elected annually until his death. Queen Anne visited Cambridge in 1705 as the guest at Trinity Lodge of the Master, Dr. Bentley, and on this occasion Newton was knighted. About the same time the controversy with Leibnitz as to the invention of the differential calculus began. In a review published anonymously of Newton's tract on quadrature, Leibnitz, in 1705, implied that Newton had borrowed from him the idea of Fluxions.

The controversy lasted many years. Leibnitz died in 1716 but it continued to affect English mathematics for more than a century. The matter is discussed very fully in the article "Newton" in the *Dictionary of National Biography* and in Ball's short *History of Mathematics*. Leibnitz had used the method in his note books of 1675, it occurs in a letter to Newton of 1677, and was published in 1684. Newton used his method of Fluxions in 1666, gave an account of it in manuscript to friends and among others to Collins, in letters from 1669 onwards but did not publish it until 1693. It was some of these letters which Leibnitz saw when in London in 1676, and previously to that, copies of one at least of Newton's letters to Collins had been sent to him. During this visit it appears probable that he saw Newton's tract on the subject. In the middle of 1708 Newton, at the urgent request of Dr. Bentley, consented to let Roger Cotes, a Fellow of Trinity, edit a second edition of the *Principia;* the volume was published in 1713, a third edition by Pemberton appeared in 1726.

Early in 1727 Newton whose health had been failing for some time was taken seriously ill; he died of stone on March 20, 1727, and was buried in Westminster Abbey on March 28th. There are portraits of him by Kneller and Thornhill in the possession of Lord Portsmouth and a second one by Kneller at Petworth. The Royal Society possesses three, one of which by Jervas was presented by Newton in 1717 and hangs over the president's chair, while at Trinity College there are a number. The statue by Roubillac was given to the College in 1750 by the Master, Dr. Smith.

BIBLIOGRAPHY.—*Bibliography of the Works of Sir Isaac Newton, with a List of Books illustrating his Works and Notes,* by G. J. Gray (second edition 1907); *Isaac Newton, 1642–1727* (bibl.) a collected edition of Newton's work was published at Lausanne and Geneva in 1744, which gives all the published works with the not unimportant exceptions of the *Arithmetica Universalis,* the *Principia,* the *Optics* and the *Methodus Fluxionum*. The fullest edition yet published is that issued by Samuel Horsley in 1779–85, under the title *Opera quae exstant omnia;* it is not complete, among notable omissions being the papers published in the *Philosophical Transactions,* and is moreover very scarce.

The standard biography is *Memoirs of the Life, Writings and Discoveries of Sir Isaac Newton,* by Sir David Brewster, 1855: it was reprinted in 1860. Brewster also wrote a short *Life of Sir Isaac Newton,* 1831, of which a new edition appeared in 1908. Valuable critical commentaries are to be found in *Essays on the Life and Works of Newton,* by Augustus de Morgan, edited with notes and appendices by P. E. B. Jourdain in 1914. A brief account of Newton's life and works is given in *Sir Isaac Newton,* by S. Brodetsky, 1927. Of great value to students of Newton is the *Catalogue of the Portsmouth Collection of Books and Papers written by or belonging to Sir Isaac Newton,* 1888 which describes the great mass of Newton's papers which came at his death into the hands of Mr. Conduitt. S. P. Rigaud, *Correspondence of Scientific Men of the 17th Century, etc., from the Originals in the Collection of the Earl of Macclesfield,* 1841, J. Edleston, Editor of the second edition of the Principia, *Correspondence of Sir Isaac Newton and Professor Cotes, including letters of other Eminent Men,* 1850, contain many Newton letters, and the letter volume includes a synoptical view of Newton's life. Among general commentaries must be mentioned:— H. Pemberton, *A View of Sir Isaac Newton's Philosophy,* 1728; Colin Maclaurin, *Sir Isaac Newton's Philosophical Discoveries,* 1775; and F. Rosenberger, *Isaac Newton und seine Physikalische Principien,* 1895.

Since the first issue in 1687 there have been many editions of the ***Principia,*** including two in Newton's lifetime. The Geneva reprint of 1739–42 contains a voluminous commentary by le Seur and Sacquier, and was long used. Lord Kelvin and H. Blackburn edited a very good edition, published at Glasgow in 1874. The first three sections of Book I. of the *Principia* have been edited by, among others, J. Carr, 1821; J. H. Evans, 1838; G. L. Cooke, 1850; P. Frost, 1883 (fourth edition). An English translation of the *Principia* was first published by Andrew Motte in 1729; the best edition is that of 1803. S. P. Rigaud, *Historical Essay on the First Publication of Sir Isaac Newton's Principia,* 1838; W. W. R. Ball, *Essay on Newton's Principia,* 1893; J. W. L. Glaisher, *Bi-Centenary of Newton's Principia,* 1888; P. G. Tait, *Newton's Laws of Motion,* 1899; *Isaac Newton, 1642–1727, A Memorial Volume edited for the Mathematical Association by W. J. Greenstreet* (1927); *Sir Isaac Newton, 1727–1927, A Bi-centenary Evaluation of His Work* (1928). *The Opticks,* first published in 1704, went through three editions in Newton's lifetime; the last (fourth) edition appeared in 1730. Of great importance for the controversy with Leibnitz is the report drawn up by order of the Royal Society, published under the title *Commercium Epistolicum,* 1712, of which editions appeared in 1722 and 1725.

(R. T. GL.)

**NEWTON, JOHN** (1725–1807), English divine, the friend of William Cowper, was born in London on July 24, 1725 (O.S.). His father, who for a long time was master of a ship in the Mediterranean trade, became in 1748 governor of York Fort, Hudson Bay, where he died in 1751. The lad had little education and served on his father's ship from 1737 to 1742; shortly afterwards he was impressed on board a man-of-war, the "Harwich," where he was made a midshipman. For an attempt to escape while his ship lay off Plymouth he was degraded, and treated with so much severity that he exchanged into an African trader. He made many voyages as mate and then as master on slave-trading ships, devoting his leisure to the improvement of his education. He left the sea in 1755, when he was appointed tide-surveyor at Liverpool. He began to study Greek and Hebrew, and in 1758 applied to the archbishop of York for ordination. This was refused him, but, having had the curacy of Olney offered to him in April 1764 he was ordained by the bishop of Lincoln. In October 1767 William Cowper settled in the parish. An intimate friendship sprang up between the two men, and they published together the *Olney Hymns* (1779). In 1779 Newton left Olney to become rector of St. Mary Woolnoth, London, where he laboured with unceasing diligence and great popularity until his death on Dec. 31, 1807.

Like Cowper, Newton held Calvinistic views, although his evangelical fervour allied him closely with the sentiments of Wesley and the Methodists. His fame rests on certain of the *Olney Hymns* (*e.g.,* "Glorious things of Thee are spoken," "How sweet the name of Jesus sounds," "One there is above all others"), remarkable for vigour, simplicity and directness of devotional utterance.

His prose works include an *Authentic Narrative of some Interesting and Remarkable Particulars in the Life of John Newton* (1764). *Omicron* (a series of letters on religion, 1774), and *Cardiphonia* (1781). His *Letters to a Wife* (1793) and *Letters to Rev. W. Bull*

(posthumous, 1847) illustrate the frankness with which he exposed his most intimate personal experiences. A *Life* of Newton by Richard Cecil was prefixed to a collected edition of his works (6 vols., 1808; 1 vol. 1827). *See* also T. Wright, *The Town of Cowper*.

**NEWTON, JOHN** (1823–1895), American general and engineer, was born in Norfolk, Va., on Aug. 24, 1823, and graduated at the U.S. Military academy in 1842. From 1842 to 1861 he was engaged in coast defence constructions and waterway improvements; he was assistant professor of engineering in the Military academy from 1843 to 1846, became a captain in 1856 and was chief engineer in the Utah expedition of 1857–58. He served in the Virginian campaign of 1861, and was promoted brigadier general, U.S. volunteers. He distinguished himself in the Seven Days' battle and at Antietam, and after the battle of Fredericksburg was made major general, U.S. volunteers. In the Chancellorsville campaign Newton took part in the storming of Marye's heights at Fredericksburg, on May 3, 1863, and at the battle of Gettysburg he was for a time in command of the I. corps. Later in Sherman's army, as a division commander under Gen. Oliver O. Howard, he took part in the Atlanta campaign. For gallant conduct at Peach Tree creek he was made brevet brigadier general, and at the close of the war was made brevet major general, U.S. army. In 1884, he became chief of engineers, and held this position until his retirement in 1886. In 1887–88 he was commissioner of public works in New York, and from 1888 until his death on May 1, 1895, was president of the Panama railway.

*See* Gustavus Smith, *In Memoriam of General John Newton* (1895).

**NEWTON,** a city of Iowa, U.S.A., 33 mi. E. of Des Moines, on federal highway 6 and state highway 14. It is the judicial centre of Jasper county. It is served by the Rock Island, the Minneapolis and St. Louis railways and by a bus line. Pop. (1940) 10,462. It is a manufacturing town and is generally known as the "workshop of Iowa." There are two leading washing machine manufacturers there, producing approximately 350,000 machines annually. Other products manufactured are trench excavators, highway equipment, advertising specialties and caskets. The city was founded in 1846 and incorporated in 1857.

**NEWTON,** a city of Kansas, U.S.A., 160 mi. S.W. of Kansas City, in the fertile Arkansas river valley, on federal highways 50S and 81, and served by the Missouri Pacific and the Santa Fe railway systems; the county seat of Harvey county. Pop. 9,781 in 1920 (84% native white); and in 1940 (federal census) 11,048. It is the seat of Bethel college, founded (1887) and still supported by the Mennonites; a division point on the Santa Fe, which furnishes employment to over 1,200 persons; a supply centre for the Fred Harvey system of hotels and restaurants along the Santa Fe route; and a shipping point for grain, fruit and other agricultural products. Its principal manufactures are flour (1,000,000 bbl. a year), threshing machines, brooms, ice, butter and poultry products. Newton was founded in 1871 and chartered in 1872. For several years, beginning in 1873, it was the focus of a large immigration of German Mennonites from Russia and various parts of the United States, who played an important part in building up the city and developing the surrounding country. Each family from Russia brought over a bushel or more of Crimean wheat for seed, from which was grown the first crop of hard winter wheat in Kansas. Since 1927 Newton has had a commission-manager form of government.

**NEWTON,** a city of Middlesex county, Massachusetts, U.S.A., 10 mi. W. of Boston, on the southern bank of the Charles river and the Boston and Albany railroad. Pop. (1920) 46,054 (20% foreign-born white); 65,276 in 1930 and 69,873 in 1940 by federal census. The city has 11 mi. of river front and a land area of 17.4 sq.mi. Within its boundaries are 11 villages and 34 parks, including parts of the metropolitan park system. It is primarily a residential suburb, but it has a variety of manufacturing industries, with an output in 1937 valued at $14,157,147. The assessed valuation for 1940 was $167,587,000. Newton was incorporated as a separate town in 1688 and received its present name in 1691. In 1873 it was chartered as a city. A monument marks the site of Waban's wigwam, where John Eliot, on Oct. 28, 1646, founded the first Indian church. At Newton Centre is the Newton Theological institution, the first Baptist theological seminary established in America (1825).

**NEWTON ABBOT,** a town and seaport of Devonshire, England, 20 mi. S. by W. of Exeter by G.W.R. Pop. (est. 1938) 14,570. Area of urban district, 6.5 sq.mi. Situated at the head of the Teign estuary, the town grew rapidly in the 19th century. The two parish churches, St. Mary's in Wolborough and All Saints' in Highweek, are Perpendicular in style. St. Mary's contains a Norman font. The Jacobean Forde house was visited by Charles I and William of Orange, who first read his declaration to the people of England at Newton Abbot market cross. The portion of Newton Abbot in the parish of Highweek was formerly a separate town known as Newton Bushel. Agriculture is the chief industry, but the G.W.R. locomotive and carriage works employs many men and there is a foundry, also malt-houses.

**NEWTON-IN-MAKERFIELD** or Newton-le-Willows, an urban district in Lancashire, England, 15½ mi. W. of Manchester by the L.M.S.R. Pop. (est. 1938) 20,460. Area 4.9 sq.mi. Newton-in-Makerfield gave its name in Saxon times to one of the hundreds of Lancashire. The barony was held by the Banastres from the Conquest to 1286 and passed successively to the Langtons, Fleetwoods and Leghs. The barons were not summoned to parliament, and the title fell into disuse after the abolition of feudal tenures. Near the town is a moated Elizabethan half-timbered house and also an ancient barrow. The industrial establishments include foundries, printing and stationery works, paper mills and glassworks. Coal abounds in the neighbourhood. Newton was anciently a borough and sent two members to parliament from 1559 to 1832.

**NEWTOWN,** a market town of Montgomeryshire, Wales, situated on the Severn in a narrow part of the valley near the eastern border of the county. Pop. of urban district of Newtown and Llanllwchaiarn (est. 1938) 4,701. Area 11.3 sq.mi. It shares with Welshpool the privilege of being the administrative capital of the shire. We first hear of it as a Llan (church settlement) known as Llanfair Cedewain, in the 13th century. The presence of water power was probably a factor in the origin and growth of the settlement at this time. The Norman Mortimers established there the market of their new territories on the border. In the 15th century the New Town received a municipal charter with a constitution modelled upon that of Hereford and Breteuil, but the corporation was abolished in the days of Charles I. Through the early 19th century the flannel factories of the town were of great importance, but the flannel industry is no longer carried on, though there are still distributing warehouses. In the days of coach roads Newtown was a route centre, for the old road from Ludlow via Bishops' Castle and Kerry had to drop into the Severn valley and so reached Newtown.

The old church, now in ruins, is superseded by the modern St. Mary's, with the font and rood screen of the old building.

**NEWTOWNARDS,** a municipal borough of Co. Down, Northern Ireland, near the N. extremity of Strangford lough, on a branch of the Belfast and Co. Down railway, 9½ mi. E. of Belfast. Pop. (1937) 10,546. Area .74 sq.mi. The town owes its origin to a Dominican monastery founded in 1244 by Walter de Burgh. It received a charter from James I. The ruined abbey of Movilla, 1½ mi. N.E., is attributed to St. Finian (*c.* 550). One of the two Ulster civil airports is there. Linen is the principal trade.

**NEW ULM,** a city of southern Minnesota, U.S.A., on the south bank of the Minnesota river, 88 mi. S.W. of Minneapolis; the county seat of Brown county. It is on federal highway 14 and is served by the Chicago and North Western and the Minneapolis and St. Louis railways. Pop. (1920) 6,745 (22% foreign-born white); in 1940 it had increased to 8,743. It is an important trading centre in a rich agricultural region; has a large milling industry and is the seat of Dr. Martin Luther college (1884). New Ulm was founded in 1854. During the Sioux uprising of 1862 it was twice attacked and almost destroyed.

**NEW WASHINGTON,** a municipality of the province of Capiz, island of Panay, Philippine Islands, on the north coast about 17 mi. W. of Capiz, the provincial capital. Pop. (1939) 12,192 (a gain of 2,315 since 1918); there were no whites. New

Washington is the port for the Aklan valley. The principal crops are palay (rice), abacá (Manila hemp), maize (corn) and sugar. Cattle and horses are bred for export as well as for domestic use, and household industries are numerous. The vernacular is Panay-Bisayan. Of the inhabitants aged 6 to 19 inclusive, 40% were reported in 1939 as attending school, and 40% of the population 10 years old and over was reported as literate.

**NEW WESTMINSTER,** city on the north bank of the Fraser river, 17 mi. from the mouth, and third port of British Columbia. Pop. (1941) 21,967. Founded in 1859, it was the capital of British Columbia when the British possessions on the Pacific coast formed two colonies—*i.e.,* British Columbia (the mainland portion) and Vancouver island. The city has a fine harbour with 30 to 40 ft. of water, modern terminal facilities and a cold storage plant and has a large trade, particularly in timber. New Westminster is a manufacturing centre, fish, fruit and vegetable canning, iron-founding, shingle and lumber mills and shipbuilding being among the industries; and fruit-growing, dairying and mining are carried on in the district. The city is on the Canadian Pacific, Great Northern and Canadian National railways, and is connected with Vancouver, 12 mi. distant, by electric railway. The Columbian Methodist college is there.

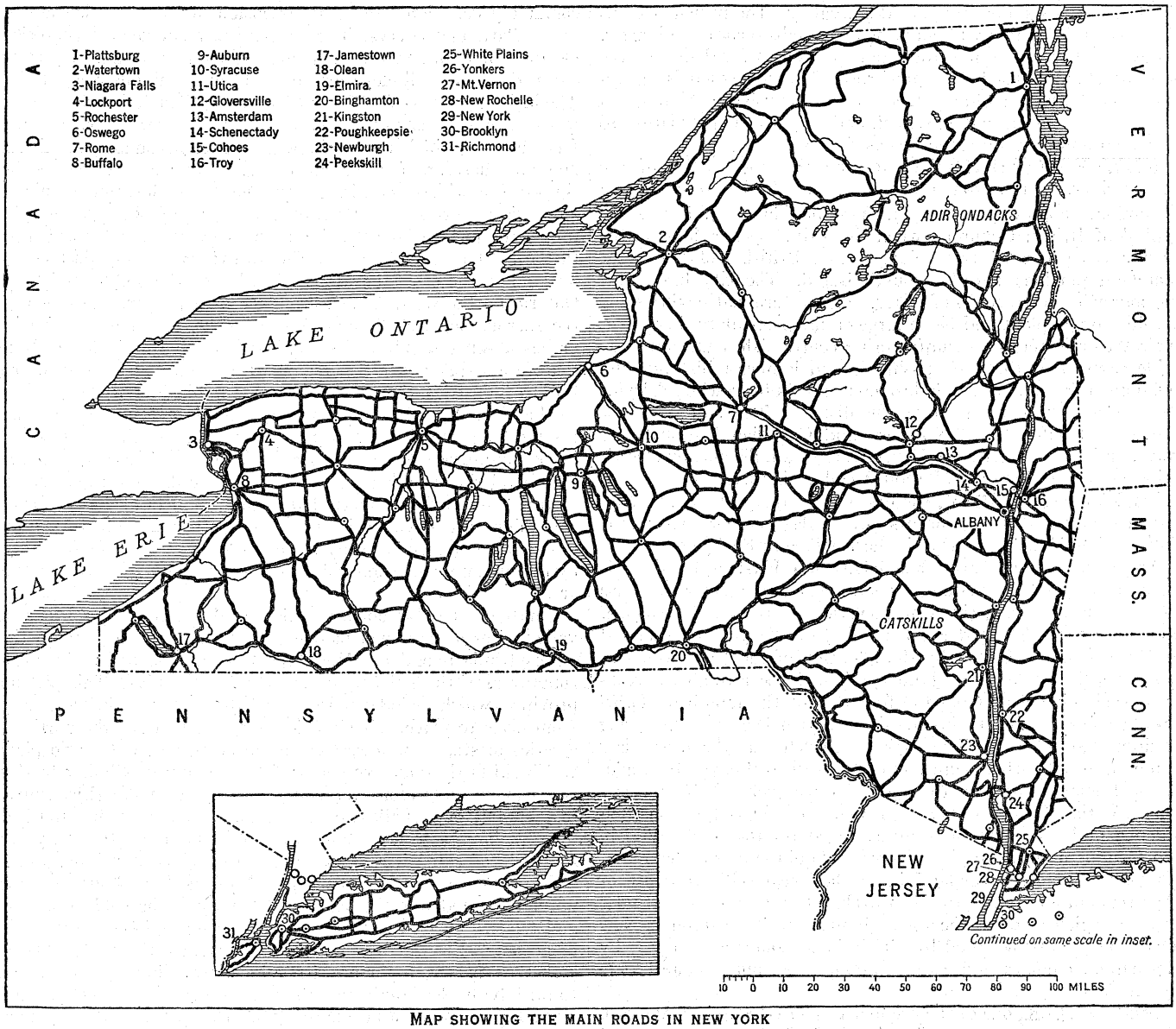
**NEW YEAR'S DAY,** the first day of the year. In the Gregorian calendar this date occurs twelve days earlier than in the Julian; thus New Year's Day is the English 13th of January.

The ancient Egyptians, Phoenicians and Persians began their year at the autumnal equinox (Sept. 21) and the Greeks until the 5th century B.C. at the winter solstice (Dec. 21). The ancient Romans once celebrated the beginning of the year on the 21st of December, but Caesar by the adoption of the Julian calendar postponed it to the 1st of January. The Jews have always reckoned their civil year from the first day of the month of Tishri (Sept. 6–Oct. 5), but their ecclesiastical year begins at the spring equinox (March 21). The 25th of March was the usual date among most Christian peoples in early mediaeval days. In Anglo-Saxon England, however, the 25th of December was New Year's Day. At the Norman Conquest owing, it is believed, to the coincidence of his coronation being arranged for that date, William the Conqueror ordered that the year should start on the 1st of January. But later England began her year with the rest of Christendom on the 25th of March. The Gregorian calendar (1582), which restored the 1st of January to its position as New Year's Day, was accepted by all Catholic countries at once; by Germany, Denmark and Sweden about 1700, but not until 1752 by England.

**NEW YORK,** one of the original 13 United States of America, situated between 40° 29′ 40″ and 45° 0′ 2″ N. and between 71° 51′ and 79° 45′ 54·4″ W. Although one of the smaller States in the Union, being 29th in area, New York ranks first in population and in wealth, and has won for itself the name "Empire State." Its northern boundary is, for the most part, formed by Lake Ontario and the St. Lawrence river, which separate it from the Province of Ontario, Canada; but north of the Adirondacks the boundary line leaves the St. Lawrence, extending in a due east direction to the lower end of Lake Champlain. Thus the boundary between New York and the Province of Quebec, Canada, is wholly artificial. Vermont, Massachusetts and Connecticut bound New York on the east; the Atlantic ocean, New Jersey and Pennsylvania on the south; and Pennsylvania, Lake Erie and the Niagara river on the west. The State has a triangular outline, with a breadth from east to west of 326·46 m. and from north to south, on the line of the Hudson, of 300 miles. In addition, it includes Long island and Staten island on the Atlantic coast. Its land area is 47,929 sq.mi. and the area of the inland waters is 1,647 sq.mi., giving a total area of 49,576 sq. miles. In addition to this, New York includes 3,140 sq.mi. of water in Lakes Ontario and Erie.

**Physical Features.**—The most notable topographic feature is the roughly circular mountain area of north-eastern New York, known as the Adirondack mountains (*q.v.*). This is a very ancient mountain mass of crystalline rocks resembling more the Laurentian mountains of Canada than the Appalachians. Indeed, it is commonly considered to be an extension of the Canadian mountains. Parts of the crystalline area are worn down to a condition of low relief, but in the main mountain mass, although greatly worn, there are still elevations of truly mountainous proportions. The highest peak is Mt. Marcy (5,344 ft.), though associated with it are several other peaks with an elevation from 4,000 to 5,000 feet. Even the higher summits are worn to a rounded condition, and are therefore for the most part forest-covered up to the timber line which, on Mt. Marcy, is at an elevation of about 4,900 feet. From the crest of the dome of the Adirondacks proper the surface slopes in all directions to surrounding lowlands; to the St. Lawrence valley on the north; the Champlain-Hudson lowland on the east; the Mohawk valley on the south; and Lake Ontario on the west. The Adirondack area proper, and much of the surrounding ring of more recent rocks, is either too rugged, or has a soil too thin and rocky for extensive agriculture. It is therefore a sparsely settled region with lumbering for one of the leading industries, though there is some mining, as of iron. Owing to the varied and beautiful scenery, this is a favourite summer resort; the game of the forest and the fishing in the streams and in the multitude of lakes serve as further attractions. In the peripheral ring farming increases, especially dairying; and manufacturing industries connected with the products of forest, farms and mines are developed. These and other manufacturing industries are greatly aided by the extensive water-power furnished by the mountain streams which flow out radially from the central area.

South of the Adirondack region, and south of the Mohawk valley, rises a high-level plateau which extends westward to the Pennsylvania boundary. Here the rocks are all essentially horizontal and of the Palaeozoic age, mainly Devonian. This plateau province, which includes more than half the State, differs greatly from place to place. Its elevation decreases toward the north by a series of steps, the lowest elevation being on the Ontario plain which skirts the southern shore of Lake Ontario. Similar to this is a narrow plain along the southern shore of Lake Erie, which, in fact, lies in a shallow depression in this Erie plain. Both of these plains are so level, and have so fertile a soil that they are the seats of extensive agriculture, especially fruit raising, which is further encouraged by the influence of the large bodies of lake water that moderate the heat of summer and the cold of winter, and tend to check the late frosts of spring and the early frosts of autumn. Elsewhere in the plateau province the land is higher and the surface far more irregular, increasing in ruggedness toward both the south and the east. Elevations of 1,500 and 2,000 ft. are common in this region all the way from Chautauqua county in the extreme west to the Catskill mountains in the east; and in places the surface becomes so rugged as to simulate the features of mountains and locally to win the name of mountain. Valleys are deeply sunk in the plateau, the largest with bottom lands of sufficient width to give rise to strips of fertile farmland. The valley walls rise to undulating and often fairly level uplands, which are, in large part, cleared of forest. In the main they are grazing lands—the seat of important dairy and sheep-raising industries. This is the region of abandoned farm houses. Since the plateau region is a northward extension of the Allegheny plateau, which skirts the western base of the Appalachian mountains, it rises as the mountains are approached. Thus, in south-east New York, where the Appalachians enter the State, the plateau becomes much higher than in the west, reaching its culmination in the Catskills. Here, partly because of elevation, and partly because of the resistant nature of the Catskill sandstone, dissection has so sculptured the plateau as to carve it into a mountainous mass generally known as the Catskill mountains (*q.v.*). In this part of the plateau, summit elevations of from 3,000 to 4,000 ft. are common, the highest point being Slide mountain (4,205 ft.). Like the Adirondacks, this region is largely forest covered, and is a favourite summer resort; but it is far less a wilderness than the Adirondacks, and in places is cleared for farming, especially for pasturage. In the plateau province there are other areas known as mountains, of which the Helderberg mountains are the most conspicuous. This formation is really an escarpment facing




MAP SHOWING THE MAIN ROADS IN NEW YORK

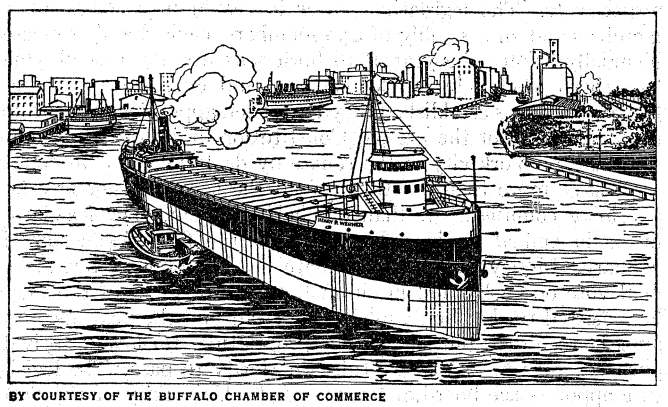
the lower Mohawk and the Hudson river, south of Albany, where there is a downward step in the plateau. The steeply rising face of the plateau here is due to the resistance of a durable layer of limestone, known as the Helderberg limestone. Of other lower escarpments the most notable is the Niagara which extends eastward from Canada, past Lewiston and Lockport—a downward step from the Erie to the Ontario plain.

South and south-east of the Catskills, although including only a small portion of the State, there are a number of different topographic features, due to the belts of different rock structure which cross the State from south-west to north-east. The most pronounced of these upfolded strata in New York form the low Shawangunk mountains, which descend, toward the south-east, to a lowland region of folded strata of limestone, slate and other rocks in Orange and Dutchess counties. This lowland area, due to the non-resistant character of the strata, is a continuation of the Great Valley of the Appalachians, and extends north-east into Vermont and south-west across New Jersey, Pennsylvania, Maryland and Virginia. It is bounded on its south-east side by the Highlands, a belt of ancient crystalline rocks which extends north-east into Connecticut and Massachusetts, and south-west into the highlands of New Jersey and thence to the Blue Ridge. South of the Highlands, in New Jersey, but extending to the very banks of the Hudson, is a belt of Triassic sandstone with intrusions of trap rock, which, on account of its peculiar columnar jointing, has developed a palisade structure—the famous Palisades of the lower Hudson. Long Island, though modified by extensive glacial deposits, may be considered a north-east extension of the coastal plains which attain a much more perfect development in New Jersey and the States farther south.

The entire surface of New York, with the exception of a very small area in the extreme west, in Chautauqua and Cattaraugus counties, was covered by the continental glacier. It broadened and deepened many of the valleys; rounded the hills; turned aside many streams, causing changes in drainage and giving rise to innumerable waterfalls and rapids; and it formed the thousands of lakes, large and small, which dot the surface. As the ice receded, it halted at various points, forming moraines and other glacial deposits. Thus the soil of almost the entire State has been derived by glacial action.

The drainage of New York finds its way to the sea in various directions. The St. Lawrence system receives most, mainly from short streams from the plateau province and from the Adirondacks. A small part of the State, in the west, drains to the Ohio, and thence, by way of the Mississippi, to the Gulf of Mexico; and a much larger area drains into the Susquehanna, entering the head of Chesapeake bay. A part of the Catskills, and the region farther south, drains into Delaware bay through the Delaware river. Thus New York is pre-eminently a divide region, sending its drainage, by various courses, into widely separated parts of the

ocean. Only the Hudson (*q.v.*) and a few streams in the extreme south have independent courses to the sea within the State itself. The Hudson is by far the most important river in the State, for, owing to the sinking of the land, which has admitted the tide as far as Troy, it is navigable for 151 m. from the sea. It is noted for its remarkable scenery, especially where it crosses the Highlands. Westward from Troy, the Mohawk valley furnishes a



BY COURTESY OF THE BUFFALO CHAMBER OF COMMERCE

**ENTRANCE TO BUFFALO HARBOUR, GREAT INLAND WATER PORT OF THE UNITED STATES**

Buffalo is situated at the foot of Lake Erie, where navigation for the big lake carriers ends

highway which is followed by canal, railway and motor road. Thus there is here a gap, easily traversed, across the Appalachian mountains and plateaus to the more level and fertile plains beyond.

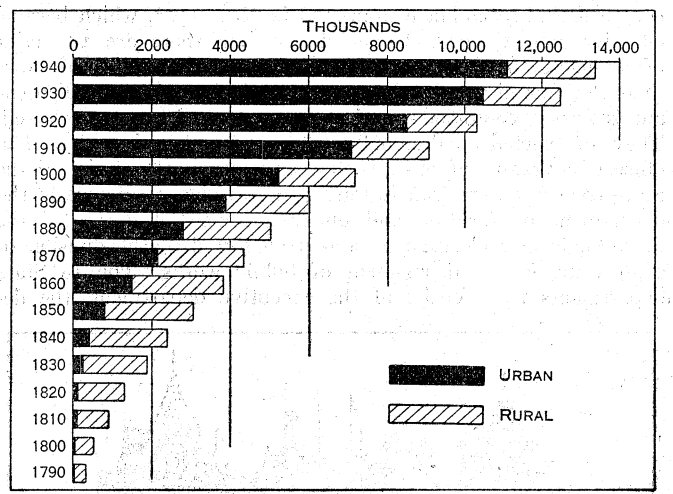
There are about 2,000 lakes and ponds in the state, most of them very small and all, even including Lakes Erie and Ontario, the result of glacial action. The largest lake apart from Erie and Ontario is the beautiful Lake Champlain, which lies on the eastern boundary. The largest lake entirely within the State is Lake George. In the central part of the State area is a series of peculiar elongated lakes, extending in a nearly north-south direction, known as the Finger lakes. The largest of these are Cayuga, Seneca, Keuka, Canandaigua, Owasco and Skaneateles. Here too is Watkins Glen acquired by the State for a park. In the extreme western part of the State is Chautauqua lake, beautifully situated in the plateau of western New York. New York is noted for its many falls and rapids, some of them of great beauty. Of these the largest is the cataract of Niagara, about 1 m. wide and 165 ft. high. The American fall is entirely within the State; but the Canadian boundary-line passes down the centre of the Horseshoe or Canadian fall. Other notable falls are those of the Genesee at Portage and at Rochester, the falls in the Cayuga and the Seneca valleys, Trenton falls, the Falls of Ticonderoga, and a multitude of falls and rapids in the Adirondack region.

New York has an extensive coast-line along the Great Lakes, 75 m. on Lake Erie and over 200 m. on Lake Ontario. The largest of the lake ports is at Buffalo at the head of Niagara river, where, owing to the Niagara cataract, lake boats from the west must transfer their goods to rail or canal. Buffalo lies at the lower end of natural lake navigation, though by the building of a ship canal in Canada, lake steamers can proceed into Lake Ontario and thence to the St. Lawrence. The ocean coast-line, though of limited extent, is by far the most important in the United States. The greater part of the sea-coast is on Long island—a low, sandy coast, the seat of numerous summer resorts and of some fishing. The mainland, opposite the western end of Long Island, is traversed by the lower Hudson and other channels—submerged valleys—which form a branching bay with several islands, the largest of which are Staten and Manhattan islands. This bay makes an excellent protected harbour, with an immense water front, at the outlet of the chief natural highway from the east to the interior of the country.

**Climate.**—In general the climate of New York is typical of that of northern United States, a climate of extremes, hot in summer, and cold in winter, and yet healthful, stimulating, and, on the whole, not disagreeable. The average mean annual temperature is not far from 45° though it varies from over 50° near New York city, and 48° near the Lake Erie shore, to less than 40° in the high Adirondacks. The average maximum summer heat is about 93°, a temperature of 100° being rarely reached. In the winter the temperature descends below zero during exceptionally cold spells. Most of the rivers and smaller lakes freeze over completely in winter. The average rainfall is between 40 and 45 in. but it is less than 30 in. in the Lake Champlain valley and over 55 in. north of New York city. In the Adirondack region the snowfall is heavy, the winter long and severe. In central New York it is not uncommon for snow to accumulate to the depth of 3 or 4 ft. and yet this is not persistent. About New York city, and on Long Island, the snow rarely exceeds 1 ft. in depth. The climate is variable owing to the frequent passage of cyclonic storms from the west and south-west, bringing warmer weather with rain and snow in winter, and causing days of great heat and humidity, with thunder-storms, in summer. About New York city, and on Long Island, the ocean softens the rigours of winter, and through the influence of cold surface waters off the coast, tempers the heat of summer.

**Soil.**—The soil is mostly glacial drift, but its depth and composition often vary greatly even within small areas. The most widely distributed soil, especially in the west half of the State, is mainly a clay which was formed by the glacial pulverizing of limestone and shale and is still forming from the decomposition of fragments of these substances. In the larger valleys and along the shores of lakes alluvium is mixed with this clay.

**Population.**—The population of New York in 1790 was 340,120; in 1820 it was 1,372,812; in 1850, 3,907,394; in 1880, 5,082,871; and in 1910, 9,113,614. The population of the state and its principal cities is summarized for recent censuses in the following table:




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

**URBAN AND RURAL POPULATION OF NEW YORK, 1790–1940**

| Area | Population | | | Per cent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 13,479,142 | 12,588,066 | 10,385,227 | 7·1 | 21·2 |
| Urban | 11,165,893 | 10,521,952 | 8,589,844 | 6·1 | 22·5 |
| Rural | 2,313,249 | 2,066,114 | 1,795,383 | 12·0 | 15·0 |
| Per cent urban | 82·8 | 83·6 | 82·7 | .. | .. |
| Principal cities: | | | | | |
| New York city | 7,454,995 | 6,930,446 | 5,620,048 | 7·6 | 23·3 |
| Buffalo | 575,901 | 573,076 | 506,775 | 0·5 | 13·1 |
| Rochester | 324,975 | 328,132 | 295,750 | −1·0 | 10·9 |
| Syracuse | 205,967 | 209,326 | 171,717 | −1·6 | 21·9 |
| Yonkers | 142,598 | 134,646 | 100,176 | 5·9 | 34·4 |
| Albany | 130,577 | 127,412 | 113,344 | 2·5 | 12·4 |
| Utica | 100,518 | 101,740 | 94,156 | −1·2 | 8·1 |
| Binghamton | 78,309 | 76,662 | 66,800 | 2·1 | 14·8 |
| Niagara Falls | 78,029 | 75,460 | 50,760 | 3·4 | 48·7 |
| Troy | 70,304 | 72,763 | 71,996 | −3·4 | 1·1 |
| Mount Vernon | 67,362 | 61,499 | 42,726 | 9·5 | 43·9 |
| New Rochelle | 58,408 | 54,000 | 36,213 | 8·2 | 49·1 |

The population per square mile in 1940 was 281·2, as compared with 44·2 for the United States as a whole. Of the 1940 popula-

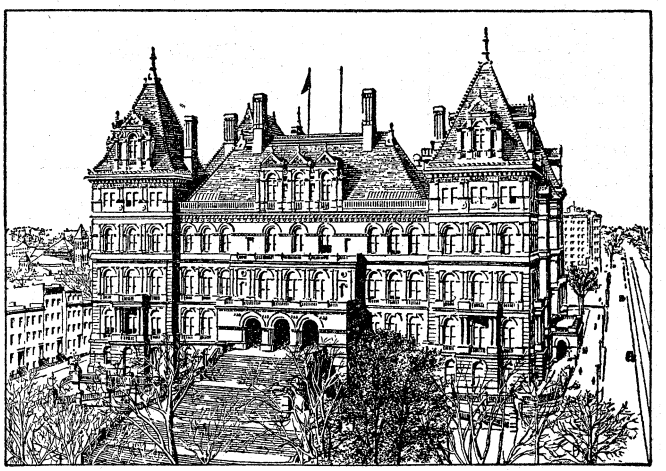
tion, 11,165,893, or 82·8%, lived in urban places, that is, in cities and villages of 2,500 or more. The number of occupied dwelling units returned in the housing census of 1940 was 3,662,618, which is approximately the same as the number of families.

The average population per family (occupied dwelling unit) declined from 4·0 in 1930 to 3·7 in 1940. The white population of New York formed 95·5% of the total in 1940, as compared with 96·5% in 1930, practically all the nonwhite population being Negro. The number of males per 100 females in the entire population of the state was 99·2; in the urban population the sex ratio was only 97·3, but in the rural population there were 108·5 males per 100 females.

**Government.**—Since becoming a State, New York has been governed under four constitutions, adopted in 1777, 1821, 1846 and 1894 respectively. A Constitutional Convention met and proposed a new Constitution in 1915, but it was rejected by the people. The present Constitution may be amended by a majority vote of the members of two successive legislatures and approval by the electorate.

Suffrage is bestowed on all citizens who have attained the age of 21 years and have been inhabitants of the State for one year, but for the protection of the ballot, citizenship for 90 days, residence in the county for four months, and in the election district for 30 days next preceding the election are required. An absentee voting law, subsequently amended, went into operation in 1919.

The executive and administrative department of New York State is functioning under a reorganization plan, authorized by a constitutional amendment approved in Nov. 1925, which became effective Jan. 1, 1927. Under this system there are 18 major departments to which have been allocated the duties of more than 180 commissions and bureaux. Only the governor, lieutenant governor, comptroller and attorney general are now elected. They are elected quadrennially (in even-numbered years). The office of secretary of State is now appointive; the duties of the State treasurer were transferred to the division of finance in the department of taxation and finance; while the duties of the State engineer and surveyor were transferred to the division of engineering in the department of public works. The 18 State departments now consist of the executive department, the departments of audit and control, of taxation and finance, of law, of state, of public works, of conservation, of agriculture and markets, of labour, of education, of health, of mental hygiene, of social welfare, of correction, of public service, of banking, of insurance and the department of civil service.



THE STATE CAPITOL AT ALBANY

The governor submits to the legislature, not later than Jan. 15 (except in the case of a newly elected governor, when the date is extended to Feb. 1), a budget containing a complete plan of proposed expenditures and estimated revenues for the next fiscal year. The budget also contains recommendations of the governor for new taxes, loans or other appropriate actions to meet any estimated deficiency for the ensuing fiscal year. A bill or item of an appropriation bill that has been vetoed by the governor can become a law only with the approval of two-thirds of the members elected to each house of the legislature. The salary of the governor and of the lieutenant governor, as fixed by an amendment of the Constitution in 1927, is $25,000 and $10,000 respectively. The legislative power is vested in a senate of 51 members and an assembly of 150 members, each chamber elected biennially. Since the year 1846 both senators and assemblymen have been elected by single districts, and ever since the State Government was established they have been apportioned according to population, but the present Constitution limits the representation of New York city in the senate by declaring that no county shall have more than one-third of all the senators, nor any two adjoining counties more than one-half of them. The legislature meets in annual sessions, beginning on the first Wednesday in January. Money bills may originate in either house, but at the final vote on such a bill in either house three-fifths of the members elected to that house must be present and the yeas and nays must be recorded; bills entailing appropriations for local or private purposes must receive a two-thirds majority to pass. The legislature appoints the board of regents of the University of the State of New York. The judicial system comprises a supreme court of 135 justices, four appellate divisions of the same, a court of appeals, a court of claims and local courts. The highest judicial court in the State is not, as in most States of the Union, the supreme court, but the court of appeals. This court consists of a chief judge and six associate judges elected from the State at large for a term of 14 years. Its jurisdiction is limited, except where judgment is of death, to a review of questions of law. Vacancies are temporarily filled from among the justices of the supreme court by the governor. To expedite business, at the request of the court, the governor may designate not more than four justices of the supreme court to act temporarily as additional associate judges of the court of appeals. The salary of the chief judge is $22,500, of the associate judges $22,000 a year. The justices of the supreme court are elected for 14 years from the nine districts into which the State is divided. The jurisdiction of each justice extends over the entire State. Vacancies are temporarily filled by the governor. The supreme court has general jurisdiction in law and equity, including both civil and criminal actions. The salary of each justice is $15,000 except in the 1st, 2nd and 9th districts where $10,000 more is raised from local sources. Presiding judges receive an additional $2,500 and all assigned to appellate work an extra $2,000. The State is divided into 4 departments for each of which there is an appellate division consisting of 8 justices in the first department, 7 in the second and 6 each in the others. The justices and presiding justices are designated from among the justices of the supreme court by the governor; the presiding justice and a majority of the other justices of each department must be residents of the department. The court of claims consists of three judges, one presiding, appointed by the governor for a term of nine years. It has jurisdiction to hear and determine private claims against the State. New York city (*q.v.*) has an extensive judiciary system of its own.

**Local Government.**—The State is divided into 62 counties, each (unless wholly included in a city) having a county board of supervisors elected for two years, one from every town or city ward. This board has certain administrative and legislative powers. Other county officers are a county judge and a county surrogate elected for a term of six years, except in New York and Kings counties where the term is 14 years, a treasurer, a clerk, a district attorney, a sheriff and from one to four coroners elected for a term of three years. Cities are of three classes, those having a population of: (1) 175,000 or more; (2) between 50,000 and 175,000; and (3) less than 50,000. The classification is according to the latest State enumeration. All city elections are held in odd-numbered years. The organization of cities and villages is provided by the legislature, which may restrict their powers of taxation and of contracting debts and may fix salaries. Town (or township) Government in New York somewhat resembles that

of New England; the chief executive officer of the town is a supervisor, who represents his town in the county "board of supervisors."

**Finances.**—The aggregate assessed value of real property in the state on June 30, 1940, was $25,752,020,264, which under the system of assessment represented an actual value of more than $30,000,000,000. The assessed valuation was $100,000,000 greater than that of 1936. For many years the state levied an annual tax on real estate. In 1925 it yielded $28,460,190, but was soon after abolished. It was levied for the last time in 1928, when it yielded only $12,666,314 out of total receipts of more than $330,000,000 for that year. Special taxes were for years the chief source of revenue, but after 1928 they were virtually the only source. The total receipts of the state for the year ending June 30, 1940, were $449,912,538, and the total ordinary appropriations by the legislature amounted to $393,802,987. The receipts from the principal special taxes were: corporations, $94,503,667; inheritances, $27,953,769; stock transfers, $19,348,584; personal income, $164,720,690; motor vehicles, $50,950,126; motor fuels, $70,930,619; cigarettes, $21,529,778; alcoholic beverages, $54,949,194. The income tax yielded $90,000,000 more than in 1936, the alcoholic beverage tax $36,000,000 more and the tax on corporations $26,000,000 more. At the beginning of 1940 the gross bonded debt was $671,936,000. The sinking fund contained $145,947,430, which reduced the gross debt to a net of $525,783,570. Of the total debt, $150,700,000 was incurred for canal improvement.

In 1851 a state banking department was created, and at the head of this is a superintendent of banks appointed by the governor, with the consent of the senate. This office was continued under the reorganized administrative system which became effective on Jan. 1, 1927. The superintendent—or examiner appointed by him from a civil service list—is required to examine every bank, trust company and other financing institution within the state, national banks excepted. On June 30, 1940, there were 1,223 financial institutions in the state under the supervision of the banking department. The deposits in all these institutions were $17,922,632,672, credited to 11,078,816 depositors. The capital was $670,759,510 and the total resources were $21,385,047,880. In addition to the banks under state supervision there were 427 national banks with a capital of $281,936,000, deposits of $6,226,339,000 and assets of $7,120,224,000.

**Education.**—The first school was established by the Dutch at New Amsterdam (now New York city) as early as 1633, and at the close of the Dutch period there was a free elementary school in nearly every settlement. King's college was founded in 1754; and from 1704 to 1776 the other schools were principally those maintained by the Society for the Propagation of the Gospel in Foreign Parts. Hardly any schools remained in operation throughout the Revolutionary War. In Jan. 1784 Governor George Clinton recommended legislation for the "revival and encouragement of seminaries of learning," with the result that the legislature passed an act establishing a State university of which Columbia college, formerly King's, was the "mother" portion. In 1787 a second university act was passed which restored to Columbia college the substance of its original charter and made the University of the State of New York an exclusive executive body with authority to incorporate new colleges and academies and to exercise over them the right of visitation. The functions of the university were extended to include an oversight of the professional, scientific and technical schools, the administration of laws relating to admission to the professions, the charge of the State library at Albany, the supervision of the local libraries, the custody of the State museum and the direction of all scientific work prosecuted by the State. This dual system was consolidated by the Educational Unification Act of 1904, in conformity with which the university regents have become a legislative body, subordinate to the State legislature, for determining the general educational policy of the State, and a commissioner of education acts as the chief executive, advisory and supervisory, officer of the whole educational system.

The regents of the university are chosen by the legislature, one retiring each year; and an act of 1909 requires that their number shall at all times be three more than the number of judicial districts. The commissioner of education is chosen by the regents and continues in office during their pleasure. The commissioner (subject to approval of the regents) appoints three assistant commissioners for higher, secondary and elementary education respectively. The elementary schools are under the general control of district superintendents. The number in a county ranges from five to eight. Any two or more adjoining school districts may unite to form a union free school district, and in any village or union free school district having a population of 4,500 or more the board of education may appoint a superintendent of schools. The total public school enrolment in 1940 was 2,244,142 and the total school expenditures were $347,775,704.30, of which $123,885,607.76 was paid by the state and the remainder by the local communities. Of the total public school enrolment, 1,506,601 were in the elementary and kindergarten schools and 735,542 in the secondary schools. The public schools of the state employed 82,349 teachers. Attendance by children of school age has long been compulsory.

For the training of teachers the State maintains teachers colleges at Albany and Buffalo, and normal schools at Brockport, Cortland, Fredonia, Geneseo, New Paltz, Oneonta, Oswego, Plattsburg and Potsdam. The State controls professional and technical schools through the regents' examinations of candidates for admission to such schools and to the professions, determines the minimum requirements for admission to college by the regents' academic examinations, maintains the large State library and the valuable State museum, and occasionally makes a gift to a college or university for the purpose of maintaining courses in practical industry. Under such an arrangement are maintained the State college of Agriculture and the State college of Home Economics both connected with Cornell university (*q.v.*), at Ithaca; the State agricultural experiment station, at Geneva; the State school of Agriculture at St. Lawrence university, at Canton; the State school of Agriculture at Alfred university at Alfred; the State school of Agriculture at Morrisville; the State school of Agriculture at Cobleskill; the State school of Agriculture at Delhi; the State Institute of Applied Agriculture on Long Island at Farmingdale, L.I.; the State school of Forestry at Syracuse university, Syracuse; and the State school of Clay Work and Ceramics at Alfred university, at Alfred.

Among the institutions of higher learning in the State, besides Columbia university (*q.v.*) and Cornell university (*q.v.*), are: Union university at Schenectady; Hamilton college at Clinton; Colgate university at Hamilton; Hobart college at Geneva; Rensselaer Polytechnic Institute at Troy; New York university in New York city; Alfred university at Alfred; Fordham university in New York city; College of the City of New York; University of Rochester at Rochester; Polytechnic Institute of Brooklyn at Brooklyn; Niagara university at Niagara Falls; St. Lawrence university at Canton; St. Bonaventure's college at Alleghany; Long Island university at Brooklyn; Manhattan college at New York city; Vassar college (*q.v.*), Poughkeepsie; St. John's university, Brooklyn; Canisius college at Buffalo; Syracuse university at Syracuse; Adelphi college at Garden City; Clarkson college of Technology at Potsdam; St. Rose's college at Albany; Wells college at Aurora; St. Francis college at Brooklyn; D'Youville college at Buffalo; St. Joseph's college for Women at Brooklyn; University of Buffalo at Buffalo; Elmira college at Elmira; Houghton college at Houghton; Keuka college at Keuka Park; College of New Rochelle at New Rochelle; College of Mount St. Vincent at New York city; College of the Sacred Heart at New York city; Cooper Union at New York city; Hunter college of the City of New York; Skidmore college at Saratoga Springs; Marymount college at Tarrytown; Russell Sage college at Troy; Good Counsel college at White Plains; and Brooklyn college at Brooklyn. The U.S. Military academy (1802) is at West Point.

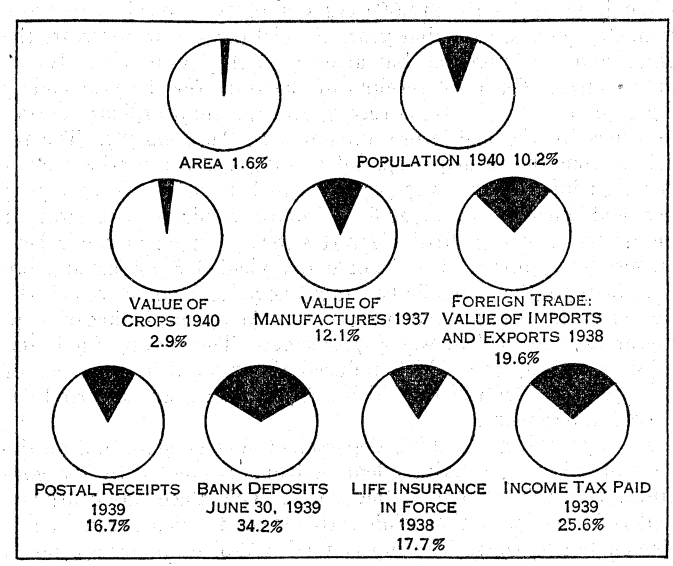
**Charities and Corrections.**—Penal institutions are under the supervision of the department of correction; schools for mental defectives and hospitals for the insane, except for the criminal insane, are under the supervision of the department of mental hygiene; and all other charitable and correctional institutions,

maintained wholly or in part by the State, except the State camp for veterans at Bath which is under the control of the executive department, are under the supervision of the department of charities. At the head of the department of corrections is the commissioner of correction, appointed by the governor with the consent of the senate for a term equal to that of the appointing governor. The division of parole, a branch of the executive department, consists of three members appointed by the governor for a term of six years. The duties of visitation and inspection are vested in a commission of correction composed of seven members appointed by the governor and the commissioner of correction. The institutions under this department in 1941 included: Attica prison at Attica; Auburn prison at Auburn; Clinton prison at Dannemora; Great Meadow prison at Comstock; Green Haven prison at Green Haven; Sing Sing prison at Ossining; hospitals for the criminal insane at Dannemora and Matteawan; reformatory at Elmira; training school at Albion; reformatory for women and the Westfield state farm at Bedford Hills; institute for defective delinquents at Napanoch; Walkill prison at Walkill.

At the head of the department of mental hygiene is the commissioner of mental hygiene appointed by the governor with the consent of the senate. He holds office during the term of the appointing governor, and receives an annual salary of $12,000. In 1941 the department of mental hygiene had supervision over the following institutions: State schools for mental defectives at Newark, Rome, Syracuse, Thiells, Wassaic; the Craig Colony (epileptics) at Sonyea; hospitals for insane at Binghamton, Brooklyn, Buffalo, Central Islip, Helmuth, Wingdale, Poughkeepsie, Kings Park, New York, Middletown, Rochester, Ogdensburg, Utica, Creedmoor, Marcy, Brentwood, Orangeburg and Willard; psychopathic hospitals at New York and Syracuse.

The State department of charities consists of a State board of social welfare of 15 members, one member from each of the nine judicial districts and six additional members for the State at large, all appointed by the governor with the consent of the senate for a term of five years. The board appoints a chief executive officer with the title of commissioner of social welfare. In 1941 the State charitable institutions were as follows: State training school for girls, Hudson; State agricultural and industrial school, Industry; Thomas Indian school, Iroquois; State Woman's Relief Corps Home, Oxford; and the Training School for Boys at Warwick. The Hospital for Treatment of Incipient Pulmonary Tuberculosis at Raybrook; the State Reconstruction Home at West Haverstraw; recently erected tuberculosis hospitals at Oneonta and Mount Morris; the State Institute for the Study of Malignant Diseases at Buffalo, and the recently completed Hermann M. Biggs Memorial Hospital at Ithaca are under the control of the department of health. Facilities for educating the blind are provided by the State school for the blind at Batavia and by private institutions where pupils are maintained on a *per caput* basis. The deaf and dumb are educated in private institutions. Such pupils as are appointed by the commissioner of education are maintained by the State. The condition of several of these State institutions was so unsatisfactory that in 1930 the State legislature voted an appropriation of $18,300,000 to assist the institutions in improving their facilities.

**Agriculture and Stock-raising.**—Although New York has lost in the competition with the Western States in the production of most of the grains, especially wheat, barley and Indian corn, and in the production of wool, mutton and pork, it has steadily progressed in the dairy business but has lost first rank as a hay producing State. It has made great advances, too, in the production of flowers, ornamental plants, nursery products, fruits, vegetables, poultry and eggs. The farm acreage in 1935 was 18,686,000 or 61.6% of the State's total land area. Of this total, 8,239,650 ac. were listed as crop land, 7,519,842 ac. as pasture land, and 2,061,284 ac. as woodland. The number of farms steadily decreased from 226,720 in 1900 to 177,025 in 1935. The average acreage per farm, in the latter year, was 106, a slight increase over the 99.9 ac. in 1900. More than 86.8% of the farms were operated by owners or part owners. The total value of all farm property in the state in 1935, according to the federal agricultural census of that year, was $1,044,391,981. In 1940 New York ranked first in the production of onions (4,108,000 sacks), beets (28,900 tons), and cabbage for kraut (72,800 tons). Of the total farm acreage, 178,370 ac. were devoted to truck farming on which, in addition to onions, beets and cabbage, 42,300 crates of strawberries were raised, 405,000 bu. of green peas, 1,780,000 bu. of tomatoes, 10,300 tons of soybeans, 36,800 tons of sweet corn, 262,000 bu. of cucumbers, 832,000 crates of lettuce, 2,104,000 crates of celery, 28,838,000 bu. of white potatoes, and 903,000 bags of edible beans. Many farms are devoted exclusively to the raising of fruit and on many others it is a side issue. The greater orchards are in the tier of counties bordering on the shores of Lake Ontario and Lake Erie and in Dutchess and Ulster counties in the Hudson river valley. Chautauqua county is the chief producer of grapes, but they are grown also in the region of Seneca and Keuka lakes and in the lower Hudson valley. The central New York grapes are used chiefly in wine making. In 1940 the state produced 12,936,000 bu. of apples, 1,670,000 bu. of pears, 22,130 tons of cherries, 1,380,000 bu. of peaches and 75,800 tons of grapes. While there are many truck and fruit farms, diversified farming is the rule with the land devoted to different crops and to dairying. The state long held first place as the producer of hay, but in 1940, with a crop of 5,554,000 tons, it fell to fourth place, yielding precedence to three states in the middle west. It raised 21,452,000 bu. of corn, 29,966,000 bu. of oats, 7,996,000 bu. of wheat, 3,799,000 bu. of barley, 423,000 bu. of rye and 2,194,000 bu. of buckwheat, or about one-third of the amount raised in the whole United States. On many farms there is a grove of sugar maples, locally known as sugarbush. These trees yielded in 1940 212,000 lb. of maple sugar and 734,000 gal. of syrup. In 1940 there were 2,137,000 cattle of all kinds on the farms, valued at $130,699,000. In addition there were 377,000 sheep and lambs, 309,000 horses and 259,000 hogs. There were also 14,830,000 chickens valued at $13,347,000, and 66,000 turkeys worth $206,000. The value of all livestock for 1940 was $203,905,000, compared with $192,269,000 for 1939. The total cash farm income for 1940 received from the sale of produce and livestock was $328,455,000. In addition the farmers received from the federal government $6,211,000, making a total cash income of $334,666,000.




RELATIVE IMPORTANCE OF NEW YORK STATE IN CERTAIN ASPECTS OF THE NATIONAL LIFE

**Minerals.**—More than 30 mineral substances are obtained in commercial quantities from the mines, quarries and wells of New York, but, because of the absence of coal and of petroleum in large quantities, it produced only 1.5% of the mineral wealth of the United States in 1938. New York in 1925 ranked 14th among the states of the union with a mineral production of $102,035,557. By 1938 these products had declined to $73,217,430. The table below shows the principal products and their values in that year:

| Product | Quantity | Value |
|---|---|---|
| Coke, short tons | 3,945,358 | $23,529,198 |
| Pig iron, long tons | 1,222,832 | 25,450,764 |
| Petroleum, barrels | 5,045,000 | 9,550,000 |
| Ferroalloys, long tons | 72,174 | 7,699,520 |
| Stone, short tons | 10,001,250 | 10,527,452 |
| Cement, barrels | 5,720,922 | 7,893,270 |
| Salt, short tons | 1,717,064 | 5,467,077 |
| Sand and gravel, short tons | 13,566,370 | 6,493,090 |
| Natural gas, M. cu. ft. | 39,402,000 | 19,419,000 |
| Gypsum, short tons | 611,394 | 941,744 |
| Zinc, short tons | 29,896 | 2,870,016 |
| Silver, troy ounces | 37,200 | 24,048 |

During 1938 New York ranked first among the states of the union in the production of abrasive garnet, crystalline graphite, gypsum, sand and gravel and talc, and was second in the production of salt, ferroalloys and stone.

**Manufactures.**—The establishment of a great highway of commerce through the State from New York city to Buffalo by the construction of the Erie canal, opened in 1825, and later by the building of railways along the line of the water route, made the State's manufactures quite independent of its own natural resources. Thus it happens that from Buffalo to New York city there is a chain of busy manufacturing centres; but away from the great natural route of commerce New York is not especially noteworthy either for its density of population or for extensive manufacturing and commerce.

New York State has ranked first in the Union in the value of its manufactures since 1830, and this value rose to $7,134,400,147 in 1939. The value ($4,168,582,102) of the products of the manufactures of New York city alone represented approximately 60% of the total. The manufacture of clothing, begun in New York city about 1835, was not only the city's chief product but was also the principal product of the State. The value of the clothing produced within New York city was $802,334,842 in 1933. New York city, also, ranked first among the American cities in printing and publishing ($338,216,363); fur goods ($66,321,087); millinery and lace goods ($62,271,489); bakery products ($140,139,613); sugar refining ($75,728,867); jewellery ($11,063,268); and manufactured gas ($88,066,368). Buffalo, the city second in manufactures, shares largely with New York city the business of slaughtering and meat-packing, the refining and smelting of copper, and the manufacture of foundry and machine-shop products. It is a principal centre for the manufacture of flour and grain mill products and for the motor vehicle industry. Rochester, the city third in manufactures, was first among the cities of the United States in the manufacture of photographic materials and apparatus and optical instruments. Niagara Falls and New York city manufacture a large part of the chemicals. Other cities with products valued at more than $25,000,000 in 1933 were: Albany, Binghamton, Schenectady, Syracuse, Troy and Utica.

The number of industrial establishments, with products over $5,000 in 1925, was 33,393. The 1,066,202 wage-earners in 1925 received $1,533,893,390 wages. The industries with products valued at more than $100,000,000 in 1925 were: clothing, $1,495,741,841; printing, publishing, $548,304,377; foundry and machine shop, $257,655,999; bread and bakery products, $248,166,437; furniture, $155,826,177; motor vehicles, $155,647,161; flour and grain mill products, $151,599,561; paper and wood pulp, $141,396,762; electrical machinery, $239,262,117; slaughtering and meat-packing, $233,901,277; fur goods, $197,437,970; millinery and lace goods, $197,324,664; boots and shoes, $191,375,288; knit goods, $183,233,931; sugar refining, $164,515,037; chemicals, $132,658,955; cigars and cigarettes, $122,613,390; silk, $112,156,313; food preparations, $111,134,193; steel works and rolling mills, $107,059,150; motor vehicle bodies and parts, $105,798,733; gas, manufactured, $102,859,050. In 1939 there were in the state 34,506 manufacturing establishments, each producing goods valued at more than $5,000. They employed 957,844 and paid $1,163,785,198 in wages. The value of their products was $7,134,400,147.

The chief products were: clothing, $917,563,506; printing and publishing, $426,760,806; motor vehicles and parts, $201,485,963; bakery products, $242,882,633; flour, $75,590,791; paper, $108,329,371; wholesale meat packing, $115,400,375; fur goods, $151,257,538; boots and shoes, $86,701,831; chemicals, $122,506,542; food preparations, $40,277,756; steel works and rolling mill products, $197,884,816; carpets and rugs, $64,123,427; malt liquors, $86,703,575; refined cane sugar, $79,738,320; paints and varnishes, $49,464,321; furniture, $45,773,341.

**Transport and Commerce.**—From the very beginning of the occupation of New York by Europeans, commerce was much encouraged by the natural water-courses. The Erie canal was opened to boats of about 75 tons burden in 1825. The Champlain canal, connecting the Erie with Lake Champlain, was completed in 1823. The Oswego canal, connecting the Erie with Lake Ontario, was begun in 1825 and completed in 1828. Several other tributary canals were constructed during this period, and between 1836 and 1862 the Erie was sufficiently enlarged to accommodate boats of 240 tons burden.

The first railway in the State and the second in operation in the United States was the Mohawk and Hudson, opened from Albany to Schenectady in 1831. The first great trunk line in the country was that of the Erie railway, opened from Piermont, on the Hudson river, to Dunkirk, on Lake Erie, in 1853. The New York Central railway, nearly parallel with the water route from New York city to Buffalo, was formed by the union, in 1869, of the New York Central with the Hudson River railway. In 1886 the New York Central Railroad company leased the West Shore railway for a term of 475 years, and this company operates another parallel line from Syracuse to Buffalo, a line following closely the entire north border of the State, and several cross lines. Other important railways are the Lehigh Valley, the Delaware, Lackawanna and Western, and the Pennsylvania in the central and western sections, the Delaware and Hudson, the Rutland, the Boston and Maine, the Central New England and the New York, Ontario and Western in the east, and the Long Island on Long island. In 1939 the operated steam railway mileage in New York was 7,786. In 1920 there were more than 2,000 mi. of electric street railways in operation in the state outside of New York city. This had fallen to less than 400 mi. in 1940, with the mileage constantly decreasing. In the same year there were 83,785 mi. of highways, 57,895 mi. of which were classified as improved and 14,043 mi. under state control. In competition with the railways, traffic on the existing canals suffered a marked decline. As this decline was accompanied with a considerable decrease in the proportion of the country's export which passed through the port of New York, interest in the canals revived, and in 1903 the electorate of the state authorized the issue of bonds to the amount of $101,000,000 for the purpose of increasing the capacity of the Erie, the Champlain and the Oswego canals, to make each navigable to barges of 1,000 tons burden. The project adopted by the state for the enlargement of the Erie provided for a new route up the Hudson from Troy to Waterford and then to the Mohawk river above the Cohoes falls. The improvement projects were completed in 1918. In addition to the canalized rivers and lakes (382 mi.), the state has a canal mileage of 525. The total tonnage carried by the state canals in 1940 was 4,768,160, of which 1,926,834 were eastbound and 2,843,326 were westbound. Of this total, 2,587,154 tons were through freight. The port of New York city, to which much of this was carried, is the greatest port in the world. A large proportion of the exports from the U.S.A. and imports into it pass through the New York customs district. For the year ending June 30, 1940, the total imports were valued at $1,218,864,675, of which $800,630,478 were free and $418,234,342 dutiable, on which a tariff of $158,103,242 was collected. The total exports were valued at $1,640,306,403. (G. W. Do.)

## HISTORY

The aboriginal inhabitants of New York had an important influence on its colonial history. Within its limits from the upper Hudson westward to the Genesee river was the home of that powerful confederacy of Indian tribes the Mohawks, Oneidas, Onondagas, Cayugas and Senecas, known to the French as the

Iroquois and to the English as the Five (later Six) Nations. When supplied with firearms by Europeans they reduced a number of other tribes to subjection and extended their dominion over most of the territory from the St. Lawrence to the Tennessee and from the Atlantic to the Mississippi. They were at the height of their power about 1700. Of much less influence in New York were several Algonkin tribes in the lower valley of the Hudson and along the sea coast.

**Early Dutch Traders and Colonists.**—New York bay and the Hudson river were discovered by Giovanni da Verrazano in 1524, and were probably seen by Esteban Gomez in 1525; for many years following, French vessels occasionally ascended the Hudson to trade with the Indians. The history of New York really begins, however, in 1609. In July of that year Samuel de Champlain discovered the lake which bears his name and on its shores led his Algonkin Indian allies against the Iroquois, thus provoking against his countrymen the hostility of a people who for years were to hold the balance of power between the English and the French in America. On Sept. 3 Henry Hudson, in the employ of the Dutch East India company, entered New York bay in the "Half Moon" in search of the "northwest passage." He conceived that a vast trade with the Iroquois for furs might be established. His report aroused great interest in Holland, and the United Netherlands, whose independence had been acknowledged in the spring, claimed the newly discovered country. In 1610 a vessel was despatched with merchandise suitable for traffic with the Indians, the voyage resulted in profit, and a lucrative trade in peltries sprang up. Early in 1614 Adriaen Block explored Long Island sound and discovered Block island. The merchants of Amsterdam and Hoorn soon formed themselves into the New Netherland company, and on Oct. 10, 1614, received from the States-General a three years' monopoly of the Dutch fur trade in New Netherland; *i.e.*, that part of America between New France and Virginia or between latitudes 40° and 45° north. Late in the same year or early in 1615 a stockaded trading post called Ft. Nassau was erected on Castle Island, now within the limits of Albany, and a few huts were erected about this time or earlier on the southern extremity of Manhattan island; but no effort at colonization was as yet made. On the expiration of the charter of the New Netherland company (1618) the States-General refused to grant a renewal, and only private ventures were authorized until 1621. When the West India company was first chartered for a term of 24 years, to it was given a monopoly of Dutch trade with the whole American coast, authorized to plant colonies and to govern them under a very limited supervision of the States-General. In June, 1623, however, New Netherland was formally erected into a province and the management of its affairs assigned to the chamber of Amsterdam, which in March, 1624, despatched the "New Netherland," with the first permanent colonists (30 families mostly Walloon), under Cornelis Jacobson Mey, the first governor or director of the colony. Arriving at Manhattan early in May, a few of the men remained there, but more than one-half of the families proceeded up the Hudson to Ft. Orange, and there founded what is now Albany. Three more vessels arrived in 1625, and when in that year Mey was succeeded as director by William Verhulst the colony had a population of 200 or more. The Government of the province was fully established in 1626 and was vested mainly in a director general and council. Peter Minuit, the first director general, arrived with more colonists in May, 1626, and soon afterwards Manhattan island was bought from the Indians, Ft. Amsterdam was erected at its lower end, and the settlement here was made the seat of Government.

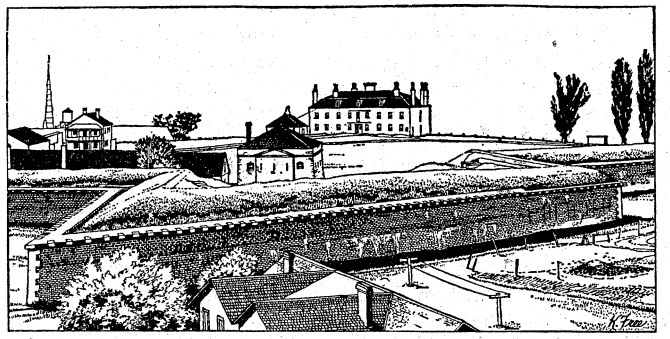
In 1629, mainly to promote agriculture, the company issued its famous charter of privileges and exemptions, which provided that any member might have anywhere in New Netherland except on Manhattan island his choice of a tract of unoccupied land extending 16 m. along the seacoast or one side of a navigable river, or 8 m. along the river on both sides "and so far into the country as the situation of the occupyers will permit" by purchasing the same from the Indians and planting upon it a colony of 50 persons, within four years from the beginning of the undertaking, and that any private person might with the approval of the director general and council take up as much land as he should be able to improve. The founder of a colony was styled a *patroon,* and, although the colonists were bound to him only by a voluntary contract for specified terms, the relations between them and the patroon during the continuance of the contract were in several important respects similar to those under the feudal system between the lord of a manor and his vassals. The single colony of Rensselaerwyck established by Killian van Rensselaer on both sides of the Hudson and extending in all directions from Ft. Orange (Albany), was the only one that prospered under the patroon system. In the meantime the patroons had claimed unrestricted rights of trade within the boundaries of their estates. These were stoutly denied by the company. Director-general Minuit was recalled in 1632 on the ground that he had been partial to the patroons; and Wouter van Twiller, who arrived in 1633, endeavoured to promote only the selfish commercial policy of the company; at the close of his administration (1637) the affairs of the province were in a ruinous condition.

William Kieft was appointed director-general late in 1637, and in 1638 the company abandoned its monopoly of trade in New Netherland and gave notice that all inhabitants of the United Provinces, and of friendly countries, might trade there subject to an import duty of 10%, an export duty of 15%, and to the requirement that the goods should be carried in the company's ships. At the same time the director-general was instructed to issue to any immigrant applying for land a patent for as large a farm as he required for cultivation and pasturage, to be free of all charges for ten years and thereafter subject only to a quit-rent of one-tenth of the produce. Two years later, by a revision of the charter of privileges and exemptions, the prohibition on manufactures was abolished, the privileges of the original charter with respect to patroons were extended to "all good inhabitants of the Netherlands," and the estate of a patroon was limited to four miles along the coast or a navigable river and eight miles back into the country. These inducements encouraged immigration not only from the Fatherland but from New England and Virginia. But the freedom of trade promoted dangerous relations with the Indians, and an attempt of Kieft to collect a tribute from the Algonkin tribes in the vicinity of Manhattan island and other indiscretions of this officer provoked Indian hostilities (1641–45), during which most of the outlying settlements were laid waste.

Out of this warfare arose an organized movement for a Government in which the colonists should have a voice. In Aug. 1641, Kieft called an assembly of the heads of families in the neighbourhood of Ft. Amsterdam to consider the question of peace or war. The assembly chose a board of 12 men to represent it, and a few months later this board demanded certain reforms, but Kieft later denied its authority to exact promises from him, and dissolved it. At another crisis in 1643, he was obliged to call a second assembly of the people. This time a board of eight men was chosen to confer with him. It denied his right to levy certain war taxes, and when it had in vain protested to him against his arbitrary measures it sent a petition, in 1644, to the States-General for his recall, and this was granted. Peter Stuyvesant (*q.v.*), his successor, arrived at Ft. Amsterdam in May, 1647. Under his rule there was a return of prosperity; from 1653 to 1664 the population of the province increased from 2,000 to 10,000. Stuyvesant was, however, extremely arbitrary. Although he permitted the existence of a board of nine men to act as "tribunes" for the people he treated it with increasing contempt.

**English Occupation.**—Notwithstanding the good claim to their province which the Dutch had established by discovery and occupancy, the Government of Great Britain, basing its claim to the same territory on Cabot's discovery (1498), the patent to the London and Plymouth companies (1606), and the patent to the Council for New England (1620), contended that the Dutch were intruders, and by the Treaty of Hartford (1650), the commissioners of the United Colonies of New England forced Stuyvesant to agree to a boundary which on the mainland roughly determined the present boundary between New York and Connecticut and on Long Island extended from Oyster bay to the Atlantic ocean. In

1653, the Dutch, fearing an English attack, built a wall, from which the present Wall street was named, across Manhattan island at what was then the northern limits of New Amsterdam. In March 1664, Charles II. formally erected into a province the whole territory from the west side of the Connecticut river to the east side of Delaware bay together with the whole of Long Island and granted it to his brother James, the duke of York and



OLD FORT NIAGARA, SHOWING RAMPARTS AND HISTORIC BUILDINGS
Fort Niagara, located a short distance from Niagara Falls, was a gateway to the West in frontier days. In the right background is the French castle, built in 1726. The bakehouse, beside it, was erected by the English in 1762. In the foreground is the English blockhouse, dating from 1771–73

Albany, as its lord proprietor. The duke appointed Col. Richard Nicolls governor and placed him in command of an expedition to effect its conquest. Nicolls won over the burgomaster of New Amsterdam and other prominent citizens by the favourable terms which he offered, and Stuyvesant was forced, without fighting, into a formal surrender on Sept. 8. The duke's authority was proclaimed and New Netherland became New York. Among numerous changes from Dutch to English names was that from Ft. Orange to Ft. Albany. A treaty of alliance with the Mohawks and Senecas procured for the English the same friendly relations with the Iroquois that the Dutch had enjoyed. The transition from Dutch to English institutions was effected gradually and the private rights of the Dutch were carefully preserved. The introduction of English institutions into settlements wholly or largely English was begun in 1665 by the erection of Long Island, Staten Island and Westchester into an English county under the name of Yorkshire, and by putting into operation in that county a code of laws known as the "Duke's Laws." It gave the freeholders of each town a voice in the government of their town by permitting them to elect a board of eight overseers and a constable. The board sat as a court for the trial of small causes. Nicolls resigned the governorship in 1668, but his successor, Francis Lovelace, continued his policy—autocratic government, arbitrary in form but mild in practice, and progressive in the matter of religious toleration.

In Aug. 1673, Holland and England being at war, a Dutch fleet surprised New York, captured the city, restored Dutch authority and the names of New Netherland and New Orange. But by the Treaty of Westminster, Feb. 1674, the Dutch title to the province was finally extinguished, and in November the English again took possession. In 1675 Governor Andros established at Albany a commission for Indian affairs which long rendered important service in preserving the English-Iroquois alliance. The imperious manner of Andros made him many enemies. Some of them preferred charges against him relating to his administration of the revenue. He was called to England in 1681 to answer these, and during his absence the demand for a representative assembly was accompanied by a refusal to pay the customs duties and so much other insubordination that the duke appointed Col. Thomas Dongan to succeed Andros, and instructed him to call the desired assembly. It met at Ft. James in the City of New York on Oct. 17, 1683, was in session for about three weeks, and passed 15 acts. The first, styled a charter of liberties and privileges, required that an assembly elected by the freeholders and freemen should be called at least once every three years; vested all legislative authority in the governor, council and assembly; forbade the imposition of any taxes without the consent of the assembly; and provided for religious liberty and trial by jury.

The king, in an attempt to strengthen the imperial control over New England as well as to erect a strong barrier against the French, in 1688 consolidated New York and New Jersey with the New England colonies into the Dominion of New England and placed it under the viceregal authority of Sir Edmund Andros as governor-general. The news of the English revolution of 1688, however, caused an uprising in Boston, and in April 1689 Andros was seized and imprisoned. The fall of Andros encouraged a number of the restless spirits, especially in the City of New York and on Long Island to take matters into their own hands. They found a leader in a German merchant, Jacob Leisler (*q.v.*). On May 31, 1689, the militia captains seized Ft. James and Leisler assumed command later. In the following month Nicholson, the lieutenant-governor, deserted his post and sailed for England, and Leisler easily gained possession of the city. He called an assembly which conferred upon him the powers of a dictator. Some time after a copy of the order of the new monarchs (William and Mary) to continue all Protestants in their offices in the colonies had been received, Leisler falsely announced that he had received a commission as lieutenant-governor. Albany defied his usurped authority until his recognition was necessary to present a united front against the French and their Indian allies, who, in Feb. 1690, had surprised and burned Schenectady. French attacks had at the same time been directed against New England, and to meet the dangerous situation Leisler performed the one statesmanlike act of his public career, notable in American history as the first step toward the union of the colonies. At his call, delegates from Massachusetts, Plymouth, Connecticut and Maryland met in New York city with delegates from New York on May 1, 1690 to consider concerted action against the enemy, although the expedition which they sent out was a failure. Leisler had proclaimed the new monarchs of Great Britain and had declared that it was his purpose only to protect the province and the Protestant religion until the arrival of a governor appointed by them, but he was enraged when he learned that he had been ignored and that Col. Henry Sloughter had been appointed as the new governor. Leisler refused to give up the fort, and after some bloodshed was arrested and executed. The execution was regarded by many as an act of revenge, and for many years the province was rent by the Leislerian and anti-Leislerian factions.

Governor Sloughter, as his commission directed, re-established in 1691 the assembly which James II. had abolished in 1686, and throughout the remainder of the colonial era the history of the province relates chiefly to the rise of popular Government and the defence of the northern frontier. Until Gov. Cornbury's administration (1702–08) both the Leislerians and the anti-Leislerians repeatedly bid for the governor's favour by supporting his measures instead of contending for popular rights. But Cornbury's embezzlement of £1,500, appropriated for fortifying the Narrows connecting upper and lower New York bay, united the factions against him and started the assembly in the important contest which ended in the establishment of its control over the public purse. In 1706 it won the right to appoint its own treasurer to care for money appropriated for extraordinary purposes, and in 1737 the custom of continued revenue acts was replaced by annual appropriations.

The first newspaper of New York, the *New York Gazette,* was established in 1725 by William Bradford, as a semi-official organ of the Administration. In 1733 a popular organ, the *New York Weekly Journal,* was established under John Peter Zenger (1697–1746), and in 1735 both the freedom of the press and a great advance towards the independence of the judiciary were the outcome of a famous libel suit against Zenger. He was arrested for libel in Nov. 1734 for printing criticisms of the administration. When his counsel, James Alexander (1690–1756) and William Smith (1679–1769), took exception to the commissions of the chief justice, James de Lancey (1703–60) and one of his associates, because by these commissions the justices had been appointed "during pleasure" instead of "during good behaviour," the chief justice disbarred them. Their places, however, were taken by Andrew Hamilton, speaker of the assembly of Pennsyl-

vania and a lawyer of great reputation in the English colonies. The jury quickly agreed on a verdict of not guilty, and the acquittal was greeted by the populace with shouts of triumph. The further independence of judges became a leading issue in 1761 when the assembly insisted that they should be appointed during good behaviour, and refused to pay the salaries of those appointed during pleasure; but the home Government met this refusal by ordering that they be paid out of the quit-rents.

**The Defence of the Northern Frontier** was a heavy burden to New York, but by its problems the growth of the union of the colonies was promoted. The main effort of the French, however, was, by diplomacy, to destroy the English-Iroquois alliance. To counteract the influence of French priests dwelling among the Iroquois, the English, in 1701, prevailed upon the chiefs to deed their territory, said to be 800 m. in length and 400 m. in breadth, to the king of England. The English, also, frequently distributed presents. But the success of the French at the close of the 17th century and the early portion of the 18th was prevented only by the ceaseless efforts of Peter Schuyler (1657–1724) whose personal influence was for years dominant among all the Iroquois except the Senecas. When they had assumed a neutral attitude, he persuaded a number of them to join troops from New York, New Jersey and Connecticut in the unsuccessful expeditions of 1709 and 1711 against the French at Montreal. In order to regulate the trade with the Iroquois, Governor Burnet established a trading post at Oswego in 1722 and fortified it in 1727 and thereby placed the Iroquois in the desirable position of middlemen in a profitable fur trade with the "Far Indians." In King George's war New York was left alone to protect its own frontier and while the assembly was wrangling with Governor Clinton for the control of expenditures the French and their Indians were burning farm houses, attacking Saratoga (Nov. 17, 1745), and greatly endangering the English-Iroquois alliance. A reconciliation was effected, however, by Col. (later Sir William) Johnson (*q.v.*), a former agent of Indian affairs. Largely to secure the co-operation of the Iroquois the home Government itself now called the most important assembly of colonial deputies that had yet gathered to meet at Albany (*q.v.*). This body, consisting of 23 commissioners and representing seven colonies, met in June 1754, and, besides negotiating successfully with the Iroquois, it adopted, with some modifications, a plan of colonial union prepared by Benjamin Franklin; the plan was not approved, however, either by the home Government or by any of the colonies. In the first year of the French and Indian war (1755) Maj.-Gen. William Johnson defeated a French and Indian force under Baron Dieskau in the battle of Lake George. In Aug. 1756 Montcalm took Oswego from the English and destroyed it, and in 1757 he captured Ft. William Henry; but in the latter year the elder Pitt assumed control of affairs in England, and his aggressive, clear-sighted policy turned the tide of war in England's favour. Victory followed victory, Ticonderoga, Crown Point and Niagara were wrested from the French and New York was freed of its foes.

**The Revolutionary War.**—England's attempt to make the colonies pay the expenses of the war by means of the stamp tax thoroughly aroused the opposition of commercial New York, already chafing under the hardships imposed by the Navigation Acts and burdened with a war debt of its own exceeding £300,000. The assembly authorized its committee, which had been appointed to correspond with the New York agent in London, to correspond also with the committees in the other colonies and this committee represented New York in the Stamp Act Congress, which met in New York city in Oct. 1765. In the series of events which followed important changes were made in party lines. The court party and propertied classes became the Loyalist Party, standing for law as against rebellion, monarchy and the union of the empire as against republicanism; the popular party became the Patriot Party, determined to stand on its rights at any cost. The Stamp Act was repealed in March 1766, but the Townshend acts were met in New York by fresh outbursts of the Sons of Liberty and, by an association of merchants, the members of which pledged themselves not to import anything from England until the duties were repealed. New York had also been requested to provide certain supplies for the British troops quartered in the city. This the assembly refused to do but parliament answered (1767) by forbidding it to do any other business until it complied. It was under these conditions that the Loyalists, in the elections of 1768 and 1769, gained control of the assembly and in the latter year passed an act granting the soldiers' supplies. The moderate Loyalists joined in the election of delegates to the first Continental Congress; but the great body of Loyalists in New York strongly disapproved of the "dangerous and extravagant" measures adopted by that body, and the assembly, in Jan. 1775, refused to approve its acts or choose delegates to the second Continental Congress. The Patriots met this refusal by calling a provincial convention to choose the delegates. Scarcely had they done this when news of the encounter at Lexington produced a strong reaction in their favour, and in May 1775 they called a Provincial Congress which usurped the powers of the assembly. Still, conditions were such in New York that a fight for independence was not to be lightly considered. In the south the chief city was exposed to the British fleet, and the northern border was exposed to attack from the British and their Iroquois allies. In various sections, too, considerable numbers of Loyalists were determined to aid the British. When, in June 1776, a vote on the Declaration of Independence was pending in the Continental Congress, the New York Provincial Congress refused to instruct its delegates in the matter; but a newly elected Provincial Congress, influenced by a Loyalist plot against the life of Washington, adopted the Declaration when it met, July 9.

It was a settled point of British military policy throughout the war to hold New York city, and from it, as a base, to establish a line of fortified posts along the Hudson by means of which communication might be maintained with another base on Lake Champlain. Such a scheme, if successfully carried out, would have driven a wedge into the line of colonial defence and cut off communication between New England and the southern colonies. A few days after the fight at Lexington and Concord, Connecticut authorized an expedition under Ethan Allen which surprised and captured Ticonderoga and Crown Point. In the following year (1776) the British began their offensive operations for the control of the Hudson. Sir William Howe, with a force of British and Loyalists vastly superior in equipment and numbers to Washington's untrained militia, landed in July on Staten Island and late in August defeated Washington at the battle of Long Island within the present limits of Brooklyn borough. In the following month Washington withdrew from New York city which the British entered and held until the close of the war. Washington prepared to withstand the British behind fortifications on Harlem Heights, but discovering that Howe was attempting to outflank him by landing troops in the rear he retreated to the mainland, leaving only a garrison at Ft. Washington, and established a line of fortified camps on the hills overlooking the Bronx river as far as White Plains. This brought on the battle of White Plains late in October, in which Howe gained no advantage; and from here both armies withdrew into New Jersey, the British capturing Ft. Washington on the way. In 1777 General John Burgoyne succeeded in taking Ticonderoga, but in the swampy forests southward from Lake Champlain he fought his way against heavy odds, and in the middle of October his campaign culminated disastrously in his surrender at Saratoga. Col. Barry St. Leger led an auxiliary expedition from Oswego against Ft. Stanwix on the upper Mohawk, and on Aug. 6 he fought at Oriskany one of the most bloody battles of the war, but a few days later, deserted by his terror-stricken Indian allies, he hastened back to Montreal. Early in October Howe sent an expedition up the Hudson under the command of Sir Henry Clinton. Clinton met with little difficulty from the principal American defences of the Highlands, consisting of Fts. Montgomery and Clinton on the western bank, together with a huge chain and boom stretched across the river to a precipitous mountain (Anthony's Nose) on the opposite bank, and ascended as far as Esopus (now Kingston) which he burned, but he was too late to aid Burgoyne. The year 1778 saw the bloody operations of the Tory Butlers and their Loyalist and Indian allies in the Mohawk and Schoharie valleys and notably the massacre at

Cherry valley. In retaliation a punitive expedition under Generals John Sullivan and James Clinton in 1779 destroyed the Iroquois towns, and dealt the Indian confederacy a blow from which it never recovered. The American cause was strengthened this year also by several victories along the lower Hudson of which General Anthony Wayne's storming of the British fort at Stony Point was the most important. The closing episode of the war as far as New York was concerned was the discovery of Benedict Arnold's attempt in 1780 to betray West Point and other colonial posts on the Hudson to the British. On Nov. 25, 1783, the British forces finally evacuated New York city, but the British posts on Lakes Erie and Ontario were not evacuated until some years later.

New York ratified the Articles of Confederation in 1778, and when Maryland refused to ratify unless those States asserting claims to territory west to the Mississippi agreed to surrender them, New York was the first to do so. But under the leadership of George Clinton, governor in 1777–95, the State jealously guarded its commercial interests. This led to determined opposition to the new Federal Constitution. In support of the Constitution, however, there arose the Federalist party under the able leadership of Alexander Hamilton. When a majority of the Constitutional Convention of 1787 had approved of the new Constitution, Hamilton alone of the three New York delegates remained to sign it; and when, after its ratification by eight States, the New York Convention met at Poughkeepsie (June 17, 1788) to consider ratification, two-thirds of the members were opposed to it. But others were won over by the news that it had been ratified by New Hampshire and Virginia or by the telling arguments of Hamilton, and on July 26 the motion to ratify was carried by a vote of 30 to 27.

**Elections and Legislation.**—The Constitution having been ratified, personal rivalry among the great families—the Clintons, the Livingstons and the Schuylers—again became dominant in political affairs. The Livingstons, piqued at Washington's neglect to give them the offices they thought their due, joined the Clintons, but the Federal patronage was used against the anti-Federalists or Republicans with such effect that in 1792 John Jay received more votes for the governorship than George Clinton, although the latter was counted in on a technicality. Jay was elected in 1795 and re-elected in 1798, but in 1801 the brief Federalist *régime* in the State came to an end with the election of George Clinton for a seventh term. The Republican leaders straightway quarrelled among themselves, thus starting the long series of factional strifes which have characterized the party politics of New York State. The leaders of the several Republican groups were Chancellor Robert R. Livingston, Aaron Burr, then vice-president, Governor George Clinton and his nephew, De Witt Clinton, who in 1802 was elected United States senator. The first break came in the spring of 1804 when Burr, who had incurred the enmity of his Republican colleagues in 1800 by seeking Federalist votes in the electoral college at Jefferson's expense, became an independent candidate for the office of governor against Morgan Lewis. Hamilton's action in counselling Federalists not to vote for Burr just as he had counselled them not to support Burr against Jefferson in 1800, was one of the contributary causes of Burr's hostility to Hamilton which ended in the duel (July 1804) in which Burr killed Hamilton. Hamilton's death marked the end of the Federalists as a power in New York. New York, whose growing shipping interests had suffered by the Embargo of 1807, was as a commercial State opposed to the war of 1812 with Great Britain. Politically this opposition had the effect of temporarily reviving the Federalist Party, which secured control of the legislature, and gave the electoral vote of the State in 1812 to De Witt Clinton, whom the Federalists had accepted as a candidate to oppose Madison for re-election on the war issue. During the war New Yorkers served with the regular troops at Niagara, Plattsburg and other places on the western and northern frontiers of the State. For some years after the war political contests in New York State as in the rest of the country were not on party lines. De Witt Clinton was elected governor and, largely through his efforts, the Erie canal was begun.

The election of Martin Van Buren as governor in 1828 marked the beginning of the long ascendancy in the State of the "Albany Regency," a political coterie in which Van Buren, W. L. Marcy, Benjamin Franklin Butler (1795–1858) and Silas Wright were among the leaders. Thurlow Weed, their bitterest opponent and the man who gave them their name, declared of them that he "had never known a body of men who possessed so much power and used it so well." Thurlow Weed owed his early political advancement to the introduction into State politics of the anti-Masonic issue (*see* ANTI-MASONIC PARTY), which also brought into prominence his co-worker W. H. Seward. As the anti-Masonic wave subsided, its leaders and most of its adherents found a place in the newly organized Whig Party which was powerful enough in New York to elect William H. Seward governor in 1838, and to re-elect him and to carry the State for W. H. Harrison against Van Buren in 1840. It was during the first administration of Governor Seward that the anti-rent agitation in the Hudson river counties began. Vast estates in Albany, Rensselaer, Columbia, Schoharie, Delaware, Sullivan and other counties were the seats of disturbance. Besides rent, many of the tenants were required to render certain services to the proprietor, and in case a tenant sold his interest in a farm to another he was required to pay the proprietor one-tenth to one-third of the amount received as an alienation fine. Politically, the anti-rent associations which were formed often held the balance of power between the Whigs and the Democrats, and in this position they secured the election of Governor John Young (Whig) as well as of several members of the legislature favourable to their cause, and promoted the passage of the bill summoning the Constitutional Convention of 1846. In the new Constitution clauses were inserted abolishing feudal tenures and limiting future leases of agricultural land to a period of 12 years. The courts pronounced the alienation fines illegal. Under the pressure of public opinion the great landlords rapidly sold their farms. Up to the election of Seward as governor, New York had usually been Democratic, largely through the predominating influence of Van Buren and the "Albany Regency." After the defeat of Governor Silas Wright in 1846, however, the Democratic Party split into two hostile factions known as the "Hunkers," or conservatives, and the "Barnburners," or radicals. The factions had their origin in canal politics, the conservatives advocating the use of canal revenues to complete the canals, the radicals insisting that they should be used to pay the State debt. Later when the conservatives accepted the annexation of Texas and the radicals supported the Wilmot Proviso the split became irrevocable. Only once between 1846 and the Civil War did the Democratic Party regain control of the State—in 1853–55 Horatio Seymour was governor for a single term. A succession of Republican governors then held office until 1862 when discouragement in the north with respect to the Civil War brought a reaction which elected Seymour governor.

With the exception of New York city the State was loyal to the Union cause during the war and furnished over half a million troops to the Federal armies. Certain commercial interests of New York city favoured the Confederate cause, but Mayor Wood's suggestion that the city (with Long Island and Staten Island) secede and form a free-city received scant support, and after the sanguinary draft riots of July 1863 (*see* NEW YORK CITY), no further difficulty was experienced.

After the Civil War the State began to reassume the pivotal position in national politics which has always made its elections second only in interest and importance to those of the nation, and the high political tension emphasized the evils of the "spoils system." In 1868 John T. Hoffman, a favourite of Tammany Hall, was chosen governor on the Democratic ticket. Tammany and Hoffman were again victorious in 1870; but in 1871 the New York *Times* disclosed the magnitude of the Tweed "Ring's" thefts, amounting in the erection of the New York county court house alone to almost $8,000,000, and Tweed and his "Ring" were crushed in consequence. The Republicans carried the State in 1872, but in 1874 Samuel J. Tilden, a Democrat and the leading prosecutor of Tweed, was elected governor. The Republican legislature had in 1867 appointed a committee to investigate the management of the canal system, but the abuses were allowed to con-

tinue until in 1875 Governor Tilden disclosed many frauds of the "Canal Ring," and punished the guilty. In 1876, Tilden having been nominated for the presidency, New York cast its electoral vote for him. In 1880 it was cast for Garfield, the Republican nominee. Two years later the Republicans, having split over a struggle for patronage into the two factions known as "Half-breeds," or the Administration Party, and "Stalwarts" of whom the leader was Roscoe Conkling, were defeated, Grover Cleveland being chosen governor. In 1884 Cleveland as the Democratic presidential nominee received the electoral vote of his State. In 1888 Benjamin Harrison, the Republican candidate, the factional quarrels being settled, carried New York, but in 1892 Cleveland again carried the State. Hostility to free silver and "Bryanism" in the large financial and industrial centres put the State strongly in the Republican column in the State and national elections from 1894 to 1910. In the election of Nov. 1910 the Democrats carried not only the State but also the legislature, and John A. Dix was elected governor.

The Democrats again carried the State and the legislature in Nov. 1912, and Sulzer became governor. In the presidential contest, the Democrats carried the State for the first time in 20 years.

In April 1913, Governor Sulzer sent a special message to the legislature urging a direct primary law that would abolish party conventions. The legislature refused to enact the primary bill, and the governor vetoed the legislative substitute. When the legislature recessed on July 23 the governor declared the special session adjourned, but the legislature reassembled on Aug. 11. Two days later the assembly voted to impeach the governor; on Oct. 17 he was removed from office and Martin H. Glynn, lieutenant-governor, succeeded.

The Republicans were successful in the elections of Nov. 1914, and Whitman became governor, and in 1916 was re-elected. In the November election, 1918, Alfred E. Smith (Democrat) was elected governor by a small plurality of about 15,000. Most of the other State officers and the legislature, however, remained Republican. One of the most important laws of the year provided for an income tax of from 1% to 3%. Shortly after his inauguration Smith appointed a non-partisan reconstruction commission to investigate the problem of a fundamental reorganization of the State Government, and to consider other important problems of reconstruction resulting as an aftermath of World War I. This commission recommended an executive budget and the consolidation of the numerous administrative agencies.

In 1920, a presidential election year, the Republican candidate, Nathan L. Miller, won over the Democrat, Alfred E. Smith, by 74,066 votes. The direct primary was abandoned and the convention system restored for the nomination of State and judicial officers. The 1922 legislature authorized life-insurance companies to invest 10% of their assets in new buildings for dwelling purposes; extended the emergency rent laws to 1924 and fixed assessments as the basis for determining the reasonableness of rents. Women were given representation on county party committees. A home rule amendment was adopted. The 1922 election resulted in the selection of Alfred E. Smith as governor by an absolute majority of 269,609 votes.

In the autumn elections (1923) the voters approved an amendment extending to cities a large measure of home rule. The referendum on a bond issue for $50,000,000 for new hospitals was likewise approved. An important measure of the session was the Home Rule Enabling Act, designed to carry out the amendment adopted the previous year. This law, drafted by the State home rule commission, was adopted unanimously by both houses of the legislature. The New York amendment differs from constitutional provisions in some other States in that it grants powers in general terms. In the presidential election of 1924 the Republicans carried the State by a majority of 383,813. Gov. Smith, however, was re-elected but the Republican candidates for the other six elective State offices were successful, and the legislature became more strongly Republican. In the fall election of 1925 the voters approved four constitutional amendments. The most important provided for the governor's plan of consolidating the numerous State administrative agencies into 19 departments. In 1926 the Democrats succeeded in re-electing Governor Smith though the legislature remained Republican in both branches. Again in 1928 they won the governorship for their candidate, Franklin D. Roosevelt, but failed to carry the State in the presidential contest for Governor Smith. In the election of 1932 New York cast its vote in favour of the national Democratic ticket, headed by Governor Franklin D. Roosevelt, and elected Herbert H. Lehman, a Democrat, as governor. Governor Lehman was re-elected in 1934, 1936 and 1938, the last time for a term of four years. The Democrats carried the State in the national elections in 1936, 1940 and 1944, although Thomas E. Dewey, a Republican, was elected governor in 1942. In the 1944 national election, Dewey, running against Roosevelt for the presidency, was defeated by a majority of 316,013 in New York State. Roosevelt's plurality had been 1,112,265 in 1936 and 231,350 in 1940.

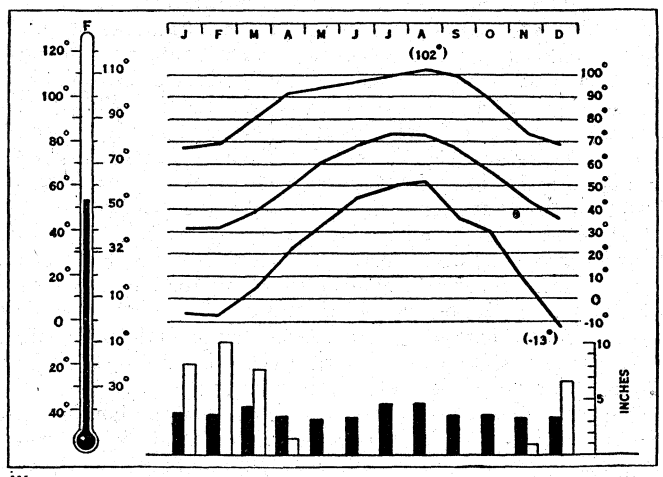
BIBLIOGRAPHY.—(1.) *Physical Features and Climate:*—R. S. Tarr, *Physical Geography of New York State* (1902), with a chapter on climate by E. T. Turner; *Reports of the New York Geological Survey from 1842 to 1854; Reports of the Topographical Survey of the Adirondack Region of New York* (1873–80); *Reports of the New York Meteorological Bureau* (1889 *seq.*); and publications of the United States weather bureau; for Fauna and Flora see *Reports of the Conservation Departments;* and *Bulletins of the New York State Museum* (1888 *seq.*). (2.) *Government:*—Report of the State Reorganization Commission issued as *Legislative Document No. 72 State of New York* (1926); the annual volumes of the *State Legislative Manual;* and the *Reports* of the various State departments, especially the *Annual Reports of State Education Department;* C. Z. Lincoln, *The Constitutional History of New York* (1906), an elaborate and able study of the growth of the Constitution; *History of the State of New York, Political and Governmental* ed. R. B. Smith (1922); E. H. Roberts, *New York: The Planting and Growth of the Empire State* (1896) is a popular but rather superficial treatment of the entire period. The early historical documents of the State were collected by E. B. O'Callaghan in his *Documentary History of the State of New York* (1849–51); and more completely by J. R. Brodhead in *Documents Relating to the Colonial History of the State of New York Procured* (vols. i. xi. edited by E. B. O'Callaghan and xii.–xv. by B. Fernow 1853–83); O'Callaghan also edited *A Calendar of Historical Manuscripts in the Office of the Secretary of State in New York* (1865–66); and wrote a *History of New Netherland* (1846); J. R. Brodhead, *History of the State of New York* (1853 and 1871) is a standard work on the early history. Mrs. M. J. Lamb's *History of the City of New York* (1877) and Mrs. S. Van Rensselaer's *History of the City of New York in the Seventeenth Century* (1909) include the history of the province. W. Smith's *History of the Late Province of New York, from its Discovery to 1762* (1st part, 1757, reprinted in the 1st series of the New York Historical Society *Collections,* 1829–30) is still the chief authority for the period from the English Revolution of 1688 to the eve of the Revolutionary War. For the same period, however, consult C. W. Spencer, *Phases of Royal Government in New York, 1691–1719* (1905); John Fiske, *The Dutch and Quaker Colonies in America* (1900) which is admirable in its generalizations but unreliable in its details; M. W. Goodwin, *Dutch and English on the Hudson; a Chronicle of Colonial New York* (1919); G. W. Schuyler, *Colonial New York: Philip Schuyler and his Family* (1885), a family history, but especially valuable in the study of Indian affairs and the intermarriages of the landed families; C. Colden, *A History of the Five Indian Nations* (London 1747 and many later editions) and Francis W. Halsey, *The Old New York Frontier* (1901); A. C. Flick's *Loyalism in New York during the American Revolution* (1901) and H. P. Johnston's *Campaign of 1776 around New York and Brooklyn* (1878) are thorough studies. For the military history of the Revolutionary War *see* also J. Winsor's *Narrative and Critical History of America,* vol. vi. (1888). For strictly political history *see* a series of articles by Carl Becker in the *American Historical Review,* vols. vi., vii. and ix., and the *Political Science Quarterly,* vol. xviii., J. D. Hammond's *History of Political Parties in the State of New York* (1842); D. S. Alexander's *Political History of the State of New York* (1906–23); and D. R. Fox, *The Decline of Aristocracy in the Politics of New York* (1918). *See* also E. P. Cheney, *The Anti-Rent Agitation in the State of New York* (1887); C. McCarthy, *The Anti-Masonic Party* (1902); N. E. Whitford, *History and the Canal System of the State of New York* (1906); and D. C. Sowers, *The Financial History of New York from 1789 to 1912* (1914). *See* also J. Sullivan, ed., *History of New York State,* 8 vol. (1927–32); A. C. Flick, ed., *History of the State of New York,* 8 vol. (1933–35); *New York, a Guide to the Empire State,* Federal Writers' Project, WPA (1940); U.S. Census Bureau *Reports.* (A. E. SM.; X.)

**NEW YORK (CITY),** the largest city in the United States, is situated at the mouth of the Hudson river, here sometimes called the North river. The five boroughs comprising the city are: the Bronx (Bronx county), 41 sq.mi., on the southeastern-

most part of the mainland adjoining Westchester county and separated from the borough of Manhattan by the Harlem river (a canalized waterway connecting the Hudson and East rivers); Manhattan (New York county), 22 sq.mi., on Manhattan island between the Hudson and East rivers; Queens (Queens county), 108 sq.mi.; Brooklyn (Kings county), 71 sq.mi., on the western end of Long island, adjoining Nassau county and separated from the Bronx and Manhattan by the East river; and Richmond (Richmond county), 57 sq.mi., on Staten island southwest of Brooklyn and separated from it by the Narrows (a strait connecting Upper and Lower bays) and from the mainland of the state of New Jersey by tidal estuaries known as Kill van Kull and Arthur Kill. The city hall, near the southern end of Manhattan island, is in lat. 40° 42′ 43″ N., and long. 74° 0′ 29″ W. The greatest width of the city, east and west, is 24 mi. and the greatest length, northeast and southwest, is 35 mi. The land area is 299 square miles. The city's more important small islands are: North and South Brother, Riker's, City, Hunter, Hart, Governor's (occupied by a U.S. military reservation), Welfare (formerly Blackwell's), Ward's, Randall's (the latter three occupied by state and city institutions) and numerous islands in Jamaica bay. Bedloe's island (on which stands the Bartholdi statue of Liberty) and Ellis island (occupied by the federal government as an immigrant station) are in Upper bay, within the bounds of New Jersey.

The total water front is 578 mi., of which Manhattan has 43 mi.; Brooklyn, 201 mi.; the Bronx, 80 mi.; Queens, 197 mi.; and Richmond, 57 miles.

**Population.**—In 1626 there were fewer than 200 inhabitants, 1,000 in 1656, and but 14,000 in 1760. About 1783 New York began its rapid growth as the leading port. Between 1786–96 the population had nearly doubled, and by 1871 it was 1,000,000. In 1920 the total population was 5,620,048; in 1940, 7,454,995, divided as follows: Manhattan 1,889,924, Bronx 1,394,711, Brooklyn 2,698,285, Queens 1,297,634, Richmond 174,441. The




WEATHER GRAPH OF NEW YORK CITY. THE THERMOMETER INDICATES NORMAL ANNUAL MEAN TEMPERATURE. THE CENTRE CURVE SHOWS NORMAL MONTHLY MEAN TEMPERATURE; THE CURVES ABOVE AND BELOW, THE HIGHEST AND LOWEST EVER RECORDED IN EACH MONTH. THE COLUMNS INDICATE THE NORMAL MONTHLY PRECIPITATION; THE SHADED COLUMN, TOTAL PRECIPITATION (INCLUDING MELTED SNOW); THE WHITE COLUMN, SNOWFALL

increase in the decade 1930–40 was 524,549 or 7·6%. In 1898 five boroughs were united to form Greater New York.

The Negro population (327,706 in 1930) is centred in the Harlem district, between 116th and 150th streets, in an area bounded on the east by Fifth avenue and on the west by St. Nicholas avenue. The Chinese quarter is in the neighbourhood of Chatham square, on Mott, Pell and Doyers streets. Congestion of population somewhat diminished after 1910 as a result of rapid transit facilities and the movement to suburban areas. Density of population in 46 blocks of the "Lower East Side" declined from 970 persons per acre in 1905 to 438 per acre in 1930 according to the report of the Cities Census commission, Inc., and that of the adjacent "Lower West Side" blocks dropped from 1,013 to 462. In the same period the figures for the "Upper East Side" fell from 853 to 546. A high proportion of New York's population in these areas is foreign-born or of foreign parentage. For all three districts the average reduction of congestion during the period was about 50 per cent. The city of New York has more Jews than any other city, approximately 1,800,000; the centre of the Jewish population has recently shifted from the borough of Manhattan to Brooklyn.

**Harbour.**—The harbour is naturally divided into several parts. At the entrance from the Atlantic is the outer harbour (about 122 sq.mi.), known as Lower bay. Raritan bay lies adjacent to the Lower bay on the west and Raritan river and Kill van Kull flow into the west side of Raritan bay. The Ambrose channel is the chief of several channels crossing the broad bar at the entrance to the outer harbour. It leads northwestward and then northward into the inner harbour, through the Narrows, a neck about 1 mi. wide between Long island and Staten island. The inner harbour consists of the Upper bay, 4 mi. long and 4 mi. wide, lower Hudson river, East river, Long island sound and tributary waterways. The tributary waterways to the east are Gowanus creek, Newtown creek, Harlem river, Bronx river, Westchester creek, Flushing bay and creek and Eastchester creek. Tributaries to the west are Kill van Kull, Arthur Kill, Newark bay, Passaic river, and Hackensack river. Anchorage channel, an extension of Ambrose channel, extending through the Upper bay to the mouth of the Hudson river at the Battery, affords a depth of 40 ft. at mean low water for a width of 2,000 ft. Within the port are 42 channels, from 38 to 45 ft. deep. Direct water frontage of the port of New York is 771 mi. and the developed frontage around the some 2,000 piers and heads of slips is about 350 miles. The frontage measured around piers and along shore line is 1,000 miles. The mean tidal range is 4·6 ft. in the Lower bay and 4·5 ft. in the Upper bay. The harbour also has two northern entrances: the northeast entrance from Long island sound by the East river, principally used by New England coasting vessels; and the North (lower Hudson) river, by which the inland water-borne traffic of the Hudson river and Erie canal is brought to the port of New York.

## I. METROPOLITAN DISTRICT

The New York metropolitan district, as defined by the U. S. Census bureau, includes a land area of 2,514·11 sq.mi. lying in the states of New York, New Jersey and Connecticut, and had a population according to the 1940 census of 11,690,520. In addition to New York city, it includes such important centres of industry and population as Newark, Paterson, Elizabeth, Bayonne, Hoboken, Passaic, Union City, East Orange, Perth Amboy, Orange and New Brunswick, in New Jersey; Yonkers, Mount Vernon, New Rochelle and White Plains, in New York; and Stamford and Norwalk in Connecticut. Altogether the district contains 373 independent, self-governing municipalities lying within a radius of approximately 40 mi. from New York city hall.

## II. COMMERCE AND INDUSTRY

About 120,000,000 tons of commerce moves through the port annually. In 1939 a total of 6,511 vessels of 26,808,651 net registered tons entered and 6,083 vessels of 26,939,542 net registered tons cleared the port in foreign trade alone. In domestic trade, 3,082 vessels of 9,523,369 net registered tons entered and 3,373 vessels of 10,190,288 net registered tons cleared the port. The area of the port of New York district within the jurisdiction of the port authority is about 1,500 sq.mi., extending from below Sandy Hook on the south to Tarrytown on the north.

Serving this area is the first of the projected belt lines, a consolidation of short transfer lines, extending along the west bank of the Hudson and connecting all the trunk lines entering the Jersey side of the port. The Holland vehicular tunnel, opened in 1927, was brought under the port authority's control in 1930. The Lincoln vehicular (midtown) tunnel opened in 1938.

Two bridges across the Arthur Kill, one from Perth Amboy, N. J., to Tottenville, S. I., and the other from Elizabeth, N. J., to Howland Hook, S. I., were opened to traffic on June 29, 1928. A

third, the magnificent George Washington bridge across the Hudson at 178th street, was opened on Oct. 25, 1931 and a fourth, the Kill van Kull arch between Staten island and Bayonne, New Jersey, was opened on November 25 of the same year. The suspension span of the George Washington bridge, measuring about 3,500 feet, is more than twice as long as any such span previously constructed. The port authority completed in 1933 the 16-story inland freight terminal occupying the entire block between 8th and 9th avenues and 15th and 16th streets.

Motor vehicle registration in 1940 was more than 2,000,000.

**Banking, Exchange and Insurance.**—Since the beginning of the city's history, the financial district of New York has been at the end of Manhattan island, below Fulton street. Here are the largest banks and trust companies, the exchanges, and many insurance headquarters. In 1784, Alexander Hamilton wrote the constitution for the Bank of New York, the first bank to be established in the city, in operation five years before the U.S. constitution was adopted. This bank was originally at 67 Saint George's square, now Pearl street, and was later moved to 48 Wall street. The first bank of the United States was established in 1791, and a branch known as the office of discount and deposit was opened in New York in the same year. The Bank of the Manhattan company was the third bank to be organized in the city and its charter is notable as being the first to enable a public utility company to engage in banking. The Manhattan company furnished New York with water for 43 years. The Bank of the Manhattan company is still at its original location at 40 Wall street. It continues to operate under its original charter, through the expedient of maintaining a water tower. The Merchants and Mechanics and Metals National banks, the Bank of America, the Phenix and City (now the National City bank), all date from the early 19th century. When the Chemical National bank was organized in 1823, there were already 12 others, having an aggregate capital of over $15,000,000.

The subtreasury of the United States, formerly on Wall street, was abolished in 1914. On Feb. 21, 1940 it became a national monument—Federal Hall memorial. A part of the functions of the subtreasury are carried on by the U.S. assay office at 32 Wall street. The New York clearing house, located on Cedar street, was established in 1853. Bank clearings for the fiscal year 1940 totalled $320,861,197,000. New York is the centre of the federal reserve district No. 2 (*see* FEDERAL RESERVE SYSTEM, THE). The number of savings banks in greater New York in 1940 was 57; their total deposits were, excluding dividends, $1,089,749,496. The New York stock exchange (*see* STOCK EXCHANGE) occupies a building designed by James Rennick and had in 1941 1,375 members.

The New York curb market was formerly an open-air market for unlisted securities. It is housed in its own buildings at 78 Trinity place, completed in 1921.

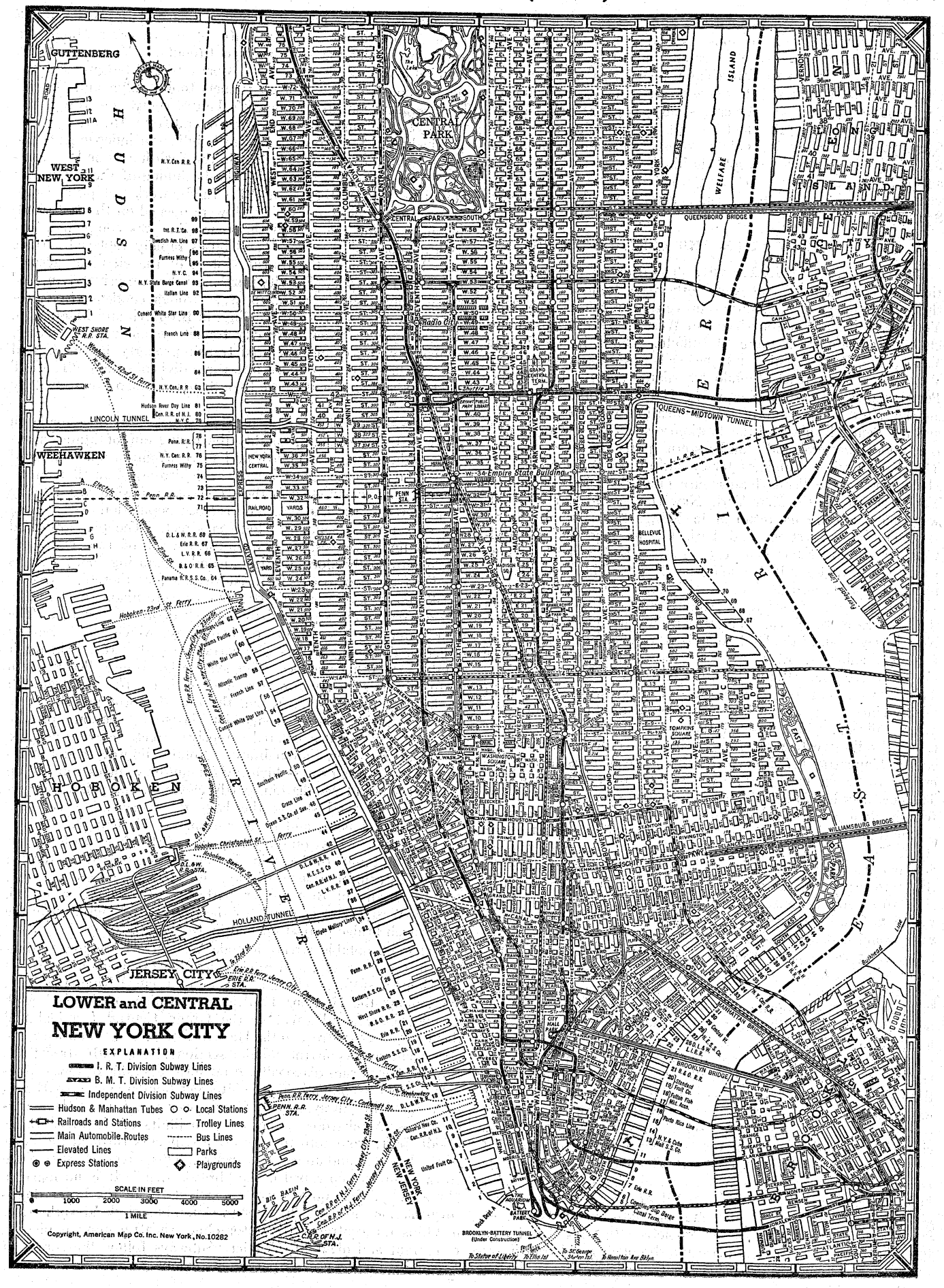
**Wholesale Trade.**—The clothing industry is chiefly centred in Manhattan, between Washington square and 42nd street, and in cross streets between 7th avenue and Broadway. Silk establishments have two principal centres, one bounded roughly by 23rd and 34th streets and Third and Fifth avenues; the other, on or adjacent to Broadway between Canal and Eighth streets. Fur establishments are now sharply localized between Broadway and Eighth avenue and 26th and 30th streets. The millinery business, formerly chiefly along Broadway, between Canal and 14th streets, is moving to a centre between Broadway and Fifth avenue above 34th street. Boot and shoe establishments are almost exclusively in lower Manhattan between Broadway and West Broadway below Canal street. Jewellery, formerly concentrated in and about Maiden lane, has become distributed in smaller groups between Maiden lane and 50th street along Broadway and Fifth avenue, with a large and growing centre at and about the intersection of Canal street and the Bowery. Fruit and produce markets are centralized in Manhattan between Canal and Cortlandt streets, and West Broadway and the North river. The fish, butter, egg and cheese markets, are highly concentrated on the lower west side between Harrison and Greenwich streets and meat establishments centre at West 14th street and the North river. The coffee, tea and spice markets are mainly in a small area on the lower east side about Water and Front streets. Hardware houses are around Warren and Chambers streets, west of Broadway; paper and stationery are much more widely scattered than formerly, largely owing to the uptown movement of printing and publishing establishments, one great centre being at or near Park Row and the other in the neighbourhood of the new post office about 34th street. Drug establishments are chiefly in lower Manhattan, while leather dealers are just below Brooklyn bridge. Total value of wholesale trade for the city for 1939 was $12,954,252,000, or 23·4% of the nation's total.

**Retail Trade** has followed the northward movement of population. In 1850 it was at Canal street and by 1880 at 14th street. It now lies between 31st and 59th streets, and Third and Eighth avenues. Fifth avenue was formerly exclusively residential but is now given up to retail trade as far north as 59th street. Beyond that a zoning ordinance reserves it for residence. Some of the largest department stores are still on 34th street, and the greatest volume of trade is done there. One store on this street receives more than $1,000,000 a week from purchasers. But the northward trend of the residential section has affected the character of the trade, and the more expensive shops, including some of the oldest retail firms, are farther up Fifth avenue, continually pressing on toward the most exclusive residential quarters of the city which are now on Park and Fifth avenues, above 60th street. The dressmakers, milliners and tailors for this district are on the side streets leading off Fifth avenue. Madison avenue, because of its situation between Park and Fifth avenues, is rapidly taking on the aspect of the latter, and is lined with shops from 42nd street to the Eighties. The art and antique dealers are on 57th and adjacent streets, and on Madison and Lexington avenues. There are a number of small antique shops on Eighth street. Automobile houses are near Columbus circle and up Broadway from 55th street for more than ten blocks. Brooklyn and the Bronx have important shopping and financial districts of their own. The total value of retail trade for the city in 1939 was $3,192,594,000.

**Building Construction.**—In 1939 the total number of buildings constructed in the five boroughs was 15,688, with an estimated cost of $195,657,317, as compared with 6,105 costing $49,888,333 (the lowest recent year) in 1933. Modern building construction in New York dates from the erection of the ten-story Tower building in 1889. The loftiest edifice in the world to date, the Empire State building on Fifth avenue at 34th street, rises to a gross height of 1,250 ft. from the street level and has 102 stories. A 50-mi. panorama is visible from its tower. Rockefeller centre, largest privately-owned business and amusement centre in America, begun in 1931 and completed in 1940, covers almost 12 ac. between Fifth and Sixth avenues from 48th to 51st streets. There are 14 separate buildings and the five edifices of the western section of the centre comprise Radio city. The estimated daily population of the centre is 151,000.

In 1938, under a new charter, a department of housing and buildings, directed by a commissioner, took control over planning, construction and occupancy of all buildings in the city. The department enforces the multiple dwelling law, the labour law and the building code. Laws affecting building in the city date back to 1647. Early laws dealt primarily with fire prevention. In 1867 a law dealing with fire and ventilation was passed; in 1899 a new building code was adopted; in 1901 a tenement house law was enacted. After 1935, through the activity of the New York City Housing authority, the federal government, private enterprise and the department of housing and buildings, great strides in modern housing were made. Outstanding projects were the Metropolitan project in the Bronx, First houses in Manhattan, Williamsburg houses in Brooklyn, Harlem River houses in Manhattan, Red Hook development in Brooklyn and the Queensbridge development in Queens.

**Manufacturing.**—New York city is the leading U.S. manufacturing city, a position it has held since 1824. In 1937 New York city accounted for a quarter of the industrial production of the 14 largest cities, and the total value of products manufactured was $3,962,292,660. There were 506,208 wage earners in


GUTTENBERG
WEST NEW YORK
WEEHAWKEN
HOBOKEN
JERSEY CITY
HUDSON RIVER
EAST RIVER
CENTRAL PARK
CENTRAL PARK SOUTH
QUEENSBORO BRIDGE
QUEENS-MIDTOWN TUNNEL
LINCOLN TUNNEL
HOLLAND TUNNEL
WILLIAMSBURG BRIDGE
BROOKLYN BRIDGE
MANHATTAN BRIDGE
BROOKLYN-BATTERY TUNNEL (Under Construction)
Empire State Building
PENN STA.
GRAND CENTRAL TERM.
BELLEVUE HOSPITAL
WASHINGTON SQUARE
TOMPKINS SQUARE
CITY HALL PARK
BATTERY PARK
LONG ISLAND
WELFARE ISLAND
N.Y. Cen. R.R.
Int. R.T. Co.
Swedish Am. Line
Furness Withy
N.Y.C.
N.Y. State Barge Canal
Italian Line
Cunard White Star Line
French Line
Penn. R.R.
D.L.&W.R.R.
Erie R.R.
L.V.R.R.
B.&O.R.R.
Panama R.R.S.S.Co.
Panama Pacific
White Star Line
Atlantic Transp.
Cunard White Star Line
Southern Pacific
Cosulich Line
Ocean S.S.Co. of Sav.
Clyde Mallory Lines
Eastern S.S.Co.
West Shore R.R.
B.&O.R.R.
Erie R.R.
Con.R.R.of N.J.
Central R.R. of N.J.
Lehigh Valley R.R.
Lehigh Valley Transfer Co.
Colonial Nav. Co.
United Fruit Co.
Porto Rico Line
N.Y.& Cuba Mail S.S.Co.
Ward Line
Clyde S.S.Co.
Mallory Line
Seaboard Air Line
Merchants & Miners Transp. Co.
Old Dominion S.S.Co.
Bull Line
Savannah Line
Metropolitan Line
Munson Line
Hamburg-American Line
North German Lloyd
Holland-America Line
Red Star Line
Atlantic Transport Line
Anchor Line
Cunard Line
Canadian Pacific
Furness Line
Royal Mail Line
Lamport & Holt Line
Booth Line
Nelson Line
Prince Line
Norton Lilly & Co.
Munson Steamship Line
Panama Mail S.S.Co.
Grace Line
Isthmian Line
Moore-McCormack Lines
Barber Line
Scandinavian American Line
Swedish American Line
Finland Line
Baltic-American Line
Polish Transatlantic Line
Gdynia-America Line
Italian Line
Lloyd Sabaudo
Navigazione Generale Italiana
Transatlantica Italiana
Fabre Line
Cosulich Line
Greek Line
Arrow Line
Turkish Line
Egyptian Line
Ellerman Line
Bibby Line
Ropner Line
Furness Withy
Manchester Line
Manchester Liners
Shaw Savill Line
Blue Funnel Line
Glen Line
Ben Line
Alexander Line
Union Castle Line
Clan Line
Currie Line
Donaldson Line
Anchor-Donaldson Line
Canadian National Steamships
Canadian Pacific
Furness Line
Red Cross Line
Quebec S.S.Co.
Canada Steamship Lines
Great Lakes Transit Corp.
Pittsburgh Steamship Co.
Cleveland-Cliffs Iron Co.
Bethlehem Steel Co.
Republic Steel Corp.
Inland Steel Co.
Pittsburgh Coal Co.
Pittsburgh Steamship Co.
Pittsburgh Coal Co.
Pittsburgh Steamship Co.
Pittsburgh Coal Co.
Pittsburgh Steamship

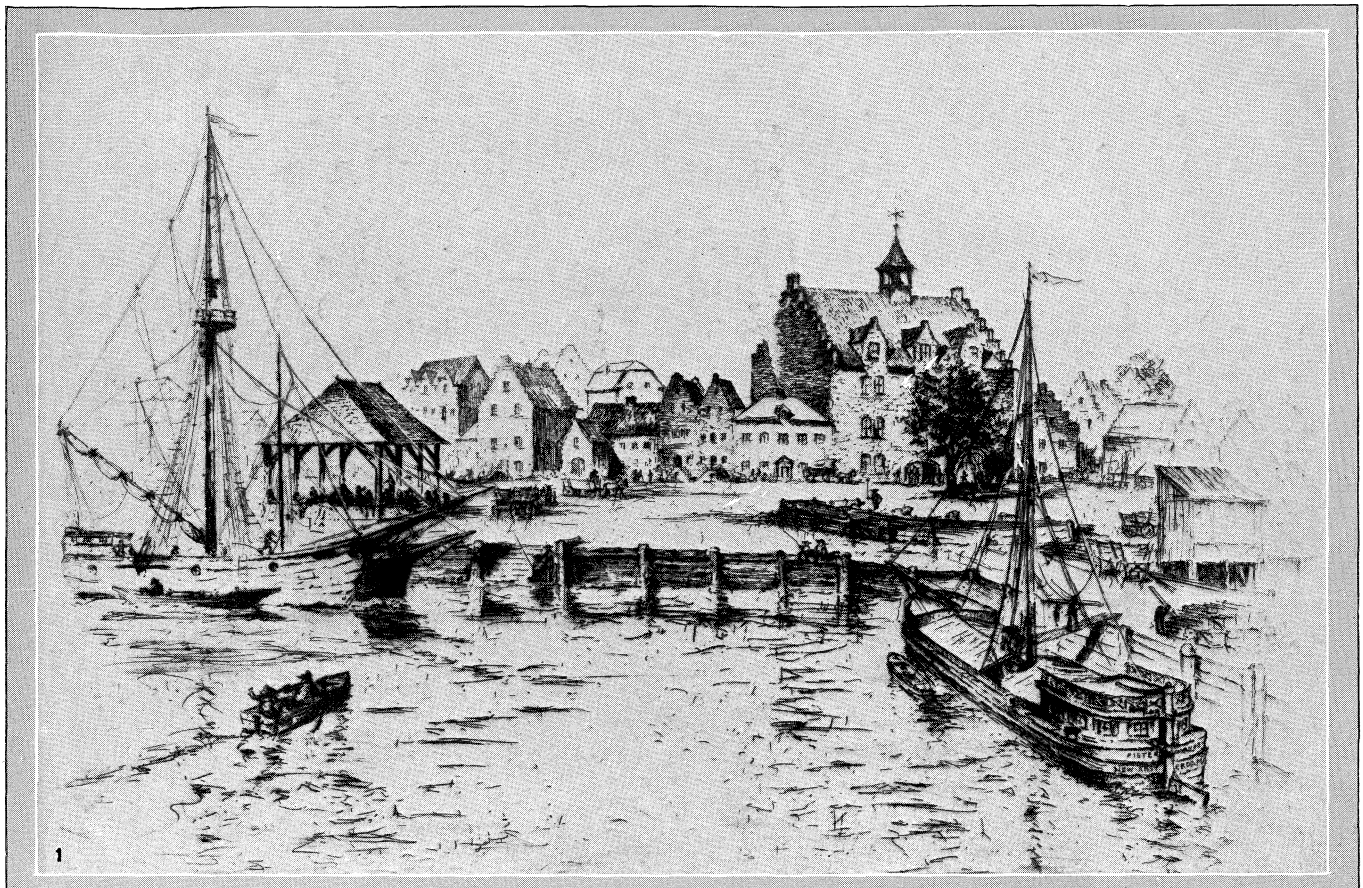
the city (70·5 per 1,000 population) and 22,235 factories. The average annual wage of the industrial wage earner in the city in 1937 was $1,244. The ten leading industries by value of products, according to the Merchants' association of New York city, were, in 1937: apparel and accessories (leather included), $1,366,907,104; foods and beverages, $674,154,792; printing and publishing, $573,762,517; metals and machine-shop products, $303,373,618; chemicals, paints, drugs and allied products, $220,690,996; textiles (except clothing), $127,765,658; paper and paper products, $101,316,959; wood products, $84,780,835; vehicles, $42,652,292; stone, clay, glass and glass products, $30,275,595.

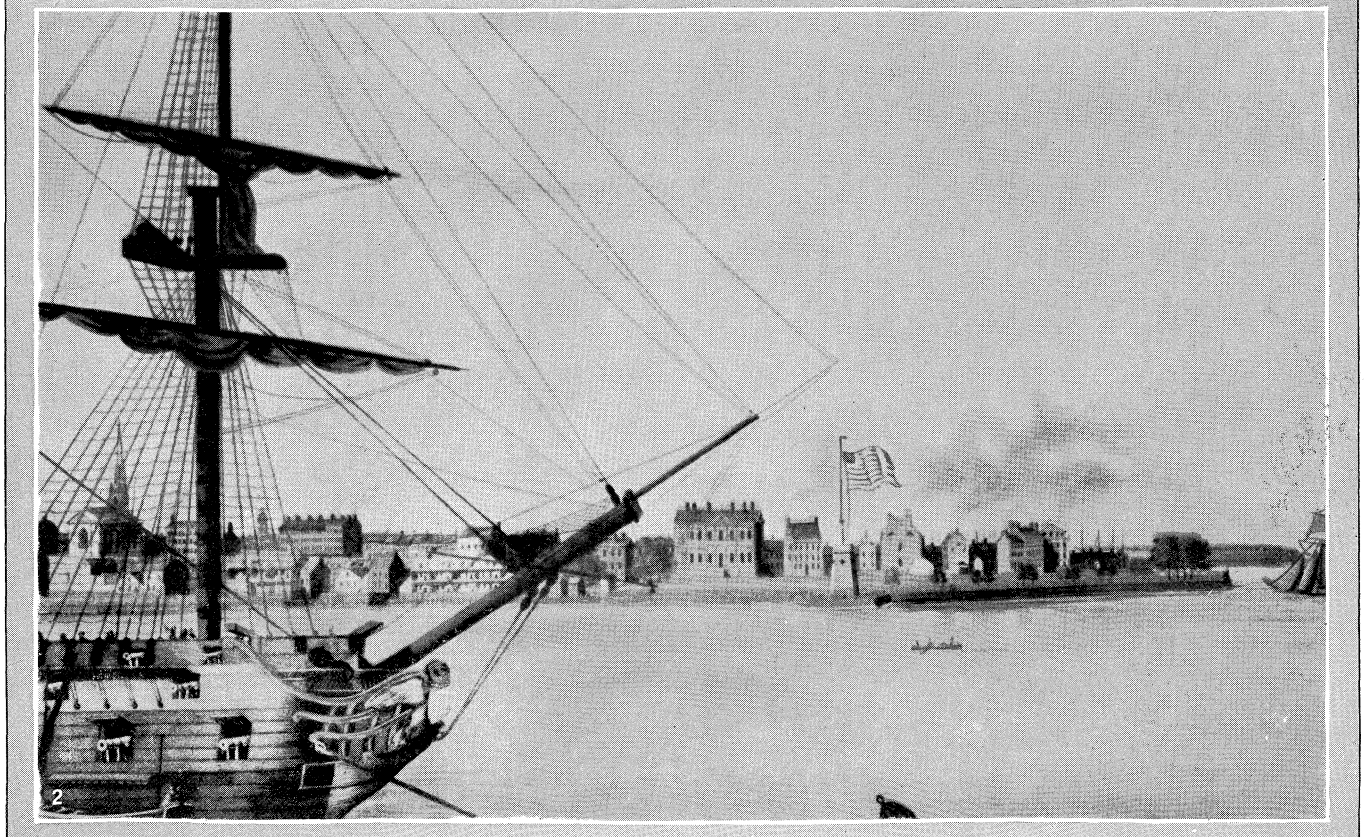
### III. TRANSPORTATION AND COMMUNICATION

**Railroads and Rapid Transit.**—The problem of transportation and communication in New York city is unique because of the extraordinary concentration in certain regions. The New York Central and Hudson river and West Shore railways follow closely the Erie canal route to Buffalo. The Erie, the Lehigh Valley, the Pennsylvania and the Delaware, Lackawanna and Western railways reach Buffalo by routes across New Jersey, Pennsylvania and western New York. The New York, New Haven and Hartford railway affords communication with New England; and the Pennsylvania, and the Baltimore and Ohio railways, with the middle-western and southeastern parts of the country. The Central railroad of New Jersey and the Long Island railway (belonging to the Pennsylvania) are primarily local. The New York Central and the New York, New Haven and Hartford railways have a common terminal in Manhattan (Grand Central station), at 42nd street and Park avenue, and the Pennsylvania has its great terminal at 32nd street and Seventh avenue, with tunnels to Long island and New Jersey. The Pennsylvania terminal is used also as a terminal by the Long Island railway which has another terminal at Atlantic and Flatbush avenues in the borough of Brooklyn. The other railway terminals are on the New Jersey bank of the Hudson and are reached either by tunnel, ferries or subways. Elevated or subway systems were operated by the Interborough Rapid Transit Co., the Brooklyn-Manhattan Transit Co., and the city itself. The subways were built mostly since 1913. Steam locomotives were used on the first elevated railroad, which formed that part of the Ninth avenue elevated railway extending from Battery place near the southerly end of Manhattan to 30th street. This piece of construction was opened for traffic in 1870, and was slightly over 3 mi. in length. The next decade witnessed its growth to 32·5 route miles of track, forming four separate transit lines extending north and south on Manhattan; three reached the Harlem river and one ended at 59th street. These lines were entirely private enterprises, built and operated over the public streets under perpetual franchises granted by the state legislature. For the next 20 years there were no extensions to the rapid transit lines on Manhattan, but some progress was made in other boroughs—the Third avenue "L" in Manhattan was extended across the Harlem river as far as 169th street by 1888, to 177th street by 1891, to Fordham road by 1901 and to its terminus at Bronx park by 1902. In the borough of Brooklyn, the first elevated, the Lexington avenue line, having a route length of about 6 mi., was opened in 1885. This line was extended and other lines built until by 1900 the Brooklyn system had a route length of 62 miles. In 1902 the motive power of these elevated lines was changed from steam to electricity. In 1900 the first "subway" was planned and finally extended from the Bronx, through Manhattan, to Brooklyn, under the East river. This rapid transit system was a municipal undertaking, its construction cost being entirely defrayed by the sale of bonds issued by the city of New York. Between 1908–10 two tubes under the Hudson river connecting Manhattan with Hoboken (terminus of the Delaware, Lackawanna and Western) and Jersey City (terminus of the Erie, Pennsylvania and Central of New Jersey railways) and a connecting tube which extends up Sixth avenue from Cortlandt street to 33rd street, were completed. In 1913 the city entered into contracts to create two interborough rapid transit systems, each comporting extensions to the existing lines; the one provided for a new Lexington avenue line and the extension of the west side subway down Seventh avenue to lower Manhattan and thence under the East river to Brooklyn. Another contract included a four-track subway on Broadway and Seventh avenue, Manhattan, extending through tunnels to Brooklyn and Queens. The operating contracts made with the two companies were to run for 49 years, dating from Jan. 1, 1919, and from Aug. 1, 1920, respectively. In 1925, the city began building an independent subway system, the main unit of which, the Eighth avenue line, commenced operation in 1932. With the beginning of the LaGuardia administration and the aid of WPA funds, work was pushed rapidly and many more miles of track were opened on the Independent subway, and the new Sixth avenue line was completed. The Sixth avenue "L" was razed, and buses rapidly replaced surface cars. Unification of the transit system of the city was accomplished in June 1940. The city purchased the two privately-owned transit companies for $326,248,187; through condemnation proceedings it acquired title to "L" lines in Brooklyn and Manhattan. Thus in 1941 the New York city transit system was the largest municipally-owned and operated transit property in the United States. The system is divided into three divisions, the IRT, BMT and IND, and represents more than $1,000,000,000 investment by the city.

**Streets.**—The first comprehensive street plan was made in 1811; with few changes, notably the laying out of Madison avenue, midway between Fourth and Fifth avenues, north of 23rd street, and Lexington avenue between Third and Fourth avenues, north from 21st street, it is the street plan of Manhattan today as far north as 155th street. The 120,000 population at that time was concentrated south of Houston street. The plan provided straight line "avenues," with a uniform width of 100 ft. extending longitudinally along the island and separating block lengths ranging from 610 to 920 feet. At right angles thereto, "streets" usually 60 ft. wide were laid out, but 15 were made 100 ft. wide. These streets were separated by a block depth of 200 feet. The plan included the extension of Broadway, which has a general direction diagonally across Manhattan to 79th street, whence it parallels the other avenues. This system has been called upon to perform duties hardly foreseen at that time. The rapid growth of the city, the skyscraper, and the use of motor vehicles have produced serious traffic congestion in some sections of the city; and this has necessitated extensive street widening and the development of new thoroughfares. Notable improvements of recent years are the express highway for motor vehicles running up the west shore of Manhattan, partly elevated, and joining Riverside drive at 72nd street; the East river drive, a seven-mile parked embankment, and its extension, the Harlem river drive; the three-mile viaduct on the Jersey side of the river, leading from the Holland tunnel to the main highway to Trenton; the extension of the Hutchinson river parkway, the Henry Hudson parkway, and the beautiful Bronx river parkway, extending for 15 mi. through Westchester county; and the bridges and highways in the Triborough bridge project opened in July 1936.

The more notable streets include Wall street, on lower Manhattan, the heart of the financial district; Fifth avenue with its fine shops, residences, clubs, library and museum; Riverside drive, overlooking the Hudson; Park avenue, which continues Fourth avenue above 32nd street to the Grand Central terminal and thence from 45th street to the Harlem river, and is lined with fine apartment houses in the middle section above 45th street; the Bowery, which runs diagonally through the east side of lower Manhattan from Brooklyn bridge to intersect Fourth avenue at Eighth street; and Broadway, which extends over 18 mi. from the southern tip of Manhattan to the northern limits of the city. In its middle part, from 10th to 79th streets, it cuts through the heart of the business and amusement centre. This street owes its name to the Dutch, who called it the "breede weg." It is no longer a "broad way," but quite narrow, particularly in the lower downtown section. From 34th street to Columbus circle at 59th street it forms the centre of the automobile, theatre, moving picture, restaurant and night life district. Subways follow the course of Broadway for the greater part of its extent.





(2) KEYSTONE VIEW CO.

NEW YORK HARBOUR, IN 1690 AND 1794

1. The town of New Amsterdam in 1690; an etching by Anton Schutz

2. The Battery in 1794, as seen from the Hudson river

PHOTOGRAPH, EWING GALLOWAY

## MANHATTAN ISLAND

An air view of Manhattan island, showing the Hudson (North river) at the left, and East river at the right. In the right foreground is Battery park, southernmost tip of the island; immediately behind is the downtown business district

Surface cars are rapidly being displaced by bus lines, particularly in the borough of Manhattan. The transformation of the Madison avenue line was carried out in 1935; and in 1936 the bankrupt Eighth and Ninth avenue systems as well as the system of the New York Railways corporation were reorganized to operate entirely with busses. Trolley cars continued in active use on Third avenue and on some of the crosstown services—the crosstown cars serving primarily as "feeders" for the rapid transit lines and to a less extent for the ferries plying between Manhattan, New Jersey and Staten island.

In the boroughs of the Bronx and Brooklyn, however, the street railways still form an important part of the transportation facilities. In 1940 the surface railways of Manhattan carried 72,946,803 revenue passengers; those of Brooklyn, 332,984,224; and those of the city as a whole, 535,334,179. The total number of revenue passengers, exclusive of Staten Island Rapid Transit road, carried by bus companies in 1940 was 690,804,230.

**Bridges and Tunnels.**—There were in 1941 six bridges spanning the East river and one over the Hudson river which extends from a point near 178th street, Manhattan, to Fort Lee, N.J. The span is 3500 ft., tower height 600 ft. The Brooklyn, Manhattan and Williamsburg bridges have their Manhattan terminals at Park Row, Canal, Clinton and Delancey streets, respectively. All are suspension bridges and connect Manhattan island with Brooklyn. Brooklyn bridge, the first to span the East river, was opened to traffic on May 24, 1883. The Manhattan bridge was opened to traffic on Dec. 31, 1909, the Williamsburg bridge on Dec. 19, 1903 and the Queensboro bridge on March 30, 1909. All of these are municipally owned and operated for highway, trolley, elevated railways and pedestrian traffic. The Hell Gate bridge over the East river is owned by the New York Connecting railroad company and is exclusively for railway traffic. The Triborough bridge over the East river, which opened in 1936, actually consists of four bridges over water and 12 on land, its arms extending into Manhattan, the Bronx and Queens. The vertical lift bridge between Randall's island and Manhattan is the largest in the country. The Bronx-Whitestone bridge, opened in 1939, connects the Bronx with Queens.

The Harlem river is crossed by 13 bridges of various types and designs. The most notable is the famous High bridge (1848) which carries an aqueduct of the city water supply. This was rebuilt in 1928 to improve navigation.

Transportation of passengers by rail between the boroughs of Manhattan, Brooklyn, the Bronx and Queens, and New Jersey is provided by means of tunnels constructed well below the beds of the East, Hudson and Harlem rivers. Vehicular transportation between Manhattan and Jersey City was made possible by the opening to traffic of the Holland vehicular tunnel in Nov. 1927, a twin-tube highway, 9,250 ft. in length. In Dec. 1937 the Lincoln tunnel, connecting 39th street in Manhattan with Weehawken in New Jersey, was opened to traffic. A new north-south avenue, midway between Ninth and Tenth avenues, permits entrance to this tunnel at 34th, 35th, 36th, 40th, 41st and 42nd streets (*see* HOLLAND AND LINCOLN VEHICULAR TUNNELS). The Queens Midtown tunnel, finished in 1940, connects Manhattan on the east side at 36th and 37th streets with Long Island city. It is a twin-tube highway, 7,500 ft. long. The Pennsylvania railroad has four tubes across the East river and two across the Hudson. The Hudson and Manhattan railroad company has two systems, each comprising two single track tubes from Jersey City, one to the downtown section of Manhattan looping around Fulton and Cortlandt streets at Church street, the other entering at Morton street and extending to 33rd street. The Brooklyn-Manhattan Transit corporation has six rapid transit tubes under the East river, these are laid in pairs leaving Manhattan at Whitehall, East 14th and East 60th streets. The Interborough Rapid Transit company also has three pairs of transit tubes leaving Manhattan at Whitehall street, Old Slip and East 42nd street. Practically all of the present railroad and rapid transit tunnels were completed between 1900 and 1920. In connection with the new independent subway system, the board of transportation designed five new tunnels, four of which were opened for service in 1933. Of the two which pass under the East river one extends from 53rd street, Manhattan, to Mott avenue, Queens, connecting the Sixth and Eighth avenue trunk lines and the lines from Jamaica and central Brooklyn at Union Station in Long Island city; the other runs from Fulton street, Manhattan, to Cranberry street, Brooklyn. Under the Harlem river a three-track tunnel connects the Washington Heights line with the subway under the grand concourse in the Bronx. This extends from the Polo grounds at 156th street and Eighth avenue, Manhattan, to 161st street and Jerome avenue, the Bronx. The fourth tunnel under Newtown creek extends from Manhattan avenue in Brooklyn to Jackson avenue, Queens. The projected fifth line will be under the East river from Rutgers street, Manhattan, to Jay street, Brooklyn.

**Ferries.**—The city department of docks, the railroads with terminals in New Jersey, and many private companies operate ferries in and about New York harbour. The city in 1941 maintained four municipal ferry lines and the small ferries serving the East river islands where city institutions are maintained.

**Airports.**—Commercial flying fields in operation in 1940 included LaGuardia field, Queens; Floyd Bennett field, Brooklyn; Roosevelt field, L.I.; and the Newark airport at Newark, N.J.

LaGuardia (North Beach) airport, covering 550 ac., opened in 1939, and serves both transcontinental and transoceanic service. The daily average for incoming and outgoing flights in 1940 was 250. The approximate cost of the field was $28,000,000, paid for by both city and federal governments. The land plane base consists of a large land plane administration building, three hangars and four runways: 6,000, 5,000, 4,700 and 3,600 ft. in length. For the seaplane base, the airport has water on three sides, has two hangars admitting planes with 200-ft. wingspread, and its own administration building.

Floyd Bennett field, completed in 1931, is the main base of the U.S. coast guard aviation service on the east coast. It has modern runways, a radio range beacon and a U.S. weather bureau airport station. The Newark airport, closed to commercial aviation in May 1940, was reopened in May 1941.

**Telephone and Telegraph.**—In 1940 there were in greater New York city 1,713,521 telephones as compared with 1,811,410 in the year 1930. Telegraph and cable service is supplied mainly by the Western Union and the Postal Telegraph companies. The former maintained 190 offices and the latter 118 within the limits of the city in 1941. Twenty-six cables touch New York, 13 owned by the Western Union, seven by the Commercial, three by the French, two by the All America and one by the United States and Haiti cable companies.

**Postal Service.**—The post office of New York city in 1827 was located in a small two-story frame building on Garden street (now Exchange place), and the entire force consisted of some eight clerks and six letter carriers. Fifty years later the City Hall station at Park Row and Broadway was the general post office. In 1914, the present general post office building was opened on Eighth avenue from 31st to 33rd streets, containing 500,000 square feet of floor space. There were in addition 72 classified stations and 92 contract stations in the city in 1940 and a total of 21,504 employees. The transportation of mails is expedited by means of an underground pneumatic tube system consisting of 27 miles of double line 8-inch tubes, with a carrying capacity of over 200,000 pieces of mail per hour. In the year 1827, the postal receipts amounted to about $125,000; in the year ending June 30, 1940 they exceeded $73,544,812. On an average day the post office receives, delivers and dispatches 15,700,000 pieces of ordinary mail; weighs and dispatches 258,000 lb. of newspapers and periodicals, and 70,000 insured and C.O.D. parcel post packages.

## IV. GOVERNMENT

The city's form of government was inaugurated by the greater New York charter of 1897. It provided for a mayor elected at large, five borough presidents, chosen by the voters of their respective boroughs, a board of aldermen of 65 elective members, one from each aldermanic district, with a president of the board of aldermen, elected at large. A controller, elected at large,

was head of the department of finance. The mayor, controller, president of the board of aldermen and the five borough presidents were designated as members of the board of estimate and apportionment.

A new city charter, adopted by popular referendum on Nov. 3, 1936, became effective on Jan. 1, 1938. It provides for a city council elected by a system of proportional representation, whose membership will vary in rough proportion to the voting population of the boroughs; that is, each borough is entitled to one councilman for every 75,000 valid votes cast therein, with an additional member for any fraction of that number above 50,000. Thus 26 councilmen were elected in 1937, but only 21 in 1939 because of the falling off in the number of votes cast. This body takes the place of the former board of aldermen. The board of estimate continues with little change beyond the substitution of the president of the council for the president of the board of aldermen. It constitutes the general administrative branch and has no control over legislation except in the case of local laws directly affecting the organization and administration of the government and amendments to the charter, for which its approval is required. With respect to all local laws, however, the mayor retains his veto, which can be overridden only by a two-thirds majority of the council. A city treasurer appointed by the mayor heads the department of finance.

In addition to these major divisions, there is a new department of public works responsible for the municipal plant and structures; a department of housing, a city-planning commission; a department of investigation; and 20 other departments and bureaus, including departments of education, of docks, of correction, of health, of hospitals, of law, of parks, of police, of public welfare, of purchase, and of sanitation, a fire department and a civil service commission. Among its functions, the planning commission has control of zoning. The board of estimate has exclusive authority to grant franchises, but no franchise may be for a longer term than 25 years, except that a tunnel railroad franchise may be for a period not exceeding 50 years.

The mayor, as chief executive, continues to appoint the heads of all departments except those under the exclusive direction of the borough presidents. All purely local improvements, such as streets and sewers, continue in the hands of local improvement boards and the borough presidents, while improvements affecting broader areas such as intercepting sewers and sewage disposal plants are under the control of the new central department of public works.

An amendment to the state constitution, approved by the voters in Dec. 1935, provides for a reform of the county government within the city of New York. There are five county governments within greater New York, namely, New York, Bronx, Kings, Queens and Richmond. The officers of the five different counties function almost independently of the city officers and often in duplication of the activities of the latter. Under the amendment the city has the theoretical power through the enactment of local laws to abolish any county office within its limits except that of judge, county clerk or district attorney; or it may reassign the functions of county officers, with certain exceptions, to city or other county officials or to the courts. The county clerks are appointed and removable by the appellate division of the supreme court in the judicial department in which their respective counties are located.

Civil service regulations apply to all officers and all employees of the city except those who are elected by the people, legislative officers, and staffs of those educational institutions which have special professional standards. The civil service commission of the city consists of three members appointed by the mayor, not more than two of whom may be of the same political party. Salary of the president is $8,500 a year; of the commissioners, $6,500.

In 1920 the New York city employees' retirement system was put into effect. All persons in city service, whether appointive or elective, who entered or re-entered the city service after Oct. 1, 1920, and who have completed six months of city service are eligible to the benefits of this retirement system, except those entitled to share in the police pension fund, the fire department relief fund, the teachers' retirement system, or the department of street cleaning relief and pension fund.

## V. FINANCE AND TAXATION

The city's budget is far from being a comprehensive financial plan. The current or "expense" budget as proposed by the mayor totalled $581,000,000 for the fiscal year beginning July 1, 1940. This figure did not include approximately $147,000,000 from borrowed and special funds carried in the same document, thus making a total of $728,000,000 for the current budget. The emergency relief requirements, financed by special city taxes plus about $40,000,000 of state aid, are entirely outside the current budget. They are budgeted by semiannual periods. For the fiscal year beginning July 1, 1940, the emergency relief budget of the city approximated $128,000,000, about $88,000,000 of which was financed by special sales and other taxes collected within the city. In June 1940 the city government acquired and unified its rapid transit system, which operates practically on an independent budgetary basis. The budget of the system is prepared by the board of transportation. The transit system's total debt service, including unification bonds, ran close to $57,000,000 for the first year.

Other city utilities are included in the current budget, their earnings being merged in the general fund revenues. Finally, there is the so-called "capital" budget, prepared by the city planning commission, which applies to the calendar year rather than to the fiscal year of the city. For 1940 it ran to approximately $145,000,000. The annual budgetary requirements of the city are therefore approximately $1,000,000,000. The city's financial difficulties appeared to grow more perplexing with each passing year.

The assessed valuation of taxable real estate in the city (including special franchises and the real estate of corporations) for 1940 aggregated $16,470,000,000. The peak of $19,600,000,000 was reached in 1932. The basic tax rate of the city for the fiscal year 1940–41 was $2.84 for each $100 of assessed valuation. This rate became $2.95 when city-wide assessments were added to it.

The city charter, which became effective Jan. 1, 1938, made numerous changes in the fiscal organization and procedure of the city government. It changed the beginning of the fiscal year from Jan. 1 to July 1, and bridged the gap by a six-months' budget. The current or "expense" budget operates on the basis of the fiscal year, while the capital budget follows the calendar year. A bureau of the budget, under a director appointed by the mayor, is established to assist the mayor in preparing the current budget. The budget goes to the board of estimate, then to the council, which must act upon it by May 21, otherwise it is deemed to be adopted as passed by the board of estimate. Finally, the mayor may veto any changes made by the council. The capital budget is prepared by the city planning commission and is completely separated from the current budget.

Under the new charter, the controller, who is elected at large, is the chief financial officer of the city government. It is his business to advise the board of estimate, to approve the disbursement of funds, to audit the accounts of the city departments and agencies, and to manage the sale and retirement of the city's securities. There is no independent audit of the decisions, books, records and reports of the controller. Aside from the office of controller and the bureau of the budget mentioned above, there is a department of finance, headed by the treasurer (formerly the city chamberlain), who is appointed by the mayor. This department includes the bureau of city collections and the bureau of receipts and disbursements.

Four agencies handle the tax and licence work of the city: the tax department, the board of assessors, the board of revision of assessments and the department of licences. The financial organization of the city also includes a department of purchase, headed by a commissioner appointed by the mayor. The department has sole authority to purchase supplies and equipment for all departments and agencies of the city government except the institutions and offices of the board of higher education and the

department of education.

**Police.**—The police force of the city of New York, including uniformed, non-uniformed, extra and special personnel, numbered 19,490 in 1940. It is under the direction of a commissioner, appointed and removable by the mayor, at a salary of $12,500 a year. The headquarters of the police department are in Manhattan. There are 34 precinct station houses in Manhattan, 34 in Brooklyn, 16 in Queens, 13 in the Bronx and 3 in Richmond.

The administrative activities of the department are carried on through the commissioner and six deputy commissioners, while a uniformed force is under the supervision of a chief inspector.

A significant feature of the police department is its academy for training, through which all recruits must pass. Two thousand men drawn from the ranks of patrolmen form the detective division. The budget appropriation for 1940–41 was $63,935,610.95, the great bulk of which was allotted to personal service. The total number of arrests on criminal charges in 1939 was 1,046,933.

**Fire.**—A fire commissioner with a salary of $12,500 a year, appointed and removable by the mayor, heads the fire department, which in 1940 had 11,158 employees, including full-time paid firemen, officers and civil employees. At the head of this force and in charge of fire fighting is the chief of the department (frequently the commissioner). In 1940 the three-platoon system and the eight-hour day were put into effect.

There were also in 1940 a deputy commissioner, $7,000; a deputy chief, $8,000; four deputy chiefs, $7,500; two deputy chiefs, $7,000; 47 deputy chiefs, $6,300; 160 battalion chiefs, $5,300; two captains, $5,000; 363 captains, $4,500; 1,085 lieutenants, $3,900; one lieutenant, $4,200; and 8,973 firemen with salaries ranging from $2,000 to $3,000. There were 236 engine companies, 170 hook and ladder, two combination, four rescue, ten fireboat, four searchlight, three gas wagon and two ambulance companies. The department budget figure for 1940–41 was $36,522,551.34. In 1939 there were 32,454 fires in New York city, resulting in losses amounting to $8,600,544. For the five boroughs this loss amounted to: Manhattan, $3,217,550; Brooklyn, $3,388,809; Queens, $971,750; Bronx, $782,820; Richmond, $239,615. Deaths from fires totalled 119.

**Health.**—The department of health is under the direction of a commissioner appointed by the mayor at an annual salary of $11,000. He has two deputy commissioners, each at a salary of $7,000. The 1940–41 budgetary appropriation for the department was $4,551,713.64. It has a personnel of about 2,900 employees. Within the department is the board of health, consisting of the commissioner, who is chairman, and four other members, appointed for a term of eight years, to serve without salary. The main office is in Manhattan, but the department operates offices, health centres and health stations in each borough. Beginning in 1933, with the Central Harlem Health centre, which was housed in rented quarters, the department divided the city into 30 health districts, each with a population of about 2,500 and representing 20 administrative units; 12 districts function as individual units and eight other units represent the 18 remaining districts. Fifteen district health officers and five medical officers-in-charge direct the 20 administrative units. Eleven modern health centre buildings and one remodelled building were in operation in 1941; others were under construction. Each district was to have a modern health centre by 1945.

The major bureaus in the department are: administration, public health education, tuberculosis, nursing (850 nurses), child hygiene, social hygiene, preventable diseases, laboratories, records, sanitation, and food and drugs.

The board of health is responsible for matters of public health policy and for drafting the city's sanitary code. The department exercises sanitary supervision over about $3,000,000,000 worth of food supplies each year and regulates the sanitary conditions in about 100,000 establishments manufacturing, handling or storing food or patent medicine products; including bakeries, milk stores, restaurants and food stores.

In 1938 the city achieved the lowest recorded death rate, 10.0 per 1,000 population; in 1940 there was a slight rise, to 10.2 per 1,000. Diphtheria deaths decreased from 86 in 1933 to 10 in 1940; diphtheria cases from 1,891 in 1933 to 386 in 1940. Tuberculosis mortality decreased from 64 per 100,000 in 1933 to 48.6 per 100,000 in 1940. Pneumonia mortality declined from 108 per 100,000 in 1933 to 45.7 per 100,000 in 1940. Typhoid fever had practically disappeared, the death rate per 100,000 being only .2 in 1940. New low mortality rates were recorded for automobile accidents, whooping cough, measles and other diseases. The birth rate in 1940 was 14.4 per 1,000. The lowest recorded is that for 1936, 13.6.

The U.S. Public Health service maintains general offices in the city under a medical director and consulting health specialists. It manages the U.S. Quarantine station at Rosebank, Staten island, and provides for inspection of ships' cargoes and all persons on board ships for quarantinable diseases, and for the medical inspection of immigrants at Ellis island, where a U.S. marine hospital is maintained. Other U.S. marine hospitals are at Stapleton, Staten island and 67 Hudson street, New York city.

The Federal Food and Drug administration maintains its eastern district office and respective services and laboratories in the city.

About 40 voluntary health agencies operate in the city and cooperate with the health department. Among the more important of these are: New York chapter of the American Red Cross, American Social Hygiene association, New York Cancer committee, Brooklyn Tuberculosis and Health association, Committee on Neighborhood Health Development, Community Service society of New York, Committees on Health of New York Academy of Medicine, New York Tuberculosis and Health association, New York Heart association, New York Diabetes association, State Charities Aid association.

**Hospitals.**—The department of hospitals was established in 1930 by the consolidation of the general and special hospitals of the departments of health and welfare, and Bellevue and allied hospitals. The head of the department is the commissioner, appointed by the mayor at an annual salary of $10,000; there are also two deputy commissioners at salaries of $6,500 and $6,000 each. Twenty-eight municipal hospitals are maintained and operated by the department, which is the second largest of the city departments in number of employees (department of education is the highest). The department's appropriation for 1940–41 was $29,776,811.24.

The total number of city and voluntary hospitals is about 200, including approximately 145 general hospitals, ranging in size from 1,000 beds to 50 beds or less. These 200 hospitals provide about 50,000 hospital beds and care for nearly 800,000 patients annually. Of the total hospital beds available in the city, about 31,000 are in general hospitals. The general and special hospitals, exclusive of beds for mental diseases, tuberculosis and acute communicable diseases, provide about 4.5 beds per 1,000 population within the city, and they are occupied on the average to about 76% of capacity. The municipal hospitals provided, in 1939, 20,072 beds and cared for 284,256 persons. The voluntary hospitals of the city supply approximately one-quarter of the city's care of medical indigents. Persons approved by the city are cared for in these hospitals at city expense at varying per diem rates fixed in the city budget. Eighty of the larger voluntary hospitals, not including convalescent homes, are members of the United Hospital fund, an association for co-operative hospital financing and financial reporting.

Among the chief private general hospitals are Mount Sinai, St. Luke's, Presbyterian, New York, Roosevelt, Lenox Hill and the Post Graduate. All of these hospitals are in the borough of Manhattan. In Brooklyn are the Long Island College hospital, Jewish, Brooklyn, and Methodist Episcopal. Of the private special hospitals for women and children, the Lying-in, Sloane Maternity, Nursery and Child's, Woman's and Misericordia are the largest. Other special hospitals of note are the Orthopaedic, Ruptured and Crippled, Joint Diseases, New York Eye and Ear infirmary, Manhattan Eye, Ear and Throat hospital, Skin and Cancer hospital and Neurological institute.

The larger municipal hospitals, each providing 1,000 beds or more, are Bellevue, Kings County, City, Metropolitan, Seaview and Triboro. Among the events of interest in connection with the private hospital services of the city was the establishment of the Presbyterian-Columbia Medical centre and the New York Hospital Medical centre. There in upper Manhattan are clustered the buildings of five separate units: the Presbyterian hospital (including the Presbyterian hospital, the Sloane hospital for women, the Vanderbilt clinic, the Squier Urological clinic, the Stephen V. Harkness private patient pavilion and the Presbyterian Hospital School of Nursing); the Columbia university group (including the College of Physicians and Surgeons, the School of Dental and Oral Surgery, the School of Oral Hygiene, and the DeLamar Institute of Public Health); the Babies' hospital of the city of New York; the Neurological institute of New York; and the New York State Psychiatric institute and hospital. The New York

Hospital Medical centre includes the Lying-in hospital, the Manhattan maternity and dispensary, the Nursery and Child hospital, Payne Whitney Psychiatric clinic, and is associated with Bloomingdale hospital for mental diseases and the convalescent hospital for children at White Plains, N.Y. All above services are affiliated with the Cornell University Medical school.

**Charities.**—The charities of the city are provided principally by the city's department of welfare and the board of child welfare. Under present federal, state and municipal laws, public agencies provide the bulk of family and individual relief of the poor. In 1940 the average relief case load of the department of welfare was 154,094; that of private agencies, 7,236.

The department of welfare is under a commissioner appointed by the mayor at a salary of $11,000 a year. He has two deputies who receive $6,500 and $5,000, respectively. Divisions of the department include: home relief, dependent children, veteran relief, public solicitation, old-age assistance, blind assistance, consultant social service. It maintains the municipal lodging house for temporary shelter care of adult homeless persons, but provides no other institutional services. The 1940–41 budget for the department was $27,059,057, not including large expenditures from other special revenues. Total expenditures in 1940 were $144,612,581, of which the city contributed $82,729,262; the state, $52,656,382; the federal government, $9,226,937. Emergency home relief alone in 1940 cost $117,553,524, of which the city paid $73,152,142 and the state $44,401,382.

The board of child welfare consists of ten members, at least three of whom are women, appointed by the mayor for a term of ten years to serve without salary. An executive secretary with a salary of $6,000 directs the administration of the board. The board's responsibility is aid to dependent children (mother's aid) as defined under the federal social security act. Its budget appropriation, 1940–41, was $15,127,187, approximately half to be paid by the city and one-quarter by the state and federal governments, respectively.

The private relief agencies of the city offer a great variety of services for family welfare and institutional care. The more important ones are affiliated in the welfare council of New York city, which seeks to co-ordinate the efforts of the individual agencies and carry on special research and informational services in the interest of all agencies and the general public. Mention should be made also of the Jewish Board of Guardians, the many Catholic charities, and of the Community Service society of New York. The Association for Improving the Condition of the Poor (1848) and the Charity Organization society (1883) merged in April 1939 to form the Community Service society.

**Correction.**—The department of correction is under the direction of a commissioner appointed by the mayor at a salary of $10,000, and there are two deputy commissioners, each with a salary of $6,500. It administers the city institutions for the care and custody of criminals and misdemeanants and for the detention of witnesses in criminal actions. Under it are seven city prison units and 12 local district prisons; also, the house of detention for women, the New York city reformatory and the city penitentiary and workhouse. The budget appropriation, 1940–41, was $3,987,783. The total number of admissions to these prisons and institutions is about 170,000 annually.

Apart from the department of correction, the city magistrate's courts, the courts of domestic relations, the courts of special sessions and the county courts provide an extensive system of probational investigation and supervision. There is also a city parole commission comprising the commissioner of correction, the police commissioner (*ex officio*) and three members appointed by the mayor for ten years each. The mayor designates the chairman from the three appointees and the chairman receives $8,000 a year, and the other two members each $6,000. The budget of the parole commission, 1940–41, was $124,729. The commission employs a chief parole officer and 32 other parole officers. The jurisdiction of the commission extends to prisoners given indeterminate sentences by the city courts, and the officer assigned to each offender retains supervision for three years.

A large number of private agencies, including the Protestant Big Brother movement, the Catholic Big Brother and Big Sister organizations, the Volunteers of America, Salvation Army and the Jewish Board of Guardians, also deal with correctional problems.

**Public Water Supply.**—In the early days, the water supply of New York was derived from wells and from streams and ponds. In 1799 the Manhattan company was incorporated ostensibly to supply the city with water, but under a clause in its charter, devoted itself primarily to the banking business. In 1834 the legislature authorized the city to begin the necessary works to bring water from the Croton watershed more than 30 mi. north, and the first Croton water was delivered to the city in 1842 through the Croton aqueduct. In 1883 the new Croton aqueduct was authorized, and thus additional water became available in 1890. In 1905 the board of water supply was created and work was begun immediately on a new system to bring water from the Catskill mountains, more than 100 mi. north. This commission developed an additional water supply from the Esopus and Schoharie watersheds with a total dependable yield of about 600 million gallons daily flowing through the Catskill aqueduct.

The Catskill aqueduct delivers its water just north of the city line into Hill View reservoir, which has a storage capacity of 900 million gallons. From the Hill View reservoir, Catskill water is delivered into the five boroughs of the city by a circular tunnel in solid rock at depths varying from 200 ft. to 750 ft. below the street level, and reducing in diameter from 15 ft. to 11 feet. The total cost of the Catskill water-supply system was about $193,000,000. The average daily consumption of water in New York city for 1939 was 1,002.1 million gallons. Since the Catskill supply was so large, the city decreased its use of Croton water, but later facilities to use the entire Croton supply were provided. The present public water-supply systems provide a dependable yield of about 1,050 million gallons per day. In view of the narrow margin between this and the mounting consumption, a new construction program to draw water from the Delaware river was begun in 1936. The first stage of the Delaware supply system, comprising Rondout and Neversink reservoirs, with a short tunnel connecting them, and the Delaware aqueduct from Rondout reservoir to the city, was well under construction by 1941. The Delaware aqueduct will be a deep-pressure tunnel in rock, 13½ ft. to 19½ ft. in diameter and 85 mi. long. Like the Catskill aqueduct, the Delaware aqueduct will lead into Hill View reservoir at the northern boundary of the city, 295 ft. above sea level. From here through city tunnels nos. 1 and 2 the water will reach all five boroughs. The water supply is aerated and chemically treated, so the city's water is clear and wholesome. This first stage will add 170,000,000 gal. per day to the supply. The proposed second stage comprises the East Delaware reservoir and a 26-mi. tunnel to Rondout reservoir. Together they will add 540,000,000 gal. per day, and New York city will have a dependable supply of 1,500,000,000 gal., or 6,250,000 tons of water per day. A drainage area of 1,700 sq.mi., greater than the entire land area of Rhode Island, is required for the city's water supply system.

**Department of Sanitation.**—A department of sanitation was created in 1929, consolidating the five separate borough departments of street cleaning into one division of street cleaning. In 1933 the three-member sanitation commission was replaced by a single commissioner. The 1940–41 appropriation for the department was $31,556,996.40.

The area covered daily by the department consists of 5,000 mi. of streets, paved and unpaved, servicing of 655,000 buildings and homes, containing approximately 2,300,000 apartments for removal of garbage, ashes and refuse. This work is ordinarily accomplished with a personnel of about 14,000 men and 3,900 pieces of automotive equipment. About 25,000,000 cu.yd. of garbage, ashes and rubbish are collected daily. In outlying districts refuse is used for land fills; an outstanding example of such a reclaimed area is the site of the World's fair of 1939–40, which was turned into a park and recreational area. In emergencies such as heavy snowstorms this man power may be augmented by 35,000 extra labourers and 3,000 additional pieces of automotive equipment. In the winter of 1935–36, when there was a total snowfall of 32.8 in., its removal cost over $6,500,000.

**Public Works.**—The department of public works is directed by a commissioner appointed by the mayor at a salary of $12,000 a year. The department has charge and control of all planning, construction and repair work of all structures, buildings and other public works, paid for wholly or in part by city funds, and it must maintain and operate them. It also has charge of sewers and sewage-disposal plants. The budget appropriation for 1940–41 was $6,947,445.49.

The total plant controlled by the department reaches a value of $350,000,000. In 1939 the estimated cost of projects under construction totalled more than $101,000,000.

The city in 1941 was engaged in a vast sewage-disposal project whereby pollution of harbour waters will be eliminated. An engineering bureau was established in 1930 to tackle this problem, and in 1938, under the new charter, it came under the department of public works. The early bureau commenced work on the Ward's island plant, and completed the Coney island plant, giving the city its first modern sewage-disposal plant in 1935. Within five years three additional plants had been completed and put into operation: Ward's island plant, Tallmans island plant and a part of the Bowery bay plant.

The WPA program in 1939 involved public works projects in New York city costing $208,801,000 and employing 175,000 workers.

**City Planning and Zoning.**—The greater New York charter adopted in 1898 provided that the responsibility for laying out street systems should be primarily vested in the borough presidents, with specific approval resting on the board of estimate and apportionment, and independent approval by the mayor for changes in plan. In 1903 the board of aldermen created an improvement commission which reported in 1907. In 1913 a heights of buildings commission was created. This led to the building zone resolution of July 25, 1916, which regulated the height and bulk of buildings thereafter erected and the boundaries for trades and industries. This resolution divided the city into "use," "height" and "area" districts. The "use" districts are: (1) "residence," where no building can be erected other than for specified uses, such as dwellings, clubs, hotels, etc.; (2) "business," where specified trades considered as either offensive or dangerous are prohibited; and (3) "unrestricted," where no zoning regulations or restrictions are provided. The "height" districts provide for "setbacks" in buildings erected in excess of certain heights, the height and extent

# NEW YORK (CITY)

PHOTOGRAPHS, FAIRCHILD AERIAL SURVEYS, INC.

## NEW YORK'S MIDTOWN SKYSCRAPERS

1. Aerial view of New York City showing 42nd St. section with the RCA Building at the upper left and the spire of the Chrysler Building and the Queensboro Bridge in the background at the upper right

2. Aerial view of New York City showing 34th St. neighbourhood with the Empire State Building in the centre. The street slanting across the lower left is Broadway

# NEW YORK (CITY)

PHOTOGRAPH, ACME

**THE COMPLETED ROCKEFELLER CENTER**

Left to right, RKO building, containing the Radio City Music Hall; RCA building with fronting NBC studios; and the U.S. Rubber building rising above the Center theatre

of the "setbacks" depending on the width of the adjoining streets. There were six "area" districts designated as A, B, C, D, E and F, and the size of court and rear yard required bore a definite ratio with the height of the building. The new city planning commission designated a seventh, "G"—a residential zone restricted to one-family dwellings. Changes in the zoning regulations of 1916, and amendments thereto were vested in a standing committee of the board of estimate and apportionment, called the city plan and public improvements committee.

New York was the first city to adopt a zoning resolution. Efforts in 1939 and 1940 to establish a planning commission and a master plan for the city failed. However, the new charter provided for a city planning commission to consist of a full-time chairman, at a salary of $15,000 a year, and six members appointed by the mayor, and the chief engineer of the board of estimate. The chairman is head of the city planning department. The commission is charged with preparing a master plan of the city for its future development. It is responsible for completing and maintaining the city map; for zoning changes; the preparation of a capital budget and a five-year capital program; the approval of assessable improvements; the platting of land and the acquisition of land for streets and other public purposes. Appeals from the actions and decisions of the different superintendents of buildings and officers of the fire department who are charged with the enforcement of zoning regulations are made to the board of standards and appeals.

**Public Markets.**—The commissioner of public markets, who is appointed by the mayor at a salary of $10,000 a year, has jurisdiction over all public markets, market places and lands, and all auctioneers of foods and permits and leases for business. He also supervises the manufacture and sale of ice. The chief markets, wholesale and retail, are the Bronx terminal market, Essex street retail market, First avenue retail market, Fulton fish market, Gansevoort, Park avenue, Washington, West Washington, Thirteenth avenue retail market, Wallabout and numerous smaller street markets. A picturesque feature of the city's congested foreign districts is the open-air push-cart market. To protect the retailer and real estate values, the city has regulated the itinerant pedlar.

**Parks and Recreation.**—Reorganization in 1934 established a department of parks which is directed by a commissioner appointed by the mayor at a salary of $13,500 a year. All the employees are under civil service and the 1940–41 budget figure was $10,663,859.92. In 1939 the city had 381 modern playgrounds, ranging from a quarter acre to 30-ac. developments, such as Macomb's dam park in the Bronx. At the end of 1938 the park system included 20,246 ac. Among major additions and improvements were Flushing Meadows (site of the World's fair of 1939–40), Red Hook recreation area, Brookville and Juniper valley parks, Riverside park, Fort Tryon park, the Municipal stadium on Randall's island, Jacob Riis park, new zoos in Central and Prospect parks, and the entire reconstruction of Bryant, Highland and St. James' parks. The modern parkways for motor traffic are planned with regard to proper connections with state and county systems.

The largest of the parks are the Pelham bay (Bronx), 1,977 ac.; Van Cortlandt (Bronx), 1,132 ac.; Marine (Brooklyn), 1,593 ac.; Marine (Richmond), 1,256 ac.; Flushing Meadows (Queens), 1,054 ac.; Central (Manhattan), 840 ac., and Bronx, 719 ac.

Central park extends from 59th to 110th streets, between Fifth and Eighth avenues. It was purchased in 1856 for about $5,500,000, and laid out and developed by the architects Frederick Law Olmsted and Calvert Vaux, under the direction of a board of 11 commissioners, the first committee of construction including William Cullen Bryant, Washington Irving and George Bancroft. Van Cortlandt, Pelham bay and Forest parks are the largest generally devoted to outdoor sports and recreation. In Van Cortlandt park is the Van Cortlandt mansion, built in 1748, and now maintained as a museum. The Bronx park is noted for its zoological and botanical exhibits, the African veldt, opened in 1941, being one of its major attractions, and Prospect park for its beauty. Riverside park, in Manhattan, extends along the east bank of the Hudson river from 72nd to 129th streets, a distance of about three miles. Battery park was the site of "The Battery" in the early days of the city. The aquarium occupies the old Castle garden in this park. City Hall park constitutes a part of what was called "The Common Lands" in the middle of the 17th century. Roger Morris park is the site of the Jumel mansion, the home of Mme. Jumel, wife of Aaron Burr, and here Gen. Washington made his headquarters during the battle of Harlem heights. In Audubon park was the home of the naturalist John James Audubon. Poe park, in the Bronx, is the site of the Edgar Allan Poe cottage. In Fort Greene park, Brooklyn, is a vault containing the remains of a few of those who died in the British prison ships in 1776 and after.

**Courts.**—The judicial system of the city is composed of the following courts: magistrates' (minor offences), including felony, homicide, municipal term, night, probation, traffic, week-end, women's, arrest, summons and adolescent courts; municipal (civil actions involving not more than $1,000); city (civil actions involving $1,000 to $3,000); county (in New York county, the court of general sessions; major crimes); special sessions (chiefly misdemeanours); domestic relations, including family and children's courts (children under 16, except murder in the first degree); and surrogate's (estates of infants and deceased persons). The mayor appoints about 80 city marshals.

## VI. EDUCATION

**Public School System.**—The free public school system is administered as the department of education by an unpaid board of seven, appointed by the mayor, for terms of seven years. The school system in 1940 comprised 763 public day schools with an enrolment of 1,055,633. There were 75 high schools, 24 of which were vocational. For each district there is a local board of five appointed by the borough president for five years. Members receive no compensation and may be removed by the borough presidents after a hearing.

The chief executive officer of the board of education is the superintendent of schools who is elected by the board of education and sits with this body though without vote. He receives a salary of $25,000 a year and holds office for six years. There are eight associate superintendents of schools. The superintendent and associate superintendents of schools constitute the board of superintendents. Teachers are chosen by the board of education from eligible lists of those who have qualified before a board of examiners of seven members appointed by the board of education. The total personnel of the department of education is estimated at 47,904. Expenditures of the city for educational purposes (including libraries) in 1940–41 amounted to $194,169,792.02, of which $53,415,187.04 was appropriated by the state toward the payment of teachers' salaries. A teachers' retirement system is administered by the teachers' retirement board of seven unpaid members.

**Higher Educational Facilities.**—The city provides such facilities in the College of the City of New York (co-educational), Hunter college (women), Brooklyn college and Queens college. The College of the City of New York, or City college, was established as the free academy in 1847. The name was changed to the present one in 1866. The college occupies buildings of English Gothic style, constructed at a cost of over $5,000,000. Its enrolment in 1940 was in excess of 30,000, while its teaching staff was 989. Hunter college for women, originally intended as a teacher training school, was established by the board of education in 1869 as the "normal and high school." Free to women residents of the city, its enrolment in 1940 numbered 14,216, its staff 539. In addition, New York is the seat of Columbia university (*q.v.*), and New York university, which was founded in 1831. In 1835, it moved to Washington square, and in 1891 added a site of about 48 ac. on University heights in the Bronx. It enrols over 36,000 students. Fordham university (7,000 men students) was founded in 1841 as St. John's college. In 1846 it was turned over to the Jesuits and incorporated as Fordham university. It is situated in the Bronx. Long Island university in Brooklyn had in 1940 an enrolment of 1,365 students, chiefly in the schools of law and medicine. The year 1928 witnessed the opening of Yeshiva college (Jewish) which occupies new buildings of Ancient Semitic architecture situated in upper Manhattan. In 1940 it had just 204 students. Among the more important of the professional schools are: the General Theological seminary (Protestant Episcopal); Union Theological seminary (Presbyterian); Jewish Theological Seminary of America; Cornell university medical college; College of Physicians and Surgeons in the city of New York (Columbia university); University and Bellevue hospital medical college (New York university); New York Post Graduate Medical school and hospital; Homeopathic Medical college; Long Island university medical college in Brooklyn; Columbia university law school (Columbia university); Fordham university law school; New York law school; New York university law school; Brooklyn law school of St. Lawrence university; Brooklyn college of pharmacy; college of pharmacy of Columbia university; Fordham university college of pharmacy; School of Dental and Oral Surgery of Columbia university; Teachers' college of Columbia university; New York school of social work; the Institute of Public Administration; and the New School for Social Research. The chief technical institutions are the Mechanics Institute school, founded in 1820; Cooper Union (*q.v.*); the Peoples institute for the promotion of adult education; and Pratt and Polytechnic institutes, both in Brooklyn. The New York State Nautical school is conducted on board the U.S.S. "Newport."

**Libraries.**—The first public library in New York was the Corporation library, established at the City Hall (1697–1701). Up to 1795 it remained at the City Hall and was the Library of Congress when New York was the nation's capital. It is now called the Society library. Other older libraries are: the Columbia university library (1754), that of the American Historical

Society (1804), and the Mercantile library, founded in 1820 by merchants' clerks. The municipal library system consists of the New York public library, serving Manhattan, the Bronx and Richmond; the Brooklyn public library and the Queens public library. (For the numerous and important special libraries in New York see *American Library Directory*, 1935.)

**Art.**—Most of the principal American sculptors have at some time resided in New York and it is here, frequently in inconspicuous places, that one finds their masterpieces. St. Gaudens is represented by his "Peter Cooper," the equestrian statue of Sherman, the Admiral Farragut statue, the bronze relief of the Rev. Henry W. Bellows and other works; John Quincy Adams Ward, by the "Pilgrim," "Shakespeare," "Indian Hunter," and a monumental bronze Washington; Frederick W. MacMonnies by his "Nathan Hale," "Civic Virtue," "Horse Trainers and a Quadriga"; Daniel Chester French by the "Alma Mater"; and George Gray Barnard by a fountain at Columbia; Karl Bitter by an "Abundance" and an equestrian statue of Franz Sigel; Anna Hyatt by a "Jeanne D'Arc"; Kirke Brown by an equestrian Washington; F. Auguste Bartholdi, the French artist, by a "Lafayette"; H. P. Proctor by a bronze group of panthers; and Edward Kemeys by a "Still Hunt." On the front of the Public library is Paul Bartlett's statue. A group by Albert Weinter depicting the purchase of Manhattan island is in the City Hall of Records. The "Statue of Liberty" of Bartholdi, gift of France for the 100th anniversary of American independence, rises from Bedloe's Island 300 ft. above the harbour. *See* LIBERTY, STATUE OF.

Central and Prospect parks are adorned with many examples of fine statuary, and unfortunately, also, with many which are lacking in merit. Many sculptors are represented in the busts of great Americans in the Hall of Fame at New York University.

A few striking examples of 18th and early 19th century architecture still remain, notably St. Paul's chapel, designed by MacBean and built in 1764, the old church of St. Mark's-in-The-Bouwerie, completed in 1799, and City Hall, the work of Mangen and Macomb, completed in 1811. Renwick designed the Gothic Grace church, completed in 1845, and St. Patrick's cathedral, which was built between 1858 and 1879. After the Civil War Richard M. Hunt, a graduate and teacher in the Paris School of Fine Arts, began his American career. Among his first works were the recently demolished French chateau of William K. Vanderbilt, the Astor and Gerry houses and the Tribune building. George B. Post designed many beautiful residences, the Times and World buildings and the Produce and Cotton exchanges. Charles F. McKim, William R. Mead, and Stanford White were designers of the old Madison Square Garden, the Washington arch and the Metropolitan club. R. H. Robertson is known for his work on the American Tract Society and United Charities buildings. Carrère and Hastings planned the National Academy of Design and the New York public library; H. I. Hardenburg the Waldorf, Savoy and Manhattan hotels, and the American Fine Arts building; and Ernest Flagg the Singer building, St. Luke's hospital and the Scribner building. The chief collection of art objects in America is in the Metropolitan Museum of Art. The Cloisters, in Fort Tryon park, is a branch of the museum. A gift of John D. Rockefeller, Jr., it contains the outstanding set of Gothic tapestries in the U.S.: "The Hunt of the Unicorn."

The art commission of the City of New York was established in 1898, being the first American municipal organization designed to protect a city against inferior structures and memorials.

**Music.**—In the first quarter of the 19th century, the Park theatre became a famous stage for dramatic and musical art. In the '40s and '50s the musical centre was Tripler hall on lower Broadway, which became Metropolitan hall in 1854 and then, following its destruction by fire shortly after, was rebuilt and rechristened the New York theatre and Metropolitan opera house. Later its name was changed to the Winter Garden. The present Metropolitan opera house was built in 1883. In the latter half of the 19th century several other large halls for musical recitals were opened, notably, Steinway, Chickering, Hardman and Carnegie halls, the last named being the largest auditorium available in this period. It was in the middle and latter part of the 19th century, however, that the musical history of New York really began (*see* MUSIC: *United States*).

**Literature.**—Cadwallader Colden, author of the *History of the Five Nations* (1730) was perhaps the first New York author of general reputation. The first authors' club, the Ancient club of New York, was founded in the latter part of the 18th century and later included among its members Washington Irving, Fitz-Greene Halleck, James Kirk Paulding and Joseph Rodman Drake. A little later John James Audubon, Richard Henry Dana, James Fenimore Cooper, Edgar Allan Poe, William Cullen Bryant, John Bigelow, Julia Ward Howe and Robert Bonner were members of New York's literary life. In the 19th century the Bread and Cheese club brought together a most creditable group of writers. As the country expanded, however, the influence of New York upon letters declined somewhat although it is the centre of American printing and publishing. The chief society of authors having headquarters in New York is the American Academy of Arts and Letters. Other notable literary organizations are the Society of Arts and Letters, Authors' Guild, Catholic Writers' Guild of America, New York Drama League, American Dramatists, Grolier Club, Century Association and League of American Penwomen.

**Scientific Collections and Learned Societies.**—Chief of the scientific collections is that of the famed American Museum of Natural History. The Aquarium at Battery park and the Zoological park in Bronx park are both under the control of the New York Zoological Society.

The Botanical garden in Bronx park occupies about 400 ac. The museum contains a library, collections with about 1,800,000 specimens and research laboratories; its income comes from an endowment and from public funds. The Brooklyn Institute of Arts and Science (*q.v.*) maintains another large botanical garden.

The Hispanic Society of America, founded by Archer M. Huntington, maintains an excellent museum of Spanish and Portuguese paintings, manuscripts, maps, coins and antiquities. Other interesting collections are in the Museum of the American Numismatic Society, containing exhibits of medals and coins of all countries and of all periods, and the American museum of Safety (industrial safety appliances).

The New York Historical Society, founded in 1804, is the most important for material on New York State History. The Long Island Historical Society of Brooklyn and the New York Geneological and Biographical Association, founded in 1869, are notable in this field. The Quadrangle at Broadway and 156th street is the location of the American Numismatic Society, the Geographical Society of New York, the Museum of the American Indian and Hispanic Society of America. The New York Academy of Medicine, established in 1847, the Academy of Political Science at Columbia university, founded in 1880, and the New York metropolitan chapter of the American Society for Public Administration, also deserve mention. (*See* SOCIETIES, LEARNED.)

(For New York city press data *see* PUBLISHING; NEWSPAPERS. For foundations *see* CARNEGIE TRUSTS; ROCKEFELLER BENEFACTIONS, etc. For museums *see* MUSEUMS AND ART GALLERIES and MUSEUMS OF SCIENCE.)

## VII. THEATRES, CLUBS AND CHURCHES

**Theatres, Arenas and Exhibitions.**—The first dramatic performances in New York were probably those given in a building in Pearl street by a company of actors from London in 1732. Another company from London came to New York in 1749. The real beginning of the permanent theatre in New York was, however, in 1750, when a company under the management of Kean and Murray came from Philadelphia and established themselves in a house on Kip street (now Nassau), between John street and Maiden Lane. Lewis Hallam arrived in 1753 from Virginia and erected a theatre in Nassau street, the first building constructed for theatre purposes, and opened it in 1753 with *The Conscious Lovers* and *Damon and Phelleda*. The first performance of *Romeo and Juliet* was given at this theatre in 1754 with Mrs. Hallam as Juliet. This theatre was abandoned the same year and was converted into a church by a society of Calvinists. The next

theatre was at Crugers wharf on the East river and was opened by David Douglass in 1758 with *Jane Shore*. Douglass also opened another theatre at the corner of Nassau and what is now Beekman street in 1761 with *The Fair Penitent* and later gave the first performance of *Hamlet* in New York; he also established the John Street theatre, in 1767. This theatre flourished until the Revolution and during the British occupancy of the city was used for amateur theatricals. After the British evacuation, Washington and his generals were frequent patrons of this theatre.

In 1798 was created a three-story stone theatre "The Park," between Ann and Beekman streets on Park Row, for Hallam and Hodgkinson. This building was a very magnificent one for its time, costing about $180,000. The story of the theatre in New York for the next 50 years is largely the story of the Park theatre (*see* DRAMA: *United States*). In 1837 New York had five theatres, the Park, Bowery, Olympic, Chatham and Richmond Hill. Palmer's opera house was built in the '40s as was also the Astor Place opera house, where the Astor Place riot occurred as the result of a dispute between friends of the American actor Forrest and his English rival Macready. Twenty-two persons were killed and about 40 were wounded by the militia called to quell the disturbance. In 1850, P. T. Barnum brought Jenny Lind to America for a series of concerts which began at Castle Garden at the Battery. Similar "pleasure gardens," as Niblo's, the New York, Cold Spring, East River, Vauxhall and Ranleagh, were utilized for concerts and other performances for which the capacity of theatres was inadequate. The Crystal Palace in Murray Hill was also a great amusement centre in the early '50s. By the middle of the century the theatrical district was well established in the neighbourhood of Union square, which was also the shopping centre. The Academy of Music, the Union Square, Irving Place and Wallack's were the chief theatres in this area. By 1870 23rd street had become the upper limit of the theatrical and shopping centre, with the Fifth Avenue theatre and Booth's. Ten years later the theatres had invaded the lower '30s with Daly's, the Standard, Wallack's and the Casino. In 1883 the erection of the Metropolitan opera house at 39th street started an invasion of the '40s and by the end of the century, 42nd street had become the real centre of the theatrical district as it is to-day. The present theatre district comprises roughly a strip of Manhattan extending from 14th to 59th streets, and from Fifth to Eighth avenues. Broadway cuts diagonally across the strip and in the language of the district is the "main stem" to which the cross streets are tributary. In this area there are to-day about 200 theatres, including those in which moving pictures are a part of the program. According to the best available data, there are in all 4,445 theatres in Greater New York, including those exhibiting moving pictures as part of their entertainments. Among the largest are: Radio City Music hall (6,200), Roxy (5,920), the Capitol (4,845), the Academy of Music (3,600), Paramount (3,664) and the Metropolitan opera house (3,418).

Most of the theatres exhibiting the "legitimate" drama or musical comedies only are of less than 2,000 capacity (*see* STADIUM). The total seating capacity of places of amusements is about 1,500,000. (*See* THEATRE; DRAMA.)

**Clubs.**—Club life in New York is less significant now than in the earlier part of the present century before the development of the apartment house hotels, the change in social habits and customs coincident with the expansion of business and trade into former residential districts, and the exodus from the city into suburban areas of so many of the leisured class who formerly sought city clubs for recreation and entertainment. The first social organizations of importance were the authors' Bread and Cheese club (1824), and the artists' sketch club (1829). It was not until 1836, however, that club life in New York really began with the founding of the aristocratic Union and Hone clubs. The Knickerbocker (1871), was also the resort of the descendants of original New York settlers. The St. Nicholas was formed a little later for those whose ancestors were early residents of the colonies. The Metropolitan (1891), with its costly house, was in fact a protest against the exclusiveness of many of the older clubs. The Union League (1863) was established for the purpose of aiding the Union, and its first work was the organization of regiments of Negro troops. To offset this Republican influence, the Manhattan was organized in 1864 to advance Democratic ideals, although this is not now greatly emphasized.

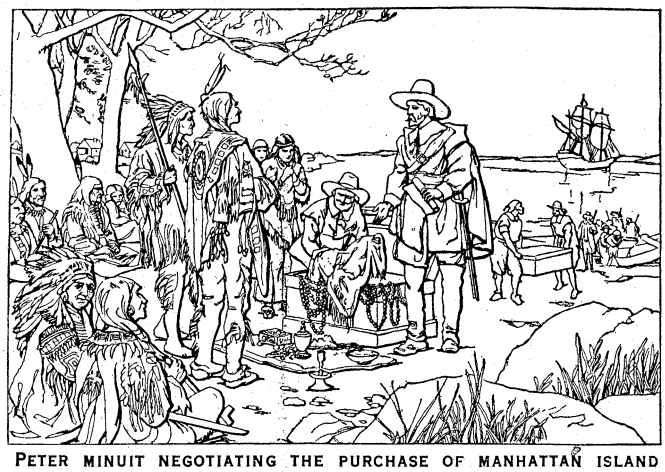
The chief sport and athletic clubs are the New York Yacht (1844), the New York Athletic (1868) and the Racquet and Tennis. Other important clubs with more or less specialized interests are the Advertising Club of New York, Automobile Club of New York, the Camera, Century, City, Colony, Engineers, Explorers, Harvard, Lambs, Yale, Lawyers, Lotos, Players, and Salmagundi clubs. Many of the great office buildings in down-town New York contain luncheon clubs, such as the Down-town Association, the Lawyers, Bankers and Whitehall.

**Churches.**—The Dutch Reformed Church (1628) was the first church in the city and is to-day known as the Collegiate Church of New York city. The Presbyterians organized here as early as 1638 and were tolerated by the Reformed Church, but it was not until the English occupancy that they made their influence felt. In 1719, the first Presbyterian church was built in Wall street; there are about 100 to-day. It was not until 1847 that a Congregational church attained great prominence in New York, when the Plymouth Church of Brooklyn was founded with Henry Ward Beecher as pastor. The Congregationalists now number about 50 active churches. In 1664, the Lutherans obtained permission from the English Governor Nicolls to establish a church. The first Lutheran church was at Broadway and Rector street; it was destroyed in the fire of 1776. They grew rapidly and now number nearly 200 churches and chapels. The Protestant Episcopal Trinity church was built in 1697 at Broadway and Wall street where the present Trinity (1846) now stands. St. Paul's chapel (1766), at Broadway and Vesey street is the oldest church edifice in the city; Grace, St. Thomas's, the Church of the Transfiguration, familiarly known as "The Little Church Around the Corner," and the great Cathedral of St. John the Divine, at 110th street and Morningside avenue, are other notable Episcopal churches. The first Methodist church (1768) was erected in John street. African Methodist Episcopal churches for Negroes have a large membership. The first Baptists in New Amsterdam (1657), received little consideration at official hands and met in a private house in Broad street in 1715. In 1762 they built a church in Gold street. At present, they have about 120 churches, some of the largest being for Negroes. St. Peter's (1785) was the first Roman Catholic church and in 1808, New York was made the seat of an Episcopal see. In the years prior to the Civil War the Catholic Church grew rapidly. In 1858, the present St. Patrick's cathedral at Fifth avenue and 51st street was begun, and in 1879 it was dedicated. It is the fourteenth in size among cathedrals and seats about 4,500 persons. There are about 430 Catholic churches. Besides other Christian groups there are numerous flourishing Jewish congregations, some of them of considerable age. There is also a number of undenominational churches and missions. (L. GU.)

## VIII. HISTORY

New York bay and Hudson river were probably first discovered by Giovanni da Verrazano, an Italian navigator, in 1524, and seen also by Estéban Gómez, a Portuguese, in 1525. It is commonly stated that the first competent exploration of New York bay and its environs was made by Henry Hudson in the "Half Moon" in Sept. 1609. But there is in Paris a map dated (1570) which shows in considerable detail the topography near the mouth of the Hudson. In 1611 Adrien Block came to Manhattan island and returned to trade for furs with the Indians. In 1614 he explored the harbour of Manhattan and its adjacent waters and was probably the first European to enter Long Island sound. The States-General of Holland granted a charter to the New Netherland Company giving it the exclusive right to trade in New Netherland for four voyages, to be made within three years from Jan. 1, 1615. In 1615 the company built a storehouse and fort on the south end of Manhattan and a few huts sprang up around it. On Jan. 1, 1618, the charter expired. In June 1623 New Netherland was formally established as a province of the West India company.

The next year a party of about 30 Protestant Walloon families arrived. Of these colonists only about eight men remained on Manhattan, the remainder going to establish Ft. Orange where Albany now is. The next year more colonists came, and when director May gave way to director Van der Hulst, the colony numbered almost 200 persons. The government of the New Netherland province was vested in a director general and a council.



PETER MINUIT NEGOTIATING THE PURCHASE OF MANHATTAN ISLAND FROM THE INDIANS, 1626. AFTER THE PAINTING BY ALFRED FREDERICH

These officers, though formally appointed by the company, were subject to the approval of the States-General. The first director-general, Peter Minuit, arrived with additional colonists in 1626, purchased Manhattan island from the Indians with pieces of bright cloth, beads and other trinkets to the value of 60 guilders or about $24, erected Ft. Amsterdam at the lower end of the island, and made New Amsterdam the seat of government. Wouter Van Twiller, who succeeded him in 1633, was recalled in 1637 because of his mismanagement. Under the wise rule of Peter Stuyvesant (*q.v.*) the province prospered and, at the time of the transfer of New Netherland to English control, the population stood at about 10,000 (*see* NEW YORK: *History*). In 1658 Stuyvesant established a "Rattle Watch" of eight men which may properly be called New York's first police force. The strife between the English and Dutch went on until 1664, when Col. Richard Nicolls took possession of the city without bloodshed on Sept. 8, 1664. The English flag was raised over the fort, which was renamed Ft. James, and New Amsterdam became New York.

The rights of the Dutch settlers were carefully maintained at first, and established institutions changed only gradually. The English reorganized the city government (1665) with a mayor, aldermen and sheriff to be appointed by the governor of the province for a term of one year, and also extended the city limits to include all of Manhattan island. The Dutch reoccupied the city from July 30, 1673, to Nov. 9, 1674, when Colve surrendered to Sir Edmund Andros, the new English governor. Andros restored the English form of city government. The next hundred years is in the main a record of continuous struggle for control of the city government between the royal agents and the inhabitants. There were good and bad governors, but none was capable of stemming the tide of popular demand for greater freedom of self-determination. The first serious break in English resistance came with the refusal of the merchants of New York and other parts of the province to pay certain duties exacted by the "Duke's Laws." Governor Thomas Dongan called the first New York assembly on Oct. 17, 1683, and to this body freemen were permitted to elect representatives. Dongan's régime is notable also for "Dongan's Charter," which was granted the city in April 1686 and whereby sources of income were vested in the city corporation, all previous rights and privileges being confirmed and conveyed to the corporation, including the proprietorship of the City Hall, the market houses, bridges, wharves, docks, cemeteries, ferries, unoccupied lands, and the waters within the city. The city seal presented to the corporation the same year is that which it now employs with its motto *Sigillum Civitatis Novi Eboraci*, except that an eagle was substituted for the royal crown in 1784. Under the rule of Jacob Leisler (1689–91) the people were permitted, for the first time, to elect their own mayor, Peter De Lanoy, a privilege that lapsed until 1834. Sloughter, Leisler's successor, appointed as mayor Abraham DePeyster, a young, cultured and popular man of irreproachable character. He was effective in conciliating the warring factions, and responsible for many public improvements. The old "rattle watch" or police of the city was reorganized by DePeyster in 1697, and placed again under civil control. DePeyster built new wharves, provided the first system of poor relief, and instituted sanitary betterments. Business prospered in spite of the unrest in the province as a whole. Pirates in and about New York were a source of constant irritation, and Governor Benjamin Fletcher, who had succeeded Sloughter, was even suspected of being in league with them. They were finally dispersed by Bellomont, Fletcher's successor, and a measure of confidence in the government restored. But the incompetence of governors Cornbury and Lovelace increased resentment against English government; and its appointed mayors, though in the main men of good standing, were so frequently changed that none except William Peartree (1703–1709) made noticeable impressions upon municipal affairs. Peartree established the first free grammar school and a school for Negro slaves. He also improved the jail and provided a debtor's prison in the city hall. Governor Robert Hunter, a cultured gentleman, who took office in June 1710, was more tactful than his predecessors; but his regime was ten years of turmoil. In April 1712, insurgent Negroes massacred nine white men and wounded many more. Twenty-one Negroes were legally executed, some in a most barbaric manner, and a large number of others, innocent as well as guilty, were imprisoned. Broadway was graded from Maiden Lane to the Commons, under Mayor Caleb Heathcote, and a new Presbyterian church was built. In 1725 under Governor William Burnet, William Bradford established the first New York weekly paper, the *New York Gazette*. In 1731 the city imported a fire engine from London. In 1733, John Peter Zenger, proprietor of the *New York Weekly Journal*, was charged with libelling Governor William Cosby and was brought to trial, but was so ably defended that the jury exculpated him almost without deliberation. This was regarded as establishing the freedom of the press. A "Negro plot" against the whites was "revealed" by an irresponsible servant girl in 1741. Thirty-four Negroes were killed, 24 whites thrown into jail, and suspicion fell upon many prominent people. In 1742 the paid civil patrol was abandoned and an unpaid citizens' watch established. This was so unsatisfactory that in 1747 a military watch was reinstated and continued until 1762, one year after the inauguration of street lighting.

### IX. INDEPENDENCE

By the middle of the 18th century New York city was regarded as the focal point of resistance to royal authority. A majority of its leading citizens were descendants of the Dutch patroons, intelligent men and women who, though loyal to the English Government, were fully aware of its incompetency in America. Governor George Clinton, who returned to England in 1753 after a stormy rule of ten years, turned over the government to Sir Danvers Osborn on Oct. 7. The next day, Osborn's body was found hanging in the garden of his home. Chief Justice DeLancey took oath as lieutenant governor and became acting governor. On Oct. 31, 1754, DeLancey signed the charter of King's college (now Columbia university, *q.v.*), which had been established in 1753 in the vestry room of Trinity church. News of the capture of Quebec by Wolfe in 1759 was hailed in New York with great enthusiasm, and causes of resentment against English rule were soon supplied by the imprisonment of New York sailors by British men-of-war in the very harbour of the city. When copies of the Stamp Act reached New York, it was denounced by the newspapers. On Oct. 7, 1765, the Stamp Act Congress was called at the City Hall, with representatives from all provinces. While the congress was still in session on Oct. 23, a British ship arrived loaded with stamps, and in the face of the resistance of the people

PHOTOGRAPH, ACME

## SKYSCRAPERS OF NEW YORK CITY

Aerial view of midtown New York, with the Hudson river in the foreground. The two tallest spires in the centre are those of the Empire State building and the Chrysler building

PHOTOGRAPH, FAIRCHILD AERIAL SURVEYS, INC.

## THE STATUE OF LIBERTY, BEDLOE'S ISLAND, NEW YORK HARBOUR

This statue was presented to the United States by France; the sculptor was Frederic Auguste Bartholdi. Every traveller entering or leaving New York harbour views this statue as a landmark and a symbol of the country. A new flood light system was inaugurated in October 1931

the fort prepared itself for defence. On Nov. 1, 1765, a band of the Sons of Liberty hanged Governor Colden in effigy at the very door of the fort, and then burned the houses of several prominent officials. Mayor John Cruger finally induced Colden to turn over the stamps to the city corporation; but the Sons of Liberty were firm in their resistance to the enforcement of the Stamp Act and it was finally repealed on March 18, 1766. New York went wild with excitement and the Sons of Liberty on June 4 erected a liberty pole in "The Fields" (City Hall park), where a replica now stands. Rioting between the Sons of Liberty and the British soldiers was of almost daily occurrence and finally, in 1770, Mayor Hicks issued a proclamation forbidding soldiers to leave the barracks unless accompanied by an officer. The liberty pole, which had been erected and cut down several times, was finally put up on the Commons and inscribed "Liberty and Property." But with the arrival of Sir William Tryon as governor, in July 1771, it became apparent almost at once that the temporary peace would shortly end. News that a tea ship was on its way to New York to carry out Lord North's purposes of taxation was received with violent expressions of defiance throughout the city. The Sons of Liberty reorganized to stir up resistance. When the ship reached New York, on April 7, 1774, its landing was refused, a few chests of tea were thrown into the bay by a committee of the Sons of Liberty previously appointed, and the ship sent home to England. The closure of the port of Boston was the signal for the calling of a meeting at Fraunces' tavern and the election of a Committee of Fifty-one, which issued the call for the first congress of the Colonies. The Committee of Fifty-one was dissolved with the election of a new committee of observation to enforce in New York the Nonimportation Act of the First Congress. From this time on events moved swiftly. On April 23, 1775, news of the Battle of Lexington reached New York. A mob took possession of City Hall and seized munitions stored there. Two British ships in the harbour were seized and their cargoes unloaded. The Committee of Sixty called for the election of a new Committee of One Hundred to arrange for calling a war congress of deputies from all New York counties. The provincial congress met in New York and declared obedience to the Continental Congress, while reserving their right of internal control. On June 25, Gen. Washington arrived in New York with his staff on the way to Boston and the same day Governor Tryon returned from England. Each was received with official ceremony, but Washington's reception as he passed up Broadway was an ovation. On April 4, 1776, New York was put under military rule by Gen. Israel Putnam, and batteries were installed along the East river and other strategic points. On the evacuation of

FROM PHELPS STOKES COLLECTION

**NEW AMSTERDAM C. 1650, FROM A VIGNETTE ON THE N.J. VISSCHER MAP OF NEW BELGIUM, 1651–55**

**At the southern extremity is the fort; the building with the spire is the church and directly behind it is the general's house**

Boston, Washington moved his headquarters to New York. The news of the Declaration of Independence came to New York on July 9, 1776, and was read to the soldiers who immediately thereafter tore down the equestrian statue of George III. in Bowling Green, an act denounced by Washington in the next day's general orders. On July 12, Admiral Howe appeared with his fleet in the harbour, but not until Aug. 22 were troops landed at Gravesend bay. On Aug. 27, the advance of British troops toward the American lines on Brooklyn Heights was begun and by 2 o'clock the same day, the heights were taken by the British. On the evening of the 29th Washington withdrew all his troops from Long island without interference and reorganized in New York. The British then undertook to cut off the American army, on Sept. 15, by throwing a line of troops across Manhattan at about 34th street. But the Americans got to Harlem Heights, where Washington again reorganized. On Sept. 16, the British attacked unsuccessfully at Harlem Heights. About a week later, a fire broke out at Whitehall Slip and almost completely destroyed the lower part of the city. Trinity church was burned but St. Paul's and King's college were miraculously saved by a shifting of the wind. On this same evening, Nathan Hale, a spy for the American army, was captured on Long island and tried in New York by Gen. Howe. He admitted that he was a spy and was condemned and hanged at a spot near 45th street and First avenue. New York was held by the British troops for the remainder of the war. During British occupancy, it was used largely as a prison camp. Churches, warehouses, jails and stores were packed with men sick and well. On the site of the fire, a village of huts and tents had sprung up which was called "Canvas Town," and occupied by bandits and "roughs." Robberies were a daily occurrence and citizens could expect no relief from the British soldiers. In Wallabout bay, on the East river, an old hulk, the "Jersey," was used by the British as a prison ship and there over 11,000 men died. The city was in desperate straits for want of supplies, and sickness ravaged the people. There was no government except military rule, and the oppression of civilians by the soldiery was the cause of frequent riots. Justice was not to be had and the revenues of the city corporation were appropriated by the military for their private uses. After the surrender of Cornwallis at Yorktown, however, Sir Guy Carleton, a humane and honest officer, succeeded the intolerant Sir Henry Clinton in May 1782, and immediately undertook the restoration of law and order. By the time of the evacuation, Nov. 25, 1783, confidence in government was in a fair way to restoration.

The parting of Washington with his troops came on Dec. 4, 1783, at Fraunces' tavern. After the departure of Washington, James Duane was appointed mayor by Governor Clinton. Business slowly revived with freedom from restrictions of trade. King's college, by act of legislature, May 1, 1784, became the State university, and its name was changed to Columbia college. At this time, the population of the city was about 24,000. Congress made New York the capital. On April 30, 1789, Washington was inaugurated at Federal hall at the corner of Broad and Wall streets, and a day of celebration followed. There was still intense feeling against the loyalists, but commercial interests soon erased the memories of personal conflict. The rise of commerce and wealth drew many people to New York, and it began to take on the appearance of a metropolis. As capital, the city was continually gay with festivities, public and private. But on Aug. 12, 1790, Washington made his last official visit to Federal hall and went to the new capital, Philadelphia. Edmond Charles Genet, on his arrival with the secret purpose of embroiling America in a war with England, was received in New York at first with great enthusiasm, but with his recall, interest in French affairs grew cool. Men were too busy with their own affairs. Since 1786, the population had doubled and new streets and public utilities had been laid out. Collect pond, now the site of the Tombs (city prison), was the scene of the first trials of John Fitch's steamboat in 1796. New York ceased to be State capital in 1797. On July 11, 1804, the death of Alexander Hamilton in his duel with Aaron Burr threw the city into mourning and Burr was so execrated he left in the night of July 21. This year the New York Historical Society was founded. With the help of Mayor DeWitt Clinton and of several of the founders of the society, there was organized, in 1805, the Society for Establishing a Free School in the City of New York. Under Clinton schools were built and Columbia college improved, philanthropic organizations increased in number, and arts and letters were stimulated. In 1807 there were 19 newspapers, of which eight were dailies. Although the Embargo Act of that year struck New York trade a serious blow, it was not without benefit in stimulating home industry. Finally, the Non-intercourse Act relieved the situa-

tion somewhat. The City Hall was completed in 1812, and there was at this time a very considerable advance both in architecture and building construction. Many new buildings, chiefly churches, were built, new streets were graded, and swamps were filled in along the water front. Collect pond was filled in and the hills and valleys of lower Manhattan were rapidly leveled for homes and other structures. In the midst of this prosperity, war was declared against Great Britain. The toll exacted from New York was tremendous; the burning of Washington by the British resulted in a great concentration of troops in New York. New fortifications were thrown up along the water front and the old ones strengthened. But on Feb. 11, 1814, the ship "Favorite" arrived at New York under flag of truce with British and American messengers and the treaty of peace. A jubilee followed and Sunday was a day of fervent thanksgiving. New York was then transformed almost over night. DeWitt Clinton was again mayor, and under his guidance the services of government were everywhere improved. Cadwallader D. Colden succeeded Clinton and likewise advanced all governmental and private services for public welfare. Great numbers of immigrants from Europe arrived and the problems of dealing with this great mass of new residents taxed the city to its limits. Yellow fever broke out in 1819, 1822 and 1823, and hundreds died daily until the epidemics were checked with the coming of cold weather; others occurred ten years later with similar loss of life, but the city continued to grow with amazing rapidity. The opening of the Erie canal on Nov. 4, 1825, began a three days' celebration. At this date, the modern history of New York begins.

Under Mayor Philip Hone (1826) fine dwellings, public buildings and mercantile establishments multiplied; wealth increased and the continuing influx of immigrants made evident the need for greater educational opportunities. The University of the City of New York was established in a splendid new building opened in 1835. There were now over 200,000 people in the city, and transportation was a pressing problem, only partly solved by the horse-drawn street cars. Another great fire broke out below Wall street on Dec. 16, 1835, and the succeeding months saw great distress. Croton water was furnished the city July 4, 1842. Blackwell's (now Welfare) island, purchased in 1828 for $50,000, was made the site of the city's correctional institutions and hospitals. The New York *Sun,* whose issue by Benjamin H. Day was begun in 1833, sold for a penny. The *Herald* of James Gordon Bennett appeared in 1835, the *Tribune* of Horace Greeley in 1841, Henry J. Raymond's *Times* in 1851. The theatre was thriving, business was rapidly spreading uptown, and Union square was the residential centre. Beyond Union square, there was little but open fields at the middle of the century. The World's Fair at the Crystal palace on Murray Hill was the outstanding event of 1853; in 1856 Central park was purchased. But in 1857 business was paralysed, thousands thrown out of work, and over 900 merchants failed; riots and disturbances of all kinds ensued. The same year, the State legislature laid the basis for the modern metropolitan police force, and a new régime of law and order was begun. The city recovered quickly from the depression of 1857, and at the outbreak of the Civil War was again thriving; it authorized a loan of $1,000,000 for defence of the Union, and hundreds of thousands more were privately pledged. New York was again filled with soldiers. Rioting broke out in July 1863 as a protest against army drafts and for five days there was turmoil. More than 50 buildings were burned and several hundred people killed or wounded. Mayor Opdyke, in 1863, reported that the people of New York had contributed up to that time $300,000,000 for war purposes, and had furnished over 80,000 men. During the war, the establishment of schools, scientific and literary associations, libraries, museums, and clubs went on apace, and at its end New York was still able to find resources for great public works. Brooklyn bridge was begun in 1870, and sanitary conditions, which in 1865 had been thoroughly studied by a citizens' committee and found deplorable, were on their way to betterment. New public improvements opened fresh opportunities for "graft" by public officials. Under the Tammany mayor, A. Oakey Hall, in 1872, a gigantic conspiracy for looting the city, known as the "Tweed Ring," was exposed by the New York *Times* and a citizens' committee. The thefts of the "ring" ran into hundreds of millions, the "graft" in the erection of the county court-house alone amounting to about $8,000,000. "Boss" Tweed and many of his followers were tried and sent to prison, and Tweed died there. Then followed a reform administration, but in 1874 Tammany regained control. The corporate limits of the city were extended in 1874 to include about 13,000 ac. across the Harlem river, in the Bronx, and in 1895, a still further extension in the same county was made which brought the city limits to the southern boundaries of Yonkers and Mount Vernon. In this same year, Col. George E. Waring, representing a reform administration under Mayor William L. Strong, was made commissioner of street cleaning and with his "white wings" inaugurated the modern system of street cleaning and refuse collection. The city was still further increased in 1898 by the annexation of Kings, Richmond, and a part of Queens, counties, and a new charter was enacted for the Greater New York. During all this period of administrative reconstruction, Tammany Hall continued the great political power, although occasionally defeated for the mayoralty. In 1897, Tammany again got control of the mayor's office by the election of R. A. Van Wyck, but was defeated in 1901, because of its abuse of power. Seth Low, a reform mayor, served during 1902 and 1903 when Tammany regained control. During the next 30 years Tammany generally maintained its political power. Mayors George B. McClellan (1904–10) and William J. Gaynor (1910–14) were both elected by Tammany and both were able men and strove to give the city good government, even under the handicaps of the Tammany political system. In Mayor McClellan's administration, however, a citizens' civic agency, the New York Bureau of Municipal Research (organized in 1906), disclosed and published a report on irregularities in the administration of the office of Borough President Ahearn of Manhattan. Mayor McClellan appointed as a special counsel, John Purroy Mitchel, who secured sufficient evidence of these irregularities to warrant Governor Hughes in removing Borough President Ahearn for incompetency. In Mayor Gaynor's administration, a police lieutenant was arrested, tried and later found guilty of complicity with gangsters in the murder of a New York merchant, who was on the point of making disclosures of police corruption to the district attorney. Mayor Gaynor, wounded in an attempt upon his life, failed in health and died Sept. 10, 1913, almost at the end of his term. The police scandals of Gaynor's administration swung popular sympathy against Tammany, and John Purroy Mitchel, candidate for mayor on a "fusion" ticket, was elected and took office in 1914. In Sept. 1914, a special aldermanic committee of investigation undertook a complete survey of police administration and methods. The facts finally brought out by this committee furnished clear evidence of police incompetency and corruption. Mayor Mitchel's administration from 1914 to 1918 was regarded as exceptionally efficient because of the administrative reforms which he instituted.

Yet in the next election Mitchel was defeated by an overwhelming vote, and John F. Hylan, another Tammany mayor, took office in 1918, on a platform of outspoken repudiation of the Mitchel administration. Mayor Hylan held office for two terms during which time there was continuous wrangling among the superior officers of administration to the extent that little of importance for the city's betterment was accomplished. One of the outstanding features of government in the period covered by the administrations of Gaynor, Mitchel and Hylan, was the enormous increase of budget from $163,130,270.37 in 1910, to $345,530,039.77 in 1921. In 1925, Mayor Hylan, denounced by many of his own Tammany supporters, was refused party support, and James J. Walker, a representative of the "new Tammany," who had made a good record in the State senate, received the Democratic nomination. He was well supported by Governor Alfred E. Smith who was everywhere recognized as the actual leader of Tammany Hall, and, without much opposition from the Republicans, Walker was elected with the endorsement of a great popular vote. The great issues of the Hylan administration, rapid transit and subway fares, continued paramount under the new Mayor without

however, reaching a satisfactory solution. In 1932 Mr. Walker was summoned before Governor Roosevelt to answer charges of graft brought by Mr. Seabury, counsel for the Hofstadter committee; and failing to halt these proceedings for his removal, he chose to resign from office. After an interim under Joseph V. McKee (Sept. 1–Dec. 31, 1932) and John P. O'Brien, during which the city's credit became badly strained, a reform candidate on a fusion ticket, Fiorello LaGuardia was elected mayor in 1933 and re-elected in 1937 and 1941. The LaGuardia administration was marked by such events as the unification of the transportation system under city operation, the completion of the Triborough bridge and Lincoln tunnel and Queens mid-town tunnel, development of the Delaware water supply system and the World's fair of 1939 and 1940. The wave of civic regeneration set in motion by the Seabury investigations was carried forward by District Attorney Thomas E. Dewey and John H. Amen, with a series of political and gangster prosecutions and convictions. Though Tammany hall strengthened its shattered position with each election, the voters were twice given an opportunity, in 1936 and 1938, to vote on proportional representation and each time voted in its favour.

LaGuardia did not run for re-election in 1945, and William V. O'Dwyer, a Democrat, was elected mayor.

BIBLIOGRAPHY.—R. B. Rankin, *Guide to the Municipal Government* (1936); City Record Office, *The City Record* (1873 *et seq.*); *Municipal Assembly Record* (1924 *et seq.*); annual and special reports of the mayor, comptroller, estimate board, education, police, fire, hospital and other departments; G. Myers, *The History of Tammany Hall* (1917); biographies of mayors and other leading figures; R. B. Rankin, ed., *New York Advancing* (1936); F. A. Rexford, *Our City: a textbook on city government by high school students;* New York City Plan and Survey Committee, *Finances, and Financial Administration of New York City* (1928); City Affairs Committee, *Bulletins* (1931 *et seq.*); Citizens Union, *The Citizens Union of the City of New York, 1897–1931* (1931); Welfare Council of New York City, *Research Studies* (1926–1937); National Institute of Public Administration, *Governmental Organization within Greater New York* (1931); Regional Plan of New York and Its Environs, *Economic Series,* 12 v. (1924–1927), *Engineering Series,* 3 v. (1925–1927), *Regional Survey,* 8 v. (1927–1931), *Annual Reports* (1930 *et seq.*), *A Report of Four Years' Progress* (1933), and *Information* Bulletins (1931 *et seq.*); W. T. Bonner, *New York, the World's Metropolis, 1624–1924* (1924); L. S. Mitchell, *Manhattan: now and long ago* (1934); J. G. Wilson, ed., *Memorial History of the City of New York,* 4 v. (1892–1893); M. W. Goodwin, et al., *Historic New York,* 2 v. (1899); H. C. Brown, *The Story of Old New York* (1934); R. Gilder, *The Battery* (1936); A. F. Harlow, *Old Bowery Days* (1931); J. L. Wells, *The Bronx and Its People: a history* (1927); I. N. Phelps Stokes, comp., *The Iconography of Manhattan Island 1498–1909* (1915–1928); R. R. Wilson, *New York, Old and New, Its Story, Streets and Landmarks* (1909); W. Irwin, *Highlights of Manhattan* (1937); Columbia University Press, *Directory of Social Agencies of the City of New York* (1935); G. C. D. Odell, *Annals of the New York Stage,* 7 v. (1927–1931); Port of New York Authority, *Annual Reports* (1920 *et seq.*); H. W. Lanier, *A Century of Banking in New York* (1922); H. Brown, *Brownstone Fronts and Saratoga Trunks* (1935); A. D. Flinn, *Engineering Achievements and Activities of New York City* (1913); N. Thomas, *What's the Matter with New York?* (1932); New York State Joint Legislative Committee, *Reports* (1932); M. R. Werner, *Tammany Hall* (1931); Mrs. S. Van Rensselaer, *History of the City of New York in the Seventeenth Century* (1909); *New York City Guide,* Federal Writers' Project (1939). (R. B. F.; L. Gu.)

**NEW YORK, CHICAGO AND ST. LOUIS RAILROAD,** popularly known as the Nickel Plate Road, operated, in 1939, 1,704 miles of railroad between the city of Buffalo, New York, and the mid-western gateways of Chicago and Peoria, Illinois and St. Louis, Missouri. The first construction was between Arcadia, Ohio and McComb, Ohio, in 1881. Construction was completed between Buffalo and Chicago in 1882, and the first train operated October 22, 1882.

The New York Central Railroad Company controlled the New York, Chicago and St. Louis Railroad for many years. But in 1916 the control of the road was acquired by the Messrs. O. P. and M. J. Van Sweringen of Cleveland, who, after largely rebuilding the property, consolidated it with the Lake Erie and Western, extending from Sandusky, Ohio, to Peoria, Illinois, and the Toledo, St. Louis and Western (popularly called the Clover Leaf), extending from Toledo to St. Louis. Through this consolidation, the mileage was more than tripled, and the road's strategic position was enhanced as a result of additional gateways reached by the different rails. Since 1935 the total freight tonnage ranged from 17 to 22 million tons yearly. The capital structure, on December 31, 1939, included 337,422 shares (par $100) of common stock and 360,535 shares (par $100) of preferred stock outstanding. In 1939 the operating revenues were $43,175,402. (G. D. Br.)

**NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY, THE,** is a comprehensive transportation system serving Southern New England and New York with rail and highway transportation. It operates 1,867mi. of railroad, the network of lines being the result of consolidation and merger of 137 separate lines.

The New England Transportation Company, a subsidiary, operates passenger and freight motor service over more than 3,360mi. of highway.

Boats are operated through a subsidiary, The New England Steamship Company, between the mainland and the islands of Martha's Vineyard and Nantucket. Through the Connecticut Company, Berkshire Street Railway Company, County Transportation Company and Soundview Transportation Company, the "New Haven" is also engaged in street car and bus transportation.

The territory served comprises the most densely populated territory in the United States. Passenger traffic produces nearly 40% of the gross revenues. The important industries are metal and textile manufacturing. The New Haven was the first steam railroad in the country to adopt electrification, and its four-tracked line between New York and New Haven, with its branches, approximate 127 miles which are entirely electrified. Its capital stock (1939) was $218,693,337 and its bonded debt was $250,509,850.

**NEW YORK CENTRAL SYSTEM,** an important system of railway, serving the northern and eastern portions of the United States. Its chief termini in the East are New York and Boston, and in the West, Chicago and St. Louis; it also serves such cities as Detroit, Buffalo, Cleveland, Cincinnati, Louisville, Montreal. The most important railroad of the system is that of the New York Central Railroad Company, a consolidated corporation formed of different companies operating railroads between New York and Chicago. The first railroad of this company was chartered in 1826 and opened for traffic in 1831. The company's important subsidiaries, controlled by stock ownership or by lease, are the Michigan Central Railroad Company; the Cleveland, Cincinnati, Chicago and St. Louis Railway Company, known as the Big Four; Boston and Albany railroad; and the Pittsburgh and Lake Erie Railroad Company. The mileage of the system is 11,340mi. of road and 26,912mi. of track, a large portion of which is protected by automatic signals and automatic train control. The system is owner of 3,835 locomotives, 152,189 freight cars, and 4,598 passenger and other cars, and at the end of 1939 had an investment in road, equipment and other property of approximately $2,454,500,000. Outstanding for the system were securities (capital stock and bonds) not owned by the company or by lessor companies, amounting to $1,586,151,721, which includes a total funded debt of $967,577,197. On Dec. 31, 1939, the parent company had outstanding 6,447,413 shares, no par value, of capital stock in the hands of 62,094 stockholders. The lines transported over 145,128,339 tons of freight in 1939, of which 46% was coal, 28% manufactured articles, and the remainder general traffic. General offices are in New York city. (L. V. Po.)

**NEW YORK FERN** (*Dryopteris noveboracensis*), a beautiful North American fern of the shield-fern group. While named after New York, it is native to a much greater region, occurring in moist woods from Newfoundland to Minnesota and southward to Georgia and Arkansas. The delicate fronds, 1 to 2 ft. high, rise on slender stalks (stipes) from widely creeping rootstocks. (*See* SHIELD-FERN.)

**NEW YORK STATE BARGE CANAL SYSTEM** consists of the Erie canal, the Champlain canal, the Oswego canal, the Cayuga-Seneca canal, Cayuga Lake Inlet at Ithaca, the Glens Falls Feeder and the lakes, reservoirs, feeders, harbour basins and terminal docks facilities. The total length of the system is about 525 miles.

The total number of locks on the main channels of the improved canals, exclusive of the U.S. Government lock at Troy, is 56. There are 34 locks on the Erie, 11 on the Champlain, 7 on the Oswego canal and 4 on the Cayuga and Seneca canal.

In addition, there are two junction locks and two guard locks.

Navigation is free and the usual navigation season is about seven months from early in April to December 1. The canals are available for use 24 hours of the day. Boats about 300 ft. long, 42 ft. wide, with a draft of 10 ft. and a cargo capacity of 2,200 tons are generally used.

The Erie Barge canal is the main waterway, connecting the Hudson river at Troy with Lake Erie at Buffalo. It has a total length of 340 mi. and serves as the main route of transporting grain from the west to New York. It is 150 ft. wide and 12 ft. in depth. The cost of construction was $139,214,929.

The Cayuga and Seneca canal connects Montezuma, N.Y., with the Cayuga and Seneca lakes and affords communication between these lakes and the Erie canal. Including the lakes the length of the canal is 92 mi.; exclusive of the lakes, it is approximately 24 miles. It is 200 ft. wide and 12 ft. in depth. The cost of construction was about $8,154,000.

The Champlain canal connects Whitehall, N.Y., at the head of Lake Champlain with the Erie canal at Waterford, providing a waterway between the Atlantic seaboard and the navigable St. Lawrence. It is 60 mi. long, 125 ft. wide and 12 ft. in depth. The cost of construction was about $21,691,000.

The Oswego canal connects Lake Ontario at Oswego with the Erie canal at Syracuse and provides communication between Syracuse and Oswego, and by the use of the Welland canal, with the other Great Lakes. The cost of construction and improvement was about $12,000,000.

Through federal aid, the Erie canal from Waterford to Three River Point and the Oswego canal from its junction with the Erie canal at that point to its mouth at Oswego, the canal entrance at Lake Ontario, were being improved in order to provide for a channel depth of 14 ft. between locks. This work includes the raising of fixed bridges to a minimum vertical clearance of 20 ft. above maximum navigable pool. The usual clearance provided under the fixed bridges spanning the canals is 15½ feet.

**NEW ZEALAND,** a British dominion, consisting of a group of islands lying in the south Pacific between 34° 25′ and 47° 17′ S., and between 166° 26′ and 178° 36′ E. The group is situated eastward of Tasmania and Victoria; and Wellington, its capital and central seaport, is 1,204 mi. distant from Sydney. New Zealand has a total area of 103,416 sq.mi. The dominion proper comprises North and South Islands (44,281 and 58,092 sq.mi. respectively), cut asunder by Cook strait, a channel varying in width from 16 to 190 mi. Stewart Island (670 sq.mi.), separated from South Island by Foveaux strait; and Chatham Islands (372 sq.mi.), E. of Cook strait. The Aucklands (234 sq.mi.) and Campbell Island (44 sq.mi.) are the principal of outlying islands (the total area being 307 sq.mi.) included within the geographical boundaries of New Zealand as proclaimed in 1847; while the former are uninhabited, they contain two of the finest harbours in the Pacific. Six hundred miles north of the Aucklands are the volcanic Kermadecs (13 sq.mi.), annexed in 1887, with abundant vegetation. In Polynesia a number of inhabited islands were brought under New Zealand control in 1901. Rarotonga and Mangaia, in the Cook group (84 sq.mi.), and Niue, or Savage (115 sq.mi.), of islands outside the Cook group, are the largest of these. Rarotonga is hilly, well watered and very beautiful; Penrhyn and Suvorov, small coral atolls outside the Cook group, contain excellent harbours. New Zealand also administers Western Samoa (main islands are Upolu and Savai'i, 430 and 703 sq.mi. respectively), a League of Nations mandate; the Ross Dependency (about 175,000 sq.mi.), an antarctic region claimed by Great Britain in 1923; and the Union, or Tokelau, Islands (4 sq.mi.), in 1925 transferred from the Gilbert and Ellice Islands colony. Nauru (8 sq.mi.) is held jointly with the United Kingdom and Australia.

North Island is 515 mi. long and varies in breadth from 6 to 200 miles. It is almost cleft in twain where the Hauraki gulf penetrates to within 6 mi. of Manukau harbour. From the isthmus thus formed a narrow, very irregular peninsula reaches out northward for some 200 mi., moist and semitropical, and beautiful rather than uniformly fertile.

South of the isthmus aforesaid, the North Island rapidly broadens out. Its central physical feature is the series of unbroken mountain chains running northeast from Cook strait to East cape on the Bay of Plenty, ranges seldom under 3,000 ft., but never attaining 6,000 ft. in height. Ikurangi, their highest summit, though a fine mass, does not compare with the isolated volcanic cones which, rising west of the main mountain system and quite detached from it, are among the most striking sights in the island. Ruapehu (9,175 ft.) is intermittently active and Ngauruhoe (7,515 ft.) emits vapour and steam incessantly. Egmont (8,260 ft.) is quiescent; its symmetrical form and dense clothing of forest make it the most beautiful of the three. North of the two first-mentioned volcanoes Lake Taupo spreads over 238 sq.mi. in the centre of a pumice-covered plateau from 1,000 to 2,000 ft. above the sea; and round and beyond the great lake the region of the thermal springs covers 5,000 sq.mi. and stretches from Mount Ruapehu to White Island, an ever-active volcanic cone in the Bay of Plenty. The most uncommon natural feature of the district, the Pink and White terraces, was blown up in the eruption of Mt. Tarawera in 1886, when for great distances the country was buried beneath mud and dust, and a chasm 9 mi. long was opened. Fine lakes and waterfalls, innumerable pools, in temperature from boiling point to cold, geysers, solfataras, fumaroles and mud volcanoes still attract tourists in large numbers. The healing virtue of many of the springs is widely known. The government maintains a sanatorium at Rotorua and Te Aroha, and there are private bathing establishments in other places, notably near Lake Taupo. In South Island there are hot pools and a state sanatorium at Hanmer Plains. The most remarkable cures effected by the hot waters are in cases of gout, rheumatism, diseases of the larynx and in skin disorders. Though the overlying porous pumice reduces the fertility of the Taupo plateau, except under treatment, it has a good rainfall and is drained by unfailing rivers running through deep terraced ravines. The Waikato and Waihou flow north, the Rangitaiki northeast, and Mokau, Wanganui, Rangitikei and Manawatu west or southwest. The first named, the longest river in the colony, though obstructed by a bar like all western—and most eastern—New Zealand rivers, is navigable for some 70 miles. The Mokau and Wanganui run between ferny and forest-clad hills and precipices, often of almost incomparable beauty.

East of the Taupo plateau and south of Opotiki on the Bay of Plenty are steep thickly-timbered ranges. On the southern frontier of this mountainous tract Waikaré Moana extends its arms, the deepest and most beautiful of the larger lakes of the island.

From the mouth of the Waikato southward to about 25 mi. from Cape Terawhiti on Cook strait, and for a distance of from 20 to 40 mi. inland, the western coast skirts fertile grazing and dairy-farming country. On the east coast the same fertility is seen and, round Hawkes bay, a hotter and drier summer. In the south centre, the upland plain of the Wairarapa has a climate adapted for both grazing and cereals. The butt-end of the island, of rather poor, rough, though well grassed wind-beaten hills, is redeemed by the fine harbour of Port Nicholson, which vies with the Waitemata in utility to New Zealand commerce. Everywhere the settler may count on a sufficient rainfall, and—except on the plateau and the mountain highlands—mild winters and genial summers. To pass Cook strait and land in the middle of South Island is to pass from Portugal to Switzerland, a Switzerland, however, which has long fertile plains extending to the east coast and giving the highest yield of cereals in New Zealand. As a rule the shores of South Island are high and bold enough. They are not too well served with harbours, except along Cook strait, in Banks peninsula, and by the grand but commercially useless fjords of the southwest. In the last-named region some 15 salt-water gulfs penetrate into the very heart of the mountains, winding amid steep, cloud-capped ranges, and tall, richly clothed cliffs overhanging their calm waters. The dominating features of south New Zealand are not ferny plateaus or volcanic cones, but stern chains of mountains. There the Southern Alps rise range upon range, filling the whole centre,

almost or quite touching the western shore, and stretching from end to end of the island. West of the dividing crest they are forest clad; east thereof their stony grimness is but slightly softened by growths of scrub and tussock grass. The rivers are many, even on the drier eastern coast. But, as must be expected in an island but 180 mi. across at the widest point and yet showing ridges capped with perpetual snows, the rivers, large or small, are mountain torrents, now swollen floods, anon half dry. The largest river, the Clutha, though but 154 mi. long in its course to the southeast coast, discharges a volume of water estimated at nearly 2,000,000 cu.ft. a minute. On the west the only two rivers of importance are the Buller and the Grey, the former justly famous for the grandeur of its gorges. Te Anau and Wakatipu (52 mi. long) are the chief lakes in the south though Manapouri is the most romantic. Mt. Cook is easily first among the mountain peaks. Its height, 12,349 ft., is especially impressive when viewed from the sea off the west coast. On the northeast a double range, the Kaikouras, scarcely fall short of the Southern Alps in height and beauty. Apart from the fjords and lakes the chief beauties of the Alps are glaciers and waterfalls. The Tasman glacier is 18 mi. long and has an average width of 1¼ mi.; the Murchison glacier is 11 mi. in length. To the west of Mt. Cook the Franz Josef glacier crawls into the forest as low as 900 ft. above sea level. Among waterfalls the Sutherland is 1,904 ft. high, but has less volume than the Bowen and others. The finest mountain gorge, the Otira, is also the chief railway route from the east to the west coast. Generally the open and readily available region of South Island extends from the Kaikouras along the east and southeast coast to the river Waiau in Southland. It has a mean breadth of some 30 mi. In compensation the coal and gold, which form the chief mineral wealth, are found in the broken and less practicable west and centre.

**Climate.**—New Zealand, stretching through over 11° of latitude, would present more contrasts of climate were it not for the fact that oceanic influences penetrate everywhere. Most of it is in or near the northern border of the westerlies with their cyclones though the north end feels the trade winds in summer. The only really large mass of high land is in the southern half of South Island and even here maritime influences prevent winter cold from lasting continuously for long.

The following table resumes some important data:—

| | Jan. Mean t° | July Mean t° | Total rainfall | |
|---|---|---|---|---|
| Auckland | 66.3 | 51.2 | 45.3 | Greater in winter |
| Rotorua | 66.2 | 47.5 | 55.2 | " " " |
| Napier | 64.8 | 47.3 | 35.2 | " " " |
| Wellington | 60.9 | 47.2 | 47.5 | " " " |
| Nelson | 61.5 | 45.0 | 38.0 | " " " |
| Hokitika | 59.0 | 44.0 | 114.3 | Spring often wettest |
| Lincoln, near Christchurch | 60.3 | 42.5 | 25.6 | Generally distributed |
| Dunedin | 58.6 | 39.5 | 37.0 | " " |
| Ophir, in central Otago | 62.3 | 36.9 | 17.6 | Spring often wettest |
| Invercargill | 57.0 | 41.4 | 45.3 | " " " |

The range of mean temperatures is small, the rainfall moderate save on the west slopes of the Southern Alps. (*See* Hokitika above.) The snowline reaches down to 3,000 ft. on the eastern side of the Southern Alps which has rather lower temperatures than other parts, but on the western side it is at 3,700 feet. Nelson, sheltered from the west, is famed for its sunny climate with cool bracing nights.

The winter maximum of rainfall in the north follows naturally from the regime of the winds, the all-the-year round distribution of the light rainfall on the east side of South Island contrasts with the tendency to a spring maximum on the western and southern fringes of the Southern Alps. The heavy rainfall on the west has permitted glaciers to exist and to reach down into the lowlands in some places in spite of the general mildness. The mountainous Stewart Island has 65.2 in. of rainfall. The mildness and rainfall permit widespread evergreen vegetation and the healthiness of the islands is attested by a remarkably low death rate.

**Flora.**—There are about 1,000 species of flowering plants, of which about three-fourths are endemic. Most of those not peculiar to the country are Australian; others are South American, European, antarctic; and some have Polynesian affinities. Ferns and other cryptogamic plants are in great variety and abundance. The New Zealand flora, like the fauna, has been cited in support of the theory of the remote continental period. In appearance the more conspicuous flora differs very greatly from that of Australia, Polynesia and temperate South America, and helps to give to the scenery a character of its own.

The early colonists found quite half the surface of the archipelago covered with dense, evergreen forest, a luxuriant growth of pines and beeches, tangled and intertwined with palms, ferns of all sizes, wild vines and other parasites, and a rank, bushy, mossed undergrowth. Though much of the timber is of commercial value—notably the kauri, totara, puriri, rimu, matai and kahikatea—this has not saved the forests from wholesale, often reckless, destruction for settlement purposes. In late years active operations by the state, private companies and the settlers themselves, in re-afforestation with European, Californian and Australian soft woods are doing much to restore the earlier ravages. These improvements are mainly in the naturally open and grassy regions of the east and southeast.

**Fauna.**—In their natural state the islands had no land mammals. The Polynesians brought a dog, now extinct, and a black rat, now rarely seen. The wild dogs and pigs in outlying districts are descendants of domestic animals which have escaped into the bush. There are no snakes. There are bats, one belonging to a peculiar genus and one related to Australian and South African forms. New Zealand was very rich in birds, the tui and makomako being famed as songsters, while the flightless and weak-winged birds were numerous; the kiwi (*Apteryx*), kakapo (*strigops*), takahe (*Notornis*) cannot fly. The last named is very rare and has not been seen since 1898. New Zealand formerly possessed the gigantic running bird called the moa (*Dinornis*), a huge rail (*Aptornis*) and other bird types now extinct. The earlier destruction of the forests had disastrous effects on bird life. In the Alps a hawk-like green parrot, the kea, which has been known to kill sheep, holds its ground. The pukeko, a handsome rail, abounds in swamps.

Bush and grass fires, cats, stoats and weasels, introduced in the 19th century, have reduced the bird population; and deer, pheasants, trout and salmon have been introduced by sportsmen. The most famous New Zealand animal, scientifically, is the Tuatara, the sole survivor of the reptilian order of the Rhynchocephalia, otherwise extinct since Mesozoic times so far as is known. The butterflies are few and moths numerous; there was a native beach spider (*katipo*) now extinct. An organism named *Peripatus* has a New Zealand species; it is intermediate in structure between the earthworms and the myriapods and species occur in various isolated regions, mostly in southern lands.

Resolution, Kapiti and little Barrier islets have been set aside as sanctuaries for the native fauna.

Tidal waters furnish minute whitebait, and the mud flats of salt or brackish lagoons and estuaries flounders. Oysters, both mud and rock, are good and plentiful. Sharks are found everywhere, and are common around the north; they rarely attack man. The albatross is the most conspicuous sea bird. Penguins are found, confined to the islets of the far south. (H. J. B. D.; X.)

## GEOLOGY

New Zealand is part of the Australasian festoon on the Pacific edge of the Australasian arc. Owing to its critical position it has had a particularly varied geological history, and includes, for its size, an unusually complete series of marine sedimentary rocks. It is still a matter of doubt whether pre-Cambrian rocks constitute any portion of the islands. The oldest rocks, however, extend at intervals down the western side of the South Island. They include a complex of gneisses, schists and dioritic igneous rocks in Fiordland, and sillimanite gneisses on Stewart Island.

**Main Divisions.**—The first evidence of life appears in rocks of Lower Ordovician age, forming a folded belt in the south at Preservation inlet and in the extreme northwest at Collingwood. They comprise graptolitic slates, quartzites and marbles, and are characterized by an Arenig fauna including *Tetragraptus, Bryograptus, Dichograptus* and *Didymograptus*. According to the Geological survey the metamorphic rocks already referred to form a Pre-Ordovician series below these fossiliferous sediments, but it is to be noted that no clear line of separation between the two series has yet been discovered. An alternative view regards the Ordovician rocks as passing gradually into mica schists, which are invaded, as in Fiordland, by gneissic diorites. The strike of these ancient rocks ranges from west-northwest to north-northeast, but is not very different from the associated Ordovician sediments.

Between the Ordovician sediments and the succeeding Silurian series a strong unconformity is probable. The latter are known only in the northwest of the South Island, on the Baton river and at Reefton. The rocks include argillaceous limestones and shales on the Baton river, and a littoral facies of quartzite, greywacke and limestone at Reefton, both with a Wenlock fauna.

Nothing is known of the geological history of New Zealand between the Upper Silurian and the close of the Palaeozoic period, from which time the stratigraphic record in the islands is particularly complete. Much of the highlands are built up of folded greywackes, slates and some limestone, with a volcanic horizon recognized near the base of this folded series. The whole is divided into a Permian (Maitai) series and a Mesozoic (Hokonui) series. The nature of the junction between the two is still little understood, various authorities claiming a complete conformity, much regression, or marked diastrophism with plutonic (dioritic) intrusions.

In the type locality (Nelson district) the Maitai series (limestones, shales and slates) contain *Platyschisma, Strophalosia, Martiniopsis* and *Spirifer bisulcata,* a fauna characteristic of the Permian beds of eastern Australia. An extensive series of basic breccias (Te Anau series) forms the base of the Maitai series and upon which the fossiliferous sediments rest. The top of the series is formed of greywackes, in places containing annelid tubes (Terebellina). These are referred to a Lower Triassic age. This Permian series has a wide distribution in the South Island. The succeeding events are not clear. Probably there followed a regression of the sea, succeeded in turn by a transgression when the Hokonui beds were laid down. The base of this series is of Middle Triassic age, these beds being followed by Upper Trias. They include the Carnic, Noric and Rhaetic stages, the sediments being greywackes, limestones, an horizon of basic tuffs (Noric) and Rhaetic plant beds. The sequence or portions of it are recognized from both the South and North Islands.

The Noric beds, characterized by an abundance of *Pseudomontis,* have a very wide distribution, extended throughout the Southern Alps in Canterbury, along the Hokonui hills, in the Nelson district, and in the Mokau district of North Taranaki. The series extending from the Middle Trias to the Rhaetic is of great thickness, of the order of 10,000 feet. These beds are followed conformably by Jurassic felspathic sandstones, conglomerates, plant beds and some thin coal seams. Liassic, Bajocian and also Upper Jurassic marine faunas have been described. A widespread series of sediments containing *Inoceramus* occurs in the east of the North Island, probably, in part, of Upper Jurassic age, but extending into the Lower Cretaceous. The problematical schists of the South Island, well developed in the Otago region, and referred to as the Otago schists, are perhaps of Mesozoic age, though they have been referred to horizons from the Archaean to the Jurassic. They appear to pass outwards into sediments indistinguishable from Ordovician or Mesozoic strata.

At the close of this sedimentation, in Lower Cretaceous times, a strong orogenic movement supervened, in which the Hokonui system was folded along meridional lines, the earth movements being accompanied by widespread plutonic intrusions throughout the length of New Zealand. The dunite sills of the Dun mountain region and the gabbros and norites of North Cape belong to this epoch, as perhaps do also some of the diorites of the southwestern district of the South Island. The intensest folding in the North Island is developed in the east; in the west the flexures become more open and undulating strata predominate. In the Otago region, the Otago schists have recently been interpreted as a flat lying series forming a packet of recumbent folds, the participating rocks being referred to members of the Maitar and Hokonui series.

**Sequence of Formations.**—Following the Hokonui diastrophism a series of sediments ranging from Middle Cretaceous to Upper Pliocene was deposited, but the record has received diverse interpretations, particularly in regard to the structural relations of the beds and the correlation of formations in neighbouring regions. According to the view of Marshall, the whole series is conformable throughout, a difference in age of the basal strata in different districts being ascribed to overlap over an irregular surface of the older rocks. Summarily, the sequence of formations is as follows:

| | |
|---|---|
| Middle Cretaceous (Albian) . | Marine beds (in Kaikoura ranges) |
| Upper Cretaceous { Senonian . | Greensands, basal coal measures |
| Upper Cretaceous { Danian . | Limestones (partly foraminiferal) |
| Eocene . . . . . | Marine beds and coal measures |
| Oligocene } Miocene } . . . . . | Marine beds |
| Pliocene . . . . . | Marine beds and gravels |

The oldest rocks of this sequence are developed in the Karkoura mountains of Marlborough, where a thickness of from 3,000 to 9,000 ft. of sandstones and mudstones, with conglomerates and some coal measures were deposited. These Albian beds are followed by the Amuri limestones (2,500 ft.), but in Canterbury and the coast of Marlborough Senonian strata underlie the limestone series. In the succeeding Eocene period the coal measures of the southwestern district of the South Island were formed and constitute the most valuable coal seams of New Zealand. The transgressions of Oligocene and Miocene times submerged much of both South and North Islands, but in the central region of Otago the land remained emergent. Fluviatile and lacustrine deposits, however, covered large parts of this area. They are frequently auriferous. A general retreat of the sea from the South Island took place in Pliocene times, but the North Island remained largely below sea level. In the Wanganui area a wonderful development of clays, 3,500 ft. thick, was deposited, apparently without break. The present topography of New Zealand developed as a result of important crust warpings and block faulting. The faults are not simple tensional movements, but involved strong lateral pressure, in which overthrusting and overfolding are developed. The isoclinally folded Tertiary rocks of the Lake Wakatipu region show particularly well the extreme effects of this movement. The earliest development of vulcanicity after the Post-Hokonui orogeny is seen in the Middle Cretaceous basalts of the Clarence region and the Upper Cretaceous rhyolites near Christchurch. Vulcanicity became more widespread in Mid-Tertiary times. To this period belong the pillow lavas and tuffs of the Oamaru district and the rhyolites, andesites and dacites of the Coromandel peninsula. Propylitization of these andesitic rocks gave rise to the auriferous deposits of this latter area. Somewhat later came the alkaline eruptions of the Dunedin district and the basalts forming Banks peninsula. The alkaline rocks of the former area include a varied succession of alkaline trachytes, phonolites, trachydolerites and basalts.

Volcanic activity of Upper Tertiary time extending to the present day led to extensive eruptions of andesites and rhyolites in the North Island. Mt. Egmont consists largely of andesite. The main centres of activity lie on a northeast line of crustal weakness extending from Ruapehu to Mt. Edgecumbe, and the great rift of the Tarawera eruption extending to Lake Rotomahana has a similar trend. In the Pleistocene, the present system of glaciers had a great extension, and they undoubtedly reached sea level in the southwest of the South Island. On the east they appear to have been confined to the mountain valleys.

Study of the fossil fauna and flora of the New Zealand region

points from many lines of evidence to intimate connection, in Mesozoic times, between this land, Australia and Malaysia. In the later Cretaceous period the connection between Australia and New Zealand was severed, though the latter was directly associated with Antarctica. In the Upper Cretaceous only one species of mollusc (*Natica variabilis*) is known to be common to Australia and New Zealand. The complete isolation of the New Zealand region seems to have been accomplished by Middle Tertiary time, by a gradual break up of the circum-Pacific connections.

BIBLIOGRAPHY.—Information on the geology of New Zealand is contained in the *Bulletin* of the Geological Survey of New Zealand, and in the *Transactions* of the New Zealand Institute. *See* also C. W. Cotton, *The Geomorphology of New Zealand* (1922); F. W. Hutton and J. Drummond, *Animals of New Zealand* (4th ed., 1923); C. C. Nutting, *Fiji-New Zealand Expedition: Narrative and Preliminary Report of a Scientific Expedition from the University of Iowa* (1924); N. E. Coad, *Geography of the Pacific* (1926); W. R. B. Oliver, *New Zealand Birds* (1930); W. J. Phillips, *Fishes of New Zealand*, vol. I (1940); R. M. Laing and E. W. Blackwell, *Plants of New Zealand* (4th ed., 1940); W. G. McClymont, *The Exploration of New Zealand* (1940); W. Martin, *The Flora of New Zealand* (rev. ed., 1940). (C. E. T.; X.)

## POPULATION AND IMMIGRATION

**Population.**—In Jan. 1840 New Zealand had a more or less fluctuating population of about 1,000 whalers, sealers, traders, missionaries and settlers. By 1861 the number was still slightly under 100,000. Gold discoveries in the 1860s and in the next decade a vigourous developmental policy of public works and assisted immigration multiplied the number of colonists nearly five times to 489,933 in April 1881. Then increase slackened because of economic depression, but with the development of the frozen-meat trade and rising world prices in the 1890s the population again increased steadily, and by March 1901 New Zealand's whites numbered 770,000. Natural increase (*i.e.*, excess of births over deaths), rather than migration, proved the principal factor for growth in population during the first 30 years of the 20th century. The rate of increase year by year declined substantially, however, and in the five depression years 1931–35 there was actually a net exodus from New Zealand of 9,918. Excluding Maori, at the census in 1921 the population numbered 1,218,913; in 1926 it was 1,344,469; and in 1936, 1,491,484. Since the census due in 1941 was postponed because of war conditions, the following table gives only estimates of population (except in the case of the Cook Islands):

| | Date | Males | Females | Totals |
|---|---|---|---|---|
| New Zealand proper (exclusive of Maori) | April 1, 1941 | 765,131 | 778,851 | 1,543,982 |
| Maori | " | 47,290 | 44,958 | 92,248 |
| Totals, New Zealand proper | " | 812,421 | 823,809 | 1,636,230 |
| Kermadec Islands | " | 12 | 1 | 13 |
| Cook Islands and Niue | Census, 1936 | 8,367 | 7,983 | 16,350 |
| Tokelau Islands | 1941 | 674 | 706 | 1,380 |
| Mandated Territory of Western Samoa | April 1, 1941 | 31,957 | 30,330 | 62,287 |
| Totals | | 853,431 | 862,829 | 1,716,260 |

As of Dec. 31, 1942, the estimated population of New Zealand (inclusive of Maori but exclusive of Cook and other Pacific Islands) amounted to 1,636,403 (males 793,677 and females 842,726). The white population is chiefly centred in North Island, the heart of the dairy industry, and the Maori also reside for the most part in that island.

The birth rate declined steadily after 1921, reaching a figure of 16.17 per 1,000 of the population in 1935. Thereafter a steady improvement set in, and the rate for 1941 (22.81) was the highest attained after 1922; in 1942 the rate was 21.73 per 1,000. The Maori birth rate was approximately double that of the white population, the figure for 1940 being 46.87 per 1,000. The favourable climate of the country and the high efficiency of health services contributed toward a comparatively low death rate. In 1933 the death rate reached a new low point of 7.99 per 1,000; thereafter there was an increase, in 1942 the death rate being 10.6 per 1,000 mean population.

**Immigration.**—By blood, 91% of the total population is of British stock (53% English, 22% Scots, 15% Irish and 10% Welsh). During the 1930s there was an influx of immigrants from foreign countries; for the period 1933–38 the yearly average of immigrants entering New Zealand from Yugoslavia was 58; from China 41; from Germany 35; and from the United States 29. The majority of immigrants in 1941 came from China, Germany, Austria, Czechoslovakia and the United States—in the order named. Persons not of British blood and parentage are prohibited from landing in New Zealand unless in possession of permits issued by the customs department. Such persons, however, are allowed to pay temporary visits to New Zealand for the purposes of business, pleasure or health, temporary permits being normally restricted to a period not exceeding six months. American nationals, providing they are of European race and descent, are admitted on the same basis as British nationals. In 1935 New Zealand law was brought into conformity with that of the United Kingdom relative to the nationality of married women. Also, a woman who had lost her British nationality by reason of her marriage to an alien was granted the right, while she remained in New Zealand, to claim the same privileges as if she had remained a British subject.

In normal times the immigration policy of New Zealand was to provide assistance, by free or reduced passage rates, to desirable immigrants from Great Britain. This policy was suspended in 1927, however, owing to unemployment in the dominion, except in the case of domestic servants and a few parties of youths to undertake farming. Under the New Zealand scheme assistance was restricted, except in the case of domestic servants, to persons nominated by permanent residents of the dominion, provided such persons were healthy and under 50 years of age. The nominator undertook to make provision for the maintenance and employment of the nominee, and guaranteed that residence should extend to at least five years. The quota of such assisted new arrivals was fixed from period to period. A large section of the sheep owners of the dominion also had a fund, allocated out of wool profits made during World War I, for training sons and daughters of sailors of the navy and mercantile marine who were killed or incapacitated during the conflict, the lads in farming at a special institution in New Zealand, and the girls in domestic and light farming work at another. Free passages from Britain were provided by the government of New Zealand, and the children were found suitable employment after training. Both schemes were under the scrutiny of the minister for immigration, and both operated with entire success and satisfaction. The British government co-operated with the dominion in its assisted migration and provided a share of the passage money.

| Period | Governmentally assisted immigrants | Immigrants not governmentally assisted | Total net migration increase |
|---|---|---|---|
| 1920–21 to 1924–25 | 6,848 | 6,715 | 9,701 |
| 1925–36 to 1929–30 | 5,301 | 5,497 | 5,052 |
| 1930–31 to 1934–35 | 317 | 2,376 | −1,229* |
| 1935–36 to 1939–40 | 8 | 4,566 | 2,382 |

*Decrease.

In the above analysis of migration increase the figures given are annual averages for the periods quoted.

BIBLIOGRAPHY.—Information regarding the population and immigration is given in such publications of the dominion's census and statistics department as the volumes of census results, the *New Zealand Year Book*, and the annual reports on population and buildings and on vital statistics. *See* also S. H. Roberts, *Population Problems of the Pacific* (1927); I. L. G. Sutherland, *The Maori People Today* (1940); A. Ngata, *The Maori People* (1941). (W. B. PN.)

## HISTORY

The date, even the approximate date, of man's arrival in New Zealand is uncertain. All that can be safely asserted in that by the 14th century A.D. Polynesian canoemen had reached its northern shores in successive voyages. By 1642 they had spread to South Island, for there Abel Jansen Tasman found them when, in the course of his circuitous voyage from Java in the "Heemskirk," he chanced upon the archipelago, coasted along much of its western side, though without venturing to land, and gave it the name it still bears. One hundred and twenty-seven years later,

Cook, in the barque "Endeavour," gained a much fuller knowledge of the coasts, which he circumnavigated, visited again and again, and mapped out with fair accuracy. He annexed the country, but the British government disavowed the act. After him came other navigators, French, Spanish, Russian and American; and, as the 18th century neared its end, came sealers, whalers and trading schooners in quest of flax and timber. English missionaries, headed by Samuel Marsden, landed in 1814, to make for many years but slow progress. They were hindered by murderous tribal wars in which muskets, brought in first by the chief Hongi, more than decimated the Maori. Still, cruel experience and the persevering preaching of the missionaries gradually checked the fighting, and by the year 1839 peace and Christianity were in the ascendant. So far the British government had resisted any pressure brought to bear in Downing street in favour of annexation. In vain Edward Gibbon Wakefield, organizer of colonizing associations, prayed and intrigued for permission to repeat in New Zealand the experiment tried by him in South Australia. Lord Glenelg, the colonial minister, had the support of the missionaries in withstanding Wakefield's New Zealand company, which at length resolved in desperation to send an agent to buy land wholesale in New Zealand and dispatch a shipload of settlers thither without official permission. Before, however, the "Tory" had thus sailed for Cook strait, it had become known to the English government that a French colonizing company—*Le Compagnie Nanto-Bordelaise*—was forming, under the auspices of Louis Philippe, to anticipate or oust Wakefield. With the assent of the Protestant missionaries the British authorities reluctantly instructed Captain Hobson, R.N., to make his way to northern New Zealand with a dormant commission of lieutenant-governor in his pocket and authority to annex the country to Australia by peaceful arrangement with the natives. Hobson landed in the Bay of Islands on Jan. 22, 1840, hoisted the Union Jack, and had little difficulty in inducing most of the native chiefs to accept the queen's sovereignty at the price of guaranteeing to the tribes by the treaty of Waitangi possession of their lands, forests and fisheries. Some French settlers, convoyed by a man-of-war, reached Akaroa in South Island in the following May. But Hobson had forestalled them, and those who remained in the country became British subjects. Meanwhile, a week after Hobson's arrival, Wakefield's colonists had sailed into Port Nicholson, and proposed to take possession of immense tracts which the New Zealand company claimed to have bought from the natives, and for which colonists had in good faith paid the company. Other bands of company's settlers in like manner landed at Nelson, Wanganui and New Plymouth, to be met with the news that the British government would not recognize the company's purchases. Then followed weary years of ruinous delay and official inquiry, during which Hobson died after founding Auckland. His successor, Fitzroy, drifted into an unsuccessful native war. A strong man, Captain Grey, was at last sent over from Australia to restore peace and rescue the unhappy colony from bankruptcy and despair. Grey, much the best of the absolute governors, held the balance fairly between the white and brown races, and bought large tracts of land for colonization, including the whole South Island, where the Presbyterian settlement of Otago and the Anglican settlement of Canterbury were established by the persevering Wakefield.

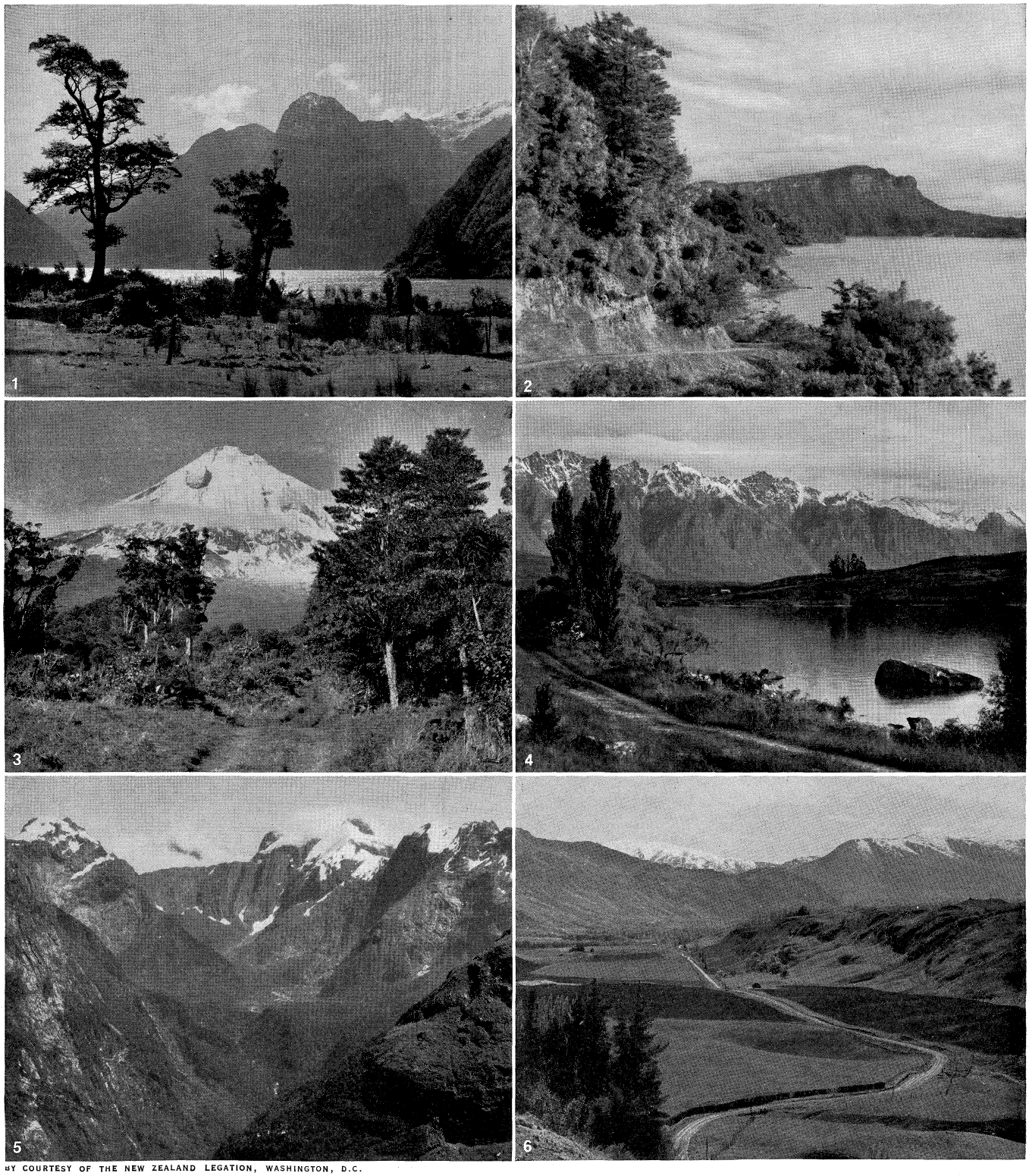
### SELF-GOVERNMENT

In 1852 the mother country granted self-government, and, after much wrangling and hesitation, a full parliamentary system and a responsible ministry were set going in 1856. For 20 years thereafter the political history of the colony consisted of two long, intermittent struggles—one constitutional between the central government (first seated at Auckland, but after 1864 in Wellington) and the powerful provincial councils, of which there were nine charged with important functions and endowed with the land revenues and certain rating powers. The other prolonged contest was racial—the conflict between settler and Maori.

**The Maori Wars.**—The native tribes, brave, intelligent and fairly well armed, tried, by means of a league against land-selling and the election of a king, to retain their hold over at least the central North Island. But their kings were incompetent, their chiefs jealous and their tribes divided. Their style of warfare, too, caused them to throw away the immense advantages which the broken bush-clad island offered to clever guerrilla partisans. They were poor marksmen, and had but little skill in laying ambuscades. During ten years of intermittent marching and fighting between 1861 and 1871 the Maori did no more than prove that they had in them the stuff to stand up against fearful odds and not always to be worsted. Round Mount Egmont, at Orakau, at Tauranga and in the Wanganui jungles, they more than once held their own against British regiments and colonial riflemen. The storming of their favourite positions—stockades strengthened with rifle pits—was often costly; and a strange anti-Christian fanaticism, the Hau-Hau cult, encouraged them to face the white men's bullets and bayonets. But even their fiercest fighting leaders, Rewi and Te Kooti, scarcely deserved the name of generals. Some of the best Maori fighters, such as the chiefs Ropata and Kemp, were enlisted on the white side, and with their tribesmen did much to make unequal odds still more unequal. Had Gen. Pratt or Gen. Cameron, who commanded the imperial forces from 1860 to 1865, had the rough vigour of their successor, Gen. Chute, or the cleverness of Sir George Grey, the war might have ended in 1864. Even as it was the resistance of the Maori was utterly worn out at last. After 1871 they fought no more. The colonists too, taught by the sickening delay and the ruinous cost of the war to revert to conciliatory methods, had by this time granted the natives special representation in parliament. A tactful native minister, Sir Donald McLean, did the rest. Disarmament, roads and land-purchasing enabled settlement to make headway again in the North Island after 12 years of stagnation. Grey quarrelled with his masters in Downing street, and his career in the imperial service came to an end in 1868. His successors, Sir George Bowen, Sir James Ferguson, the marquess of Normanby and Sir Hercules Robinson, were content to be constitutional governors and to respect strictly the behests of the colonial office.

**Sheep Farming and the Discovery of Gold.**—Meanwhile the industrial story of New Zealand may be summed up in the words wool and gold. Extremely well suited for sheep farming, the natural pastures of the country were quickly parcelled out into huge pastoral crown leases, held by prosperous licensees, the squatters, who in many cases aspired to become a country gentry by turning their leases into freeholds. So profitable was sheep farming seen to be that energetic settlers began to burn off the bracken and cut and burn the forest in the North Island and sow English grasses on the cleared land. In the south artificial grassing went on for a time hand in hand with cereal-growing, which by 1876 seemed likely to develop on a considerable scale, thanks to the importation of American agricultural machinery, which the settlers were quick to utilize. Even more promising appeared the gold fields. Gold had been discovered in 1853. Not, however, until 1861 was a permanent field found—that lighted upon by Gabriel Read at Tuapeka in Otago. Thereafter large deposits were profitably exploited in the south and west of South Island and in the Thames and Coromandel districts of the Auckland province. Gold mining went through the usual stages of alluvial washing, deep sinking, river dredging and quartz-reef working. Perhaps its chief value was that it brought many thousand diggers to the colony, most of whom stayed there. Pastoral and mining enterprise, however, could not save the settlers from severe depression in the years 1867 to 1871. War had brought progress in the north to a standstill; in the south wool-growing and gold mining showed their customary fluctuations. For a moment it seemed as though the manufacture of hemp from the native *Phormium tenax* would become a great industry. But that suddenly collapsed, to the ruin of many, and did not revive for a number of years.

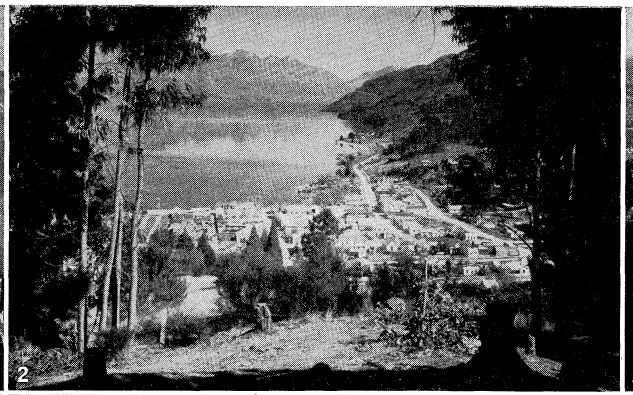
In 1870 peace had not yet been quite won; industry was depressed; and the scattered and scanty colonists already owed £7,000,000 sterling. Yet it was at this moment that a political financier, Sir Julius Vogel, in that year colonial treasurer in the ministry of Sir William Fox, audaciously proposed that the central government should borrow £10,000,000, make roads and railways, buy land from the natives and import British immi-

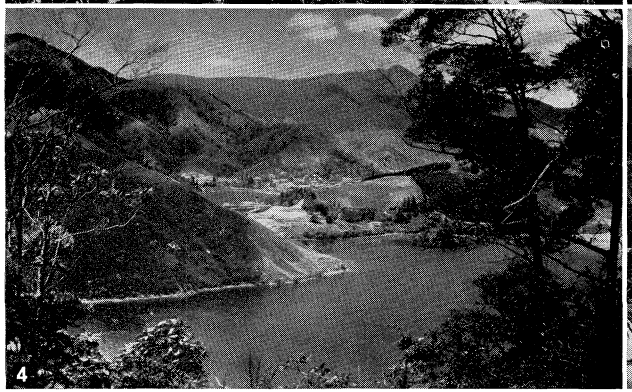


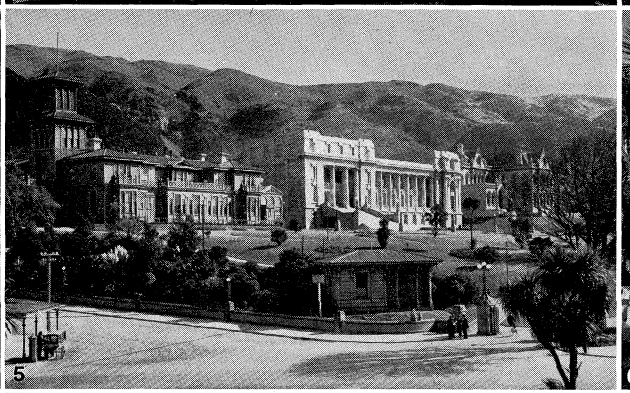
BY COURTESY OF THE NEW ZEALAND LEGATION, WASHINGTON, D.C.

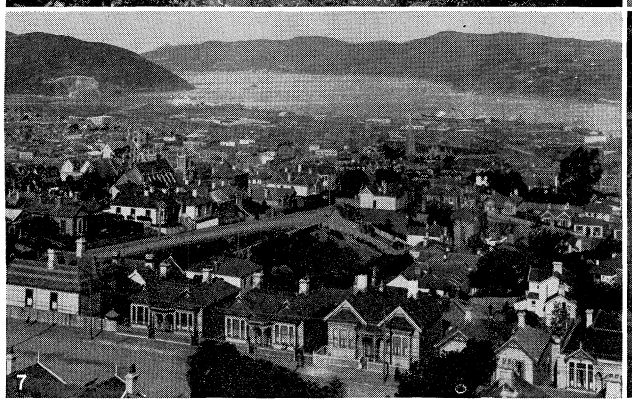
## MOUNTAIN AND LAKE SCENES OF NEW ZEALAND

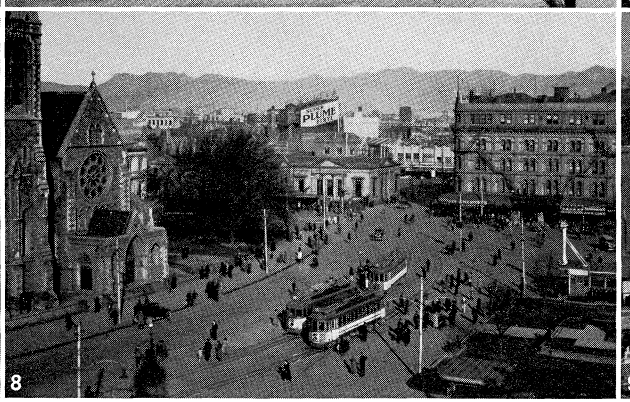
1. Milford Sound, one of the most magnificent fjords on the coast of South Island. In the background is Pembroke Peak and the Lion, so called because it resembles a lion couchant
2. Lake Waikaremoana and Panekeri Bluff, in the southeastern portion of the Auckland district. This is the scene of an extensive hydro-electric development
3. Mount Egmont, visible from nearly every part of Taranaki, is an extinct volcanic cone, on the western side of North Island
4. Lake Wakatipu, bordered on one side by the majestic Remarkables mountains, lies between Kingston and Queenstown, South Island
5. Arthur Valley and Diamond Gully lie at the head of Milford Sound on the west coast of Otago, on South Island
6. View of the agricultural country near Arrowtown, in the Wakatipu district, South Island

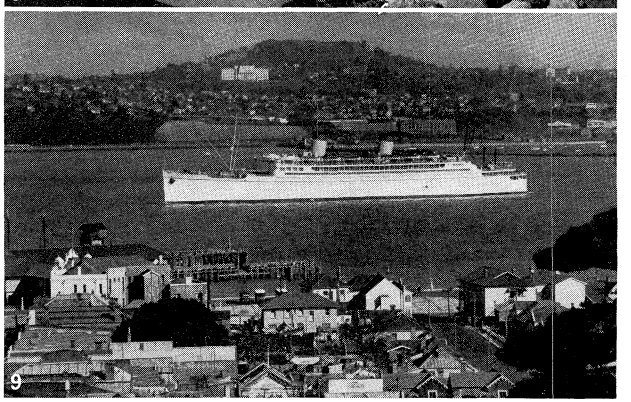












BY COURTESY OF THE NEW ZEALAND LEGATION, WASHINGTON, D.C.

## CITIES AND HARBOURS OF NEW ZEALAND

1. Wellington, capital of New Zealand, lies on the south end of North Island, on Port Nicholson
2. Queenstown, picturesquely located midway up Lake Wakatipu, is a favourite resort town in South Island
3. St. Kilda, a suburb just outside Dunedin, South Island, has a fine sandy beach on the ocean where there is good surf bathing
4. Picton, at the head of Queen Charlotte sound (Marlborough district, South Island), is 50 miles from Wellington, across Cook strait
5. Parliament buildings in Wellington, the seat of government and political centre of the dominion
6. Napier, capital of the Hawke's Bay district, showing the Cenotaph erected to the memory of soldiers of World War I. Napier has been rebuilt since it was destroyed in the earthquake of 1931
7. General view of Dunedin, capital of the Otago district, South Island
8. Christchurch, capital of the Canterbury district, South Island, showing Cathedral square in the heart of the city, which is on the plains 5 miles from the sea
9. Auckland, the largest city in New Zealand, on a beautiful deep-water harbour, North Island

grants. The house of representatives, at first aghast, presently voted £4,000,000 as a beginning. Coinciding as the carrying out of Vogel's policy did with a rising wool market, it for a time helped to bring great prosperity, an influx of people and much genuine settlement. Fourteen million of borrowed money, spent in ten years, were on the whole well laid out. But prosperity brought on a feverish land speculation; prices of wool and wheat fell in 1879 and went on falling. Faulty banking ended in a crisis, and 1879 proved to be the first of 16 years of almost unbroken depression. Still, eight prosperous years had radically changed the colony. Peace, railways, telegraphs (including cable connection with Europe), agricultural machinery and a larger population had carried New Zealand beyond the primitive stage. The provincial councils had been swept away in 1876, and their functions divided between the central authority and small powerless local bodies. Politics, cleared of the cross issues of provincialism and Maori warfare, took the usual shape of a struggle between landed wealth and radicalism. Sir George Grey, entering colonial politics as a Radical leader, had appealed eloquently to the workpeople as well as to the Radical "intellectuals," and though unable to retain office for very long he had compelled his opponents to pass manhood suffrage and a triennial parliaments act. A national education system, free, non-religious and compulsory, was established in 1877. The socialistic bent of New Zealand was already discernible in a public trustee law and a state life insurance office. But the socialistic labour wave of later years had not yet gathered strength. Grey proved himself a poor financier and a tactless party leader. A land tax imposed by his government helped to alarm the farmers. The financial collapse of 1879 left the treasury empty. Grey was manoeuvred out of office, and Sir John Hall and Sir Harry Atkinson, able opponents, took the reins with a mission to reinstate the finances and restore confidence.

**Politics.**—Sixteen years of depression, from 1879 to 1895, were followed by 26 years of great prosperity and in turn by six years of depression again, from 1921 to 1927. The slump conditions which prevailed in the 1880s (due to a fall in the world price level) intensified the political atmosphere. In politics nearly 12 years of Conservative government, or at least capitalistic predominance in public affairs, were succeeded by 20 years of radicalism. The main aim of the legislation, which evoked world-wide interest, was social justice. Only in 1912 did the Conservatives regain office. Up to Jan. 1891, the Conservative forces which overthrew Sir George Grey in 1879 controlled the country in effect though not always in name, and for 10 years progressive legislation was confined to a mild experiment in offering crown lands on perpetual lease, with a right of purchase (1882), a still milder instalment of local option (1881) and an ineffective Factories act (1886). In Sept. 1889, however, Sir George Grey succeeded in getting parliament to abolish the last remnant of plural voting. Finance otherwise absorbed attention; by 1890 the public debt had reached £38,000,000 against which the chief new asset was 1,300 mi. of railway, and though the population had increased to 650,000, the revenue was stagnant. A severe property tax and an increase of customs duties in 1879 only for a moment achieved financial equilibrium. Although taxation was seconded by a drastic, indeed harsh, reduction of public salaries and wages (which were cut down by one-tenth all round) yet the years 1884, 1887 and 1888 were notable for heavy deficits in the treasury. Taxation, direct and indirect, had to be further increased, and as a means of gaining support for this in 1888 Sir Harry Atkinson, who was responsible for the budget, gave the customs tariff a distinctly protectionist complexion.

(W. P. Re.; X.)

During the years 1879–90, the leading political personage was Sir Harry Atkinson. He, however, withdrew from party politics when, in Dec. 1890, he was overthrown by the progressives under John Ballance. Atkinson's party never rallied from this defeat, and a striking change came over public life, though Ballance, until his death in April 1893, continued the prudent financial policy of his predecessor. The change was emphasized by the active intervention in politics of the trade unions. These bodies decided in 1889 and 1890 to exert their influence in returning workmen to parliament, and where this was impossible, to secure pledges from middle-class candidates. This plan was first put into execution at the general election of 1890, which was held during the industrial excitement aroused by the Australasian maritime strike of that year. It had, however, been fully arranged before the conflict broke out. The number of labour members thus elected to the general assembly was small, never more than six for over 20 years and no independent labour party of any size was formed. But the influence of labour in the progressive or, as it preferred to be called, Liberal party, was considerable and the legislative results noteworthy. Ballance raised the pay of members of the house of representatives, but otherwise directed his energies to constitutional reforms and social experiments. These did not interfere with the general lines of Atkinson's strong and cautious finance, though the first of them was the abolition of his direct tax upon all property, personal as well as real, and the substitution therefor of a land tax of 1*d.* in the £ on capital value, and also of a graduated tax upon unimproved land values, and an income tax also graduated, though less elaborately. The graduated land tax in 1943 was 1*d.* in the £ where the unimproved value did not exceed £5,000, and thereafter rose by stages to a maximum rate of 6*d.* in the £. Where the unimproved value did not exceed £1,500 the owner was allowed an exemption of £500; there was a similar exemption where the value lay between £1,500 and £2,500, diminished, however, by £1 for every £2 over the £1,500 mark, so that no exemption was allowed when £2,500 was reached. An alternative scale of exemption was provided where land was subject to a registered mortgage. In 1891 the tenure of members of the legislative council or nominated upper house, which had hitherto been for life, was altered to seven years. A new form of land tenure was introduced in 1892, crown lands being leased for 999 years at an unchanging rent of 4% on the prairie value; right of purchase was not granted until 1913, but this occupation-with-right-of-purchase tenure ceased in 1926.

On Ballance's death in 1893, his place was taken by Richard Seddon, who put through the bill of that year granting woman suffrage; in 1919 women became eligible as parliamentary candidates. The Advances to Settlers act, 1894, inaugurated a series of schemes of state money-lending to farmers on mortgage of freehold or leasehold land; most classes of such advances were later administered by the State Advances corporation, created in 1936. Workers' wages were first safeguarded by the Truck act, 1891, and a series of acts between 1892 and 1899 aimed at making the payment of wages more certain and secure, and at limiting creditors' rights to attach future earnings. Subsequently this code was consolidated into the Wages Protection and Contractors' Liens act, 1908, and in turn that was superseded by a measure of like title in 1939.

The keystone of the regulative system was laid by the passing of the Industrial Conciliation and Arbitration act, 1894, under which disputes between employers and unions of workers were compulsorily settled by state tribunals; these, the arbitration courts, were empowered in 1898 to prescribe minimum rates of wages; and an amendment in 1903 prohibited any employer, worker, union of employers or union of workers from taking proceedings to defeat any of the provisions of an award during its currency. The law was consolidated in 1925, and an important amending act was passed in 1936, *inter alia* restoring the compulsory provisions of the law, which had been repealed in 1932. The Old Age Pensions act, 1898, a pioneer measure in British countries, was the precursor of several in an outstanding program of social security. The divorce law was amended in 1898; existing legislation was consolidated in 1928, and in 1930 again amended. In 1898, also, the municipal franchise was greatly widened; it was a variable one, differing greatly between urban and country districts. Borrowing on a larger scale was begun in 1895, and in 12 years twice as many millions were added to the public debt. The continued success of the government life insurance office led in 1899 to creation of an accidents insurance office and, in 1903, to a state fire insurance office. The general election of 1899 was the most languid held in 15 years, for politics ceased to be the chief topic of interest after New Zealand sent troops to

serve in the South African War.

A long depression ended in 1895 and a marked commercial revival began, mainly due to the steady conversion of the colony's waste lands into pasture; the development of frozen meat and dairy exports; the continuous increase in the output of coal; the invention (in New Zealand) of gold dredging; the revival and improvement of hemp manufacture; the exploiting of the deposits of kauri gum; the reduction in the rates of interest on mortgage money; a general rise in wages, obtained without strikes, which increased the spending power of the working classes. Commercial confidence was restored by the reconstruction of the Bank of New Zealand in 1895, and activity was stimulated by large public loans, while more cautious banking and the systems of taxation and rating on land values contributed to check land speculation.

**The Reform Party.**—The party headed by Ballance, Seddon and Ward held office without a break for 21 years, a result mainly due to the general support given to its agrarian and labour policy by the smaller farmers and the working classes. In 1912 it fell and the more conservative side, which by then had taken the title of Reform party, at last returned to office. Though at the moment of success it could claim but a small majority in parliament and none outside, in 1925 it scored a sweeping victory at the elections. The farmers, who were organized into a powerful union early in the 20th century, sought to destroy the liberal system of state tenancy in favour of freehold tenure with complete right of sale under a cheap and speedy land transfer law. The Reform party was prepared to give them this and numbers of them joined it. At the same time labour began to break away from the Progressives, under whose regime very few labour leaders had gained seats in parliament. After 1910 New Zealand labour followed the example of Australia in creating its own party and, though serious strikes occurred in 1913, 1916 and 1921–22, the dominion remained on the whole industrially pacific. Experience had taught the unions the value to them of the Arbitration law and in 1927, when it was attacked by the farmers, they unanimously declared for it intact.

**Period of World War I.**—The Reform party began by granting the freehold according to promise, by revision of the Education act and by putting some check on strikes by unions not registered under the Arbitration act. In 1914 came World War I and a coalition ministry of Reformers and Progressives was formed in which William Ferguson Massey, the prime minister, had the help of Sir Joseph Ward as finance minister, of Sir James Allen as minister of defense, and of Sir Francis Bell, first as minister of immigration and later as attorney general. New Zealand was not unprepared to be of service in war time. A law passed in 1909 paved the way for compulsory training of the militia. Volunteers for service overseas came forward with enthusiasm and their fine physique, initiative and self-reliance were qualities which distinguished the New Zealand contingents through their long years of arduous warfare.

Heavy taxation and other severe war measures had to be endured in the dominion. Largely by forced loans from the banks and others direct from the taxpayers, £55,000,000 were borrowed internally. The output of gold and the chief products of food and raw material were commandeered at war prices for the imperial government. The war debt, for the size of the population enormous, finally exceeded £81,500,000; but the interest on it was punctually paid. The £26,340,245 owing to the British government in 1922 because of war expenditure was funded, and funded-debt payments continued until 1931 when the British government, following the Hoover proposals, voluntarily suspended these obligations of New Zealand. At the peace New Zealand received a League of Nations mandate to administer Western Samoa, formerly German.

Social legislation was more or less at a standstill in war time but an important change was made in the Liquor law. Local option was abandoned in favour of a triennial poll for and against national prohibition, which might be voted by a bare majority. Maintenance of the *status quo* was increasingly favoured in successive polls. In 1922 the figures were 282,669 for national continuance, 35,727 for state purchase and control, and 300,791 for national prohibition; in 1943 the figures were 462,401, 109,317 and 238,070 respectively.

**Between the World Wars.**—Peace in 1918 was followed by three years of feverish activity and a wild speculation in rural land. When a very sudden fall of prices in 1921 stopped the orgy, the reaction was extremely severe. Thousands had mortgaged themselves in buying freeholds without adequate capital, nearly 1,000 farmers sought the bankruptcy court in the seven years 1921–27, and a large number had to part with their holdings. Owing to rural embarrassment, a law of 1919 providing for a moratorium in the case of mortgages, other than trade mortgages, and of deposits, other than bank deposits, was continued until 1927.

After World War I the government had to deal with many thousands of demobilized soldiers without employment. Pensions were bestowed on a liberal scale and more than 9,000 soldiers were settled on the land. There was a good deal of miscalculation, disappointment and failure in this scheme of military settlements. In 1936 soldiers' mortgages were transferred to the State Advances corporation. The Small Farms Amendment act, 1940, provided for settlement on the land of soldiers who had served in World War II, giving them absolute preference over all other applicants for land made available for selection under the legislation of 1932–33. With a view to protecting soldier settlers against the inflation of land values which ensued after the previous war, the Servicemen's Settlement and Land Sales act, 1943, controlled the price at which land could be sold or leased.

In 1919 the Progressive ministers withdrew from the coalition government, and the Reformers continuing in office had to meet industrial depression by economies in expenditure. The general elections of 1922 left Massey with a bare majority in the house of representatives, but the hopeless division of Labour from the Progressives enabled the Reformers just to hold their ground. Massey, the veteran premier who had led the Reformers to victory in 1912, died in 1925, his place being taken by Bell for two weeks. Following the 1925 general election the premiership went to Joseph Gordon Coates, newly elected leader of the Reform party, a comparatively young Auckland farmer. The elections proved to be the most complete triumph ever gained by a conservative party in the dominion. Labour won but 12 seats, but subsequently gained some by-elections and became the official opposition.

Owing to the encouragement given to farming, pastoral production constantly expanded, so that New Zealand had become one of the world's largest exporters of pastoral produce. As a consequence, its national income was extremely sensitive to price fluctuations of these products; so that, with the advent of the world-wide financial depression in 1930, its economic position became most vulnerable. Measures adopted during 1930–35 to help the farmers were numerous and often of a drastic character. The steps taken included the raising of the exchange rate, so that £125 N.Z. equalled £100 stg.; the adjustment of mortgages and farm indebtedness; the lowering of interest rates and farm costs; remission of certain rates and taxes; abolition of the graduated land tax; and the subsidization of farm labour.

Although New Zealand had obtained a unitary constitution in 1870, the country retained the status of a colony until Sept. 26, 1907, when it became a dominion. In common with the other dominions, representatives of the country shared in the direction of Britain's part in World War I, and in accordance with the independent status which it had attained, New Zealand was a signatory to the peace treaties and became a member of the League of Nations. As member of the British group of nations it signed the 1926 General Act for the Pacific Settlement of International Disputes (the "Kellogg pact") and the London Naval treaty of 1930, and it was an individual signatory to the naval treaty signed in London in 1936. The New Zealand parliament approved in 1931 the draft Statute of Westminster (*q.v.*), which gave legal recognition to the autonomy of the dominions; New Zealand (in common with Australia and Newfoundland) requested that the operative parts of the statute should not become applicable until adopted by its own legislature, and down to 1943 this step had

not been deemed necessary. Business of the New Zealand government in London was transacted through its own high commissioner, and the British government had a like representative in New Zealand. High commissioners were also appointed to Canada and Australia in 1942 and 1943 respectively, and with appointment of Walter Nash to Washington, D.C., in 1942 New Zealand was first represented by a minister of its own in a foreign country.

Joseph Ward became prime minister in May 1928, to be succeeded 30 months later by George William Forbes, and in 1931 the latter formed a coalition administration. At the Imperial Economic conference in Ottawa in 1932 New Zealand agreed to more liberal tariff preferences for goods of British origin, and these were given legislative effect in 1934. The dominion introduced its own silver currency in 1933, and in 1939 its first bronze coinage. Because of a worsening economic condition, there was a general reduction of 10% in wages and salaries in 1931, and the next year reductions were effected in pensions, salaries of state employees, rent, interest rates and other fixed charges. Such was the condition of the country at the time, between 1931 and 1935 there was a net exodus from New Zealand of 9,918 persons.

At the general election in 1935 the Labour party came into office under the premiership of Michael Joseph Savage, the party winning 53 seats, against 20 for the National party and 7 held by Independents. Much legislation of the highest importance followed. The Reserve Bank of New Zealand, which had been established in 1934, was nationalized in 1936, the government subscribing the capital of £500,000 previously held privately. The government became the sole purchaser of dairy products for export, and their sole marketer, guaranteeing fair prices to the farmers for their butter and cheese. An amendment to the Arbitration act in 1936 restored the powers of the arbitration court, fixed basic wages and decreed a 40-hour week for industry, while a government bureau of industry was invested with wide powers for industrial planning. In 1933 a Council for Educational Research, financed mainly by the Carnegie foundation, came into being, and in 1936 free post-primary education was made available to every child. Most existing schemes of government advances for farming and industry were placed under the administration of the State Advances corporation, reconstituted in 1936, and the government embarked upon an ambitious scheme of building houses to be rented to workers.

In 1936 the prohibition against election of public servants to the house of representatives was removed (though, if elected, they ceased to be public servants), and with repeal of legislation of 1932 trade unions and like societies once more were permitted to use their funds for political purposes. The customary three-year life of parliament was extended to five years during World War I, and, because of the acute economic crisis, to four years during 1934–37; in 1941, during World War II, the term of the 26th parliament was extended to four years. Parliament passed in 1936 the Mortgagors and Lessees Rehabilitation act, which made provision for the adjustment of excessive mortgage indebtedness; and sanctioned resumption and expansion of schemes of public works, which had been seriously curtailed during the previous period of financial stringency. The year 1938 saw passage of the Social Security act, which consolidated pension measures and initiated extensive health and medical benefits. At the 1938 general election, at which Labour was returned to office, 92.85% of the electorate exercised their votes. The Labour party held 53 seats, the National party 25 and the Independents 2; as a result of by-elections and resignations from the party, immediately prior to the 1943 general election Labour representation had been reduced to 50, with 25 Nationals, 4 Independents and 1 Democratic Labour. Approximately 84.6% of the electorate voted at the general election in 1943, at which Labour seats declined to 45, while the National party secured 34 and there was 1 Independent.

**World War II.**—Savage continued to head the Labour government until his death in April 1940; his successor as prime minister was Peter Fraser who, the following July, formed a special war cabinet. The country, no longer a belligerent automatically when the United Kingdom was at war, elected voluntarily and unanimously, to support Britain's declaration of hostilities against Germany in 1939. The year 1940 marked the centenary of the proclamation of British sovereignty in New Zealand and, despite limitations occasioned by the state of war, the historical significance of the event was accorded country-wide recognition. A Centennial exhibition was held in Wellington during Nov. 1939—May 1940, historical publications were produced and special stamps and coins issued.

Early in the conflict emergency war legislation was enacted, including the prohibition of strikes, a volunteer force was recruited for overseas service, and service for home defense again became compulsory. After Dunkirk the dominion shipped half of its stock of rifle ammunition to Britain, where it was urgently needed, and in 1942, when the onrush of Japanese aggression was still unchecked, New Zealand dispatched half its trained troops, half of its limited bomber force and all of its anti-aircraft guns to defend the outpost of Fiji, key to strategy in the Pacific. The country became a base for U.S. forces, many on their way to combat zones completing their training there and, when relieved in the tropical fighting, returning for rest and recuperation.

BIBLIOGRAPHY.—A. W. Shrimpton and E. E. Mulgan, *Maori and Pakeha* (1921); J. Cowan, *The New Zealand Wars: A History of the Maori Campaigns and the Pioneering Period,* 2 vols. (1922–23); *Cambridge History of the British Empire,* vol. VII, pt. II, *New Zealand* (1933); J. C. Beaglehole, *New Zealand—A Short History* (1936) and *The Discovery of New Zealand* (1939); J. B. Condliffe and W. T. G. Airey, *Short History of New Zealand* (6th ed., 1938); E. Sweetman, *The Unsigned New Zealand Treaty* (1939); H. M. Simpson, *The Women of New Zealand* (1940); N. E. Coad, *New Zealand from Tasman to Massey* (1940); I. F. G. Milner, *New Zealand's Interests and Policies in the Far East* (1940); I. L. G. Sutherland, *The Maori People To-day* (1940); F. L. W. Wood, *New Zealand in the World* (1940); W. Nash, *New Zealand: A Working Democracy* (1943). (W. B. PN.)

## ADMINISTRATION

**Central Government.**—New Zealand was not colonized in the ordinary manner around one centre. There were in its early years six distinct settlements—Auckland, Wellington, Nelson, New Plymouth, Canterbury and Otago—between which communication was for several years irregular and infrequent. To meet their political needs the Constitution act of 1852 created them into provinces, with elective councils and superintendents respectively, subordinated to one colonial legislature. In 1876 the provincial system, which produced confusion because of lack of uniformity, was abolished and full control passed to the legislature, known precisely as the general assembly but more usually as parliament.

This body comprises two chambers—the legislative council (the upper house) and the house of representatives (the lower house). The number of members of the legislative council is indeterminate (in 1943 it was 36), and they are appointed for seven years by the crown, that is, by the governor-general on the advice of the cabinet; women became eligible for appointment in 1941. Provision was made in 1914 for an elected legislative council, but down to 1943 this change had not been made. Members are paid and, subject to certain exemptions, may be fined for absence. As in the case of the British house of lords, the legislative council can not initiate or amend taxation and revenue bills, and as a general rule most legislation is in fact first introduced in the lower house.

The house of representatives has 80 members, four of whom are Maori. After each population census the 76 European electorates are re-adjusted according to population distribution. An addition is made to rural populations so that the number of rural electorates, in proportion to their population, is higher than urban electorates. The "country quota," as this allowance is called, first appeared in 1881; it is computed on the basis that 28% is added to the rural population—for electoral purposes, population other than that contained in a city or borough of more than 2,000 inhabitants or in any area within five miles of the chief post offices at Auckland, Wellington, Christchurch or Dunedin. In 1937 the life of parliament was fixed at three years, but in 1941, because of conditions occasioned by World War II, the term of the 26th parliament was extended to four years. Women became eligible as

parliamentary candidates in 1919 and public servants in 1936, the latter with the provision that if elected they immediately cease to be public servants. Members of the legislative council were ineligible, as were individual contractors to the public service where payment of more than £50 was involved. An elector must be a British subject resident for one year in the dominion and for three months in the electoral district in which he claims to vote. Registration became compulsory in 1924. Maori are qualified to vote only at elections of the four members representing their race, a secret ballot being introduced in 1937.

Executive administration is conducted on the principle of the British parliamentary system, that is, executive power is vested in a cabinet (the members of which, with the governor-general, also constitute the executive council) responsible to the elected chamber of the legislature—the house of representatives. The cabinet, chosen from members of the majority party in the house, consisted (in 1942) of 14 members who were the ministers (or "political heads") of departments of the dominion government. Should the party of which they are the representatives lose its majority in the house, a new cabinet would be formed from members of the new majority. It is customary for the Maori race to be represented by one of its members in the cabinet. Members of the house of representatives are paid, and should they be chosen as ministers (*i.e.*, become members of the cabinet) the salaries are higher. Cabinet portfolios are allocated by the prime minister, the leader of the majority party in the legislature. In the case of the Labour party, those who shall become members of the cabinet are selected by caucus (*i.e.*, by all the parliamentary Labour members), the prime minister only assigning those chosen to their respective posts; the prime ministers of other parties are free to decide who shall enter the cabinet.

The governor-general is the king's personal representative in New Zealand (not an official of the British government), appointed by the king after consultation with the New Zealand government. Representing a constitutional monarch, in the execution of his powers and authorities he must be guided by the advice of the dominion cabinet; while he does not "govern," and his functions are state and formal, his signature affixed to an act of parliament or order-in-council expresses legislative or executive decision.

In 1931 the British government gave legal recognition to the equality of status attained by the dominions with passage of the Statute of Westminster (*q.v.*). At the request of New Zealand, Australia and Newfoundland, the operative parts of the statute did not apply to them until adopted by their own parliaments. In fact, down to 1943 the statute had not been adopted by the parliament of New Zealand, but this did not diminish the dominion's freedom to conduct both its internal and external affairs as it saw fit, without the direction of the British government. The British government was represented in New Zealand by a high commissioner, and a like official was the representative of the dominion in London. High commissionerships were also established in Canada and Australia in 1942 and 1943 respectively. New Zealand's first minister to a foreign power was appointed to Washington, D.C., in 1942, and the United States also established a legation in Wellington.

**Local Government.**—With abolition of provincial administration in 1876 (*see* above), the dominion was divided into 63 counties, with provision for elective councils to deal with such primary needs as road making and bridgebuilding. For purposes of local administration of this type the 63 counties were later subdivided into 129 and, in addition, there were no less than 127 borough councils (for areas not greater than 9 sq.mi. having a population of at least 1,000), 21 dependent town districts (where there were 50 householders in an area of not more than 2 sq.mi.) and 34 independent town districts (having a population of 500). Besides these 129 counties, and the boroughs and independent town districts within them regarded as separate administrative entities, there were numerous autonomous, overlapping districts formed from parts of counties (concerned with roads, drainage and rivers) and others made up of groups of adjacent districts of other types united for a common purpose. By the year 1943 there were altogether 628 local authorities. The compulsory amalgamation of many of these local bodies was sought repeatedly, but entrenched local interests frustrated all attempts at reform.

BIBLIOGRAPHY.—J. Hight and H. D. Bamford, *The Constitutional History and Law of New Zealand* (1914); W. P. Morrell, *The Provincial System of Government in New Zealand, 1852–76* (1932) and *New Zealand* (1935); J. A. Lee, *Socialism in New Zealand* (1938); L. C. Webb, *Government in New Zealand* (1940); W. B. Sutch, *New Zealand's Labor Government at Work,* a pamphlet of the League for Industrial Democracy (1940).

## PUBLIC FINANCE

The money composing the public debt of New Zealand was borrowed on the security of the country's public revenues, no portion of the public estate being pledged for payment of either principal or interest. As of March 31, 1943, the gross public debt stood at £463,825,372 (in 1922 at £219,054,385), the rate of indebtedness per head of population (inclusive of the Maori) being £283 16*s.* 10*d.* (in 1922, £168 6*s.* 10*d.*). The provision of war finance accounted for £123,500,000 of the £141,000,000 increase during the period of World War II from March 1940 to March 1943. The amount of the public debt held internally at March 31, 1943, was £304,688,774 (65% of the total), while that domiciled in London was £158,274,297 (34.1%) and in Australia £862,300 (0.2%). With the exception of that portion incurred for war purposes, the greater amount of the borrowings was for productive and developmental purposes, resulting in revenue-producing assets such as railways, hydroelectrical installations, telegraphs and telephones. In 1922, when the dominion's public debt owing to the British government amounted to £105,919,159, the sum due for repayment was £27,532,164. The debt was funded that year on an annuity basis, so that the entire amount would have been automatically discharged by 1958–59. In 1931, however, following President Hoover's proposals regarding suspension of war debt payments, the British government voluntarily suspended New Zealand's obligations in respect of the funded-debt payments. By that date the outstanding balance of the funded debt stood at £24,100,199.

While the ordinary revenue and expenditure of the government are shown in the Consolidated fund account, successive changes in system destroyed the comparability of the figures after 1924 with those for earlier periods. Railway, post and telegraph revenue and expenditure were removed; in some years motor-vehicle taxation receipts were added; exchange charges on overseas payments (in consequence of the depreciation of New Zealand currency in terms of sterling) were included; transfers were made to the Social Security fund, established in 1939; and from 1939, expenditure on defense was transferred to a separate account. The following table shows the revenue and expenditure for financial periods from 1939 to 1943:—

| Year ending March 31 | Revenue | Expenditure | Excess of revenue over expenditure |
|---|---|---|---|
| | £ | £ | £ |
| 1939 | 36,582,046 | 35,772,678 | 809,368 |
| 1940 | 37,974,159 | 37,654,820 | 319,339 |
| 1941 | 40,437,927 | 38,711,503 | 1,726,424 |
| 1942 | 41,240,959 | 39,568,497 | 1,672,362 |
| 1943 | 42,361,009 | 38,206,431 | 4,154,578 |

The receipts were derived principally from taxation and from interest on the Public Debt Redemption fund and other public moneys, with transfers from the Working Railways account and from the post and telegraphs in respect of interest on capital liability. Details were as follows for the years 1939–43:—

| | Chief Sources of Revenue | | | | |
|---|---|---|---|---|---|
| Year ending March 31 | Taxation | Railways | Post and telegraphs | Public debt redemption | Other sources |
| | £ | £ | £ | £ | £ |
| 1939. | 32,305,772 | 701,064 | 588,000 | 392,486 | 2,594,724 |
| 1940. | 32,810,599 | 1,189,031 | 639,000 | 445,556 | 2,889,973 |
| 1941. | 34,873,732 | 1,694,644 | 665,000 | 396,520 | 2,808,031 |
| 1942. | 35,101,946 | 1,820,000 | 667,196 | 396,566 | 3,195,251 |
| 1943. | 36,195,865 | 2,562,303 | 692,637 | 392,203 | 2,518,021 |

Payments from the Consolidated fund are grouped under

permanent or under annual appropriations. The latter head covers payments under departmental votes, while the former covers interest on and amortization of the public debt, exchange, disposal of special taxation for main highways, and payments under numerous special acts. Major expenditures from the fund for the years 1939–43 were as follows:—

| Year ending March 31 | Debit Charges | Agriculture | Education | Transfer to Social Security fund | Other expenditures | Total |
|---|---|---|---|---|---|---|
| | £'000 | £'000 | £'000 | £'000 | £'000 | £'000 |
| 1939 | 9,311 | 1,078 | 4,098 | — | 21,286 | 35,773 |
| 1940 | 10,466 | 970 | 4,472 | 1,000 | 20,747 | 37,655 |
| 1941 | 11,997 | 1,612 | 4,606 | 3,200 | 17,297 | 38,712 |
| 1942 | 11,120 | 1,880 | 4,503 | 3,600 | 18,466 | 39,569 |
| 1943 | 12,396 | 896 | 4,671 | 3,800 | 16,443 | 38,206 |

The fund for social security (*see* below) was derived from various sources, and in particular from taxation imposed for the purpose. The revenue of the fund from 1940 until 1943 was as follows:—

| Year ending March 31 | 1940 | 1941 | 1942 | 1943 |
|---|---|---|---|---|
| | £'000 | £'000 | £'000 | £'000 |
| Social Security charge | 8,861 | 10,110 | 10,432 | 11,624 |
| Registration levy | 635 | 604 | 605 | 541 |
| Transfer from Consolidated fund | 1,000 | 3,200 | 3,600 | 3,800 |
| Other | 871* | 54 | 49 | 49 |
| Total | 11,367 | 13,968 | 14,686 | 16,014 |

*Included £809,000 Consolidated fund surplus, 1939–39

The expenses of New Zealand's share in World War II were met by special taxation and by the proceeds of war loans. From 1940 until 1943 the total revenue of the dominion's War Expenses account was as follows:—

| | 1940* | 1941 | 1942 | 1443 |
|---|---|---|---|---|
| | £'000 | £'000 | £'000 | £'000 |
| Taxation | 2,182 | 15,745 | 21,937 | 39,556 |
| Loans | 3,286 | 18,652 | 31,767 | 78,041 |
| Transfer from Consolidated fund | 2,288† | — | 3,226 | 3,172 |
| Other | 304 | 645 | 3,924 | 27,184 |
| Total | 8,060 | 35,042 | 60,854 | 147,953 |

*From Sept. 29, 1939, to March 31, 1940
†Unexpended balance of defense appropriations

**Taxation.**—For the year ended March 31, 1939, last financial year prior to the outbreak of World War II, taxation receipts per head of mean population amounted to £23 9*s.* 2*d.* Social security and war taxation increased the figure 12 months later to £27 5*s.* 2*d.*, and for the year ended March 31, 1943, taxation receipts were £53 12*s.* 4*d.* per head. Revenue from income tax rose from £9,303,495 in 1938–39 to £25,577,874 (inclusive of the surtax imposed for war purposes). In 1940 national-security taxation was imposed to meet part of New Zealand's expenditure because of the war, this being 7½% on all wages, salaries and other income, including the income of companies. These same sources also bore a tax rate of 5% because of social security. Other major taxes comprised those on gasoline for motor vehicles, customs duties and excise taxes. The total tax revenue for the financial year 1942–43 was £87,917,168 and of this sum, £39,556,336 went to the War Expenses account, £12,164,967 to the Social Security fund and £36,195,865 to the Consolidated fund.

**Banking.**—Banking institutions comprise the Reserve Bank of New Zealand, six trading banks, the Post Office Savings bank and five trustee savings banks. The reserve bank commenced to operate on Aug. 1, 1934, having a share capital of £500,000 privately subscribed. In 1936 the subscribed share capital was abolished, the General Reserve fund, contributed by the government, then being increased from £1,000,000 to £1,500,000. The bank thus became state-owned. It was authorized to regulate and control credit and currency, the transfer of moneys to and from New Zealand, and the disposal of moneys derived from the sale of dominion products and for the time being held overseas.

Two trading banks incorporated by the dominion legislature were the Bank of New Zealand and the National Bank of New Zealand. The former bank, partly state-owned, had branches and agencies in the dominion numbering 225 in 1941, and also branches in London, Australia, Fiji and Samoa. The other four banks were predominantly Australian institutions, having in the aggregate much greater capital resources than the two New Zealand banks. These four, and the National Bank of New Zealand, had between them 308 establishments within the dominion. The function of note-issue was transferred from the trading banks to the reserve bank in 1934, and each trading bank was required to maintain with the reserve bank a balance of not less than 7% of its demand liabilities in New Zealand, and 3% of its time liabilities in that country. In 1943, 939 post offices transacted savings bank business; the number of open accounts was 1,086,996, or 67% to every 100 of the population, including the Maori. In 1934 a school savings bank section of the Post Office Savings bank was established. On March 31, 1943, 296,140 depositors had an average account of £61 12*s.* 3*d.* in the five trustee savings banks—viz., Auckland (established in 1847), New Plymouth (1850), Dunedin (1864), Invercargill (1864) and Hokitika (1866). Provision was made in 1940 for the issue of savings bonds and the opening of special savings accounts with the post office and trustee savings banks toward meeting the country's war expenditure.

**Coinage and Currency.**—Gold, silver and bronze coins of Great Britain, and Australian gold coins were legal tender in New Zealand until 1935, with Australian silver and bronze in free (though not legal) circulation. In 1933 New Zealand introduced its own silver coins (the principal requirements being identical with royal mint standards), and the dominion's bronze coins were first released for circulation in 1939. British and Australian gold coins continued to be legal tender.

With assumption by the reserve bank in 1934 of the sole right to issue bank notes, other banks were required to redeem their outstanding notes in reserve bank notes or coin, and in 1936 they were called upon to pay over to the reserve bank an amount equal to the value of their then outstanding notes issued or payable in New Zealand. The reserve bank was required to maintain a minimum reserve of not less than 25% of the aggregate amount of its notes in circulation and other demand liabilities; the term "reserve" included gold and silver bullion, sterling exchange (deposits at the Bank of England, British treasury bills and bills of exchange) and net gold exchange. Amending legislation in 1939 enabled a revaluation up to the market value of the fine gold contained in the reserve, the premium resulting from such revaluation to be credited to a special reserve.

As war measures, in 1940 the export of money and securities from New Zealand was prohibited, and owners of foreign securities were obliged to register them with the reserve bank; dealings in overseas securities were permitted only when companies concerned agreed to fulfil certain requirements, and sales to other than New Zealand residents required special permission. The government was empowered to take over any overseas securities for strengthening the financial position of the dominion (at a price not less than the market value at the time of the transfer); to require contributions to war loans; to prohibit the formation of companies and the increase of capital of existing companies; and to control advances for industrial purposes. Savings banks were permitted in 1941 to invest their funds in government securities issued in respect of war loans.

BIBLIOGRAPHY.—L. W. Holt, *The New Zealand Budgetary Problem* (1932); F. V. Field, *Economic Handbook of the Pacific Area* (1934); J. A. Lee, *Socialism in New Zealand* (1938). *See* also the *New Zealand Year Book;* annual reports of the Reserve Bank of New Zealand and the Bank of New Zealand.

## AGRICULTURE AND INDUSTRY

**Occupation of Land.**—The total area of the dominion, excluding the Cook and other Pacific Islands annexed in 1901, but inclusive of the Kermadec Islands and the "outlying islands," is 66,390,546 ac. Of this total, 42,888,337 ac. were returned in 1941 as being in occupation, including reserves and native lands leased, but excluding areas within borough boundaries, holdings of less than one acre in extent, and native land held on the communal

system; the total area in cultivation was 19,906,656 ac., and 22,981,681 ac. were unimproved land.

**Agriculture.**—The principal items cultivated are wheat, oats, grass seeds, potatoes, onions, tobacco and orchard produce, and the produce of market gardens (truck farms), nurseries and hop gardens. Wheat is the most important grain crop grown in New Zealand—three-quarters of it in the Canterbury district, and most of the remainder in North Otago. Since insufficient quantities were grown for home consumption, prior to World War II the government gave tariff protection to wheat growers and regulated sale prices.

Grass was by far the most important crop to the farmer, and in many parts of the country tussock and other naturally established grasses have given way, after hard labour, to artificially-sown pasture grasses. Large tracts of land in the Nelson district, formerly regarded as practically useless, were proved eminently suitable for growing fruit, particularly apples. Nearly half of the apple and pear crops were exported until 1939, when shipping space was required for war purposes. The local market absorbed practically all the stone fruits (mostly cultivated in central Otago) and citrus fruits (produced in Auckland and Hawke's Bay). In 1941 the area under field crops was 2,048,198 ac., under artificially-grown pasture grasses 17,737,583 ac., and under fruit trees, 20,064 ac.

**Pastoral Production.**—New Zealand is primarily a grazing country; it became the world's largest exporter of mutton, lamb and cheese, and in 1938 it was second only to Denmark as an exporter of butter. Practically every description of sheep find a favourable local habitat in the dominion; as of April 30, 1941, the total number of sheep was 31,751,660, the average size of the flocks being 979. Although ranking seventh in order among the principal sheep countries of the world, in 1941 New Zealand was fourth largest as a producer of wool and third as an exporter. In 1941 the total number of cattle in the dominion was 4,575,873. Beef breeds increased after chilled shipments to overseas markets were proved in 1933 to be satisfactory. Dairy cows in milk accounted for 39% of total cattle in 1941.

**Dairy Produce.**—Scientific management increased the season's yield of butterfat per cow from 152 lb. in 1920 to 252 lb. in 1940. There were 405 co-operative dairy factories in 1941, some exclusively concerned with turning out butter, a larger number cheese, and a few both products; butter and cheese exported in 1941 amounted to 2,263,175 cwts. and 2,366,235 cwts. respectively, and in 1942 the figures were 2,344,029 and 2,689,232 cwts. The government marketing department, created in 1936, acquired ownership of butter and cheese, at f.o.b. or in store, marketing or disposing of it in the United Kingdom or, through the internal marketing division, regulating its distribution on the local market. The New Zealand Dairy board was concerned with the internal phase of the dairy industry and herd testing; levies on manufactured butter and cheese were used to subsidize dairy research work.

**Forestry.**—State forests aggregated 8,762,079 ac. in area in 1941, this representing 63% of the total forest area and 13.2% of the total area of New Zealand proper. There were also 852,196 ac. of exotic forests, of which 663,626 ac. were planted by the State Forest service and the remainder by local authorities, farmers and commercial concerns. In order to preserve young growth and encourage natural regeneration, logging was done in state forests by the government forest service. Fire hazard prediction instruments, the radio and aeroplanes were made use of in forest fire prevention, while denudation of forests and soil erosion were also checked.

**Fisheries.**—Most important of the edible fishes are the snapper, the tarakihi, flounders of various species, blue cod and the groper or hapuku. Except for groper and ling fishing by means of long lines, most fishing is carried on at depths of less than 40 fathoms. Fishery products marketed in 1940–41 were valued at £577,063. The principal oyster beds were those in Foveaux strait. With the enormous development of pelagic whaling, New Zealand's formerly important whaling industry greatly declined, in 1940 the only shore station in commercial operation being that in Tory channel, Queen Charlotte sound. The taking of seals was prohibited. Swordfish (striped and black marlin and occasionally broadbill), mako shark and other big-game fish are found off the east coast of Auckland province.

**Minerals and Mining.**—Coal was mined in the 1930s to a greater value than gold, the mining of which had been New Zealand's chief industry in the 19th century. In 1942, 2,680,041 tons of coal, valued at £1 per ton, were produced. Figures of gold production were withheld during World War II, prior to which time the annual figure was about 569,300 oz., valued at £1,567,000. Kauri gum, the fossilized resin of former kauri forests, is counted as a mineral; production was considerable until its displacement by synthetic lacquers and resins. Silver is found alloyed with gold in the Hauraki region, and other minerals of commercial importance include tungsten ore, pumice, manganese ore, iron ore and silica sand. Copper, mercury, tin, platinum, sulphur, asbestos, bentonite and phosphatic rock also occur. Petroleum of good quality but in limited quantity has been proved, and considerable drilling was in progress during World War II.

**Factory Production.**—While the farming industries were of major economic importance, the government made every effort to encourage establishment of local manufactures. During the early days of colonization bounties were offered in many instances to aid introduction of new industries and to induce experienced factory workers to immigrate, and subsequently, in the development of New Zealand's tariff policy, locally manufactured products were afforded a measure of protection. Nevertheless, industrial expansion was necessarily limited by the size of the available market and by the competition of products of large-scale enterprises established in the more densely populated countries.

In 1930–31 there were 5,194 factories in operation in the dominion, the value of their output being £77,745,249. As a concomitant of the world-wide depression in trade and industry, factory production declined during the next two years, but a period of recovery then set in, reaching in 1941–42 a record high level with 6,367 manufacturing establishments having an output valued at £155,566,195. The principal industries were meat freezing and preserving, ham and bacon curing, and butter, cheese and condensed milk manufacture. Others of major importance included the production of heat, light and power, woollen manufacture, sawmilling and furniture making, and clothing manufacture.

In order to plan industrial activity in such a manner as to achieve a more balanced economy, a government bureau of industry was constituted in 1936. That body advised the minister of industry and commerce on measures to be adopted for the purpose of promoting the establishment of new industries and for the expansion and reorganization of established industries with a view to rendering them more efficient. By a system of licences, the bureau of industry also exercised control over the entrance of new units into certain industries, and ensured that the latter were carried on in a manner calculated to conform to industrial efficiency and national interest.

**Water Power.**—New Zealand is topographically well suited for hydroelectric development, about 4,000,000 h.p. being available in South Island and 800,000 h.p. in North Island. In 1903 sole right to use the water power of the dominion, subject to any existing rights, was vested in the crown. This right might be delegated to local authorities and private concerns, and these were required, by regulations amended in 1934, to obtain permission to generate power from the minister of public works and to pay an annual rental at the rate of £ per kva. Hydroelectric power was put to a variety of uses on the farms and in industry, while many of the railway lines were electrified. The government generating stations were Arapuni (with an installed capacity in 1941 of 109,500 kw.), Waitaki (60,000 kw.), Tuai (52,000 kw.), Lake Coleridge (34,500 kw.), Mangahao (19,200 kw.), Horahora (10,300 kw.), Lake Monowai (6,000 kw.) and Arnold River (3,060 kw.). In 1943 the government adopted a ten-year plan for increasing the hydroelectric supply on North Island. Three stations were to be built on the Waikato river with capacities, respectively, of 150,000 kw., 100,000 kw. and 80,000 kw., and an existing station was to be enlarged, and long-distance power lines

were to carry 220,000 voltage instead of the existing 110,000 voltage. New Zealand ranked sixth among the electrified countries of the world in 1942. About 93% of the population had access to electric supply, the cost of which to the consumers (83% of them domestic) was rather less than one penny per unit (kilowatt).

BIBLIOGRAPHY.—R. O. Buchanan, *The Pastoral Industries of New Zealanders* (1935); H. Belshaw, *Agricultural Organization in New Zealand* (1936); W. M. Smith, *The Marketing of Australian and New Zealand Primary Products* (1936); H. G. Philpott, *A History of the New Zealand Dairy Industry* (1937); F. W. Hilgendorf, *Wheat in New Zealand* (1939); G. T. Alley and D. O. W. Hall, *The Farmer in New Zealand* (1941); E. F. Hubbard, *The Industrial Future of New Zealand* (1941).

## EXTERNAL TRADE

The total trade of New Zealand per head of the population in the years following World War I was the highest in the world. Exports reached a record figure of £45 4*s.* 0*d.* per head in 1919, and the rate for imports was highest in 1920 at £49 10*s.* 11*d.* In 1925 the figure for exports and imports combined attained the peak of £77 15*s.* 5*d.*, and thereafter the value of external trade declined until in 1932 it was only £39 9*s.* 3*d.* per head of the population. The figure for 1939 was £65 19*s.* 5*d.*, and a year later it had risen to £74 19*s.* 3*d.*

Total merchandise trade (*i.e.*, excluding specie) for the years 1938–42 is shown in the following table in New Zealand currency:—

| Year ended December 31 | | | | |
|---|---|---|---|---|
| Year | Exports | Imports | Total trade | Visible excess of exports |
| | £ | £ | £ | £ |
| 1938 | 58,376,283 | 55,422,189 | 113,798,472 | 2,954,094 |
| 1939 | 58,049,315 | 49,387,183 | 107,436,499 | 8,662,133 |
| 1940 | 73,741,133 | 48,997,669 | 122,738,802 | 24,743,464 |
| 1941 | 67,479,413 | 49,167,010 | 116,646,423 | 18,312,403 |
| 1942 | 80,875,132 | 53,669,599 | 134,544,731 | 27,205,533 |

The excess of exports in 1942, highest in New Zealand's history, was due to wartime conditions, imports necessarily being low and the dominion's exportable foodstuffs being in urgent demand.

**Exports.**—Pastoral products constituted the greater part of New Zealand's exports. In 1924 and 1925 they amounted to 94.2% of total exports. The percentage dropped to 91.8% in 1932 and again in 1933 owing to the fall in prices, particularly wool, during the world-wide economic depression, and thereafter rose to reach a record percentage of 94.6% in 1940. Through the five years 1936–40 butter, cheese and frozen meat constituted 65.5% of total exports, while 31.6% were raw materials, mainly wool, hides, skins, tallow and gold. The quantity and value of major exports during 1938–42 are shown in the table below.

During the 26 years from 1915 to 1940, the aggregate value of merchandise exported from New Zealand amounted to £1,234,555,346, of which £1,013,137,983, or 82.1%, was taken by the United Kingdom. Among other British countries, the principal purchasers of produce of the dominion were Australia, Canada, India, the Union of South Africa and Fiji. The United States took more of New Zealand's products than any other foreign country—a percentage of total exports ranging from 1.94 in 1932 to 7.20 in 1937. Total merchandise of the dominion bought by the United States in 1937 was valued at £4,784,099, and in 1940 the figure was £2,825,898.

**Imports.**—Upwards of 80% of New Zealand's total imports consisted of articles wholly or mainly manufactured, a large proportion of them being goods (as, for instance, cotton piece goods and pigments) which could not be produced economically in the dominion. Many imports of manufactured or semi-manufactured goods formed, too, the raw material of further factory processes in the dominion. The principal groups of commodities comprise clothing and textiles, metals and machinery, sugar, tea, alcoholic liquors, tobacco, paper and stationery, oils, motor vehicles and accessories, chemicals and drugs, manures and timber. Just over half of the country's imports came from the United Kingdom in 1931, and a further one-fifth from other British countries. In 1940, 76.97% of New Zealand's imports came from within the empire, though only 46.83% came from the United Kingdom, most of the increase being due to growth in imports from Australia, which accounted for 15.97%. Almost this same figure (15.95%) represented imports into the dominion from the United States in 1931; the percentage thereafter declined, the share of the United States in New Zealand's import trade being 12.42% in 1940. Principal imports from the United States were agricultural machinery, electrical machinery and equipment, wireless apparatus, leather and leather goods, motorcars, motor trucks and motor spirits. In 1940 New Zealand had a credit balance in merchandise trade with the United Kingdom of £41,020,961, about double the average amount during the years immediately preceding World War II. With all other British countries excepting Fiji it had an adverse balance, and with all foreign countries with the exception of France. The following table shows for the year 1940 the amount of merchandise exports to, and imports from, each of the principal countries trading with the dominion:—

| Trade Balance in 1940 by Countries | | | |
|---|---|---|---|
| Country | Exports | Imports | Balance |
| | £ | £ | £ |
| United Kingdom | 64,129,106 | 23,108,145 | +41,020,961 |
| India | 776,511 | 1,402,919 | — 626,408 |
| Canada | 1,709,169 | 2,869,178 | — 1,160,009 |
| Australia | 2,159,339 | 8,226,544 | — 6,067,205 |
| Other British countries | 539,239 | 2,617,249 | — 2,078,010 |
| Totals, British countries | 69,313,364 | 38,224,035 | +31,089,329 |
| France | 716,752 | 109,508 | + 607,244 |
| Japan | 81,457 | 771,091 | — 689,634 |
| Netherlands East Indies | 6,849 | 2,196,100 | — 2,189,251 |
| United States of America | 2,825,898 | 5,884,673 | — 3,058,775 |
| Other foreign countries | 258,628 | 1,812,262 | — 1,553,634 |
| Totals, foreign countries | 3,889,584 | 10,773,634 | — 6,884,050 |
| Ships' stores | 538,185 | | + 538,185 |
| Totals, all countries | 73,741,133 | 48,997,669 | +24,743,464 |

With a view to conserving overseas funds, so as to ensure that overseas-debt services would be met and that sufficient funds would be available for essential imports, regulations were made in 1938 for the rigid control of imports and exports. Importation of all goods into New Zealand was prohibited except under a licence, and when such was obtained an importer might apply for sterling through his bank to the reserve bank. In some cases imports were restricted to the extent of 100%, and after outbreak of World War II in 1939 there was a further strengthening of controls and restrictions. Although a wide range of goods (generally materials for industry and other essential commodities) carried no restriction other than a confinement to the 1938 level, the restriction on importation of many other less important articles was extremely severe.

**Customs Duties.**—In 1932, at the Imperial Economic confer-

| Exports: Quantities and Values (000's omitted) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Butter | | Cheese | | Frozen and chilled meats | | Sheepskins and pelts | | Wool | | Gold | |
| | Quantity cwt. | Value £ | Quantity cwt. | Value £ | Quantity cwt. | Value £ | Quantity number | Value £ | Quantity lb. | Value £ | Quantity oz. | Value £ |
| 1938 | 2,615 | 16,520 | 1,611 | 5,935 | 5,373 | 15,092 | 14,178 | 1,369 | 271,283 | 12,185 | 152 | 1,297 |
| 1939 | 2,443 | 16,111 | 1,677 | 5,870 | 5,906 | 15,391 | 15,157 | 1,460 | 277,392 | 11,666 | 176 | 1,629 |
| 1940 | 2,623 | 18,228 | 2,034 | 8,233 | 6,977 | 19,681 | 13,139 | 1,932 | 300,289 | 16,875 | * | * |
| 1941 | 2,623 | 15,778 | 2,366 | 9,834 | 5,272 | 16,541 | 18,514 | 2,007 | 218,780 | 12,621 | * | * |
| 1942 | 2,344 | 16,481 | 2,689 | 11,879 | 5,791 | 17,729 | 15,592 | 2,809 | 314,942 | 18,336 | * | * |

*Not available

ence held in Ottawa, Canada, New Zealand agreed to afford protection against United Kingdom products only to industries reasonably assured of sound opportunities for success, and to grant protection on such a level as to enable the United Kingdom producer to compete on the basis of relative cost of economical and efficient production. Accordingly, the surtax on dutiable articles which had been imposed in 1930 in lieu of a primage duty was discontinued on the produce goods of the United Kingdom or any British country except Canada, the Union of South Africa, Eire, Newfoundland or India, and amendments made to the British preferential tariff in 1934 abolished certain protective duties and reduced others. New Zealand also had reciprocal trade agreements with the Union of South Africa, Australia and Canada, and others with certain foreign countries, in some cases by direct negotiation and in other instances negotiated by the United Kingdom. About one-half of the dominion's imports were admitted free of duty, as shown in the following table:—

| Year | Value of Merchandise Imports | | | Free | Dutiable | Duty |
|---|---|---|---|---|---|---|
| | Free | Dutiable | Total | | | |
| | £ | £ | £ | % | % | £ |
| 1938 . | 26,981,932 | 28,440,257 | 55,422,189 | 48.68 | 51.32 | 9,066,470 |
| 1939 . | 26,157,233 | 23,229,950 | 49,387,183 | 52.96 | 47.04 | 8,437,197 |
| 1940 . | 31,913,715 | 17,083,954 | 48,997,669 | | | 7,079,396 |

Exports duties are levied on shipments of gold and of white pine and kauri logs (not sawn timbers). Levies imposed on exports of honey, hides and wool go to boards acting in the interests of the producers.

## TOWNS AND COMMUNICATIONS

**Towns.**—More than half the population of New Zealand is urban, and two-thirds of that is found in North Island. There are four main cities. In the North Island are Auckland, the largest, with an estimated population in 1941 of 223,700 (212,159*) and Wellington, the capital, with 160,500 persons (149,971*). At these cities are the dominion's finest harbours. Christchurch and Dunedin, in the South Island, had populations in 1941 of 135,500 (132,559*) and 82,200 (81,961*) respectively. Other urban areas in the North Island, cities or boroughs, with 1941 populations are Hamilton 20,900 (19,587*), Gisborne 16,200 (15,885*), Napier 19,400 (18,689*), Hastings 19,000 (17,961*), New Plymouth 19,400 (18,520*), Wanganui 26,000 (25,795*) and Palmerston North 25,500 (24,067*); and in the South Island, Nelson 13,800 (13,584*), Timaru 19,200 (18,814*) and Invercargill 26,400 (25,772*).

**Railways.**—Most railways are state-owned. In 1941 there were 3,390 mi. of state railways open for traffic (1,634 mi. in the North Island and 1,756 in the South Island), portions of the line being electrified. The gauge is 3 ft. 6 in. Numerous mountain chains and innumerable rivers make railway construction both difficult and expensive. The capital cost had amounted in 1941 to £62,301,147, *i.e.*, the cost per mile of open line was £18,378; net revenue was £1,694,644 in 1941, representing a percentage of net revenue to capital cost of £2 12*s.* 10*d.* There were also about 180 mi. of private railways open for the transport of passengers and goods, and other lines used exclusively for the private transportation of goods.

**Roads.**—In 1940 there were 53,086 mi. of formed road in the dominion, 5,920 mi. of bridle tracks and 17,316 mi. of unformed legal roads, a total for all roads of 76,322 mi. The configuration of the country and the abundance of rivers rendered road construction as difficult as the building of railways. Bridges of 25 ft. in length or more in the roads system in 1940 numbered 7,140, having a total length of 620,062 ft. Of the 12,381 mi. of main highways, 3,990 mi., the principal arterial traffic routes, were classified as state highways and maintained by the central government.

**Civil Aviation.**—Owing to the comparative smallness of the country, aviation development was slow. When World War II broke out three companies were maintaining air services within the dominion, in 1939–40 flying 1,075,365 mi. and carrying 45,832 passengers. A service to Australia was operated by Tasman Empire Airways, Ltd., the share capital of which was held by the governments of New Zealand (39%), the United Kingdom (38%) and Australia (23%); and Pan American Airways provided a service from Auckland to San Francisco by way of Noumea, Canton Island and Honolulu.

*1936 census.

## DEFENSE

**Peacetime Organization.**—The military forces were divided into the regular force and the territorial force. The former, raised by voluntary enlistment, provided staff officers and instructors (about 1,000 strong at the outbreak of World War II) for duty at military establishments and fixed defenses, and to train the territorial force. All male British subjects from 14 to 17 years of age were liable to be trained in the senior cadets and those from 18 to 35 or to such less age as might be prescribed, in the territorial force. Compulsion was removed in 1930, those recruited for the territorial force voluntarily agreeing to serve for three years; in major respects, conditions of service were analogous to those in the national guard organization of the United States. In time of war all male inhabitants between 17 and 55 were liable for service in the militia; both that body and the territorial force were liable to serve in any part of New Zealand but could not be compelled to serve outside it. Service outside the dominion became obligatory during World War II.

New Zealand contributed toward the cost of British naval defense of its waters until 1920, when it undertook to maintain its own sea-going naval force and training centre. Officers were trained in the royal navy and ratings (enlisted for a term of 12 years) at the naval station at Devonport, Auckland, and aboard the dominion's vessels. A naval reserve force, organized in 1922, was officered by and recruited from volunteers who did not follow the sea as a profession. The royal New Zealand air force, created in 1937 as an independent arm of the defense organization, comprised, when war began two years later, regular, reserve and territorial forces.

**War Services.**—New Zealand supplied ten contingents of mounted infantry for service during the South African War, 1899–1902, comprising a total of 6,500 officers and men. In World War I New Zealand troops provided for foreign service represented nearly 10% of the total population of the dominion, a total of 128,525 officers and men, of whom 98,950 actually went overseas. Dominion troops occupied Western Samoa, and a larger force proceeded to Egypt, where it became part of the "Anzacs" (the Australian and New Zealand army corps). After sharing in the defense of the Suez canal and the Gallipoli campaign, the New Zealand division was sent to Europe and the dominion's mounted brigade operated in Palestine. New Zealanders fought in France and Belgium, as well as in the Salonika campaign, and by the time hostilities ceased their forces had suffered 57,987 casualties, of whom 16,697 lost their lives on active service. Additional numbers served in the British or Australian naval or military forces.

At the outset of World War II New Zealand was at liberty to choose neutrality or belligerency. Without hesitation it went to Britain's aid, its government declaring war against Germany without awaiting the decision of parliament. By 1943 one-third of the population, men and women, was mobilized for war service. As many men had been sent overseas as in World War I, and as many more inducted, while home guard organizations had a strength of 124,000 men.

A division of troops dispatched to the middle east became the spearhead of successive offensives launched by the British 8th army, serving with distinction in Egypt, Greece, Crete, Libya and Tunisia. In 1939 a cruiser of the New Zealand naval forces (designated the royal New Zealand navy in 1941) participated in the engagement with the German battleship *Graf Spee,* which was driven into Montevideo harbour and scuttled. New Zealand squadrons of the R.A.F. took part in the aerial warfare over Germany, and the New Zealand air force participated in the operations against Japan in the South Pacific; the dominion

shared in the Empire Air Training scheme, sending air personnel to Canada for part of their training.

Voluntary enlistment for the territorial force and the 2nd New Zealand expeditionary force (the 1st had been that of World War I) was closed in July 1940, when all men resident in the dominion over the age of 16 years automatically became members of a general reserve; all up to the age of 45 were liable for service in the armed forces in any part of the world, those not so utilized, and older men, being placed in essential industry and enrolled in the home guard. In 1942 New Zealand airmen served against the Japanese in Malaya, and military forces of the dominion later fought alongside United States troops in islands of the Southwest Pacific. Women of the dominion served in all three fighting services, many on combat duty, and performed varied work at home. The country's industrial resources were mobilized for the production of munitions and war equipment; and reciprocal aid, comprising foodstuffs, buildings, camps and small ships, was made available to United States forces.

BIBLIOGRAPHY.—*Official History of New Zealand's Effort in the Great War,* 4 vols. (1921–23); W. Nash, *New Zealand: A Working Democracy* (1943); publications of the N.Z. Army Board concerning part in World War II.

## EDUCATION

The Education act of 1877 made state education in New Zealand free, secular and compulsory between the ages of 7 and 14. The school-leaving age was subsequently raised to 15, and during World War II it was planned to continue compulsory schooling until the child was 16 years old. In 1914 the educational system was recast, the dominion department of education assuming many powers hitherto vested in local educational authorities.

**Kindergartens.**—Children below the age of five may be enrolled at free kindergartens maintained by the New Zealand Free Kindergarten association. The government made annual grants toward the support of the kindergartens, but the system was far from universal. In 1941 there were only 42 free kindergartens, with 1,893 children on the rolls.

**Primary Schools.**—While every child had to be enrolled at the age of seven as a pupil of either a public or registered (private) school, entry to primary school was permissive from the age of five. All state primary schools are co-educational. The syllabus of instruction includes, besides the three R's, elementary science, agriculture and, in some instances, dairy work. Older boys receive instruction in woodwork and metalwork at manual-training centres, and older girls are taught domestic subjects. In country districts where there are not enough children to warrant separate secondary schools, older pupils attend so-called district high schools, which are under the same control as the primary schools. In addition, there are intermediate schools (formerly termed junior high schools) which provide varied and enriched courses for older children to help them decide on their lines of further education. There were, in 1941, 2,149 public schools within the primary school system, these including district high schools and intermediate schools or departments.

**Private Schools.**—In 1922 registration of every private school was made compulsory and certain standards of efficiency and suitability of staff, premises, equipment and curriculum required. In 1941 there were 304 private primary schools, of which 232 were conducted by the Roman Catholic Church. That denomination and the Anglican and Presbyterian churches maintained their own secondary schools (there were 63 in 1940), generally boarding establishments and likewise on the same antisecular foundation.

**Post-Primary Schools.**—In 1936 free post-primary education to the end of the year in which he is 19 was offered to every child completing a primary-school course or attaining the age of 14 years. Two-thirds of the children leaving public primary schools in 1941 went on to full-time post-primary schooling. Post-primary (secondary) schools were termed grammar schools in Auckland, colleges in Wellington, and high schools in North Island and over most of South Island. Where a secondary and a technical school were amalgamated under a single governing body the resulting institution was known as a combined school. Technical schools fell roughly into two types: those in the small centres distinguishable from secondary schools only by having a rather more strongly developed practical side; and large technical schools in the main centres—where city secondary schools provided an academic curriculum. In 1940 the state conducted 39 secondary schools, 7 combined schools, 96 secondary departments of district high schools and 21 technical high schools. The government assumed in 1938 full responsibility for the work of vocational guidance at post-primary schools.

**Rural Education.**—It was the policy of the government to provide for country children, as far as practicable, the same educational facilities as those available to town children. For this purpose small rural schools were consolidated and school buses or free railway passes furnished. Where these did not suffice, a horseback allowance was made. Correspondence classes were conducted for those in very remote areas, and broadcasting was much used. Country teaching positions were relatively better paid, and every city teacher, to qualify for promotion, is required to serve for three years at a country school. The curriculum is adapted to the social and economic background of each school. The teaching of agriculture is a special feature in rural schools, and projects are undertaken by boys' and girls' agricultural clubs.

**Maori Education.**—While more than half the Maori children attend the public schools together with the white children, there are also a few native village schools provided for their education, as well as some mission schools remaining from the pre-Maori War system. The Maori (the word is both singular and plural) frequently make better progress in their own schools, where they are taught Maori arts and crafts, song, legend and history. In 1941 there were 149 native village schools and 10 native mission schools, with a total roll number of 10,916 (of whom 1,199 were non-Maori) and 659 respectively; 12,712 attended the public schools. Maori are entitled to free secondary education—provided in eight Maori high schools maintained by the government and, for those in remote districts, in private denominational schools by means of government scholarships. In 1940 three native district high schools in North Island were authorized.

**Higher Education.**—New Zealand university comprises four university colleges—at Auckland, Wellington, Canterbury and Dunedin (the last anomalously named the University of Otago). While each provides the customary arts and sciences courses, Auckland specializes in architecture, commerce and engineering; Wellington (Victoria University college) in law; Canterbury in engineering and music; and Otago in medicine, dentistry, mining and metallurgical engineering. Attached to New Zealand university is a school of agriculture comprising Massey Agricultural college, near Palmerston North, and Lincoln Agricultural college, near Christchurch. The government provides liberal scholarships, bursaries and studentships. In 1940, of 5,528 enrolled students at the four university colleges, 2,508 were in receipt of free university education.

**Adult Education.**—The Workers' Educational association is the principal agency for adult education. Operating in conjunction with the university colleges, it conducts tutorial classes in the cities and carries on work in the country by means of material specially prepared as a basis for discussion among groups of people. The organization receives government and university grants, and donations from trade unions, local bodies and private individuals. A Council of Adult Education, created in 1938, coordinates the various activities of adult education and recommends the amount and allocation of the annual grant for adult education paid by the University of New Zealand.

**Educational Research.**—With the financial assistance of the Carnegie Corporation of New York, the New Zealand Council for Educational Research was founded in 1933. It conducts a survey of the organization and administration of the New Zealand education system and pursues research on the practice of education. Studies published by the council include: L. C. Webb, *Control of Education in New Zealand* (1937); J. C. Beaglehole, *The University of New Zealand* (1937); C. E. Beeby, *Intermediate Schools of New Zealand* (1938); J. Nicol, *Technical Schools of*

*New Zealand* (1940); H. C. McQueen, *The Background of Guidance* (1941). *See*, also, M. H. Holcroft, *The Deepening Stream: Cultural Influences in New Zealand* (1940); A. E. Campbell, *Educating New Zealand* (1941).

### SOCIAL CONDITIONS

**Labour Legislation.**—In the 1890s New Zealand—still in the pioneer stage of economic development—acquired world fame as the land of advanced social legislation. The government lent money to workers to build homes or to settle on land, protected homes from the results of bankruptcy and regulated working conditions. The Industrial Conciliation and Arbitration act, 1894, encouraged the formation of industrial unions and facilitated settlement of labour disputes by conciliation and arbitration. An amending act passed in 1936 required the arbitration court to fix basic wages for adult male workers based on the needs of a man, wife and three children (and also a basic wage for adult female workers) and, where practicable, to fix the maximum hours of work per week (exclusive of overtime) at 40; no new unions might be formed where a union in respect of the same industry existed; and all workers engaged in an industry covered by an award or industrial agreement registered with the court were required to become members of the relative union. After New Zealand entered World War II in 1939 participation in a strike or lock-out was forbidden.

**Social Security.**—New Zealand's Old Age Pensions act, 1898, was the first such measure in any British country. Subsequent contributory systems provided for the old age of public servants, and the state subsidized by one-fourth contributions to the National Provident fund, an annuity scheme set up in 1911. Widows' pensions, too, were introduced in 1911; pensions were granted in 1915 to miners incapacitated through phthisis; in 1926 allowances were granted to families where the parents had more than two children and limited incomes; dependents of persons who died from the influenza epidemic after World War I, blind persons and chronic invalids also received pensions. The Social Security act, 1938, consolidated all existing pension schemes, increased the payments, and introduced a "universal superannuation," paid irrespective of income received or property owned. It inaugurated a wide range of health and medical benefits, and substituted unemployment benefit for financial assistance provided in 1936 by an Employment Promotion act. In order to finance the scheme, every person of 16 years or over was required to pay a registration fee—5*s.* per year for all women, and for youths between 16 and 20 years; all other men paid 5*s.* per quarter. However, by far the largest part of the Social Security fund was derived from a tax of 1*s.* in the pound (5%) on all wages, salaries and company and other income. Insofar as the amount so provided was inadequate, parliament might appropriate sums from the general revenue of the state.

**Hospitals and Health.**—Under the Hospitals and Charitable Institutions act, 1926, each hospital district into which New Zealand was divided was managed by a board, which financed the hospitals within the district. Levies on local authorities (*e.g.*, rates on property within the hospital district) and subsidies from the central government each accounted approximately for one-third of the total revenue of a board, patients' fees meeting less than one-third of the cost of hospitalization. In 1939 the Social Security fund assumed the cost of hospital patients' fees and of out-patient treatment, as well as paying the fees for visits by patients to doctors' surgeries. Maternity benefit provides for prenatal and post-natal attention, as well as for treatment and maintenance in maternity hospital during time of labour and for 14 days after the birth; alternatively to treatment in hospital, a patient may receive free of charge the services of an obstetric nurse in the home. All medicines, drugs and appliances are supplied free to all patients in hospital or at home, and X-ray diagnostic and massage services are provided.

**Housing.**—Through the state advances department, created in 1894, the government lent money for the purchase of homes and improvement of farms. In 1934–35 the department was reconstituted as the Mortgage corporation, a limited amount of private share capital being subscribed, but by another change in 1936 the State Advances corporation came into being, with elimination of private share capital and the liberalizing of provisions governing advances. The government undertook direct home building in 1937. While actual erection was done by private builders, the purchase of land, designing and letting of houses were functions of the state; houses were not for sale. About 300 type plans were in general use, though all the houses in one group were of different types, each having an adequate amount of land for lawns and gardens. After entry of Japan into World War II materials and men were diverted to the urgent defense construction that became necessary.

BIBLIOGRAPHY.—J. A. Lee, *Socialism in New Zealand* (1938); G. R. Powles, *et al.*, ed., *Contemporary New Zealand* (1938); D. Robb, *Medicine and Health in New Zealand* (1940); W. B. Sutch, *Social Services in New Zealand* (1941), *Poverty and Progress in New Zealand* (1941) and *The Quest for Security in New Zealand* (1942). *See* also individual bibliographies after each section. (W. B. PN.)

**NEW ZEALAND SPINACH:** *see* SPINACH.

**NEXT FRIEND,** in law, the phrase used for a person who represents in an action another person who is under the disability of infancy to maintain a suit on his own behalf. Every application to the court on behalf of an infant must be made through a next friend. Previous to the Married Women's Property act, 1882, it was also usual for a married woman to sue by a next friend, but that act, allowing a married woman to sue in all respects as a *feme sole,* has rendered a next friend unnecessary in her case. In the case of an infant the father is prima facie the proper person to act as next friend; in the father's absence the testamentary guardian, if any; but any person not under disability may act as next friend so long as he has no interest in the action adverse to that of the infant. A married woman cannot, however, act as next friend, except in special cases. (*See* Rules of the Supreme Court, O. xvi, r. 16.) An infant defends a suit, not by a next friend, but by a guardian *ad litem.* A lunatic sues by his committee, but if he has no committee, or if the committee has some interest adverse to the lunatic, he sues by his next friend. A next friend has full power over the proceedings in the action as if he were an ordinary plaintiff, and he is therefore responsible for paying the costs, but he is not entitled to be heard in person. (*See* INSANITY IN LAW.)

**NEXT-OF-KIN:** *see* KIN.

**NEY, MICHEL** (1769–1815), duke of Elchingen, prince of the Moskowa, marshal of France, was born at Saarlouis on Jan. 10, 1769. His father was a cooper, and he received only a rudimentary education. In 1788 he went to Metz and enlisted in a regiment of hussars; in 1792 he was elected lieutenant; and in 1794 he became captain and was placed by Kléber at the head of a special corps of light troops. He was soon promoted *chef de brigade,* and in 1796 general of brigade. He commanded the right wing of Hoche's army up to the peace of Campo Formio. On the resumption of hostilities he again took the field, and for his surprise of Mannheim in 1799 received the grade of general of division. He fought in the Swiss campaign of Masséna, and when Masséna turned against the Russians, who were approaching from Italy, Ney was left in command holding his ground successfully against the Austrians, although his opponent was the famous Archduke Charles. In 1800 he was present at Hohenlinden. In May 1802 he married Mademoiselle Auguié, whom Josephine had chosen for him at Bonaparte's request. This event marks a change in Ney's political opinions, which can only be explained by Napoleon's power of captivating men. He was henceforward as ardent and sincere an admirer of Napoleon as hitherto he had been of revolutionary principles, and was one of the very few officers of the army of the Rhine who became a trusted lieutenant of the emperor. He carried out an important mission in Switzerland, and in 1803 he was placed in command of the camp of Montreuil. While there he begged Napoleon to declare himself emperor, and on the establishment of the empire he was made marshal of France, and received the grand eagle of the Legion of Honour. In 1805 he commanded the 6th corps of the Grand army, and his great victory at Elchingen (for which in 1808 he was made duke of Elchingen) practically secured the surrender of the Aus-

trians at Ulm. He was then ordered to the upper Adige, when he led the decisive attack at Friedland. After Friedland Napoleon gave him the title, "the bravest of the brave."

In 1808, after the first disaster to the French arms in Spain, Ney accompanied Napoleon there as commander of the VI. corps. He took part in the Peninsular War from 1808 to 1811. When acting under Masséna in the invasion of Portugal in 1810–11, he quarrelled bitterly with his former chief, and in spite of his distinguished service he was recalled to France by Napoleon and censured. He was re-employed with the *Grande Armée* in central Europe under Napoleon himself. In the 1812 expedition to Russia Ney commanded the centre at Borodino, and was created prince of the Moskowa on the evening of the victory. In the retreat he was a tower of strength, animating the rearguard with his own sublime courage, keeping the harassed and famished soldiers together under the colours and personally standing in the ranks with musket and bayonet. He was the last to recross the frontier, and threw the remaining muskets into the Niemen. In 1813 he commanded a corps in the German campaign, and in 1814 he shared in the campaign in France. At the fall of the Empire the fact that Ney acted in the negotiations in concert with Macdonald and Caulaincourt is sufficient proof of his desire to avert Napoleon's abdication. Less satisfactory was his loud protestation of devotion to the Bourbons, when the Restoration was a *fait accompli.* But he was mortified by the disdain of the returned *émigrés,* and retired to his country seat. While on his way to take up a command at Besançon, he heard of Napoleon's return. He hurried at once to assure Louis XVIII. of his fidelity. With the famous remark that the usurper ought to be brought to Paris in an iron cage, he proceeded to Lons-le-Saulnier to bar Napoleon's progress. But he deserted with his troops, and Napoleon's march became a triumphal progress. Ney's act was undeniably treason to his sovereign, but it was hardly the calculated treason that his *émigré* detractors saw fit to imagine. Napoleon received him kindly, but did not give him a command until just before the Waterloo campaign. The marshal took up the command of the left wing on the northern frontier on June 13. The next day the army moved into Belgium. Ney took part in the campaign successively in the rôles of strategist, tactician and soldier. (*See* WATERLOO CAMPAIGN.) Much controversy has raged over his actions of June 15 and 16. At Waterloo he was subordinated to the personal command of Napoleon, but his advice was often offered and sometimes accepted, and he personally led several charges of the French up to the British squares. But when all was lost, his courage was extinguished. He made no attempt to second Davout and Grouchy in the last days of Napoleon's reign, and in despair advocated the restoration of the Bourbons. Soon a fresh order was issued denouncing him by name, and he was arrested on Aug. 5. When Louis heard of Ney's arrest he exclaimed, "By letting himself be caught he has done us more harm than he did on the 13th of March!" But neither king nor ministers were in a position to resist the clamour of the ultra-royalists for blood. Every fresh delay in the process of Ney's trial raised a new outcry at the court, in the salons and in the Chamber of Deputies; and fiercest of all in demanding immediate execution was the king's niece, the unhappy duchess of Angoulême, who lived to confess that had she known the record of Ney's services to France she would never have consented to his death. Ney was placed on trial before a court martial composed chiefly of his former brothers-in-arms, whose participation in the tragedy was probably never forgiven them by their countrymen. Others of the marshal's old comrades refused to serve, and were disgraced in consequence, until public opinion forced their reinstatement. The court took advantage of the plea of Ney's counsel that he was entitled to be tried by his equals in the Chamber of Peers. In spite of the courageous and eloquent appeal of the young duc de Broglie, the result of the trial before the latter body was a foregone conclusion; de Broglie was alone in voting for his acquittal. In the early morning of Dec. 7, 1815, Ney was shot in the Luxembourg gardens, near the Observatory. He met his death quietly and with a perfect soldierly dignity.

Ney left materials for memoirs, but in an incomplete state. The *Mémoires du maréchal Ney,* published in 1833, were collected from these papers by his brother-in-law Gamot and by General Foy. They cover only the earlier part of his career, and end with the battle of Elchingen (October 1805). An edition in English was published the same year.

*See* Rouval, *Vie du maréchal Ney* (1833); Dumoulin, *Histoire du procès du maréchal Ney* (1815, Eng. trans. 1816); Nollet-Fabert, *Éloge du maréchal Ney* (Nancy, 1852); Welschinger, *Le Maréchal Ney, 1815* (1893); A. Delmas, *Mémoire sur la révision du procès du maréchal Ney* (1832); *Military Studies by Marshal Ney* (Eng. trans., 1833); G. A. B. E. H. Bonnal, *La Vie Militaire du maréchal Ney* (1910, etc.); R. Androix, *Ney* (1914).

**NEZ PERCÉ,** a tribe of Sahaptin lineage on Snake river in Idaho and Oregon, now on Lapwai reservation, Idaho. The estimated population was 6,000 in 1805, 1,400 in 1885, 1,500 in 1921. In 1877, under Chief Joseph, they fought the United States, winning some engagements and engaging in a notable but finally unsuccessful retreat almost to Canada. They were the largest and easternmost Sahaptin tribe and most affected by influences from the Plains Indians.

**NGAMI,** a shallow lake of variable size forming the centre of an inland drainage system in the Bechuanaland (*q.v.*) Protectorate, South Africa. The lake once extended to a length of 20 m. and a width of 10 m., but is now little more than an expanse of reeds growing in a soft soil, below which brackish water is found. It is cut by 20½° S. and 23° E. Ngami is the lowest point of a large depression in the great plateau of South Africa. The area which drains to it is bounded south by the basin of the Orange, east by the Matabele hills, north by the western affluents of the Zambezi. The greater part of the Ngami water-system lies, however, north-west of the lake in the Angola highlands. On the high plateau of Bihe, in the hinterland of Benguella, rise two large rivers, the Okavango and the Kwito, which uniting discharge their waters into Ngami. From the north-east end of Ngami issues the Botletle or Zuga, a stream which runs south-east and drains towards the Makarikari marsh, from which there is no outlet.

Although Ngami has contracted in size in modern times the Okavango and its tributary the Kwito remain large rivers. The Okavango is known in its upper course as the Kubango. Its most remote source lies in about 12½° S. and 16½° E. and its length is over 900 m. It flows first south then south-east and east. In about 18° S. and 20½° E. it is joined on the north bank by the Kwito, a large navigable stream rising almost as far north as the Okavango. Its general course is south-east, but between 15° and 17° S. it flows south and even south-west. Below the Kwito confluence the Okavango, which is also joined by various streams from the south-west, is a rapid stream, generally navigable as far as the Popa falls, in 21° 50′ E. In the dry season, the water-level is from 4 to 20 ft. below the banks, but these are overflowed during the rains. At this period, April–June, some of the surplus water finds its way (in about 19° S.) by the Magwekwana to the Kwando or Linyanti (Zambezi system), to which, it is thought, the whole body of water may have once flowed. Below the Magwekwana outlet the Okavango, now called the Taukhe or Tioghe, turns almost due south, enters a swampy reed-covered plain and is broken into several branches. In this region the effects of desiccation are marked. Through the swamps the river formerly entered Ngami. Through the swamp some of the waters of the Okavango find their way eastward through a channel called Tamalakane to the Zuga or Botletle, the river which formerly flowed out of Ngami. The Botletle, whose bed is about 100 m. in length, loses itself in a system of salt-pans—round or oval basins of varying size sunk to a depth of 30 to 45 ft. in the sandstone, and often bounded by steep banks. The outer pans are dry for a large part of the year, the whole system being filled only at the height of the flood-season in August. The Botletle, which receives in addition the scanty waters of the northern Kalahari, at this season reaches the Makarikari marsh. In 1849 Livingstone found a large shallow lake. In 1896 Lugard and Passarge both found none. (*See* S. Passarge, *Die Kalahari,* 1904.)

**NIAGARA, FORT,** an American fortification, on the east side and at the mouth of Niagara river, opposite the Canadian village of Niagara-on-the-Lake. Ft. Niagara has a reservation of 288 ac., with fairly modern equipments, and several historic

buildings of the time of French and of British possession, in one of which, the old magazine (1757), William Morgan was imprisoned in 1826. Fort Niagara was long, especially during the French occupation of Canada, one of the most important forts in North America, being the key to the Great Lakes, beyond Lake Ontario. La Salle wintered here in 1678–9, built his ship the "Griffin," and established a trading post and Fort Conti, destroyed not long afterwards. Fort Denonville, built in 1687 by Jacques René de Brésay, marquis de Denonville, governor-general of Canada, in his cruel campaign against the Iroquois, was abandoned in 1688, after the garrison, commanded by Pierre de Troyes (d. 1687), had been wiped out by an epidemic. The first Fort Niagara, to be so named, was built in 1725–1727 at the instance of Charles le Moyne, 1st baron of Longueil (1656–1729), and became a very important military and trading post; the fort was rebuilt by François Pouchot (1712–1769) in 1756, but in July 1759, after a siege of about sixteen days, it was surrendered to Sir William Johnson by Pouchot. On the 14th of September 1763 a British force marching from Fort Schlosser (about 2 m. above the Falls; built 1761) to Fort Niagara was ambushed by Indians, who threw most of their captives into Devil's Hole, along the Niagara river. In July 1764 a treaty with the Indians was signed here, which detached some of them from Pontiac's conspiracy. Joseph Brant, John Butler and, in general, the Indians of north-western New York favouring the British during the Revolutionary War, made Fort Niagara their headquarters, whence they ravaged the frontier, and many loyalists and Indians took refuge here at the time of Gen. Sullivan's expedition into western New York in 1779. The fort was not surrendered to the United States until Aug. 1796. In the War of 1812 it was bombarded by the guns of Ft. George immediately across the river, and on Dec. 19, 1813 was surprised and taken by assault—most of the garrison being killed or taken prisoners—by British troops under John Murray. After the close of the war, on March 27, 1815, Ft. Niagara was restored to the United States, and a garrison was kept there until 1826. The fort was regarrisoned about 1836, and has since remained a post of the regular army.

*See* F. H. Severance, *An Old Frontier of France* (1917); L. L. Babcock, *War of 1812 on the Niagara Frontier* (1927); *Publications of the Buffalo Historical Society;* F. Parkman, *Conspiracy of Pontiac* (1851) and *Montcalm and Wolfe* (1884).

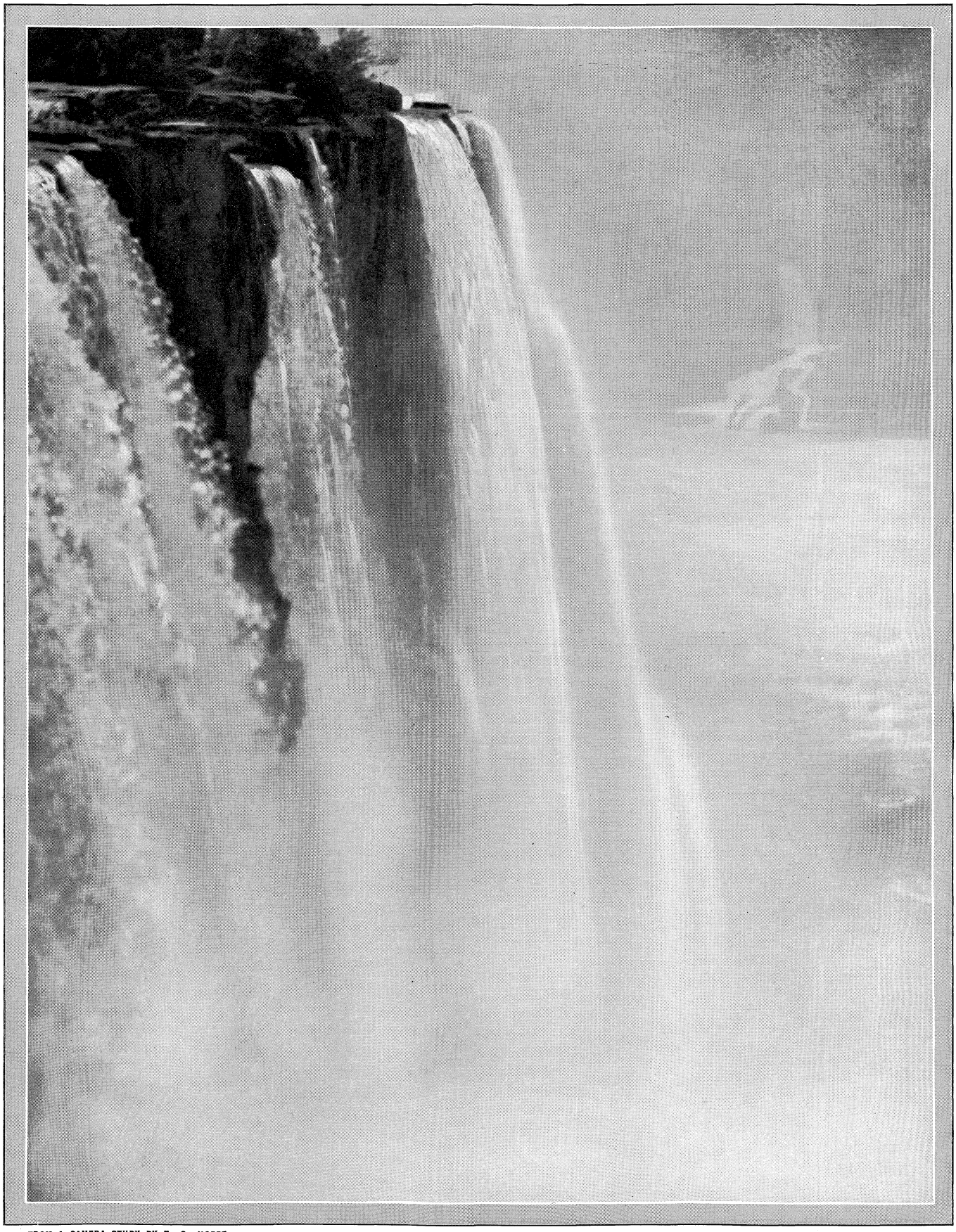
**NIAGARA FALLS** (formerly Clifton or Suspension Bridge), a city and port of entry of Welland county, Ontario, Canada, 40 m. S.S.E. of Toronto, on the west bank of the Niagara river and opposite the Falls. Pop. (1941) 20,589. It is a station on the Canadian National and Michigan Central and St. Catharines and Niagara Central railways, and has electric railway communication with the chief towns in the neighbourhood. Three steel bridges connected it in 1940 with the U.S. town of Niagara Falls on the opposite bank. Its importance was chiefly due to the tourist traffic, but the unrivalled water power is being more and more employed. Factories have sprung up and large electric power plants, and power is transmitted to Toronto and other cities. A beautiful park, named after Queen Victoria, extends along the bank of the river for 2½ m. above the Falls.

**NIAGARA FALLS,** a city and a port of entry of Niagara county, New York, U.S.A., at the great falls of the Niagara river (*q.v.*) 22 mi. N.N.W. of Buffalo. It is served by the Lehigh Valley, the Michigan Central, the New York Central, several electric railways and for freight also by the Erie and the Niagara Junction railways. Pop. (1930) 75,460 (32% foreign-born white); in 1940 it was 78,029 by the federal census. Beginning seven miles above the falls the city extends along the Niagara river to the falls. Goat island separates the American fall (165 ft. high and 1,000 ft. wide) from the Horseshoe fall on the Canadian side (160 ft. high, with a crest of over 2,000 ft. in a deep curve), and between them is the delicate Bridal Veil. Below the falls the river rushes between perpendicular walls 250 ft. high, in a series of rapids to the whirlpool. Goat island, several smaller islands, and Prospect park (10 ac. on the brink of the gorge) have been a state reservation since 1885. Every evening (since 1925) the falls are illuminated with changing colours by 24 gigantic searchlamps developing a total of 1,440,000,000 candle-power, set in Queen Victoria park across the river. Niagara Falls probably attract more visitors than any other single natural phenomenon of America. To protect their aesthetic value, the amount of water which may be diverted from either the Canadian or the American fall is limited by an international treaty. Practically all the permitted American diversion is now utilized in a hydro-electric development with an installation of over 500,000 h.p., serving half the population of the state. The city is an important manufacturing centre, especially of the electro-chemical and electro-metallurgical industries, which are largely concentrated here. Of particular importance are the manufacture of abrasives, shredded wheat, caustic soda, paper, aluminium, ferro-alloys and a great variety of chemical compounds. The aggregate factory output in 1940 was valued at over $100,000,000. Bank clearings in 1940 amounted to $283,183,836. The assessed valuation of property was $150,890,501 in 1940. Since 1916 Niagara Falls has operated under a commission-manager form of government. It is the seat of Niagara university (Roman Catholic; 1856). Old Ft. Niagara (*q.v.*) 14 mi. N., was restored to its original condition.

A fort (Little Niagara) was built on the site of Niagara Falls in 1750, and after its destruction Ft. Schlosser was built in 1761. In 1806 Judge Porter founded the village of Manchester here, on the banks of the falls. It was burned by the British in 1813, and remained a straggling little settlement until the construction of the Hydraulic canal in 1852 and the subsequent development (especially after 1877) of power from the falls. The first bridge across the river was completed in 1835; the first railroad bridge (a suspension bridge by John A. Roebling) in 1855. In 1892 the villages of Manchester and Suspension Bridge were merged and chartered as the city of Niagara Falls, which in 1900 had a population of 19,457. Electric energy generated from the falls was first used for lighting Prospect park in 1879, and in 1881 power was sold for commercial use; but the great modern development dates from the World War, and the city's growth as a manufacturing centre has followed the development of the power resources. The falls have been the scene of many daring exploits, ever since Sam Patch in 1829 successfully leaped into the river twice, only to lose his life in a similar leap at the Genesee falls in Rochester. Several men and women have safely plunged over one or the other fall or through the whirlpool in barrels, and in 1859, and again in 1860 (on the occasion of the visit of Edward VII., then Prince of Wales) Blondin performed amazing feats on a tightrope stretched across the gorge.

**NIAGARA RIVER** flows in a northerly direction from Lake Erie to Lake Ontario, a distance of about 34 miles. It constitutes part of the boundary between the United States and Canada, separating the State of New York from the Province of Ontario. It is the principal drainage outlet of the four upper Great Lakes, whose aggregate basin area is about 248,500 sq. miles. Its discharges at standard low water and standard high water of Lake Erie (570 and 575·11 ft. above mean tide at New York) are about 153,000 and 267,000 second-feet, respectively. The river is navigable from its source to the upper rapids, 20 m., and from Lewiston to the mouth, 7 miles. The current is rapid for the upper navigable portion, where the average fall is about 0·5 ft. per mile. The total fall of the lower 7 m. is 0·5 foot. The intermediate section of the river, consisting of 7 m., includes a series of rapids and Niagara Falls, and has a total fall of 315 feet. The average width is about 3,500 feet.

**Niagara Falls.**—The falls of Niagara are justly celebrated for their grandeur and beauty, and are viewed every year by over 2,000,000 visitors. They are in two principal parts, separated by an island. The greater division, adjoining the left bank, is called the Horseshoe Fall; its height is 160 ft., and the length of its curving crest line is more than 2,000 feet. The American Fall, adjoining the right bank, is 165 ft. high and 1,000 ft. broad. The water is free from sediment, and its clearness contributes to the beauty of the cataract. In recognition of the importance of the waterfall as a great natural spectacle, the Province of Ontario and the State of New York have retained or acquired title to the adjacent lands and converted them into parks, which are main-

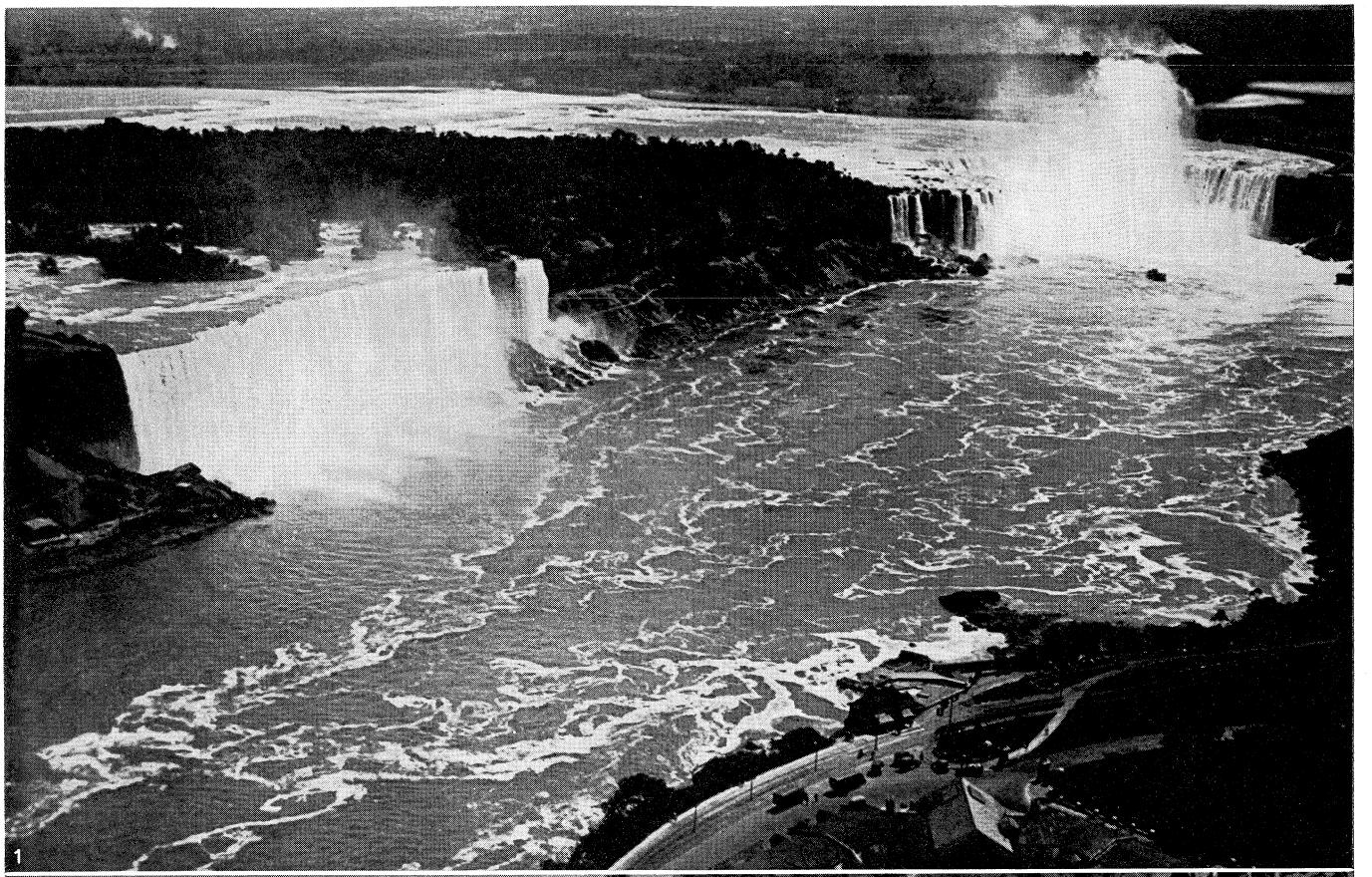


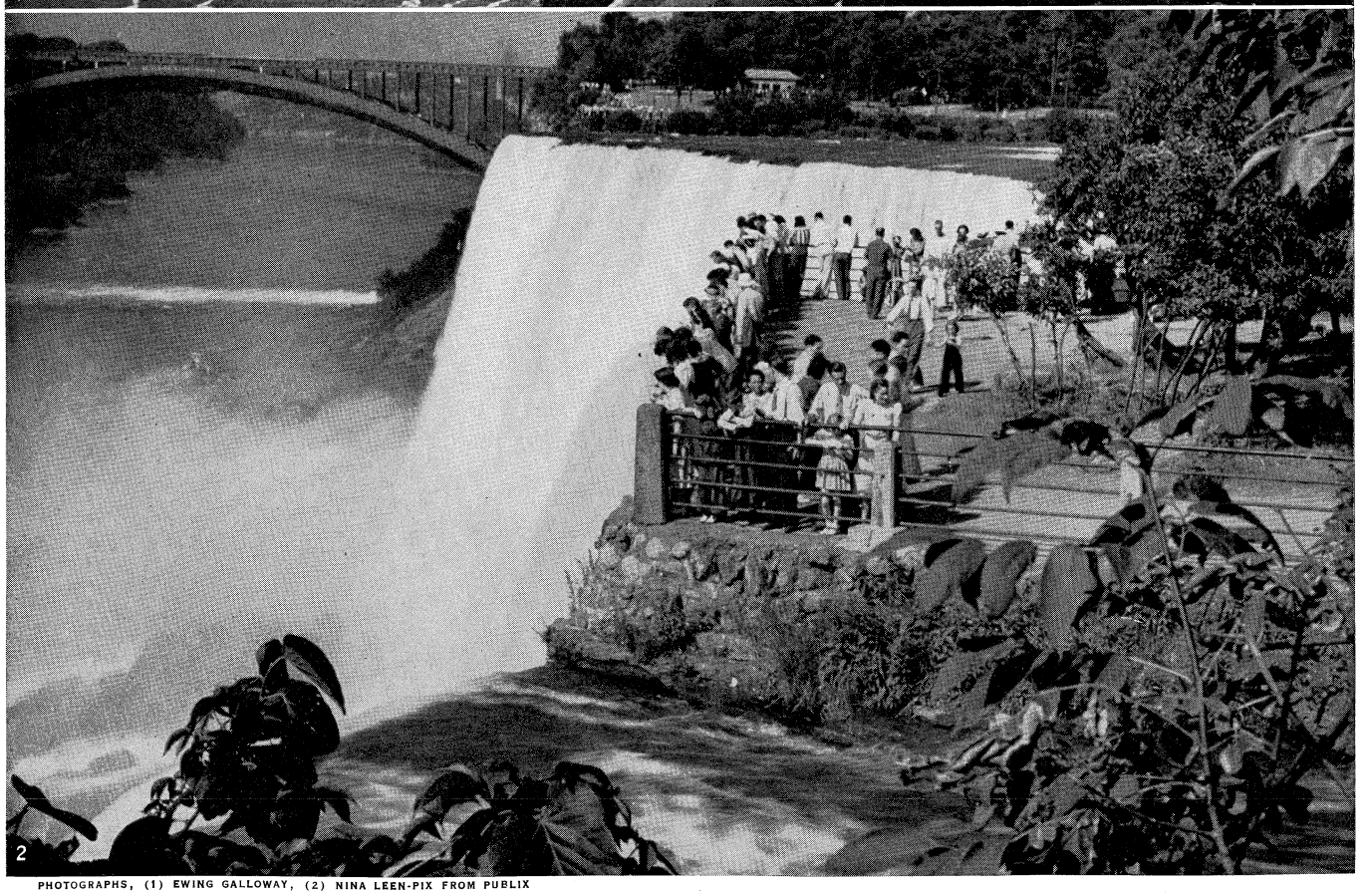
FROM A CAMERA STUDY BY E. O. HOPPE

## NIAGARA FALLS ON THE AMERICAN SIDE

The brink of the American Fall at Niagara, showing a point of Goat Island. The precipice on the American side is 167 feet in height

# NIAGARA FALLS





PHOTOGRAPHS, (1) EWING GALLOWAY, (2) NINA LEEN-PIX FROM PUBLIX

1. An airview of Niagara Falls from Ontario, Canada. The Horseshoe (Canadian) Fall at the right, 158 ft. high, is about 10 ft. lower than the American Fall, but is more than twice as long. The two falls are separated by Goat island
2. Top of the American Fall, with the observation platform for sightseers. The International bridge is at the left

tained at public expense for the convenience of visitors.

The scenic grandeur of Niagara Falls depends upon the volume of water flowing over the falls, but also on its distribution as it approaches the crest. The statement that the Horseshoe Fall is in danger of destroying itself as a spectacle by cutting a narrow "notch," destroying the symmetry of the horseshoe, possibly degenerating into a cascade and eventually draining the American Falls, has unfortunately been widely circulated. The mean annual rate of recession of the crest at the central part of the Horseshoe has been determined as being about 5 ft. since 1764, 3·7 ft. since 1842 and 2·3 ft. per year since 1906. The Horseshoe is now cutting back at a decreasing rate and the rate will continue to decrease. The recession of the American Falls is negligible. By proper action, supervision and control by the two Governments concerned, the scenic beauty of the Falls can be preserved, the tendency toward erosion in the Horseshoe can be checked, water can be distributed over the at present bared flanks of the Canadian Fall and a more dependable flow over the American Fall ensured.

**Geologic Age.**—The problem of the river's age is of much interest to geologists, because its solution would aid in establishing a relation between the periods and ages of geologic time and the centuries of human chronology. The great Canadian glacier, which in the glacial period alternately crowded forward over the Great Lakes region and melted back again, so modified the face of the land by erosion and by the deposit of drift that the waters afterwards had to find new courses. The Niagara river came into existence when the waning of the glacier laid bare the western part of the Ontario basin, and the making of the gorge was then begun. If it were supposable that the lengthening of the gorge proceeded at a uniform rate, the computation of the time would be easy, but there are various modifying conditions. A weighing of the evidence now available indicates 25,000 years as a lower limit for plausible estimates of the age of the river, but yields no suggestion of an upper limit.

**Navigation.**—Between Lake Erie and Lake Ontario, navigation passes through the Canadian Welland canal. The old canal had 25 lift locks, with a total lift of 326¾ feet. These locks were each 270 ft. long (usable length about 255 ft.) by 45 ft. wide, and were designed to have 14 feet depth on the sills. A new canal, constructed by the Dominion of Canada and opened to navigation on April 20, 1931, was formally opened, August 6, 1932. Calculated to admit the largest existing lake freighters, its southern portion is for the most part an enlargement of the old canal. The northern portion follows a new course, entering Lake Ontario at Port Weller, about three miles east of the terminus of the old canal. The new canal is twenty-five miles long and has a total lockage of 325½ feet. It has four single locks, one flight of three double locks and one guard lock. The locks have a usable length of 820 feet, a clear width of 80 feet, and 30 feet depth of water on the sill at lowest lake stages. All locks have a lift of about 46 feet. The gates are of the mitering type. The prism is 200 feet wide at the bottom, 310 feet wide at the water line, and from 25 to 26½ feet deep at low water. All masonry structures are so designed as to allow an ultimate deepening to 30 feet at low water. The construction of this canal was commenced in 1913, it was largely suspended during the World War but was later resumed.

**Water Diversion for Hydro-electric Power.**—By treaty stipulation the amount of water that may be diverted from the Niagara river for power purposes has been limited to 36,000 cu.ft. per second on the Canadian side and 20,000 cu.ft. per second on the United States side. Of the Canadian diversion all but about 10,000 cu.ft. per second is used by the Hydroelectric Power Commission of Ontario, in three plants, the largest of which, near Queenstown, has a gross head of over 300 ft. and develops about 450,000 h.p. from the nine turbo-generators installed. Of the American diversion practically all the water is utilized by one concern with an installation of 560,000 horsepower. Three of the units of the latter company are rated at 70,000 h.p. each and are the largest hydro-electric units in existence. At all the plants electricity is generated at 11,000 volts, 25 cycles. Much is used in nearby electro-chemical industries for the manufacture of aluminium, ferro-silicon, carborundum, artificial graphite, liquid chlorine, calcium carbide, cyanamide and other products. The remainder is transmitted to various cities for miscellaneous uses. The maximum distance to which this power is transmitted is somewhat in excess of 200 miles. (E. JA.)

**NIAM-NIAM:** *see* AZANDE.

**NIAS,** largest of the chain of islands off the western coast of Sumatra, D.E. Indies. It is 80 m. long and nearly 30 wide, hilly, with coasts rocky or sandy, and landing is often dangerous: it is partly volcanic and earthquakes occur. There are three small rivers. Pop. 170,000. The islets Nako, Bunga, etc., near the north and west coasts are inhabited by a race which appears to be Indonesian in character and to have some affinity with the Bataks of Sumatra. Though intelligent, they have a reputation for treachery and thieving. They squander their means on feasting and ornaments, but are hospitable and have a high code of sexual morality, any infringement of which is severely punished. Marriage is exogamic and wives are bought. At death, wife and property pass to a man's brother. Land belongs to the settler and is inherited in the direct line. A council of notables assists hereditary chiefs in administration. Slave trade was suppressed by the Dutch. Simple tattooing, teeth-filling and circumcision are practised. Weapons are carried and vendettas are common. Houses are built on piles, and sometimes are fortified with double walls. They have windows, a common room in the centre, and separate rooms for the various families which occupy one house, the entrance being through the floor, from underneath, in the house centre. Houses of chiefs are costly and have carved statues, or seats of wood, or stone, outside. The Niasese are pagans: human sacrifice on the death of a chief, also head-hunting, were prohibited by the Dutch. Statues of the household gods are hung up in the houses, the phallic symbol is known, and in South Nias menhirs and large dissoliths exist. The funeral rites of an important person are celebrated by the sacrifice of pigs. There are good craftsmen in gold, silver, and wood, the coco-nut is cultivated and the oil traded with Malay and Achinese settlers, or taken to the Sumatran coast. Pigs are kept and form an important article of trade. Coal, of poor quality, iron, and copper have been found; gold is said to exist. Nias is administrated by the residency of Tapanuli, in Sumatra; it came under Japanese control during World War II. It has no telegraphic or steamer communication with the mainland.

BIBLIOGRAPHY.—E. S. Schroder, *Nias: Ethnographische, geographische en historische.* 1917. (E. E. L.)

**NIBELUNGENLIED,** or DER NIBELUNGE NÔT, a mediaeval German heroic epic. The story on which it is based belongs to the general stock of Teutonic saga, and was very widespread under various forms, some of which are preserved. Thus it is touched upon in *Beowulf,* and fragments of it form the most important part of the northern *Eddas,* the poets of which evidently assumed that the tale as a whole was well known and that their hearers would be able to put each piece in its proper place. In the prose *Edda,* or *Volsungasaga,* which though largely primitive in spirit dates from the 13th century, it is set forth in full. The substance of this Norse version is as follows:—

"The three Anses—Odin, Loki and Hörnir—saw an otter devouring a salmon beside a waterfall. They killed and skinned the otter and, taking the skin with them, sought shelter for the night with Rodmar the giant. But Rodmar recognized the skin as that of his son, and demanded as *weregild* gold enough to cover it completely. Loki thereupon went back to the stream, where Andvari in the form of a pike was guarding a great treasure, caught him in a net, and forced him to surrender his hoard. But the piled-up gold left one hair exposed; in order to cover it Loki returned to Andvari and forced him to surrender a magic ring, which had the virtue of breeding gold. Thereupon Andvari, enraged, laid upon the hoard and all who should possess it a curse. This curse, the *Leitmotif* of the whole story, began to operate at once. Rodmar, for the sake of the treasure, was slain by his sons Fafnir and Regin; and Fafnir, seizing the whole, retired to a desolate heath and in the form of a snake or dragon brooded over the hoard. Regin, cheated of his share, plotted vengeance

and conquest of the treasure.

"To Regin, a notable smith, was sent Sigurd—son of the slain hero Sigmundr the Volsung and his wife Hiortis, now wife of the Danish king Alf—to be trained in his craft. To him Regin told of Fafnir and the hoard, and the young hero offered to go out against the dragon if Regin would weld him a sword. But every brand forged by the smith broke under Sigurd's stroke; till at last he fetched the fragments of the sword Gram, Odin's gift to his father, which Hiortis had carefully treasured. These Sigurd forged into a new sword, so hard that with it he could cleave the anvil, and so sharp that it would sever a flock of wool floating against it down stream; and, so armed, he sought and slew the dragon. But while roasting Fafnir's heart, which Regin had cut out, Sigurd burned his finger with the boiling fat and, placing it to his lips, found that he could understand the language of birds, and so learned from the chattering of the woodpeckers that Regin was planning treachery. Thereupon he slew the smith, and loading the treasure on the magic steed Grani, given to him by Odin, set out on his travels.

"On a fire-girt hill Sigurd found the Valkyrie Brunhild in an enchanted sleep, and ravished by her beauty awakened her; they plighted their troth to each other and, next morning, Sigurd left her to set out once more on his journey. Coming to the court of Giuki, a king in the Rhine country, Sigurd formed a friendship with his three sons, Gunnar, Hogni and Guthorm; and, in order to retain so valuable an ally, it was determined to arrange a match between him and their sister Gudrun. Queen Grimhild, skilled in magic, therefore gave him an enchanted drink, which caused him to forget Brunhild. Gunnar, on the other hand, wished to make Brunhild his wife, and asked Sigurd to ride with him on this quest, which he consented to do on condition of receiving Gudrun to wife. They set out; but Gunnar was unable to pass the circle of fire round Brunhild's abode, the achievement that was the condition of winning her hand. So Sigurd, assuming Gunnar's shape, rode through the flames on his magic horse, and in sign of troth exchanged rings with the Valkyrie, giving her the ring of Andvari. So Gunnar and Brunhild were wedded, and Sigurd, resuming his own form, rode back with them to Giuki's court, where the double marriage was celebrated. But Brunhild was moody and suspicious, remembering her troth with Sigurd and believing that he alone could have accomplished the quest.

"One day the two queens, while bathing in the river, fell to quarrelling as to which of their husbands was the greater. Brunhild taunted Gudrun with the fact that Sigurd was Gunnar's vassal, whereupon Gudrun retorted by telling her that it was not Gunnar but Sigurd who rode through the flames, and in proof of this held up Brunhild's ring which Sigurd had given to her. Brunhild, maddened by jealousy and wounded pride, now incited the three kings to murder Sigurd by exciting their jealousy of his power. The two elder, as bound to him by blood-brotherhood, refused; but the youngest, Guthorm, who had sworn no oaths, consented to do the deed. Twice he crept into Sigurd's chamber, but fled when he found the hero awake and gazing at him with flashing eyes. The third time, finding him asleep, he stabbed him; but Sigurd, before he died, had just strength enough to hurl his sword at the murderer, whom it cut in two. Brunhild, when she heard Gudrun wailing, laughed aloud. But her love for Sigurd was great as ever, and she determined not to survive him; distributing her wealth to her hand-maidens she mounted Sigurd's funeral pyre, slew herself with his sword, and was burnt with him.

"In course of time Gudrun married Atli (Attila), king of the Huns, Brunhild's brother. Atli, intent on getting hold of the hoard which Gudrun's brothers had seized, invited them to come to his court. In spite of their sister's warnings they came, after sinking the treasure in the Rhine. On their refusal to surrender the hoard or to say where it was concealed, a fierce fight broke out in which all the followers of Gunnar and Hogni fell. Atli then once more offered to spare Gunnar's life if he would reveal his secret; but Gunnar refused to do so until he should see the heart of Hogni. So Hogni's heart was cut out, the victim laughing the while; but when Gunnar saw it he cried out that now he alone knew where the hoard was and that he would never reveal the secret. His hands were then bound, and he was cast into a den of venomous serpents; but he played so sweetly on the harp with his toes that he charmed the reptiles, except one adder, by which he was stung to death. Gudrun, however, avenged the death of her brothers by slaying the sons she had borne to Atli and causing him unwittingly to drink their blood and eat their hearts. Finally, in the night, she killed Atli himself and burned his hall; then, leaping into the sea, she was carried by the waves to new scenes, where she had adventures not connected with those recorded in the *Nibelungenlied.*"

This story, in spite of the late date of the *Volsungasaga,* represents a very primitive version. The setting of the *Nibelungen* story, on the other hand, is mediaeval rather than primitive, though its extant versions are of much earlier date, and it contains primitive elements not found in the other. Everywhere the supernatural elements are eliminated or subordinated. The gods have vanished from the scene; there is nothing of Loki and his theft of Andvar's hoard, nothing of Odin and his gifts of the sword Gram, and the magic horse Grani; and not till the third *Aventiure,* when Siegfried comes to Worms, are we given even a hint that such things as the sword and treasure exist.

In the legend of Sigurd the Volsung, the plot had turned upon the love and vengeance of Brunhild, so in the song of the Nibelungs it is the love and vengeance of Kriemhild, the Gudrun of the northern saga, that forms the backbone of the story and gives it from first to last an artistic unity which the *Volsungasaga* lacks. The tragedy of the close of the story is emphasized by the pomp and circumstance that surround the ill-fated hero. The primitive setting of the northern version has vanished utterly. Sigmund is king of the Netherlands; the boy Siegfried is brought up by "wise men that are his tutors" (*Avent.* ii.); and when, attracted by the fame of Kriemhild's beauty, he rides to Worms to woo her, it is as the typical handsome, accomplished and chivalrous king's son of mediaeval romance.

It is at this point (*Avent.* iv.) that some primitive elements are suddenly and awkwardly introduced. As Siegfried approaches Worms, Kriemhild's brothers, the Burgundian kings Gunther, Giselhêr and Gêrnot watch his coming, and to them their faithful retainer, "the grim Hagen," explains who he is. This can be no other than the hero who slew the two kings of the Nibelungs, Schilbunc and Nibelunc, and seized their treasure, together with the sword Balmunc and the *tarnkappe,* or cape of darkness, which has the virtue of making him who wears it invisible. Another adventure, too, he can tell of him, namely, how he slew a dragon and how by bathing in its blood his skin became horny, so that no weapon could wound him save in one place, where a linden leaf had fallen upon him as he stooped, so that the blood did not touch this spot. In spite of Hagen's distrust and misgivings, Siegfried now fights as the ally of the Burgundians against the Saxons (*Avent.* iv.), and undertakes, on condition of receiving Kriemhild to wife, to help Gunther to woo Queen Brunhild, who can only be won by the man who can overcome her in three trials of strength (*Avent.* vi.). Siegfried and Gunther accordingly go together to Brunhild's castle of Isenstein in Iceland, and there the hero, invisible in his *tarnkappe,* stands beside Gunther, hurling the spear and putting the weight for him, and even leaping, with Gunther in his arms, far beyond the utmost limit that Brunhild can reach (*Avent.* vii.). Brunhild confesses herself beaten and returns with the others to Worms, where the double marriage is celebrated with great pomp (*Avent.* x.). But Brunhild is ill content; though she saw Siegfried do homage to Gunther at Isenstein she is not convinced, and believes that Siegfried should have been her husband; and on the bridal night she vents her ill humour on the hapless Gunther by tying him up in a knot and hanging him on the wall. "I have brought the evil devil to my house!" he complains to Siegfried next morning; and once more the hero has to intervene; invisible in his *tarnkappe* he wrestles with Brunhild and, after a desperate struggle, takes from her her girdle and ring before yielding place to Gunther. The girdle and ring he gives to his wife Kriemhild (*Avent.* x.).

One day, while Siegfried and his wife were on a visit to the Burgundian court, the two queens fell to quarrelling on the ques-

tion of precedence, not in a river but on the steps of the cathedral (*Avent.* xiv.). Kriemhild was taunted with being the wife of Gunther's vassal; whereupon, in wrath, she showed Brunhild the ring and the golden girdle taken by Siegfried, proof that Siegfried, not Gunther, had won Brunhild. So far the story is essentially the same as that in the *Volsungasaga;* but now the plot changes. Brunhild drops out, becoming a figure altogether subordinate and shadowy. The death of Siegfried is compassed, not by her, but by the "grim" Hagen, Gunther's faithful henchman, who thinks the glory of his master unduly overshadowed by that of his vassal. Hagen easily pursuades the weak Gunther that the supposed insult to his honour can only be wiped out in Siegfried's blood; he worms the secret of the hero's vulnerable spot out of Kriemhild on pretence of shielding him from harm (*Avent.* xv.) and then arranges a great hunt in the forest, so that he may slay him when off his guard. The 16th *Aventiure* describing this hunt and the murder of Siegfried is perhaps the most powerful scene in all mediaeval epic. When the hunters sat down to feast, it was found that the wine had been forgotten. Hagen thereupon proposed that they should race to a spring some way off in the forest. Siegfried readily agreed, and though handicapped by carrying shield, sword and spear, easily reached the goal first, but waited, with his customary courtesy, until the king had arrived and drunk before slaking his own thirst. Then, laying aside his arms, he stooped and drank. Hagen, seizing the spear, thrust it through the spot marked by Kriemhild on Siegfried's surcoat. The hero sprang up and, finding that his sword had been removed, attacked Hagen with his shield.

Then reproaching them for their cowardice and treachery, Siegfried fell dying "amid the flowers" while the knights gathered round lamenting. The whole spirit of this scene is primitive Teutonic rather than mediaeval. The same is true, indeed, of the whole of the rest of the poem. Siegfried, to be sure, is buried with Catholic rites; but Kriemhild, while praying for his soul like a good Christian, plots horrible vengeance like her pagan prototype. Mistress now of the Nibelungen hoard, she sought to win a following by lavish largesses; but this Hagen frustrated by seizing the treasure, with the consent of the kings, and sinking it in the Rhine, all taking an oath never to reveal its hiding-place (*Avent.* xix.). At last, however, after 13 years, Kriemhild's chance came, with a proposal of marriage from Etzel (Attila) king of the Huns, which she accepted on condition that he would help her to vengeance (*Avent.* xx.). Then more years passed; old feuds seemed to be forgotten; and the Burgundian kings, in spite of Hagen's warnings, accepted their sister's invitation to visit her court (*Avent.* xxiii.–xxiv.).

The journey of the Burgundians into Hunland is described by the poet at great length (*Avent.* xxv.–xxvii.). From this point onward the story is dominated by the figure of the grim Hagen, who, twitted with cowardice and his advice spurned, is determined that there shall be no turning back and that they shall go through with it to the bitter end. With his own hands he ferries the host over the Danube and then destroys the boat, so that there may be no return. At Attila's court (*Avent.* xxviii.) it is again Hagen who provokes the catastrophe by taunting Kriemhild when she asks him if he has brought with him the hoard of the Nibelungs:

> "The devil's what I bring you!" Hagen then replied,
> "What with this heavy harness and my shield beside,
> I had enough to carry; this helmet bright I brought;
> My sword is in my right hand, and that, be sure, I bring you not!"

The sword was Siegfried's. It is Hagen, too, who after the first onslaught of the Huns, strikes off the head of Ortlieb, the son of Etzel and Kriemhild, and who, amid the smoke and carnage of the burning hall, bids the Burgundians drink blood if they are thirsty.

But for all their prowess, after a prolonged struggle (*Avent.* xxix.–xxxvii.) the Burgundians were at last overwhelmed. Most of the chief figures of heroic saga had come up against them; Attila, Hildebrand, the Ostrogoth Theodoric (Dietrich von Bern). To the last named even Hagen armed with Siegfried's sword had to yield (*Avent.* xxxviii.). Kriemhild came to him as he lay in bonds and demanded the Nibelung treasure. He refused to reveal its hiding place so long as Gunther, also a prisoner, should live. Gunther was accordingly slain by the queen's orders and his head was brought to Hagen, who cried out when he saw it that all had been accomplished as he had foretold:

> "Now none knows where the hoard is save God and I alone:
> That to thee, devil-woman, shall nevermore be known!"

Whereupon Kriemhild slew him with Siegfried's sword. But Kriemhild was not destined, like Gudrun, to set out on further adventures. Hildebrand, horrified at her deed, sprang forward and cut her to pieces with his sword.

> In sorrow now was ended the king's high holiday,
> As ever joy in sorrow ends and must end alway.

To some mss. of the *Nibelungenlied* is added a supplementary poem called the *Klage* or *Lament,* a sequel of 2,160 short-line couplets, describing the lament of the survivors—notably Etzel—over the slain, the burying of the dead, and the carrying of the news to the countries of the Burgundians and others. At the end it is stated that the story was written down, at the command of Bishop Pilgrim of Passau, by a writer named Konrad (Kuonrât) in Latin and that it had since been sung (*getichtet*) often in the German tongue.

**Sources of the Story.**—The origin and nature of the various elements that go to make up the story of the *Nibelungenlied* have been, and continue to be, the subject of debate. The view at one time most generally accepted was that first propounded by Karl Lachmann in his "Kritik der Sage von den Nibelungen" (*Rheinisches Museum für Philologie,* num. 249, 250, 1829, republished in his *Zu den Nibelungen . . . Anmerkungen* in 1836), namely that the story was originally a myth of the northern gods modified into a heroic saga after the introduction of Christianity, and intermingled with historical elements. This view was also maintained by Richard von Muth in his *Einleitung in das Nibelungenlied* (Paderborn, 1877). On the other hand, so early as 1783 Johannes von Müller of Göttingen had called attention to the historical figures appearing in the Nibelungenlied, identifying Etzel as Attila, Dietrich of Bern as Theodoric of Verona, and the Burgundian kings Gunther, Giselhêr and Gêrnot as the Gundaharius, Gislaharius and Godomar of the *Lex Burgundiorum;* in 1820, Julius Liechtlen (*Neuaufgefundenes Bruchstück des Nibelungenliedes,* Freiburg-im-Breisgau) roundly declared that "the *Nibelungenlied* rests entirely on a historical foundation, and that any other attempt to explain it must fail." This view was, however, overborne by the great authority of Lachmann, whose theory, in complete harmony with the principles popularized by the brothers Grimm, was accepted by a long series of critics. In later years criticism tended to revert to the standpoint of Müller and Leichtlen and to recognize in the story of the Nibelungen a misty and confused tradition of real events and people. Mythical elements it certainly contains; and to those figures which—like Siegfried, Brunhild, or Hagen—cannot be traced to historical originals, a mythical origin is still provisionally ascribed, though Theodor Abeling (*Das Nibelungenlied,* 1907) made out a plausible case for identifying Siegfried with Segerio, son of the Burgundian king Sigimund and Brunhild with the historical Brunichildis.

The basis of the story is then, according to this view, historical, not mythical; a medley of Franco-Burgundian historical traditions, overlaid with mythical fancies. The historical nucleus is the overthrow of the Burgundian kingdom of Gundahar by the Huns in 436; and round this there gathered an accretion of other episodes, equally historical in their origin, however distorted, with a naïve disregard of chronological possibility. In the *Eddas* the identity of the original Franco-Burgundian sagas is fairly preserved. In the *Nibelungenlied,* on the other hand, the influence of other wholly unconnected stories is felt: thus Hildebrand appears during the final fight at Etzel's court, and Theodoric the Great (Dietrich von Bern; *see* THEODORIC).

**Origin of the Poem.**—The controversy as to the underlying elements of the Nibelung legend extends to the question of the authorship and construction of the poem itself. Was it from the first—whatever additions and interpolations may have followed—conceived as a single, coherent story, or is it based on a number

of separate stories, popular ballads akin to the *Eddas,* which the original author of the *Nibelungenlied* merely collected and strung together? The answer to these questions has been sought by a succession of scholars in a critical comparison of the mediaeval mss. of the poem still surviving. Of these 33 are now known, of which ten are complete, the rest being more or less fragmentary. The most important are those first discovered, viz., the mss. lettered C (Hohenems 1755), B (Schloss Werdenberg, 1769), A (Hohenems 1779); and round these the others more or less group themselves. They exhibit many differences: put briefly C is the most perfectly finished in language and rhythm; A is rough, in places barbarous; B stands half-way between the two. Which is nearest to the original? Karl Lachmann (*Zu den Nibelungen und zur Klage, Anmerkungen,* 1836) decided in favour of A. He applied to the *Nibelungenlied* the method which Friedrich August Wolf had used to resolve the *Iliad* and *Odyssey* into their elements. The poem, according to Lachmann, was based on some 20 popular ballads, originally handed down orally, but written down about 1190 or 1200. This original is lost, and A—as its roughness of form shows—is nearest to it; all other mss. including B and C are expansions of A. Lachmann's view was first seriously assailed by Adolf Holtzmann (*Untersuchungen über das Nib.,* Stuttgart, 1854), who argued that the original could not have been strophic in form—the fourth lines of the strophes are certainly often of the nature of "padding"—that it was written by Konrad (Kuonrât of the *Klage*) writer to Bishop Pilgrim of Passau about 970–984, and that of existing mss. C is nearest to this original, B the copy of a ms. closely akin to C, and A an abbreviated corrupt copy of B. This view was adopted by Friedrich Zarncke, who made C the basis of his edition of the *Nibelungenlied* (Leipzig, 1856). A new hypothesis was developed by Karl Bartsch in his *Untersuchungen über das Nibelunglied* (Leipzig, 1865). According to this the original was an assonance poem of the 12th century, which was changed between 1190 and 1200 by two separate poets into two versions, in which pure rhymes were substituted for the earlier assonances; the originals of the *Nibelungenlied* and *Der Nibelunge Nôt* respectively. Bartsch's subsequent edition of the *Nibelunge Nôt* (1st ed., Leipzig, 1870) was founded on B, as the nearest to the original. To this view Zarncke was so far converted that in the 1887 edition of his *Nibelungenlied* he admitted that C shows signs of recension and that the B group is purer in certain details.

It is impossible here to follow the further developments of the question. Theodor Abeling's *Das Nibelungenlied und seine Literatur* gives a very full bibliography from 1756 to 1905. Other important contributions since are: Andreas Heusler, in the *Sitzungsberichte der Königl. Preuss. Akad. der Wissenschaften,* xlvii. (1914), in which he investigates anew the genesis of the saga; Hermann Fischer, *Über die Entstehung des Nibelungenliedes, in Sitzungsber der Königl. Bayer. Akad. der Wiss., Philos. und hist. Klasse,* 1914, who traces the various influences at work on the poem and concludes that it was written under that of Bishop Wolfger of Passau. With this Friedrich Wilhelm (in *Müncher Archiv,* part 7, 1916) is in agreement. There have also been during latter years advocates of a Latin original of the poem; *e.g.,* R. Pestalozzi, *Die Nibelungias* (*Neue Jahrbücher,* 39, 1916–17), but this idea is generally discredited.

There are English translations of the poem by A. G. Foster-Barham (1887) and Margaret Armour (prose, 1897); and Alice Horton (1898). (W. A. P.)

**NICAEA** or NICE (mod. *Isnik, i.e., εἰς Νικαίαν*), an ancient town of Asia Minor, in Bithynia, on the Lake Ascania. Antigonus built the city (316 B.C.?) on an old deserted site, and soon afterwards Lysimachus changed its name from Antigonia to Nicaea, calling it after his wife. Under the Roman empire Nicaea and Nicomedia disputed the title of metropolis of Bithynia. Strabo describes the ancient Nicaea as built regularly, in the form of a square, with a gate in the middle of each side. From a monument in the centre of the city all the four gates were visible at the extremities of great cross-streets. After Constantinople became the capital of the empire Nicaea grew in importance, and after the conquest of Constantinople by the Crusaders became the temporary seat of the Byzantine emperor; the double line of walls with the Roman gates is still well preserved. The possession of the city was long disputed between the Greeks and the Turks. It remained an important city for some time after its final incorporation in the Ottoman empire; but became subsequently an insignificant village.

**NICAEA, COUNCIL OF.** The Council of Nicaea (A.D. 325) is an event of the highest importance in the history of Christianity. Its convocation by Constantine and its course illustrate the radical revolution which the position of this religion, within the confines of the Roman empire, had undergone in consequence of the Edict of Milan. From his accession Constantine had shown himself the friend of the Christians; and, when his victory over Licinius (A.D. 323) gave him undisputed possession of the crown, he adhered to this religious policy, distinguishing and fortifying the Christian cause by gratuities and grants of privilege. This propitiatory attitude originated in the fact that he recognized Christianity—which had successfully braved so many persecutions—as the most vital and vigorous of religions, and as the power of the future. Consequently he directed his energies toward the establishment of a positive relationship between it and the Roman state. But the Church could only maintain its great value for the politician by remaining the same compact organism which it had proved itself to be under the stormy reign of Diocletian. Scarcely, however, did it find itself in the enjoyment of peaceful relations with the state, when violent feuds broke out in its midst, whose extent, and the virulence with which they were waged, threatened to dismember the whole religious body. Donatism in the West was followed by the Arian struggle in the East. The former movement had been successfully arrested, though it survived in North Africa till the 5th century. The conflict kindled by the Alexandrian presbyter Arius with regard to the relation of Christ to God assumed a more formidable character (*see* ARIUS). Constantine therefore had recourse to an institution previously evolved by the Christian Church—the convocation of a synod to pronounce on burning questions—enlarging it, however, to correspond with the altered circumstances. He convened a council, designed to represent the whole Church of the empire, at Nicaea in Bithynia, a town situated no great way from the imperial summer-residence of Nicomedia and within easy reach by sea of the Oriental bishops. In consequence of the vast distances, the West was not largely represented, but the able theologian Hosius, bishop of Cordova, was present. The three most important bishoprics of the East were represented (Alexandria, Antioch, and Jerusalem); a prominent part was also taken by Eusebius, bishop of Nicomedia, and his namesake of Caesarea (the historian), along with a very large number of others from the east. Among the attendant clergy, the still youthful deacon Athanasius, destined to succeed Alexander in the see of Alexandria, was prominent as the most powerful antagonist of Arianism (*see* ATHANASIUS). The synod sat from May 20 to July 25.

The deliberations on the Arian question passed through several distinct stages before the final condemnation of Arius and his doctrines was reached. A clearly defined standpoint with regard to this problem—the relationship of Christ to God—was held only by the comparatively small group of Arians and a not much larger group who adhered with unshaken conviction to the Alexandrian view. The bulk of the members occupied a position between these two extremes. They rejected the formulae of Arius, and declined to accept those of his opponents; that is to say, they were merely competent to establish negations, but lacked the capacity, as yet, to give their attitude of compromise a positive expression. That the majority of the council should have adopted this neutral tendency is easily intelligible when we consider the state of theology at that period. True, at Nicaea this majority eventually acquiesced in the ruling of the Alexandrians; yet this result was due, not to internal conviction, but partly to indifference, partly to the pressure of the imperial will—a fact which is mainly demonstrated by the subsequent history of the Arian conflicts. For if the Nicaean synod had arrived at its final decision by the conscientious agreement of all non-Arians, then the confession of faith there formulated might indeed have evoked the continued antagonism of the Arians, but must necessarily have

been championed by all else. This, however, was not the case; in fact, the creed was assailed by those very bodies which had composed the *laissez-faire* centre at Nicaea; and we are compelled to the conclusion that, in this point, the voting was no criterion of the inward convictions of the council.

In the synod, an Arian confession of faith was first brought forward and read; but it aroused such a storm of indignation that obviously, in the interests of a restoration of ecclesiastical peace, there could be no question of its acceptance. On this, Eusebius of Caesarea submitted the baptismal creed of his community. Since the creed dated from a period anterior to the outbreak of the Arian struggle, its reception would have been equivalent to a declaration on the part of the council that it declined to define its position with reference to the controversy of the hour. That the greater number of delegates were not disinclined to adopt this subterfuge, and to shelve the actual solution of the whole problems by recognition of this or some similar neutral formula, is extremely probable. But the emperor saw that, if the difficulties were eluded in any such way, it was inevitable from the very nature of the case, that they should rise again in an accentuated form, and that consequently no pacification could be expected from this policy.

Accordingly Constantine proposed that the Caesarean creed should be modified by the insertion of the Alexandrian passwords (including the decisive term ὁμοούσιος, "identical in nature"), as if for the purpose of more accurate definition, and by the deletion of certain portions. That he appreciated the import of these alterations, or realized that this revision was virtually the proclamation of a new doctrine, is scarcely probable. The creed thus evolved by an artificial unity was no ratification of peace: in fact, it paved the way for a struggle which convulsed the whole empire. For it was the proclamation of the Nicene Creed that first opened the eyes of many bishops to the significance of the problem there treated; and its explanation led the Church to force herself, by an arduous path of theological work, into compliance with those principles, enunciated at Nicaea, to which, in the year 325, she had pledged herself without genuine assent.

BIBLIOGRAPHY.—*See* the Histories of Dogma by Harnack, Loofs and Seeberg; articles in Hastings, *Encyclopaedia of Religion and Ethics* and Herzog-Hauck, *Realencyklopädie*, 3rd ed.; Bethune-Baker, *Introduction to the early History of Christian Doctrine;* Gore, *Dissertations on Subjects connected with the Incarnation;* and (from another point of view) Mellone, "Athanasius the Modernist" in *The Price of Progress* (1924). In addition to the Arian problem, the council dealt with the question of the "lapsed" in the recent persecution, the question of "heretical baptism" and other matters (*see* Hefele, *History of Councils,* vol. i.).

**NICANDER** (2nd cent. B.C.), Greek poet, physician and grammarian, was born at Claros, near Colophon, where his family held the hereditary priesthood of Apollo. He flourished under Attalus III. of Pergamum. He wrote a number of works both in prose and verse, of which two are preserved. The longest, *Theriaca,* is an hexameter poem (958 lines) on the nature of venomous animals and the wounds which they inflict. The other, *Alexipharmaca,* consists of 630 hexameters treating of poisons and their antidotes. In his facts Nicander followed the physician Apollodorus. Among his lost works may be mentioned: *Aetolica,* a prose history of Aetolia; *Heteroeumena,* a mythological epic, used by Ovid in the *Metamorphoses* and epitomized by Antoninus Liberalis; *Georgica* and *Melissourgica,* of which considerable fragments are preserved, said to have been imitated by Virgil (Quintilian x. 1. 56).

Editions by J. G. Schneider (1792, 1816); O. Schneider (1856) (with the Scholia); H. Klauser, "De Dicendi Genere . . . Nicandri" (*Dissertationes Philologicae Vindobonenses,* vi. 1898). The Scholia (from the Göttingen ms.) have been edited by G. Wentzel in *Abhandlungen der k. Gesellschaft der Wiss. zu Göttingen,* xxxviii. (1892). *See* also W. Vollgraff, *Nikander und Ovid* (Groningen, 1909 *seq.*).

**NICARAGUA,** the largest country of Central America, lying between Honduras and Costa Rica, which form its north and south boundaries, respectively, and reaching from the Caribbean sea on the east to the Pacific ocean on the west. Its area, which is still undetermined owing to boundary disputes with Honduras and incomplete surveys, is generally put at from 49,200 to 51,660 sq.m., the former being the most generally accepted.

The coast line is about 300 m. on the Caribbean and 200 m. on the Pacific.

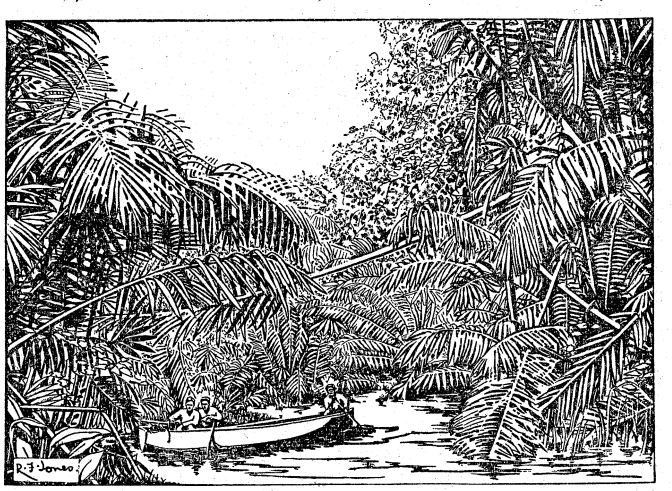
The Honduran boundary as generally accepted starts at Cape Gracias a Dios, follows the Segovia river inland and then at 86° W. takes an imaginary line to the upper waters of the Río Negro, which it follows to the Gulf of Fonseca. The Costa Rican boundary is now agreed upon, under treaties of 1858, confirmed in 1888 and settled in 1896, to be a line 2 m. S. of the San Juan river and Lake Nicaragua.

**Physical Features.**—Nicaragua is crossed by the two mountain chains that traverse the Western Hemisphere, and which provide some fine highland valleys. Its most striking natural features, however, are the two great lakes, Lake Nicaragua, about 100 m. long and 45 m. wide, and Lake Managua, to the north of it, and connected with it by the Tipitapa river. Lake Managua's length is 38 m. and its width varies from 10 to 16 miles.

The coasts of Nicaragua are strikingly different in configuration. The low, swampy and monotonous shore of the Caribbean, with its numerous lagoons and estuaries, and its fringe of reefs and islets, contains only three harbours: Gracias a Dios, Bluefields and Greytown (San Juan del Norte). The Pacific coast is bold, rocky and unbroken by any great indentation; here, however, are the best harbours of the republic—the southern arm of the Bay of Fonseca (*q.v.*), Corinto, Brito and San Juan del Sur.

The surface of the country is naturally divided into five clearly distinct zones: (1) the series of volcanic peaks which extend parallel to the Pacific at a little distance inland; (2) the plains and lakes of the great depression which lies to the east of these mountains and stretches from sea to sea, between the Bay of Fonseca and the mouths of the San Juan; (3) the main cordillera, which skirts the depression on the east, and trends north-west from Monkey Point or Punta Mico on the Caribbean sea, until it is merged in the ramifications of the Hondurian and Salvadorian highlands; (4) the plateaux which slope gradually away from the main cordillera towards the Caribbean; (5) the east or Mosquito coast (*see* MISKITO COAST), with its low-lying hinterland. The chain of volcanic cones, which constitutes a watershed quite equal in importance to the cordillera itself, consists for the most part of isolated igneous peaks, sometimes connected by low intervening ridges.

The main Nicaraguan cordillera, which flanks the depression on the east, has often been called the Cordillera de los Andes, from



SCENE IN A JUNGLE SWAMP OF THE LOW COAST-LAND OF NICARAGUA

its supposed continuity with the mountain-chains of Panama and the west coast of South America. There is in fact no such continuity, for the San Juan valley completely separates the mountains of Panama from the main Nicaraguan system. The main cordillera bears different names in different parts of Nicaragua. Thus the important section which terminates at Monkey Point is commonly called the Cordillera de Yolaina. The summits of the main cordillera seem nowhere to exceed 7,000 ft. in altitude; the mean elevation is probably less than 2,000 ft.; the declivity is sheer towards the lakes, and gradual towards the Caribbean. On

the east, the cordillera abuts upon the region of plateaux and savannas, which occupies nearly half of the area of Nicaragua.

**Climate.**—The climate along the coasts, where most of the population lives, is hot and often sultry; in the highland sections there is the usual relatively cool and even climate of the tropical upland. There are two seasons, wet and dry, the former extending from May or June to November or December and dry in the remaining period, although on the east coast, the rainy season often extends well into the so-called dry period. Rainfall varies in different sections, as much as 297in. a year having been recorded at Bluefields, on the Caribbean coast; the mean at Rivas, on the Pacific side, is 102in. a year.

**Inhabitants.**—According to the 1940 census the total population of Nicaragua was 983,160. A later estimate (Dec. 31, 1941) gave 1,013,946. In 1920, the previous census year, the total population was 638,119. The government statistical bureau, however, expressed serious doubts as to the accuracy of that census and considered the correct figure as of 1920 to have been approximately 850,000. In 1935, taking the number of registered voters in 1932 (154,539) as a gauge, and assuming that the proportion would be the same as in Salvador, where statistics are kept and where the population is comparable, the statistical bureau estimated Nicaragua's population to be 1,100,000. As Salvador's ratio of voters to population ranges from 15.3% in 1931 to 21.3% in 1935, however, the accuracy of this method is highly questionable. The principal cities and their populations (1940 census, *municipios*) were: Managua, 83,546; León, 30,573; Matagalpa, 8,506; Granada, 24,843.

An overwhelming majority of the population is mestizo (mixed white and Indian). Some Negroes live on the Caribbean coast.

**Political Organization.**—The present Constitution of Nicaragua was proclaimed in Dec. 1911, superseding those of 1905 and 1894. The legislative power is now vested in a congress composed of two chambers, senate and chamber of deputies (under the previous Constitution there was but one chamber). The country is divided into departments, to be fixed by law, representation in congress being from the departments, on the basis of one deputy for every 15,000 inhabitants, and one senator to each two deputies; deputies are elected for four and senators for six years, each having an alternate, elected at the same time, who succeeds him in case of disability. The executive power is vested in the president, elected by popular vote for a four-year term; he must be over 30 years of age and a native citizen of Nicaragua: a vice president is chosen at the same time, to succeed the president in case of death or disability. In case the vice president is eliminated, the senate elects a "designate," who assumes the office of president under the same circumstances as the vice president. The presidential cabinet consists of six ministers, appointed by the president, these being ministers of government and police, foreign relations, public instruction, treasury and public credit, war and marine, promotion (*fomento*), justice and public works. The judiciary is exercised by a supreme court of justice with five members, three courts of appeal and inferior courts. Congress elects justices of the supreme court for six years, and of the courts of appeals for four years.

**Education and Religion.**—The educational system is highly centralized under the minister of public instruction and physical education. Primary education is free and compulsory. In 1936 there were over 700 primary schools, 601 of which were under government auspices (with 43,642 pupils); 18 secondary schools (with 705 enrolment); three normal schools, two for women, one for men, and a special school for training kindergarten teachers. Higher education is provided by a law school at Managua, law, medical, and dental schools at León and Granada. The Government maintains three schools of agriculture, a school of telegraphy, a commercial school, and a special school for the training of nurses. The 1938 budget allotted to education $276,000 out of a total of $4,398,000.

Roman Catholicism is the principal religion, but all are tolerated. Managua is the seat of an archdiocese which embraces the dioceses of Granada, León, and Matagalpa. Under President Somoza religious instruction was re-established in the schools, reversing a quarter-century policy.

**Finance.**—Since 1925, the monetary unit has been the *córdoba*. It was initially on a parity with the dollar, but declined until, on June 8, 1938, it was officially established at the rate of 5 córdobas to one dollar (U.S.) and has since been controlled at that rate. A gold reserve of 9,413·2057 fine ounces is maintained in New York. The entire recognized public debt of Nicaragua was 8,177,766 córdobas on Jan. 31, 1939.

**Defence.**—Nicaragua has been virtually without an army since 1912, when American marines were first landed, to remain 13 years, and furnished ample defence to the Government from enemies within and without. A small guard was maintained at the capital, largely for parade purposes. When the marines were withdrawn on Aug. 3, 1925, a National Guard had been designed, but was organized only with difficulty by former American army officers employed by the Nicaraguan Government. Following the return of the American marines in 1927, the guard was organized on a new basis, with active American army officers and non-commissioned officers detailed to the work. The Guardia Nacional numbered (1939) 2,318 officers and men and is used as both police and military.

**Economics and Trade.**—Nicaraguan prosperity depends primarily upon her coffee crop and the world price of coffee. From 1927 to 1938, coffee ranged from 45% to 35% of the total exports. In 1938 coffee exports were valued at $2,030,570 (34·5%), against $3,078,360 (43·7%) in 1937. Bananas, second in agricultural exports, were $776,661 (13·2%), against $985,257 (14%) in 1937. Gold exports, valued at $362,805 in 1928 (3% of the total), have risen considerably since 1933, totalling $848,808 (12·1%) in 1937, and $1,550,520 (26·4%) in 1938. Cotton exports were negligible until 1935, but totalled 7·9% ($552,613) in 1937 and 4·5% ($262,098) in 1938. Other export commodities include lumber, hides and skins, sugar, ipecacuanha root, and cacao. The bulk of exports is taken by the United States (55·4% in 1937, 67·3% in 1938). Germany took 21·4% in 1937 and 14·7% in 1938.

Nicaraguan imports are textiles, especially cotton, machinery and apparatus, and miscellaneous manufactured goods and foodstuffs. The United States supplies the greater part, from 50 to 65% annually, in normal times. In the first half of 1940, however, the United States took 93·3% of exports and supplied 82·7% of imports. In that period, contrary to expectations, foreign trade aggregated 3% more than in the corresponding period of 1939.

*Nicaraguan Foreign Trade, 1931–33, 1937, 1938 and 1939 (in percent of total)*

| | Imports | | | | Exports | | | |
|---|---|---|---|---|---|---|---|---|
| | 1931–33 (average) | 1937 | 1938 | 1939 | 1931–33 (average) | 1937 | 1938 | 1939 |
| Total (in 000's of dollars) | 4,437 | 5,621 | 5,120 | 6,365 | 5,326 | 7,038 | 5,884 | 8,301 |
| Country of origin or destination | | | | | | | | |
| United States | 62.1 | 54.2 | 59.7 | 68.4 | 56.0 | 55.4 | 67.3 | 85.8 |
| Germany | 8.5 | 15.2 | 10.0 | 12.2 | 12.2 | 21.4 | 14.7 | 4.0 |
| United Kingdom | 10.5 | 8.5 | 8.3 | 5.2 | 7.0 | 0.8 | 2.3 | 1.3 |
| France | 3.1 | 2.3 | 2.1 | 2.6 | 11.5 | 8.3 | 3.2 | ..... |
| Italy | 1.5 | 0.7 | 5.7 | 0.5 | 1.1 | 0.6 | 0.3 | ..... |
| Japan | 0.9 | 4.3 | 1.6 | 0.9 | ..... | 4.8 | 2.0 | ..... |
| Others | 14.4 | 14.8 | 12.6 | 11.2 | 12.2 | 8.7 | 10.2 | 8.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

**Communications.**—Nicaragua's principal ports are Corinto (*q.v.*), San Juan del Sur, on the Pacific coast, Bluefields (*q.v.*), and Puerto Cabezas, on the Caribbean, with San Juan del Norte of lesser importance. Communications within the country are limited. River transportation is important, especially on the San Juan river. The National Railroad from Corinto on the Pacific coast through León, Managua, Masaya, Granada, to Diriamba has a length of 171m., including branch lines. In addition there is an undetermined amount of private line mileage. Highway mileage was 900m. in 1938. By Aug. 1939, 245m. of the Inter American highway had been constructed in Nicaragua, of which 16m. were paved, 17m. open in all weather, 99m. in dry weather, and 113m. mere trails.

**History.**—The history of Nicaragua in connection with the other Central American countries and down to the dissolution of the Union is discussed in the article on CENTRAL AMERICA. The

first white man to see Nicaragua was Gil González de Avila, who landed on the coast of Chiriquí in 1522. The leading Indian tribe of the country was then led by a great chief called Nicaragua, from whom the country derived its name. Nicaragua was baptized, and his tribe converted to the Roman Catholic faith, and moved with the Spaniards to the conquest of the other tribes. Hernán de Córdoba, who succeeded Gil González in command of the province for Spain, founded Granada in 1524, the city then being situated between the two great lakes. Nicaragua was incorporated, for administrative purposes, in the captaincy-general of Guatemala.

Nicaragua, with independent existence dating from the dissolution of the Central American Union in 1838, early developed into a battleground for the two rival cities of León and Granada, the former the capital of the Liberals, the latter of the Conservatives. In 1856 the American filibusterer, William Walker (*q.v.*), arrived with his 66 followers, espousing the cause of León and waging a bitter war against the Granadinos which ended in his execution in 1860. Both the United States and Great Britain, through their agents, took active but undercover parts in the Walker episode.

Nicaragua had open difficulties with various foreign powers, chiefly the United States and Great Britain, almost throughout the 19th century. The Mosquito Indians on the Caribbean coast, under the protection of Great Britain, gave that power a claim to Nicaraguan territory until 1850 when the Clayton-Bulwer Treaty between her and the United States stipulated that neither party could occupy, fortify, colonize, or exercise dominion over any portion of Central American territory. Actual transfer of the Mosquito territory did not take place, however, until 1893, when Nicaragua occupied it by force. The Clayton-Bulwer treaty also neutralized any canal which should be constructed across Nicaragua by either Great Britain or the United States. Other European powers became involved with Nicaragua during the ensuing years. In 1875, Germany and, in 1895, Great Britain, blockaded Nicaraguan ports to force redress of injuries.

In 1909, two Americans, Cannon and Groce, were executed, after torture, and this led to an American naval demonstration and demands, and was one of the direct elements leading to American intervention. A period of comparative quiet existed in Nicaragua under a series of Conservative presidents until 1893, when José Santos Zelaya, a Liberal, seized the power as a result of a revolution and ruled Nicaragua until 1909. There were various attempts at revolution, but none succeeded until that of 1909, which broke out, as most insurrections in Nicaragua do, on the Caribbean seaboard. The United States broke off diplomatic relations with Zelaya as a result of the Cannon-Groce executions, describing the Zelaya régime as a "blot on the history" of Nicaragua. The U.S. cruiser "Des Moines" prevented fighting at Bluefields on Dec. 18, 1909, thus making defeat of the Conservative revolutionists impossible, and inaugurating what is now known as the "intervention" of the United States against Zelaya and the Liberals who backed him. On Dec. 23, the Conservatives defeated the Zelaya troops at Rama, capturing most of the army, and on the following day Zelaya took refuge aboard a Mexican gunboat at Corinto and left the country. Dr. José Madriz, a Liberal, took the reins of Government, but the United States refused recognition; he was succeeded by Juan M. Estrada, an artisan, who had some Conservative and some Liberal backing and was regarded as a neutral. The United States accorded his Government recognition, but it was short-lived. Adolfo Díaz was elected provisional president in 1910. He was elected a second time in 1913, retiring in 1916; he was again chosen provisional president by vote of the senate in 1927. Under President Díaz, in 1912, the American marines were invited into Nicaragua on the plea of their need to protect foreign lives and property during the so-called Mena revolution, and the legation guard which succeeded the 1912 expeditionary force remained until 1925, and unquestionably preserved peace and gave Nicaragua the period of rest and recuperation which was marked by its prosperity. *See* CENTRAL AMERICA.

President Díaz was succeeded by Emiliano Chamorro in 1916, and he in turn by his nephew, Diego M. Chamorro (1920–23), who died in office and was succeeded by Dr. Bartolo Martínez, vice president. The election of 1924, under laws framed by an American expert but without the American supervision that had been planned, resulted in the election of a coalition ticket, President Solórzano being an anti-Chamorro Conservative, and Dr. Juan B. Sacasa, vice president, being the leader of the Liberals. Gen. Emiliano Chamorro, who stood again for the presidency as a Conservative, was defeated, and on Oct. 24, 1925, he led a *coup d'état* which captured the Loma, the fortified hill overlooking Managua, and forced the resignation and departure first of Vice President Sacasa and next of President Solórzano. Gen. Chamorro was named "designate" for the presidency by the senate, which had been changed in political complexion through the support of the Chamorro charges of fraud in the previous election (although previously these claims had been disallowed). Dr. Sacasa was declared to have given up his rights by his departure from the country and Gen. Chamorro assumed the presidency. The United States refused recognition, as did other Central American and European Governments. Dr. Sacasa, meanwhile, had pressed Washington for his own recognition as the legitimate president, but this was refused on the ground that he was not in his country nor in possession of the power. He left Washington and went to Mexico, where he had been recognized and where President Calles furnished him with arms, ammunition and men. The appearance of the Mexican element in the situation greatly disturbed Washington, and while before the attitude had been one of neutrality, the United States immediately moved to outwit the Mexican smuggling of arms, to isolate the fighting (the Sacasa forces had formed their bases on both the Caribbean and Pacific coasts) and to bring the revolution to an end with the elimination of Dr. Sacasa.

This policy of isolating the fighting and landing marines to protect foreign interests in the country resulted in weakening the Liberal offensive and also in the resignation of Gen. Chamorro. The Nicaraguan senate, reorganized with alternates or with original members in their seats, thereupon elected Adolfo Diaz "designate" and thus automatically president. An outcry arose throughout Latin America that the appointment had been forced by the United States. To allay such feelings Col. Henry L. Stimson was sent as a personal representative of President Coolidge to Nicaragua where he soon arranged an armistice between the warring elements pending an early election, which should be held under American supervision. The Liberals, with the exception of a band of *insurrectos* under General Augusto Sandino, laid down their arms peaceably. The vote was taken on Nov. 4, 1928 and resulted in an overwhelming victory for Gen. José M. Moncada, who had been leader of the Liberal army at the time of Stimson's visit. The United States soon afterwards began the gradual withdrawal of its troops as rapidly as their place could be taken by a local national guard. Guerrilla warfare continued between Government forces and Gen. Sandino's rebels.

The presidential election of 1932 was likewise held under United States supervision, and Dr. Sacasa was elected. On Feb. 3, 1933, the new Government signed a "peace pact" with Sandino, who agreed that his followers, except 100, should be disarmed, receiving in return amnesty and land. A year later, Sandino visited the president at Managua, and shortly after leaving the presidential palace was shot down in cold blood by members of the National Guard. Charges that the assassination was by direct order of the minister of war, General Somoza, were vigorously denied.

Unsatisfactory economic conditions and personal friction between President Sacasa and members of the Government brought his forced resignation in June 1936, and Carlos Jarquín became provisional president. The regular presidential elections in November of that year resulted in the election of General Anastasio Somoza as president. He took office the following January and began a vigorous policy, placing especial emphasis on public works. The already unsatisfactory condition of the world market for coffee, Nicaragua's most important product, was made acute by Brazilian abandonment of its control of coffee exports and prices. Nicaraguan finances suffered seriously, but under the firm hand of President Somoza, order and stability were main-

tained. The long-standing boundary dispute with Honduras flared up earlier in the same year, but efforts of several American republics succeeded in easing the tension.

In May 1939 President Somoza visited Washington in an effort to obtain financial credits for the furtherance of the Government public works program and attempted to rouse the interest of the United States in a revival of the Nicaragua canal project. At the outbreak of World War II (1939) Nicaragua proclaimed neutrality and followed closely the lead of the United States in policies affecting Western Hemisphere defense.

BIBLIOGRAPHY.—Department of Overseas Trade, *Reports* (London, annual); Foreign Policy Association, *Reports* (New York, semi-monthly); Pan American Union, *Bulletin* and *Commercial Pan America* (Washington, monthly); R. Belausteguigoitia, *Con Sandino en Nicaragua* (Madrid, 1934); I. J. Cox, *Nicaragua and the United States, 1909–1927* (Boston, 1928); F. Cramer, *Our neighbor Nicaragua* (New York, 1929); L. Denny, *Dollars and bullets* (New York, 1929); A. P. Davis, *Hydrography of Nicaragua* (U.S.A. Geological survey report, no. 20, Washington, 1920); R. R. Hill, *Fiscal intervention in Nicaragua* (New York, 1933); R. Nogales, *The looting of Nicaragua* (New York, 1928); H. L. Stimson, *American policy in Nicaragua* (New York, 1927); F. Ortega, *Nicaragua en los primeros años de su emancipación política* (Paris, 1894); U.S. State Dept., *Brief history of United States relations with Nicaragua, 1909–1932* (Washington, 1932); E. Squier, *Nicaragua* (New York, 1852); P. F. Stout, *Nicaragua: past, present, and future* (Philadelphia, 1859). *See* also WALKER, WILLIAM: *Bibliography*. (L. W. BE.)

**NICASTRO,** a town and episcopal see of Calabria, Italy, in the province of Catanzaro, 17 mi. W.N.W. of it by rail, and 5½ mi. E. of S. Eufemia, a station on the line along the west coast from Naples to Reggio di Calabria. Pop. (1936) 16,273 (town), 24,998 (commune). It is on the isthmus between the gulfs of S. Eufemia and of Squillace, the narrowest part of Calabria, 970 ft. above sea-level, and commands a fine view. Frederick II's son Henry was imprisoned in the castle. The place suffered greatly from the earthquake of 1638, which also destroyed the Benedictine abbey of S. Eufemia, founded by Robert Guiscard.

**NICCOLI, NICCOLO DE'** (1363–1437), Italian humanist, was born and died at Florence. He was one of the chief figures in the company of learned men which gathered round Cosimo de' Medici. Niccoli's chief services to classical literature consisted in his work as a copyist and collator of ancient mss. Many of the most valuable mss. in the Laurentian library are by his hand, amongst them those of Lucretius and of 12 comedies of Plautus. Niccoli's private library was the largest and best in Florence; he also possessed a small but valuable collection of ancient works of art, coins and medals. He regarded himself as an infallible critic, and could not bear the slightest contradiction.

*See* the *Life* in *Traversarii Epistolae* (ed. L. Mehus, 1759); G. Voigt, *Die Wiederbelebung des klassischen Altertums* (1893); G. Zippel, *Nicolò Niccoli* (Florence, 1890).

**NICCOLITE,** a mineral consisting of nickel arsenide, NiAs, containing 43.9% nickel. Crystals are hexagonal, but are rare and indistinct. It usually occurs as compact masses of a pale copper-red colour, with metallic lustre on the uneven fractured surfaces. It is opaque and brittle, and the streak is brownish-black. The specific gravity is 7.5 and the hardness 5½. Niccolite occurs with ores of cobalt, silver and copper at Annaberg and Schneeberg in Saxony, at Sangerhausen and Mansfeld in Prussian Saxony and other localities.

**NICE,** a city of France, the chief town of the department of the Alpes Maritimes, and previous to 1860 the capital of the county of Nice (Nizza) in the kingdom of Sardinia, 739 mi. by rail from Paris. Pop. (1936) 209,382. The population fluctuates with the seasons, owing to the influx of winter visitors.

The town is situated at the mouth of the Paillon (Paglione), at the northern end of the Baie des Anges. The historical nucleus of the town is an isolated limestone hill, running back for some distance from the shore and formerly crowned by a castle. Towards its south-west corner stands a tower (Tour Bellanda or Clérissy) dating, it is said, from the 5th century. The old town stretches along the western base of the hill; the "town of the 18th century" on ground farther west slopes gently towards the Paillon; and to the north-east and north and west beyond the stream lies the modern city. To the east of the hill the commercial quarter surrounds the port. The whole frontage of Nice is composed of fine embankments, notably the Promenade des Anglais begun 1822–24 at the cost of the English colony, and the course of the Paillon also is embanked on both sides. Besides a Roman Catholic cathedral—Ste. Réparate, dating from 1650—Nice possesses two Russian churches, two synagogues and an Anglican chapel. Architecturally the most remarkable church is Notre Dame du Voeu, a modern Gothic building. The lycée was founded by the Jesuits in the 17th century and at some distance from the town there is an astronomical and meteorological observatory on Mont Gros (1,220 ft.).

**Industry and Trade.**—The industrial establishments are perfumery factories, distilleries, oil-works, furniture and woodwork factories, confectionery works, soap-works, factories for silk goods, straw hats, rubber goods, pianolas, metal goods and a national tobacco factory. Besides the vine, the trees principally cultivated in the neighbourhood are the olive, the orange, the mulberry and the carob; and the staple exports are oil, agricultural produce, fruits and flowers. Nice now joins on the north-east the ancient episcopal town of Cimiez, where are the most luxurious hotels. Reckoning from east to west the town is surrounded by a girdle of beautiful towns—Carabacel, St. Etienne, St. Philippe and Les Beaumettes. On the east of the port lie Montboron, Riquier and St. Roch, the last partly occupied by barracks. The entrances to the port of Nice and the outer pier have been improved; that of the outer port is 300 ft. wide, and that of the inner 220 ft. The area of the harbour is about 8 ac.; vessels drawing more than 23 ft. cannot enter; its trade is mostly coastal, principally in French and Italian vessels. Nice is an episcopal see (first mentioned at the end of the 4th century) under the archbishop of Aix. It belongs to the XV military division (Marseilles). It is the seat of a prefect, of tribunals of first instance and of commerce and of a board of trade arbitrators. The coastal railway is the main line of communication; an extension of the branch line up the Paillon valley to l'Ecarène joining the Ventimiglio-Coni (Cuneo) line at Breil was opened on Oct. 30, 1928.

**Climate.**—Protected towards the north by hills which rise stage behind stage to the main ridge of the Alps, Nice is cele-

THE GARDEN OF KING ALBERT I IN NICE

brated for the mildness of its climate. The mean temperature is 60°, that of winter being 49°, of spring 56°, of summer 72° and of autumn 63°. For a few nights in winter there is frost, but snow is practically unknown. The highest reading of the thermometer is rarely above 90°. There are 67 days with rain in the course of a year; but it usually falls in heavy showers which soon leave the sky clear again; the whole annual amount exceeds 32 in. Fine

days and rainy days are almost equally distributed throughout the different seasons. The winds are very variable, sometimes changing several times a day, but the most frequent is the east wind. April and May are the most windy months. The south-west wind (called *Libeccio,* or wind of Libya) is moist and warm; the north-east (or *Gregaou,* Greek), which is rare, brings storms of hail and even snow in winter. The mistral (from the north-west) and the tramontane (from the north) are generally stopped by the mountains. For 2,000 years the climate of Nice has been considered favourable in chest complaints; it also benefits cases of gout, asthma, catarrhs, rachitic affections, scrofula, stone; but the reverse is the case when heart disease, nervous disorders or ophthalmia are concerned. Autumn is the best season; in spring the sudden changes of temperature demand great care. The city is famous for its carnival festivities, especially the "battle of flowers."

**History.**—Nice (*Nicaea*) was founded about two thousand years ago by the Phocaeans of Marseilles, and was named in honour of a victory (*νίκη*) over the neighbouring Ligurians. It soon became a busy trading station, but had a rival in the town of Cemenelum, in existence till the time of the Lombard invasions, which has left its ruins at Cimiez. In the 7th century Nice joined the Genoese league formed by the towns of Liguria. In 729 it repulsed the Saracens; but in 859 and 880 they pillaged and burned it, and for the most of the 10th century remained masters of the surrounding country. As an ally of Pisa, Nice was the enemy of Genoa, and both the king of France and the emperor endeavoured to subjugate it; but it maintained its liberties. In the course of the 13th and 14th centuries it fell more than once into the hands of the counts of Provence; and at length in 1388 it placed itself under the protection of the counts of Savoy. The maritime strength of Nice rapidly increased till it was able to cope with the Barbary pirates; the fortifications were largely extended and the roads to the city improved. During the struggle between Francis I and Charles V great damage was caused by the passage of the armies invading Provence; pestilence and famine raged in the city for several years. In 1543 Nice was attacked by the united forces of Francis I and Barbarossa; and the inhabitants were ultimately compelled to surrender, and Barbarossa was allowed to pillage the city and to carry off 2,500 captives. Pestilence appeared again in 1550 and 1580. In 1600 Nice was taken by the duke of Guise.

By opening the ports of the countship to all nations, and proclaiming full freedom of trade, Charles Emmanuel in 1626 gave a great stimulus to the city. Captured by Catinat in 1691, Nice was restored to Savoy in 1696, but it was again besieged by the French in 1705, and in 1706 its citadel and ramparts were demolished. The treaty of Utrecht in 1713 gave the city back to Savoy; and in the peaceful years which followed the "new town" was built. From 1744 till the peace of Aix-la-Chapelle (1748) the French and Spaniards were again in possession. In 1775 the king of Sardinia destroyed all that remained of the ancient liberties of the commune. Conquered in 1792 by the armies of the French Republic, the county of Nice continued to be part of France till 1814; but after that date it reverted to Sardinia. By a treaty concluded in 1860 between the Sardinian king and Napoleon III it was again transferred to France.

**NICEPHORUS,** the name of three emperors of the East.

NICEPHORUS I., emperor 802–811, was a native of Seleucia in Pisidia, who was raised by the empress Irene to the office of *logothetes.* With the help of the patricians and eunuchs he contrived to dethrone Irene, and to be elected emperor. His sovereignty was endangered by the revolt of his general Bardanes. But Nicephorus achieved the submission of Bardanes, who was relegated to a monastery. A conspiracy headed by the patrician Arsaber had a similar issue. Nicephorus set himself with great energy to increase the empire's revenue. By his rigorous imposts he alienated the favour of his subjects, and especially of the clergy. In 803 and 810 he made a treaty with Charlemagne, by which the limits of the two empires were amicably fixed. Venice, Istria, the Dalmatian coast and South Italy were assigned to the East, while Rome, Ravenna and the Pentapolis were included in the Western realm. By withholding the tribute which Irene had agreed to pay to Harun al-Rashid, Nicephorus committed himself to a war with the Saracens. Compelled by Bardanes's disloyalty to take the field himself, he sustained a severe defeat at Crasus in Phrygia (805), and only obtained peace on condition of paying a yearly contribution of 30,000 gold pieces. By the death of Harun in 809, Nicephorus was left free to deal with the Bulgarian king, Krum, who was harassing his northern frontiers. In 811 Nicephorus invaded Bulgaria and drove Krum to ask for terms, but in a night attack he allowed himself to be surprised and was slain along with a large portion of his army.

*See* Gibbon, ed. Bury (1911) vol. v., p. 204–205, Bury's *Eastern Roman Empire.*

NICEPHORUS II. (Phocas), emperor 963–969, belonged to a Cappadocian family which had produced several distinguished generals. He was born about 912, joined the army at an early age, and, under Constantine VII., became commander on the eastern frontier. In the war with the Saracens he began with a severe defeat (956), which he retrieved in the years following by victories in Syria. In 960 he led an expedition to Crete, and wrested the whole island from the Saracens. He then returned to the east with a large and well-equipped army. In the campaigns of 962–963 he forced his way through Cilicia to Syria and captured Aleppo, but made no permanent conquests. Upon the death of Romanus II., Nicephorus was proclaimed emperor by the eastern troops, and was eventually acknowledged at Constantinople as colleague of the infant sons of Romanus. In 964–966 he definitely conquered Cilicia and again overran Mesopotamia and Syria, while the patrician Nicetas recovered Cyprus. In 968 he reduced most of the fortresses in Syria, and after the fall of Antioch and Aleppo (969), which were recaptured by his lieutenants, secured his conquests by a peace. On his northern frontier he began a war against the Bulgarians, to whom the Byzantines had of late been paying tribute (967), and by instigating an attack from the Russians distracted their attention effectively. Nicephorus was less successful in his western wars. After renouncing his tribute to the Fatimite caliphs, he sent an expedition to Sicily under Nicetas (964–965), but was forced by defeats on land and sea to evacuate that island completely. In 967 he made peace with the Saracens of Kairawan and turned to defend himself against their common enemy, Otto I. of Germany, who had attacked the Byzantine possessions in Italy; but after some initial successes his generals were defeated and driven back upon the southern coast. Owing to the care which he lavished upon the proper maintenance of the army, Nicephorus was compelled to exercise rigid economy in other departments. By his heavy imposts and the debasement of the coinage he forfeited his popularity with the rest of the community, and gave rise to riots. He was finally assassinated in his sleeping apartment by his nephew and successor John Zimisces. Nicephorus was the author of an extant treatise on military tactics.

NICEPHORUS III. (Botaniates), emperor 1078–1081, rose to be commander of the troops in Asia. He revolted in 1078 from Michael VII., and with the connivance of the Turks assumed the purple. In face of another rebellious general, Nicephorus Bryennius, his election was ratified by the aristocracy and clergy. With the help of Alexius Comnenus he drove out of the field Bryennius and other rivals, but failed to clear the invading Turks out of Asia Minor. Nicephorus ultimately quarrelled with Alexius, and was banished to a monastery.

*See* Gibbon, *Decline and Fall* (ed. Bury, 1911); Finlay, *Hist. of Greece;* G. Schlumberger, *Nicéphore Phocas* (Paris, 1890); K. Leonardt, *Kaiser Nicephorus II.* (Halle, 1887).

**NICEPHORUS PATRIARCHA** (*c.* 758–829), Byzantine historian and patriarch of Constantinople (806–815). He was, like his father Theodorus, a zealous opponent of Iconoclasm. He was secretary to the imperial commissaries at the council of Nicaea in 787, which witnessed the triumph of his opinions; but, feeling dissatisfied with court life, he retired into a convent. In 806 he suddenly succeeded Tarasius as patriarch of Constantinople, but was deposed by the Iconoclast Leo V. in 815 and died in exile 829. After his death he was included among the saints of the Orthodox Church.

Nicephorus is the author of two important works on the iconoclastic questions: the *Apologeticus Maior* (817) and the *Apologeticus Minor;* his historical works are two: the *Chronologia Compendiaria,* a table of dates from Adam to the year of his own death; the *Breviarium Historicum,* a history of the years 602–799—a very poor composition, only valuable owing to the paucity of other materials. Editions: Complete, J. P. Migne, *Patrologia Graeca,* vol. c. Theological: A Mai, *Nova Patrum Bibliotheca* i., ii. and iii. Historical: de Boor Teubner, 1880. *See* also Krumbacher, *Geschichte der byzantinischen Litteratur* (1897) and A. Burckhardt in *Byzantinische Zeitschrift* 5. p. 465.

**NICHOLAS, ST.,** bishop of Myra, in Lycia, a saint honoured by the Greeks and the Latins on the 6th of December. His cult is as celebrated as his history is obscure. He was bishop of Myra in the time of the emperor Diocletian, was persecuted, tortured for the faith, and kept in prison until the more tolerant reign of Constantine, and is said to have been present at the council of Nicaea, though Athanasius, who knew all the notable bishops of the period, never mentions Nicholas, bishop of Myra. The oldest known monument of the cult of St. Nicholas seems to be the church of SS. Priscus and Nicholas built at Constantinople by the emperor Justinian. (*See* Procopius, *De aedif.* i. 6.) In the West, the name of St. Nicholas appears in the 9th century martyrologies, and churches dedicated to him are to be found at the beginning of the 11th century. It is more especially, however, from the time of the removal of his body to Bari, in Apulia, that his cult became popular. The inhabitants of Bari organized an expedition, seized his remains by means of a ruse, and transported them to Bari, where they were received in triumph on May 9, 1087, and where the foundations were laid of a new basilica in his honour. This was the origin of a famous and still popular pilgrimage. There are nearly 400 churches in England dedicated to St. Nicholas. He is the patron saint of Russia; the special protector of children, scholars, merchants and sailors; and is invoked by travellers against robbers. In art St. Nicholas is represented with various attributes, being most commonly depicted with three children standing in a tub by his side.

A legend of his surreptitious bestowal of dowries upon the three daughters of an impoverished citizen, who, unable to procure fit marriages for them, was on the point of giving them up to a life of shame, is said to have originated the old custom of giving presents in secret on the Eve of St. Nicholas, subsequently transferred to Christmas Day. Hence the association of Christmas with "Santa Claus," an American corruption of the Dutch form "San Nicolaas," the custom being brought to America by the early Dutch colonists. (For the ceremony of the boy-bishop elected on St. Nicholas's Day *see* BOY-BISHOP.)

*See* N. C. Falconius, *Sancti Nicolai acta primigenia* (Naples, 1751); *Bibliotheca hagiographica Graeca* (Brussels, 1895), p. 96; *Bibl. hagiogr. Latina* (Brussels, 1899), n. 6104–6221; F. Nitti di Vito, *Le Pergamene di S. Nicola di Bari* (Bari, 1901); Charles Cahier, *Caractéristiques des saints* (Paris, 1867), p. 354; Frances Arnold-Forster, *Studies in Church Dedications* (London, 1899), i. 495–501 and iii. 21; L'abbé Marin, *Saint Nicholas, évêque de Myre* (1917).

**NICHOLAS I.,** sometimes called The Great, and certainly the most commanding figure in the series of popes between Gregory I. and Gregory VII., succeeded Benedict III. in April 858. According to the annalist Prudentius of Troyes, "he owed his election less to the choice of the clergy than to the presence and favour of the emperor Louis II. and his nobles"—who can hardly have foreseen with what ability and persistency the rights of the Holy See as supreme arbiter of Christendom were to be asserted even against themselves by the man of their choice. Of the previous history of Nicholas nothing is recorded. His pontificate of nine years and a half was marked by at least three memorable contests which have left their mark in history. The first was that in which he supported the claims of the unjustly degraded patriarch of Constantinople, Ignatius (*q.v.*); but two of its incidents, the excommunication of Photius (*q.v.*), the rival of Ignatius, by the pope in 863, and the counter-deposition of Nicholas by Photius in 867, were steps of serious moment towards the permanent separation between the Eastern and the Western Church.

The second great struggle was that with Lothair (*q.v.*) the king of Lorraine (second son of the emperor Lothair I., and brother of the emperor Louis II.), about the divorce of his wife Theutberga or Thietberga. The pope not only quashed the whole proceedings against Theutberga, but excommunicated and deposed bishops Gunther and Thietgaud, who had been audacious enough to bring to Rome in person the "libellus" of the synod which had given judgment. The archbishops appealed to Louis II., then at Benevento, to obtain the withdrawal of their sentence by force; but, although he actually occupied the Leonine city (864), he was unsuccessful in obtaining any concession, and had to withdraw to Ravenna.

The third great ecclesiastical cause which marks this pontificate was that in which the right of bishops to appeal to Rome against their metropolitans was maintained in the case of Rothad of Soissons, deposed by Hincmar of Reims. In the course of the controversy with the great and powerful Neustrian archbishop papal recognition was first given (in 865) to the False Decretals, which had probably been brought by Rothad to Rome in the preceding year. (*See* DECRETALS.) Nicholas was the pope to whom Boris, the newly converted king of Bulgaria, addressed himself for practical advice in some of the difficult moral and social problems arising out of the transition from heathenism to Christianity. The pope's letter in reply to the hundred and six questions and petitions of the barbarian king is perhaps the most interesting literary relic of Nicholas I. now extant. He died on Nov. 13, 867, and was succeeded by Adrian II.

The *epistolae* of Nicholas I. are printed in Migne, *Patrologia Lat.* vol. 119, p. 769 *seq.* *See* F. Gregorovius, *Rome in the Middle Ages,* vol. iii. (Eng. trans., London, 1900–1902); H. Lämmer, *Nikolaus I. und die byzantinische Staatskirche seiner Zeit* (Berlin, 1857); J. Roy, *Saint-Nicolas I.* (Paris, 1900); J. Richterich, *Papst Nikolaus I.* (Bern, 1903); A. Greinacher, *Die Anschauungen des Papstes Nikolaus I. über das Verhältnis von Staat und Kirche* (1909).

**NICHOLAS II.,** pope from December 1058 to July 1061, was a Burgundian named Gerard, who at the time of his election was bishop of Florence. He was set up by Hildebrand, with the support of the empress-regent Agnes and of the powerful Duke Godfrey of Lorraine, against Benedict X., the nominee of the Roman nobles, and was crowned at Rome, after the expulsion of Benedict, on Jan. 24, 1059. He continued the policy of ecclesiastical reform associated with the name of Hildebrand (afterwards Gregory VII.). He entered into relation with the Normans, now firmly established in southern Italy, and the new alliance was cemented at Melfi, where Nicholas II., invested (1059) Robert Guiscard with the duchies of Apulia, Calabria and Sicily, and Richard of Aversa with the principality of Capua, in return for fealty and the promise of assistance. The first fruits of this arrangement, based on no firmer foundation than the forged "Donation of Constantine" (*q.v.*), but destined to make the papacy more independent in both the Eastern and Western Empires, was the reduction in the autumn, with Norman aid, of Galera, where the anti-pope had taken refuge, and the end of the subordination of the papacy to the Roman nobles.

Meanwhile Nicholas had sent legates to Milan to adjust the difference between the Patarenes and the archbishop and clergy. Archbishop Wido, in face of the ruinous conflict in the Church of Milan, was forced to submit to the terms proposed by the legates, involving the subordination of Milan to Rome; the new relation was advertised by the unwilling attendance of Wido and the other Milanese bishops at the council summoned to the Lateran palace in April 1059. This council continued the Hildebrandine reforms by sharpening the discipline of the clergy, and regulated future elections to the Holy See. (*See* LATERAN COUNCILS, and CONCLAVE.) The emperor's traditional rights in the matter of papal elections were completely ignored. Stephen, cardinal priest of S. Chrysogonus, was sent to the German court to attempt to allay the consequent ill-feeling, but was not received. Pope Nicholas, moreover, had offended the German bishops by what they regarded as arbitrary interference with their rights; they retaliated, in a synod held early in 1061, by declaring the new electoral law annulled, and the pope himself deposed. But party strife in Germany enabled the pope to ignore these proceedings. Nicholas II. died at Florence in July 1061.

His *Diplomata, epistolae, decreta* are in Migne, *Patrolog.* Lat. 143, pp. 1301–1366. *See* the article "Nikolaus II." by C. Mirbt in Herzog-

Hauck, *Realencyklopädie* (3rd ed., Leipzig, 1904), with bibliography. Other lists of authorities are in Potthast, *Biblioth. Hist. Med. Aev.* (2nd ed., Berlin, 1896), p. 854; and Ulysse Chevalier, *Répertoire des sources hist. biobibliogr.* (Paris, 1905), vol. 3347, *s.v.* "Nicolas II."

**NICHOLAS III.** (Giovanni Gaetano Orsini), pope from Nov. 25, 1277 to the 22nd of August 1280, was a Roman nobleman who had served under eight popes. He succeeded John XXI., largely through family influence, after a six-months' vacancy in the Holy See. A born politician, he concluded a concordat with Rudolph of Habsburg in May 1278, by which the Romagna and the exarchate of Ravenna were guaranteed to the pope; and in July he issued an epoch-making constitution for the government of Rome, which forbade foreigners taking civil office. Nicholas issued the bull *Exiit* on Aug. 14, 1279, to settle the strife within the Franciscan order between the parties of strict and loose observance. He repaired the Lateran and the Vatican at enormous cost. Nicholas brought just reproach on himself by his nepotism. *See* also the *Catholic Encyclopaedia* (*s.v.*).

*See* "Les Registres de Nicolas III.," published by Jules Gay in *Bibliothèque des écoles françaises d'Athènes et de Rome* (Paris, 1898–1916); A. Potthast, *Regesta pontif. Roman.* vol. 2 (Berlin, 1875); A. Demski, "Papst Nikolaus III.," in *Kirchengeschichtliche Studien* (Münster, 1903); F. Gregorovius, *Rome in the Middle Ages,* vol. 5, trans. by Mrs. G. W. Hamilton (London, 1900–1902); Fr. Wertsch. *Die Beziehungen Rudolfs von Habsburg zur röm. Kurie bis zum Tode Nikolaus III.* (Bochum, 1880); G. Palmieri, *Introiti ed esiti di Papa Niccolò III.* (Rome, 1889).

**NICHOLAS IV.** (Girolamo Masci), pope from Feb. 22, 1288, to April 4, 1292, a native of Ascoli and a Franciscan monk, succeeded St. Bonaventura as general of his order in 1274, was made cardinal-priest of Sta. Prassede and Latin patriarch of Constantinople by Nicholas III., cardinal-bishop of Palestrina by Martin IV., and succeeded Honorius IV. after a ten-months' vacancy in the papacy. He was a pious, peace-loving monk with no ambition save for the church, the crusades and the extirpation of heresy. He steered a middle course between the factions at Rome, and sought a settlement of the Sicilian question. In May 1289 he crowned Charles II. king of Naples and Sicily after the latter had expressly recognized papal suzerainty, and in February 1291 concluded a treaty with Alphonso III. of Aragon and Philip IV. of France looking toward the expulsion of James of Aragon from Sicily. The loss of Ptolemais in 1291 stirred the pope to renewed enthusiasm for a crusade. He sent the celebrated Franciscan missionary, John of Monte Corvino (*q.v.*), with some companions to labour among the Tatars and Chinese. He issued an important constitution on July 18, 1289, which granted to the cardinals one-half of all income accruing to the Roman see and a share in the financial management, and thereby paved the way for that independence of the college of cardinals which, in the following century, was to be of detriment to the papacy. Nicholas was succeeded by Celestine V.

*See* "Les Registres de Nicolas IV.," ed. by Ernest Langlois in *Bibliothèque des écoles françaises d'Athènes et de Rome* (Paris, 1886–1893); A. Potthast, *Regesta pontif. Roman.* vol. 2 (Berlin, 1875); F. Gregorovius, *Rome in the Middle Ages,* vol. 5, trans. by Mrs. G. W. Hamilton (London, 1900–1902); O. Schiff, "Studien zur Geschichte Papst Nikolaus IV." in *Historische Studien* (1897); W. Norden, *Das Papsttum u. Byzanz* (Berlin, 1903); R. Röhricht, *Geschichte des Königreichs Jerusalem* (Innsbruck, 1898); J. B. Sägmüller, *Die Thätigkeit u. Stellung der Kardinäle bis Papst Bonifaz VIII.* (Freiburg-i.-B., 1896); J. P. Kirsch, "Die Finanzverwaltung des Kardinalkollegiums im 13. u. 14. Jahrhunderte" in *Kirchengeschichtliche Studien* (1895). *See* also the *Catholic Encyclopaedia* (*s.v.*).

**NICHOLAS V.** (Tomaso Parentucelli or Tomaso da Sarzana), pope from March 6, 1447, to March 24, 1455, was born at Sarzana, where his father was a physician, in 1398. In 1444 he was made bishop of Bologna by Pope Eugenius IV., who sent him to Frankfort to negotiate an understanding between the Holy See and the empire with regard to the reforming decrees of the council of Basel. On his return to Rome, he was made cardinal priest of Sta. Susanna (December 1446). He was elected pope in succession to Eugenius IV. on March 6, 1447.

With the German king, Frederick III., he made the Concordat of Vienna, or Aschaffenburg (Feb. 17, 1448), by which the decrees of the council of Basel against papal annates and reservations were abrogated so far as Germany was concerned; and in the following year he secured a still greater triumph when the resignation of the anti-pope Felix V. (April 7), and his own recognition by the rump of the council of Basel, assembled at Lausanne, put an end to the papal schism. The next year, 1450, Nicholas held a jubilee at Rome. In March 1452 he crowned Frederick III. as emperor in St. Peter's, the last occasion of the coronation of an emperor at Rome. Under the generous patronage of Nicholas humanism made rapid strides. He employed hundreds of copyists and scholars, giving as much as ten thousand *gulden* for a metrical translation of Homer, and founded a library of nine thousand volumes. He restored the walls and numerous churches of Rome and began the rebuilding of the Vatican and St. Peter's.

In 1452 a formidable conspiracy for the overthrow of the papal government, under the leadership of Stefano Porcaro, was discovered and crushed. This revelation of disaffection, together with the fall of Constantinople, darkened the last years of Nicholas; "As Thomas of Sarzana," he said, "I had more happiness in a day than now in a whole year." He died on March 24, 1455.

*See* Herzog-Hauck, *Realencyklopädie für protestantische Theologie und Kirche,* vol. xiv. (1904), with full references; *Cambridge Modern History,* i. 76–78; and M. Creighton, *History of the Papacy* (London, 1882), vol. ii.

**NICHOLAS V.** (Pietro Rainalducci), antipope in Italy from 1328 to 1330 during the pontificate of John XXII. at Avignon, a native of Corbara in the Abruzzi, joined the Franciscan order in 1310. He was elected through the influence of the excommunicated emperor, Louis the Bavarian, by an assembly of priests and laymen, and consecrated at St. Peter's on May 12, 1328, by the bishop of Venice. After spending four months in Rome, he withdrew with Louis to Viterbo and thence to Pisa, where he was guarded by the imperial vicar. He was excommunicated by John XXII. in April 1329, and sought refuge with Count Boniface of Donoratico near Piombino. Having obtained assurance of pardon, he presented a confession of his sins first to the archbishop of Pisa, and then (Aug. 25, 1330) to the pope at Avignon. He remained in honourable imprisonment in the papal palace until his death in October 1333.

*See* F. Gregorovius, *Rome in the Middle Ages,* vol. 6, trans. by Mrs. G. W. Hamilton (London, 1900–1902); Baluzius, *Vitae paparum Avenionensium,* vol. 1 (Paris, 1693); J. B. Christophe, *Histoire de la papauté pendant le XIVième siècle,* vol. 1 (Paris, 1853); E. Marcour, *Anteil der Minoriten am Kampfe zwischen König Ludwig IV. von Bayern und Papst Johann XXII.* (Emmerich, 1874); Eubel, "Der Gegenpapst Nicolaus V. u. seine Hierarchie," in *Hist. Jahrbuch,* vol. 12 (1891).

**NICHOLAS I.** [NIKOLAI PAVLOVICH], emperor of Russia (1796–1855), eighth child of the emperor Paul I. and his wife Maria Feodorovna, was born at Tsarskoe-Selo on June 25 (July 6, N.S.), 1796. He was only five years old when his father's murder brought his brother Alexander I. to the throne (1801). His education was supervised by M. von Lambsdorff, director of the 1st cadet corps and ex-governor of Courland. But Nicholas and his brother Constantine had little taste for learning. They were interested mainly in military matters.

The grand-duke Nicholas joined the Russian headquarters in France in 1814, but not to take part in any fighting. In 1815 he was with the Allies in Paris, and in the following year set out on the *grand tour,* visiting Moscow and the western provinces of Russia, Berlin (where he was betrothed to Princess Charlotte Louise, daughter of Frederick William III.), and England. His marriage marked the beginning of intimate relations between the courts of Berlin and St. Petersburg. On the 17/29th of April 1818 their first child, the future emperor Alexander II., was born. In the autumn Nicholas was placed in command of the 2nd brigade of the 1st division of the Guard.

Alexander I. died at Taganrog on Dec. 1, 1825. Constantine was at Warsaw; Nicholas was too conscious of his unpopularity in the army—the fruit of his drastic discipline—to dare to assume the crown without a public abdication on the part of the legitimate heir. The result (*see* CONSTANTINE PAVLOVICH) was a three weeks' interregnum, of which the discontented spirits in the army took advantage to bring to a head a plot that had long been

hatching in favour of constitutional reform. When on Dec. 14 the troops who had already taken the oath to Constantine were ordered to take another to Nicholas, it was easy to persuade them that this was a treasonable plot against the true emperor. The Moscow regiment refused to take the oath, and part of it marched, shouting for Constantine and "Constitution," to the square before the Senate House, where they were joined by a company of the Guard and the sailors from the warships. In this crisis Nicholas showed high personal courage, if little decision and initiative. For hours he stood, or sat on horseback, amid the surging crowd, facing the mutinous soldiers—who had loaded their muskets and formed square—while effort after effort was made to bring them to reason, sometimes at the cost of life—as in the case of Count Miloradovich, military governor of St. Petersburg, who was mortally wounded by a pistol shot while arguing with the mutineers. When at last the emperor consented to use force, a few rounds of grape-shot sufficed to quell the mutiny. The chief conspirators—Prince Shchepin-Rostovski, Suthoff, Ryleyev, Prince Sergius Trubetskoi, Prince Obolenski and others—were arrested the same night and interrogated by the emperor in person. A special commission, consisting entirely of officers, was then set up; and before this, for five months, the prisoners were subjected to a rigorous inquisition. The prisoners were kept in solitary confinement in the casemates of the inner fortress of St. Peter and St. Paul. They were brought blindfolded before the commission, and then suddenly confronted with their interrogators. Many went mad under the ordeal, one died, and one starved himself to death (Schiemann, ii. 73). It was soon clear that the Dekabrist (December) rising was but one manifestation of a vast conspiracy permeating the whole army. A military rising on a large scale in the south was only averted by the news of the failure of the mutiny at St. Petersburg; and at Moscow there were many arrests, including that of Colonel Paul Pestel, the chief of the revolutionary southern league. The 121 prisoners were finally brought to trial before a supreme criminal court, established by imperial *ukaz* (June 1–12, 1826). Some were condemned to death, others to solitary confinement in fortresses, others to the Siberian mines and colonies. Of the latter many were accompanied by their wives, though the Russian law allows divorce in the case of such sentences; the emperor unwillingly allowed the devoted women to go, but decreed that any children born to them in Siberia would be illegitimate.

In spite of his reverence for his brother's memory, Nicholas made a clean sweep of "the angel's" Bible Society; as for Alexander's projects of reform, the pitiful legacy of a life of unfulfilled purposes, these were reported upon by committees, and shelved. Nicholas too saw the need for reform; the Dekabrist conspiracy had burnt that into his soul; but he had his own views as to the reform needed. The state was corrupt, disorganized; what was wanted was not more liberty but more discipline. So he put civil servants, professors and students into uniform, and for little offences had them marched to the guard-house; thought was disciplined by the censorship, the army by an unceasing round of parades and inspections. The one great gift of Nicholas I. to Russia, a gift which he really believed would be welcome because it would bring every subject into immediate contact with the throne, was—the secret police, the dreaded Third Section of the Private Chancery of the emperor.

The crowning fault of Nicholas was, however, that he would not delegate his authority; whom could he trust but himself? In this he resembled his contemporary the emperor Francis I. But Francis would "sleep upon" a difficult problem; Nicholas never slept. His constitution was of iron, his capacity for work prodigious; reviews and parades, receptions of deputations, visits to public institutions, then eight or nine hours in his cabinet reading and deciding on reports and despatches—such was his ordinary day's work. Under the "Iron Tsar" the outward semblance of authority was perfectly maintained; but behind this imposing façade the whole structure of the Russian administrative system continued to rot and crumble.

Revelations of the rottenness of the under-structure had, indeed, begun before the outbreak of the war with Turkey in 1828. The newly organized squadron which in 1827 set out on the cruise which ended at Navarino only reached Plymouth with difficulty, and there had to be completely refitted. The disastrous Balkan campaign of 1828 was an even more astounding revelation of corruption, disorganization and folly in high places. The weary and starving soldiers were forced to turn out amid the marshes of the Dobrudscha before the emperor as spick and span as on the parade grounds of St. Petersburg; but he could do nothing to set order in the confusion of the commissariat, which caused the troops to die like flies of dysentery and scurvy; or to remedy the scandals of the hospitals. His presence hampered the initiative of Prince Wittgenstein, the nominal commander-in-chief; for Nicholas was incapable of leaving him a free hand.

These then were the leading principles which underlay Nicholas's domestic and foreign policy from first to last: to discipline Russia, and by means of a disciplined Russia to discipline the world. The mission of Russia in the West was, in accordance with the principles of the Holy Alliance as Nicholas interpreted them, to uphold the cause of legitimacy and autocracy against the Revolution; her mission in the East was, with or without the co-operation of "Europe," to advance the cause of Orthodox Christianity, of which she was the natural protector, at the expense of the decaying Ottoman empire. The sympathy of Europe with the insurgent Greeks gave the tsar his opportunity. The duke of Wellington was sent to St. Petersburg in 1826 to congratulate the new tsar on his accession and arrange a concert in the Eastern Question. The upshot proved the diplomatic value of Nicholas's apparent sincerity of purpose and charm of manner; the "Iron Duke" was to the "Iron Tsar" as soft iron to steel; Great Britain, without efficient guarantees for the future, stood committed to the policy which ended in the destruction of the Ottoman sea-power at Navarino and the march of the Russians on Constantinople. By the treaty of Adrianople in 1829 Turkey seemed to become little better than a vassal state of the tsar, a relation intensified, after the first revolt of Mehemet Ali, by the treaty of Unkiar-Skelessi in 1833. In the West, Nicholas himself proposed an armed intervention of the Alliance "to restore order" in Belgium and France; and when his allies held back even proposed to intervene alone, a project rendered impossible by the outbreak of the great insurrection in Poland, which tied the hands of all three powers.

Then, the insurrection in Poland once crushed, and Poland itself scarce surviving even as a geographical expression, he drew the three eastern autocratic powers together in a new "Holy Alliance" by the secret convention of Berlin (Oct. 3, 1833) reaffirming the right and duty of intervention at the request of a legitimate sovereign. The cordial understanding with Austria, cemented at Münchengrätz and Berlin, was renewed, after the accession of the emperor Ferdinand, at Prague and Töplitz (1835); on the latter occasion it was decided "without difficulty" to suppress the republic of Cracow, as a centre of revolutionary agitation. He allowed himself to be persuaded by Metternich to support the cause of Don Carlos in Spain, and so early as May 1837, in view of the agitation in Hungary, he announced that "in every case" Austria might count on Russia.

These cordial ties were loosened, however, by the fresh crisis in the Eastern Question after 1838. Metternich was anxious to summon a European conference to Vienna, with a view to placing Turkey under a collective guarantee. Nicholas refused to be a party to it. Moreover, as Austria showed an inclination to approach the maritime powers, he determined to come to an agreement with Great Britain, in order to settle the Eastern Question according to his own views; this is the explanation of those concessions in the Eastern Question which ended in the Quadruple Alliance of 1840 and the humiliation of Louis Philippe's government. The new Anglo-Russian *entente* led in 1844 to a visit of the tsar to the English court. (*See* EASTERN QUESTION.)

When the storm of revolution burst over Europe in 1848, Nicholas remained entrenched behind the barriers of his own disciplined empire. But in 1849 he intervened in Hungary, at the entreaty of Francis Joseph, crushed the insurgent Hungarians and handed back their country as a free gift to the Habsburg king. Scarcely less valuable to Austria was the tsar's intervention in the quarrel between Austria and Prussia arising out of the Hesse inci-

dent and the general question of the hegemony of Germany. In October 1850 he had a meeting with Francis Joseph at Warsaw, at which Count Brandenburg and Prince Schwarzenberg were present. Prussia, he declared, must in the German question return to the basis of the treaties of 1815 and renew her *entente* with Austria; this was the only way of preserving the old friendship of Prussia and Russia. In face of the threat conveyed in this, the Prussian government decided to maintain peace (Nov. 2), Radowitz resigning as a protest. Thus Nicholas, who refused to believe in the perfidy ascribed by Frederick William to Austria, was the immediate cause of Prussia's humiliation at Olmütz.

Nicholas was soon to have personal experience of the perfidy of Austria in the troubles that led up to the Crimean War. Gratitude, in the tsar's opinon, should have made her neutral if not friendly. When the dispute arose with Napoleon III. over the guardianship of the Holy Places Nicholas could not believe that Christian powers would resent his claim to protect the Christian subjects of the sultan; he believed he could count on the friendship of Austria and Prussia; as for Great Britain, he would try to come to a frank understanding with her. The disillusionment that followed was profound. In October 1853 Nicholas met his brother monarchs of the triple alliance at Warsaw for the last time. In December, at the conference of Vienna, Austria had already passed over to the enemy. Prussia was wavering, neutral indeed, but joining the other powers in a guarantee of the integrity of Turkey (April 9, 1854), urging the tsar to accept the decisions of the Vienna conference, and on his refusal signing a defensive alliance with Austria (April 20, 1854), which included among the *casus belli* the incorporation in Russia of the banks of the Danube and a Russian march on Constantinople. Thus Nicholas, the pillar of the European alliance, found himself isolated and at war, or potentially at war, with all Europe. The invasion of the Crimea followed, and with it a fresh revelation of the corruption and demoralization of the Russian system. At the outset Nicholas had grimly remarked that "Generals January and February" would prove his best allies. These acted, however, impartially; and if thousands of British and French soldiers perished of cold and disease in the trenches before Sevastopol, the tracks leading from the centre of Russia into the Crimea were marked by the bones of Russian dead. The revelation of his failure broke the spirit of the Iron Tsar, and on March 2, 1855, he threw away the life which a little ordinary care would have saved.

BIBLIOGRAPHY.—All other works on Nicholas I. were more or less superseded by Professor Theodor Schiemann's *Geschichte Russlands unter Kaiser Nikolaus I.*, of which the 1st vol., *Kaiser Alexander I. und die Ergebnisse seiner Lebensarbeit*, was published at Berlin in 1904; the 2nd, carrying the history of Nicholas's reign down to the revolutions of 1830, in 1908. It is based on a large mass of unpublished material, and considerably modifies, *e.g.*, the account of the accession of Nicholas and of the Dekabrist conspiracy given in chapter xiii. of vol. x. of the *Cambridge Modern History*, and tells for the first time the secret history of the Russo-Turkish War of 1828–29. The great *Recueil des traités conclus par la Russie* of T. T. de Martens (St. Petersburg, 1874–1909) contains admirable introductory essays, based on the unpublished Russian archives, and giving much material for the study of Nicholas's character and policy. Many documents are published for the first time in Schiemann's work; some, from the archives of Count Nesselrode, are published in the *Lettres et papiers du Chancelier Comte de Nesselrode*, t. vi. *seq.* For other works *see* bibliographies attached to the chapters on Russia in vol. x. and xi. of the *Cambridge Modern History*. (W. A. P.; X.)

**NICHOLAS II.** (1868–1918), tsar of Russia, eldest son of Alexander III., was born at St. Petersburg (Leningrad), on May 18, 1868. An English tutor, Mr. Charles Heath, taught him excellent English, and inspired a love of sports and healthy exercise, while a Russian general, Danilovich, supervised his military training, but there was no attempt to provide him with the comprehensive knowledge required from one whom fate had destined to rule an immense empire. The only occasion which was offered to the young tsarevich to acquaint himself with the problems of the world was his journey to the Far East, so abruptly cut short in Kyoto by the sabre cut of a Japanese fanatic.

He wedded Princess Alix of Hesse at the deathbed of his father; at the festival of his coronation more than 3,000 people were crushed to death through the negligence of the officials who had to arrange a distribution of bounties; and during the coronation itself the imperial chain on his breast fell to the ground. Such impressions contributed strongly to inspire him with a mystic resignation, especially unsuitable for a monarch who had to lead the nation through times of great crisis at home and in foreign affairs. Nicholas II. followed in the footsteps of his father, seeking to preserve peace in foreign relations, and continuing in home affairs, though in a much milder form, the policy of centralization and Russification which had characterized the previous reign. His pacific tendencies were shown by his systematic opposition to all bellicose excitement, by his maintaining M. de Giers in the post of minister of foreign affairs, by his offering the post, on the death of that statesman, to M. de Staal, by his restraining France from dangerous adventures, and by initiating the Peace Conference at The Hague. To these ought perhaps to be added the transformation of the Franco-Russian *entente cordiale* into a formal alliance, since the alliance in question might be regarded as favourable to the preservation of the *status quo* in Europe. In the internal administration during the first years of his reign he introduced by his personal influence, and without any great change in the laws, a more humane spirit towards those of his subjects who did not belong by language and tradition to the dominant nationality, and who were not members of the Eastern Orthodox Church; but he disappointed the men of liberal views by giving it to be clearly understood soon after his accession that he had no intention of circumscribing and weakening the autocratic power by constitutional guarantees or parliamentary institutions. In spite, however, of his desire for peace he let his country drift into the disastrous war with Japan; and notwithstanding his sincere attachment to the principles of bureaucratic autocracy, it was he who granted the constitutional reforms which altered the whole political outlook in Russia. (*See* RUSSIA.)

Nicholas II.'s political outlook was dominated by a kind of theocratic or hieratic spirit; he was looking back for inspirations to the ideas and customs of the Muscovite period; he was induced to impersonate the figure of Alexis Mikhailovich, the father of the western reformer Peter the Great; in 1913 the tercentenary of Michail Feodorovich's accession to the throne after the "Great Troubles" was celebrated with much splendour and emphasis. Pilgrimages were performed with great devotion and circumstance.

The courtiers and bureaucrats in the immediate surroundings of the tsar, men like Sipiaguin, Nicolas Maklakov and Sabler, took advantage of these prepossessions in order to keep up a constant hostility against progressive reformers and western adaptations. But the most dangerous representative of mystic reaction was the tsar's consort, the Empress Alexandra Feodorovna. Of German descent on her father's side and of English descent on the side of her mother (Princess Alice, the daughter of Queen Victoria), she had received her education in England, but, on coming to Russia, she surrendered completely to the most extreme form of theocratic exaltation.

While her sister, the widow of the Grand Duke Sergius, killed by a terrorist, had devoted herself to a simple life at the head of a community of hospital nurses, Alexandra Feodorovna, highly strung and hysterical, sought providential guidance in the midst of unbalanced women and false prophets like the French medium Philippe and the famous Rasputin. The latter obtained a hold on her through the hypnotising influence he exercised over her son, the tsarevich Alexis, a boy affected by the rare disease of hereditary haemophilia. But the crafty peasant had contrived to obtain gradually a psychical domination over the empress and her friends which made it possible for him to distribute political favours and to have his say in the most important affairs of state. The empress considered him as the God-sent representative of the Russian nation, of that mass of peasants which, as she was convinced, was the firm mainstay of autocracy in Russia. And in the later years of Nicholas II.'s reign, the years of great trial and danger, Alexandra Feodorovna stepped in more and more often to direct the tsar's choice of his ministers and to prevent him from making concessions to the spirit of the time. For the circumstances which brought Russia into the World War *see* RUSSIA: *History*.

The suspicion that Alexandra Feodorovna was secretly favour-

ing the cause of Germany and revealing military secrets to the Kaiser—a suspicion often expressed abroad and popularly accepted in Russia—is, according to most competent witnesses, devoid of any basis in fact. The empress was intensely patriotic in her own way, opposed to the aggressive policy of the Hohenzollerns, and never advocated a treacherous compromise with the Central Powers. A former lady-in-waiting, Princess Vassiltchikov, who towards the close of 1916 brought the project of such a compromise from Germany, was promptly ordered out of St. Petersburg (Leningrad). Nevertheless, Alexandra Feodorovna proved to be the evil genius of the Russian dynasty, by her blind and obstinate support of reactionary tendencies and of worthless adventurers, at a time when a wise and firm policy of reform was more needed than ever. All the better representatives of the dynasty—the Dowager Empress, the Grand Duke Nicholas Mikhailovich, the Grand Duchess Victoria—warned her of the imminent danger of that régime of fleeting ministerial shadows which set in after the catastrophe of the War Office in 1915.

The emperor remained passive as commander-in-chief at headquarters while the Empress Alexandra spurned all advice with contempt and continued to pull the strings by dismissing men like Sazonov and Palivanov, and appointing timeservers like Sturmer, Protopopov or Galitzin. The assassination of Rasputin did not frighten but enraged her; she erected a kind of shrine over the body of the prophet and sent the Grand Duke Dmitry Pavlovich, who had taken part in the murder, into exile. Her power was broken only by the revolution.

The thread of the Romanov dynasty was cut without much resistance. When in March 1917 the emperor received at headquarters a telegram from the president of the Duma informing him of the events of St. Petersburg and demanding his abdication, and Gutchkov and Shulgin arrived with the act of abdication itself, he submitted with fatalistic composure. He refused to give up his crown to his son with Grand Duke Michael as regent, because he did not wish to trust the boy to the danger of a political storm; and his abdication was made in favour of the Grand Duke Michael, who in his turn refused to accept the crown unless it was tendered to him by the will of the people. The last chance of a régime of constitutional monarchy was cut short. Proposals were made on behalf of the British Government to allow Nicholas II. and his family to take up their abode in England; but the Provisional Government in St. Petersburg did not accede to that plan. Kerensky and Milyukov declared that the imperial family were in safety in Russia. Later on the emperor submitted meekly to be transferred from Pskov to Tsarskoe Selo and thence to Tobolsk, where he was interned with his family—his wife, his son and his four daughters—for months.

The end came with the rumour of a Czechoslovak advance on the Ural in 1918. The Soviet Commissaries in Moscow urged the greatest vigilance on the Ekaterinburg commissar, Yourkovsky, and the commander of the guard, Medvediev, without indicating any means for removing the prisoners from the threatened zone. The communists of Ekaterinburg held a secret meeting in which they decided to put the tsar and his family to death, and sent an order to Yourkovsky. The latter demanded that it should be duly signed, and 16 signatures were affixed to it. On the night of July 16 Yourkovsky roused the prisoners and conducted them into a cellar of the house. Medvediev, with the Lettish guards, entered the room while some Russian soldiers were looking in. Yourkovsky placed the doomed persons at one end of the room and read the sentence hurriedly by torchlight. The tsar stepped forward and said something indistinctly, when Yourkovsky drew his revolver and shot him in the head. A general fusillade followed. Later the corpses were removed and destroyed by fire. Although the belief is general that all members of the family perished, a claim arose in 1928 by Mrs. Anastasia Tschaikovsky that she was the Grand Duchess Anastasia, the tsar's youngest daughter, who had been rescued from the massacre by two soviet soldiers. (*See* RUSSIA.)

BIBLIOGRAPHY.—C. Rivet, *Le dernier Romanof* (1917); P. Gilliard, *Le Tragique Destin de Nicolas II. et de sa famille. Treize années à la cour de Russie, Peterhof, septembre 1905–Ekaterinburg, mai 1918* (1921; Eng. trans. 1921); *The Kaiser's Letters to the Tsar* (1921); *Letters from the Tsaritsa to the Tsar 1914–16* (1923); and further letters published in *The Manchester Guardian,* Jan. 9 and Feb. 7, 1924: *Journal intime de Nicholas II.,* trans. by A. Pierre (1925).

**NICHOLAS I.** (1841–1921), king of Montenegro, was born at Njeguš, the ancient home of the Njeguš-Petrović dynasty, on Sept. 1, 1841. His father, Mirko Petrović, was brother of the Vladika Danilo II. who had declined episcopal office, married and declared the succession hereditary in the direct male line. As, however, Danilo II. left no male issue, and Mirko declined the succession, Nicholas became heir to the throne of Montenegro. He was educated in Trieste and at the Academy of Louis le Grand in Paris, returning to Montenegro on the assassination of his uncle (Aug. 13, 1860). He took part in the campaign against Turkey of 1862, which, after Austria's intervention, was followed by a prolonged peace. In 1868 he travelled to St. Petersburg (Leningrad) to meet the tsar Alexander II., who received him with favour, and afterwards regularly supplied him with subventions of arms and money, referring to him on a memorable occasion as his "only friend." During the Near Eastern crisis of 1876 (*see* EASTERN QUESTION), Nicholas declared war on the Porte, and winning brilliant successes in this and the following wars at Vučidd, Podgorica and Nikćić, captured Antivari and Dulcigno. The Congress of Berlin (*q.v.*) brought Montenegro formal recognition as a sovereign State and doubled her area, besides giving her an outlet on the sea at Antivari. Nicholas now entered on a long period of peace largely filled with intrigues with and against his son-in-law, Peter, later King Peter I. of Serbia (*q.v.*) regarding a possible later Yugoslav state to comprise both Serbia and Montenegro. On Dec. 19, 1900, Nicholas assumed the title of Royal Highness.

In 1905 he was forced by public opinion, which was revolting against his despotic methods, to grant a constitution. He was at once involved in quarrels with his political opponents, culminating in the scandalous but obscure "Cetinje bomb plot" of 1905. On Aug. 28, 1910, encouraged by Austria, who helped to estrange him further from Serbia, Nicholas assumed the title of king. In the Balkan Wars (*q.v.*) he was the first to declare war on Turkey, but although these wars gave Montenegro an accession of territory, the dynasty lost prestige, its unpopularity and with it the movement for the union of Serbia with Montenegro, increased. In the World War Montenegro threw in her lot with Serbia; Nicholas, however, maintained touch with Austria, from whom he begged a separate peace (Jan. 13, 1916). On Jan. 19, Nicholas fled to Italy and France. The breach widened between him and his people, and the "Great National Assembly" on Nov. 26, 1918, proclaimed his deposition and that of his dynasty. The old ex-king passed the remainder of his days in Italy. He died at Antibes on March 1, 1921.

A rude but often benevolent despot of the fighting type, Nicholas was also a poet of talent. His works include *Balkanska Tsaritsa* and *Knyaz Arvaniti* (dramas); *Haïdana, Potini Abenserage* and *Pesnik i Vila* (poems), *Skuplijene Pesme* and *Nova Kola* (songs). In Nov. 1860, Nicholas married Milena (1847–1923) daughter of the *voivode* Petar Vukotić. On the death of Nicholas, his eldest son Danilo was proclaimed by the small monarchist party king of Montenegro (Mar. 1, 1921), but abdicated on Mar. 7, 1921, in favour of his nephew Michael, eldest son of Prince Mirko (b. Sept. 1, 1908).

**NICHOLAS** (1856–1929), Russian Grand Duke and soldier. Nikolai Nikolaievich was born on Nov. 6, 1856, the grandson of the emperor Nicholas I. and first cousin of the emperor Alexander III. Educated at the school of military engineers, he received his commission in 1872, and in the following year, at the early age of 16, entered the military academy. In the war of 1877–78, as a general staff officer for special service, he joined the staff of his father, the very popular Grand Duke Nikolai Nikolaievich (Senr.), who had been appointed commander-in-chief of the Russian forces. He distinguished himself at the crossing of the Danube at Zimnicea on April 15, 1877, and in the attack on the Shipka.

After the war the Grand Duke joined the Guard Hussar Regiment, in which the emperor Nicholas afterwards served, and passed through every stage as officer till appointed commander in 1884—a position he occupied for 6½ years. He then commanded in succession a brigade and a division, and in 1895 was appointed

inspector-general of cavalry. He held this post for ten years, a period which is regarded as a bright epoch in the history of the Russian cavalry, for he carried through fundamental reforms in training and in the organization of the cavalry schools, of the cavalry reserves and of the remount service.

In 1905 Nicholas was appointed commander-in-chief of the St. Petersburg military district, a post he held till the outbreak of the World War in Aug. 1914. Here, as elsewhere, he gave proof of his zeal for efficiency. Setting himself the task of instilling the lessons of the Japanese war, he encouraged musketry and work in extended order, but at the same time allowed no slackness in ceremonial. To help him in his work he called from the Far East men like Generals Ivanov, Lesh and Lechitski, who were of comparatively humble origin but had made their reputation in the field. The appointment of such men to high command in the Imperial Guard was characterized in his diary at the time by another grand duke as "revolutionary," but the men selected justified their choice in the World War.

In the same year (1905) as he was appointed commander-in-chief of the St. Petersburg military district, Nikolai Nikolaievich became the first president of the newly created council of national defence, and he held this position till 1908, when the council was abolished. During this time the emperor seems to have hesitated between the final adoption of a military system analogous to that of Germany, under which the chief of the general staff, as well as the minister of war, should have the right of access and of direct report to the sovereign, and of the system in vogue in countries with a constitutional Government, under which that right was confined to the minister of war. On the council the Grand Duke worked in close co-operation with General Palitsin, who, in 1908, on the emperor's decision in favour of the latter system, gave way to General Sukhomlinov as chief of the general staff, the latter, in the following year, replacing General Rediger as minister of war.

From 1908 to 1914 Nicholas took no part in the strategical preparation for the war, the work being delegated by the emperor to General Sukhomlinov and his nominees on the general staff. At the outbreak of war the emperor first intended to take command himself, and actually appointed the grand duke Commander-in-chief of the VI. (Reserve) Army at St. Petersburg (Leningrad). It was only on the evening of Aug. 1, the day of Germany's declaration of war, that he yielded to the entreaties of his ministers and decided to hand over the supreme command to the grand duke.

**Services During the War.**—The commander-in-chief was responsible for carrying out a plan which he had no hand in drawing up, a plan which was dependent on promises previously made, without his cognisance, to the French general staff. He had to work in accordance with the "Regulations for the Direction of the Army in the Field," a new edition of which had been issued on the very eve of the war, handing over much power to the two group commanders.

The plan of the Russian general staff consisted of the invasion of East Prussia by a right group (I. and II. Armies), while a left group (IV., V., III. and VIII. Armies) operated against the Austrians in Galicia, and a centre group (IX. and X. Armies) assembled at Warsaw to advance on Posen. It was owing to the decision of the grand duke that this centre group was broken up, the X. Army being sent north to fill the gap left by the failure in East Prussia, and the IX. Army sent south to overwhelm the Austrians in southern Poland.

When the Germans came to the rescue of their discomfited ally by advancing in Oct. 1914 to the outskirts of Warsaw, the transfer of the Russian armies from left to right in rear of the Vistula, and the concentration of superior forces on the enemy's left or northern flank which compelled his retreat, were masterly movements. If the next German advance, culminating in the operation of Lódz owing to mistakes by Russian army commanders, definitely removed all possibility of an invasion of Posen, the Russians held on through the winter of 1914–15 to the line of the Narev-Vistula-San-Carpathians, and were only compelled by lack of munitions in the spring and summer of 1915 to retreat to a line that they held substantially through 1916–17.

There was no demand from the fighting men at the front for the change at G.H.Q. which occurred on Aug. 21, 1915, when the emperor announced that he would assume the supreme command. It is said that Rasputin had prophesied that the Russian armies would continue to be defeated till the emperor placed himself at their head. Certainly the impostor had no reason to love the Grand Duke Nicholas. A story repeated among the soldiers relates that he had applied to the commander-in-chief for permission to come to the front "to bless the troops," and the latter had telegraphed in reply two Russian words which being translated run—"Come, I shall hang you."

The grand duke was appointed viceroy and commander-in-chief in the Caucasus. Up to that time the brunt of the fighting against Turkey had been borne by the British in Gallipoli, the Sinai Peninsula and Mesopotamia. The advent of the new commander put new life into the Russian forces. He pushed forward an expeditionary force under General Baratov through Enzeli and Hamadan to screen Persia from further German penetration, and to establish touch with the British troops in Mesopotamia. He collected guns and stores, and raised and trained efficient troops, and, in spite of immense difficulties in supply, ably assisted by Generals Yudenich and Prjvalski, occupied in three successful offensives all Armenia, including the fortress of Erzerum, the port of Trebizond and the town of Erzinjan.

The revolution of March 12, 1917, found the grand duke still in the Caucasus. The emperor's last official act was to nominate him to be once more supreme commander-in-chief. His journey from the Caucasian headquarters at Tiflis to the headquarters at Mogilev was in the nature of a triumphal procession, patriotic demonstrations and crowds of people greeting him at every station on the way. Twenty-four hours after his arrival at Mogilev he received a telegram from Prince Lvov, the chief of the provisional Government, cancelling his appointment. The next two years the grand duke spent in the Crimea, taking no part in politics. At last, in March 1919, he left Russian soil on the British cruiser "Marlborough," and lived quietly near Paris. He died in Jan. 1929. (A. W. F. K.)

**NICHOLAS, SIR EDWARD** (1593–1669), English statesman, was born on April 4, 1593, of a Wiltshire family. He was educated at Salisbury grammar school, Winchester college and Queen's college, Oxford. After studying law at the Middle Temple, Nicholas became secretary to Lord Zouch, warden and admiral of the Cinque ports, in 1618, and continued in a similar employment under the duke of Buckingham. In 1625 he became secretary to the Admiralty; then extra clerk of the privy council with duties relating to Admiralty business, and from 1635 to 1641 he was one of the clerks in ordinary to the council. In this situation Nicholas was concerned with the levy of ship-money. He had Charles's confidence, became a privy councillor and a secretary of State, and attended the king at Oxford, and carried out the business of the treaty of Uxbridge. Nicholas arranged the details of the king's surrender to the Scots, though he does not appear to have approved of the step; and he arranged the capitulation of Oxford. He went to France, and after the king's death he remained on the Continent concerting measures on behalf of the exiled royal family, but he never had any real influence with Charles II. After the Restoration he lived in retirement.

See *The Nicholas Papers*, ed. by G. F. Warner (Camden Society, 1886–97), containing Nicholas's correspondence and some autobiographical memoranda. Private correspondence between Nicholas and Charles I. will be found in the *Memoirs of John Evelyn*, ed. by W. Bray (1827); *The Egerton Mss.* and the *Ormonde Papers* contain many references to Nicholas.

**NICHOLAS, NORTHERN** or **LENIN LAND** lies in the Arctic sea, about 30 m. N. of Cape Chelyuskin, extending in a north-easterly direction from 77° 50′ N., 99° E. to beyond 81° N. The small Alexis (Little Taimir) and Starokadomski islands lie at the eastern end of Alexis strait, which separates Nicholas Land from the mainland. This land was discovered in 1913 by the Russian hydrographical expedition in the "Taimir" and "Vaigach" under B. A. Vilkitski. He took possession for Russia and charted the eastern side. In the following year he returned and

charted the southern coast. The northern and western sides are unknown. The east coast is much indented and a deep gulf or strait occurs in about 79° N. In the south there is a low plain covered with tundra, but on the east the land is lofty (1,500 ft.) and flat-topped with large valley glaciers. Both sedimentary and volcanic rocks occur, but details are lacking. Water of over 100 fathoms depth lies close to the eastern side.

*See* papers in *Petermann's Mitteilungen,* 60 (1914); *Geographical Journal* (Dec. 1919), and *Geographical Review* (July 1925).

(R. N. R. B.)

**NICHOLS, JOHN** (1745–1826), English printer and author, was born at Islington on Feb. 2, 1745. He edited the *Gentleman's Magazine* from 1778 till his death, and in that periodical, and in his numerous volumes of *Anecdotes and Illustrations,* he made invaluable contributions to the personal history of English men of letters in the 18th century. He was apprenticed in 1757 to "the learned printer," William Bowyer, who took him into partnership in 1766. On the death of his friend and master in 1777 Nichols published a brief memoir, which afterwards grew into the *Anecdotes of William Bowyer and his Literary Friends* (1782). *The Literary Anecdotes of the 18th Century* (1812–1815), into which the original work was expanded, forms only a small part of Nichols's production. It was followed by the *Illustrations of the Literary History of the 18th Century, consisting of Authentic Memoirs and Original Letters of Eminent Persons,* which was begun in 1817 and completed by his son John Bowyer Nichols (1779–1863) in 1858. He died on Nov. 26, 1826.

Nichols's other works include: A *Collection of Royal and Noble Wills* (1780); *Select Collection of Miscellaneous Poems* (1782), with subsequent additions, in which he was helped by Joseph Warton and by Bishops Percy and Lowth; *Bibliotheca Topographica Britannica* (1780–1790); with Richard Gough, *The Progresses and Public Processions of Queen Elizabeth* (1788); and the *History and Antiquities of the Town and County of Leicester* (8 vols., 1795–1815).

A full memoir of John Nichols by Alexander Chalmers is contained in the *Illustrations,* and a bibliography in the *Anecdotes* (vol. vi.) is supplemented in the later work. *See* also R. C. Nichols, *Memoirs of J. G. Nichols* (1874).

**NICHOLS, ROBERT MALISE BOWYER** (1893-1944), English poet and writer, the son of J. B. B. Nichols, also a poet, was born on Sept. 6, 1893, and educated at Winchester and at Trinity college, Oxford. In 1914 he obtained a commission in the Royal Field Artillery, and served in France until 1916. From 1918 to 1919 he was engaged on propaganda work in the United States for the Ministry of Information. From 1921 to 1924 he was professor of English literature at the Imperial college, Tokyo. In addition to his published work, he contributed to *The London Mercury* and other periodicals. Nichols died Dec. 17, 1944.

His published work includes *Invocation,* poems (1916); *Ardours and Endurances* (1917); *The Budded Branch* (1918); *Aurelia* (1920); *The Smile of the Sphinx* (1920); *Guilty Souls,* drama (1922); *Wings over Europe,* drama, with M. Browne (1929); *Fisbo,* a satirical poem (1934); *Such was my Singing,* poems (1942).

**NICHOLSON, JOHN** (1822–1857), Anglo-Indian soldier and administrator, son of Alexander Nicholson, a north of Ireland physician, was born on Dec. 11, 1822, and educated at Dungannon College. He was presented with a cadetship in the Bengal infantry in 1839 by his uncle Sir James Hogg, and served in the first Afghan War of 1839–42; he distinguished himself in the defence of Ghazni, and was one of the prisoners who were carried to Bamian and escaped by bribing the guard upon General Pollock's successful advance. In Afghanistan Nicholson first met Sir Henry Lawrence, who got him the appointment of political officer in Kashmir and subsequently on the Punjab frontier. In 1847 he was given charge of the Sind Sagar district, and did much to pacify the country after the first Sikh War. On the seizure of Multan by Mulraj, he rendered great service in securing the country from Attock, and was wounded in an attack upon a tower in the Margalla Pass, where a monument was subsequently erected to his memory. On the outbreak of the second Sikh War he was appointed political officer to Lord Gough's force, when he rendered great service in the collection of intelligence and in furnishing supplies and boats.

On the annexation of the Punjab he was appointed deputy commissioner of Bannu. There he became a kind of legendary hero, and many tales are told of his stern justice, his tireless activity and his commanding personality. In the course of five years he reduced the most turbulent district on the frontier to such a state of quietude that no crime was committed or even attempted during his last year of office, a condition of things never known before or since. He would go personally to the scene of a crime or a legal dispute and decide the question on the spot. Every man in his district, whether mountain tribesman or policeman, felt that he was controlled by a master hand, and the natives said of him that "the tramp of his war-horse could be heard from Attock to the Khyber." It is little wonder that the natives worshipped him as a god under the title of Nikalsain.

When the Mutiny broke out in May 1857 Nicholson did more than any other single man to keep the Punjab loyal and to bring about the fall of Delhi. When the news of the rising at Meerut arrived, Nicholson was with Edwardes at Peshawar, and they took immediate steps to disarm the doubtful regiments in that cantonment. Together they opposed John Lawrence's proposal to abandon Peshawar, in order to concentrate all their strength on the siege of Delhi. In June Nicholson was appointed to the command of a movable column, with which he again disarmed two doubtful regiments at Phillaur. In July he made a forced march of 41 m. in a single day in the terrific heat of the Punjab summer, in order to intercept the mutineers from Sialkot, who were marching upon Delhi. He caught them on the banks of the Ravi near Gurdaspur, and utterly destroyed them, thus successfully achieving what hardly any other man would have attempted. In August he had pacified the Punjab and was free to reinforce General Wilson on the Ridge before Delhi.

Before Nicholson's arrival the counsels of the commanders before Delhi, like those at Meerut, suffered from irresolution and timidity. As General Wilson's health declined, his caution became excessive, and Nicholson was specially sent by Sir John Lawrence to put more spirit into the attack. His first exploit after his arrival was the victory of Najafgarh, which he won over the rebels who were attempting to intercept the British siege train from Ferozepore. After marching through a flooded country scarcely practicable for his guns, Nicholson, with a force of 2,500 troops, defeated 6,000 disciplined sepoys after an hour's fighting, and thenceforth put an end to all attempts of the enemy to get in the rear of the British position on the Ridge. Nicholson grew fiercely impatient of General Wilson's procrastination, and at one time was thinking of appealing to the army to set Wilson aside and elect a successor; but at last, on Sept. 13, he forced Wilson to make up his mind to the assault, and he himself was chosen to lead the attacking column. On the morning of the 14th, he led his column, 1,000 strong, in the attack on the Kashmir gate, and successfully entered the streets of Delhi. But in trying to clear the ramparts as far as the Lahore Gate, he undertook a task beyond the powers of his wearied troops. In encouraging them as they hesitated, he turned his back on the enemy and was shot in the back. The wound was mortal; he died on Sept. 23.

His best epitaph is found in the words of Sir John Lawrence's Mutiny Report:—

> Brigadier-General John Nicholson is now beyond human praise and human reward. But so long as British rule shall endure in India, his fame can never perish. He seems especially to have been raised up for this juncture. He crowned a bright, though brief, career by dying of the wound he received in the moment of victory at Delhi. The Chief Commissioner does not hesitate to affirm that without John Nicholson Delhi could not have fallen

*See* J. L. Trotter, *Life of John Nicholson* (1904); Sir John Kaye, *Lives of Indian Officers* (1889); Bosworth Smith, *Life of Lord Lawrence* (1883); Lady Edwardes, *Memorials of Sir Herbert Edwardes* (1886); and S. S. Thorburn, *Bannu* (1876).

**NICHOLSON, JOSEPH SHIELD** (1850–1927), British economist, son of an Independent minister, was born on Nov. 9, 1850 at Wrawby in Lincolnshire, and educated at Edinburgh university and Trinity college, Cambridge, where he won the Cobden Prize in 1877 (the first award), and again in 1880. After studying at Heidelberg and at London university, he became a private tutor at Cambridge.

In 1880 he went to Edinburgh university as professor of political economy. He wrote more than twenty volumes on economics, of which the chief are: *The Silver Question* (1886); *Money and Monetary Problems* (1888); *Bankers' Money* (1903); *The Tariff Question* (1903); *The History of the English Corn Laws* (1903); *Project of Empire* (1909); and *Principles of Political Economy* (3 vols., 1893, 1897, 1901). In all his economic writings he advocated the principles of Adam Smith, of whom he was a fervent disciple. He resigned his chair in 1925, and died in Edinburgh on May 12, 1927.

**NICHOLSON, MEREDITH** (1866– ), American writer, was born at Crawfordsville (Ind.), Dec. 9, 1866, and educated in the public schools of Indianapolis. He was a reporter and later editor on the Indianapolis *News*, and was U.S. minister to Paraguay (1933–34), Venezuela (1935–38), and Nicaragua (1938– ).

He has published the following novels: *The Main Chance* (1903), *The House of a Thousand Candles* (1905), *The Port of Missing Men* (1907), *The Little Brown Jug at Kildare* (1908), *The Lords of High Decision* (1909), *A Hoosier Chronicle* (1912), *The Poet* (1914), *And They Lived Happily Ever After* (1925), *The Cavalier of Tennessee* (1928), *Poems* (1906); and several historical and critical volumes, including *The Hoosiers* (1900) and *The Valley of Democracy* (1918).

**NICHOLSON, WILLIAM** (1753–1815), English writer on natural philosophy, was born in London in 1753. Nicholson occupied himself with writing and lecturing on natural philosophy, including chemistry, and with the construction of various machines and the first voltaic pile in England. In 1797 the *Journal of Natural Philosophy, Chemistry and the Arts*, generally known as *Nicholson's Journal*, the earliest work of the kind in Great Britain, was begun; it was carried on till 1814. He died in London on May 21, 1815.

Besides contributions to the *Philosophical Transactions*, Nicholson wrote translations of Fourcroy's *Chemistry* (1787) and Chaptal's *Chemistry* (1788), *First Principles of Chemistry* (1788) and a *Chemical Dictionary* (1795); he also edited the *British Encyclopaedia, or Dictionary of Arts and Sciences* (6 vols., 8vo, London, 1809).

**NICHOLSON, SIR WILLIAM** (1872– ), English painter, engraver and illustrator, born Newark-on-Trent in 1872. He first became known to the wider public by his illustrative work in *An Alphabet, An Almanack of Sports* (with Rudyard Kipling), and *London Types* (with W. E. Henley) in 1898; by the "Portrait of Queen Victoria," a delightful coloured wood engraving, the *Velveteen Rabbit* with its clever end-papers, and by the whole series of quaint and witty books and posters which he produced in collaboration with his brother-in-law, James Pryde (as "the Beggarstaff Brothers").

His more serious work is found in his painting, whether dealing with a portrait, a landscape, or still-life. Among his paintings in oil are "The Black Pansy," "The Landlord" (Manchester City Art gallery), "The Girl with the Tattered Gloves," "Fish," and the portraits of "Marie Tempest," "Ursula Lutyens" and "The Master of Jesus." Other works are the "Square Book of Animals" and the "Buildings of Oxford."

Nicholson was knighted in 1936.

*See* monograph in *Contemporary British Artists* (1923).

**NICIAS** (d. 414 B.C.), a soldier and statesman in ancient Athens, inherited from his father Niceratus a considerable fortune invested mainly in the silver mines of Laurium. Evidence of his wealth is found in the fact that he had no less than 1,000 slaves whom he hired out. He was several times colleague with Pericles in the strategia, and on Pericles' death became the leading advocate of the Periclean policy of pinpricks (ἐπιτειχισμοί) and concentration on the Thraceward region against the offensive policy of the democrats under Cleon. At the amphibious tactics of the ἐπιτειχισμός he was unsurpassed. Having been largely responsible for the "Peace of Nicias" (421) he appears in the rather obscure history of the following years as the leader of the peace party, in opposition to Alcibiades. In 415 much against his will, he was appointed leader of the Sicilian expedition with Alcibiades and Lamachus, and the recall of Alcibiades, followed by the death of Lamachus, left him in sole command. Demosthenes came out with reinforcements early in 413, and took charge for a brief space, but at the end the main responsibility for the delay, and so perhaps for the disaster, rests with Nicias. He was put to death during that year by the Syracusans.

Besides Thucydides *see* Plutarch's *Nicias* and Diod, xii. 83; also GREECE, and PELOPONNESIAN WAR.

**NICKEL** (symbol Ni, atomic number 28, atomic weight 58·69, isotopes 58 and 60), a greyish-white metallic element of considerable malleability and ductility. It has been known from the earliest times, being employed by the Chinese in the form of an alloy called pakfong. It was first isolated in an impure condition in 1751 by A. F. Cronstedt from nicolite, and his results were afterwards confirmed by T. O. Bergman in 1775 (*De niccolo, opusc.* 2, p. 231; 3, p. 459; 4, p. 374). It occurs in the uncombined condition and alloyed with iron in meteorites; as sulphide in millerite and nickel blende, as arsenide in kupfernickel, and frequently in combination with arsenic and antimony in the form of complex sulphides. It is found in considerable quantities in New Caledonia in the form of a hydrated silicate of nickel and magnesia approximating to the constitution $(NiO, MgO)SiO_2 \cdot nH_2O$, and in Canada in the form of nickeliferous pyrrhotines, which consist of sulphides of iron associated with sulphides of nickel and copper, embedded in a matrix of gneiss; these form the chief sources of nickel. When the former is used it is roasted with calcium sulphate or alkali waste to form a matte which is then blown in a Bessemer converter or heated in a reverberatory furnace with a siliceous flux with the object of forming a rich nickel sulphide. This sulphide is then by further heating converted into the oxide and finally reduced to the state of metal by ignition with carbon in clay crucibles. The process adopted for the Canadian ores, which are poor in copper and nickel, consists in a preliminary roasting in heaps and smelting in a blast furnace in order to obtain a matte, which is then further smelted with a siliceous flux for a rich matte. This matte is then mixed with coke and salt-cake and melted down in an open hearth furnace, or in a Bessemer converter with a silicate lining.

In the Mond process, this refined matte, which contains copper, nickel and iron sulphides, is roasted to remove the sulphur, and extracted by sulphuric acid, whereby the iron and copper contents are diminished and the nickel content is relatively increased. Reduction by "water-gas" at 300° C. then leaves nickel and copper as metals and iron oxide unaffected; at the same time, the water-gas is largely deprived of its hydrogen and becomes relatively richer in carbon monoxide, the content of which is raised to 80% by passage through a retort of hot coke. This enriched gas is then passed over the metallic mixture at about 80° C., whereby the nickel is "volatilised" as the carbonyl $Ni(CO)_4$; the product is passed through towers at 180–200° C., where it decomposes and is deposited (often on pellets of pure nickel), the resulting carbon monoxide being used again. The nickel so obtained is of a high degree of purity.

The following tables show the output of nickel from Canada and the shipments of nickel ore from New Caledonia in recent years as metric tons:—

| | Canada | New Caledonia |
|---|---|---|
| 1913 | 22,539 | 164,406 |
| 1918 | 41,960 | 90,650 |
| 1923 | 28,329 | 3,520 |
| 1925 | | 4,447 |
| 1926 | 29,817 | |

The metal may also be obtained on the small scale by the reduction of the oxide by hydrogen or by carbon, by ignition of the oxalate or of nickel ammonium oxalate by reduction of the chloride in a current of hydrogen (E. Péligot), by electrolysis of nickel ammonium sulphate, as in the process of nickel plating.

Its specific gravity varies according to the method employed for its preparation, being about 8·8. It melts at 1,452° C. Its specific heat increases with rise of temperature, the mean value from 15° to 100° C. being 0·1084. It is magnetic, but loses its magnetism when heated, the loss being complete at about 340–350° C. Nickel occludes hydrogen readily, is attacked by the halogen elements, and oxidizes easily when heated in air. In the massive state it is unacted upon by dry air, but if moistened with acidified water, oxidation takes place slowly. When obtained by reduction

processes at as low a temperature as possible the finely divided metal so formed is pyrophoric, *i.e.*, it may ignite spontaneously in the air. It decomposes water at a red heat. Sheet nickel is passive to fairly concentrated nitric acid, and the metal remains passive even when heated to redness in a current of hydrogen. Nickel is largely used as a catalyst for the reduction of organic compounds by hydrogen—a process first used by P. Sabatier and J. B. Senderens (*see* HYDROGEN and HYDROGENATION).

It rapidly oxidizes when fused with caustic soda, but is scarcely acted upon by caustic potash. Hydrochloric and sulphuric acids are almost without action on the metal, but it dissolves readily in dilute nitric acid. Nickel salts are antiseptic; they arrest fermentation and stop the growth of plants. Nickel carbonyl, however, is extremely poisonous. On the toxic properties of nickel salts *see* A. Riche and Laborde, *Jour. Pharm. Chem.*, 1888 (5), 17, pp. 1, 59, 97.

Nickel is used for the manufacture of domestic utensils, for crucibles, coinage, plating and for the preparation of various alloys, such as German silver, nickel steels such as invar (nickel, 35·7%; steel, 64·3%), which has a negligible coefficient of thermal expansion, and constantan (nickel, 45%; copper, 55%), which has a negligible thermal coefficient of electrical resistance.

## COMPOUNDS

**Nickel Oxides.**—Several oxides of nickel are known. The *monoxide,* NiO, occurs naturally as bunsenite, and is obtained artificially when nickel hydroxide, carbonate, nitrate or sulphate is heated. It may also be prepared by the action of nickel on water, by the reduction of the oxide $Ni_2O_3$ with hydrogen at about 200° C., or by heating nickel chloride with sodium carbonate and extracting the fused mass with water. It is a green powder which becomes yellow when heated. It dissociates at a red heat, and is readily reduced to the metal when heated with carbon or in a current of hydrogen. It is readily soluble in acids, forming salts. The *hydroxide,* $Ni(OH)_2$, is obtained in the form of a greenish amorphous powder when nickel salts are precipitated by the caustic alkalis. It is readily soluble in acids and in an aqueous solution of ammonia. Nickel sesquioxide, $Ni_2O_3$, is formed when the nitrate is decomposed by heat at the lowest possible temperature. It is a black powder, the composition of which is never quite definite, but approximates to the formula given above. When heated with oxy-acids it dissolves, with evolution of oxygen, and with hydrochloric acid it evolves chlorine. Numerous hydrated forms of the oxide have been described. A *peroxide,* $NiO_2$, has been obtained as a salt of barium, $BaO{\cdot}2NiO_2$, by heating the monoxide with anhydrous baryta in the electric furnace. G. Pellini and D. Meneghini obtained a greyish green powder by adding an alcoholic solution of potassium hydrate to nickel chloride and hydrogenperoxide at −50°. It has all the reactions of hydrogenperoxide and S. Tanatar regards it as $NiO{\cdot}H_2O_2$. An oxide, $Ni_3O_4$, has been obtained by heating nickel chloride in a current of moist oxygen at about 400° C., or by heating the sesquioxide in hydrogen at 190° C. The former method yields greyish, metallic-looking, microscopic crystals, the latter a grey amorphous powder. A hydrated form, $Ni_3O_4{,}2H_2O$, is obtained when the monoxide is fused with sodium peroxide at a red heat, and the fused mass extracted with water.

**Nickel Salts.**—Only one series of salts is known, namely those corresponding to the monoxide. In the anhydrous state they are usually of a yellow colour, whilst in the hydrated condition they are green. They may be recognized by the brownish violet colour they impart to a borax bead when heated in an oxidizing flame. The caustic alkalis added to solutions of nickel salts give a pale green precipitate of the hydroxide, insoluble in excess of the precipitant. This latter reaction is hindered by the presence of many organic acids (tartaric acid, citric acid, etc.). Potassium cyanide gives a greenish yellow precipitate of nickel cyanide, $Ni(CN)_2$, soluble in excess of potassium cyanide, forming a double salt, $Ni(CN)_2{\cdot}KCN$, which remains unaltered when boiled with excess of potassium cyanide in presence of air (*cf.* COBALT). Ammonium sulphide precipitates black nickel sulphide, which is somewhat soluble in excess of the precipitate (especially if yellow ammonium sulphide be used), forming a dark-coloured solution. Ammonium hydroxide gives a green precipitate of the hydroxide, soluble in excess of ammonia, forming a blue solution. Numerous methods have been devised for the separation of nickel and cobalt, the more important of which are:—the cobaltinitrite method in which the cobalt is precipitated in the presence of acetic acid by means of potassium nitrite (the alkaline earth metals must not be present); the cyanide method, in which the two metals are precipitated by excess of potassium cyanide in alkaline solution, bromine being afterwards added and the solution warmed, when the nickel is precipitated; the dimethyl glyoxime method, whereby nickel is precipitated as $Ni(C_4H_7O_2N_2)_2$, a scarlet flocculent compound stable at 120° C. Similar separations are based on the insoluble cobalt compound of nitroso-β-naphthol, $C_{10}H_6(NO){\cdot}OH$, and on the insoluble compound $Ni(C_2H_5ON_4)_2{\cdot}2H_2O$, formed by nickel with dicyanodi-amidine.

**Nickel Fluoride,** $NiF_2$, obtained by the action of hydrofluoric acid on nickel chloride, crystallizes in yellowish green prisms which volatilise above 1,000° C. It is difficultly soluble in water, and combines with the alkaline fluorides to form double salts. *Nickel chloride,* $NiCl_2$, is obtained in the anhydrous condition by heating the hydrated salt to 140° C., or by gently heating the finely divided metal in a current of chlorine. It readily sublimes when heated in a current of chlorine, forming golden yellow scales. It is easily reduced when heated in hydrogen. It forms crystalline compounds with ammonia and the organic bases. It is soluble in alcohol and in water. Three hydrated forms are known, viz., a mono-, di- and hexa-hydrate, the last being the form usually obtained by the solution of the oxide or carbonate in hydrochloric acid. *Nickel chloride ammonia,* $NiCl_2{\cdot}6NH_3$, is obtained as a white powder when anhydrous nickel chloride is exposed to the action of ammonia gas, or in the form of blue octahedra by evaporating a solution of nickel chloride in aqueous ammonia. When heated to 100° C. it loses four molecules of ammonia (*see* AMMINES). Numerous double chlorides of nickel and other metals are known. The *bromide* and *iodide* of nickel resemble the chloride and are prepared in a similar fashion.

Several sulphides of the element have been obtained. The monosulphide, NiS, is obtained by heating nickel with sulphur, by heating the monoxide with sulphuretted hydrogen to a red heat, and by heating potassium sulphide with nickel chloride to 160–180° C. When prepared by dry methods it is an exceedingly stable, yellowish, somewhat crystalline mass. When prepared by the precipitation of nickel salts with alkaline sulphide in neutral solution it is a greyish black amorphous compound which readily oxidizes in moist air, forming a basic nickel sulphate. The freshly precipitated sulphide is somewhat soluble in hydrochloric acid and yellow ammonium sulphide. Nickel sulphate, $NiSO_4$, is obtained anhydrous as a yellow powder when any of its hydrates are heated. When heated with carbon it is reduced to the metal. It forms hydrates containing one, two, five, six and seven molecules of water. The heptahydrate is obtained by dissolving the metal or its oxide, hydroxide or carbonate in dilute sulphuric acid (preferably in the presence of a small quantity of nitric acid), and allowing the solution to crystallize between 15° and 20° C. It crystallizes in emerald green rhombic prisms and is moderately soluble in water. It effloresces gradually on exposure to air and passes into the hexahydrate. It loses four molecules of water of crystallization when heated to 100° C. and becomes anhydrous at about 300° C. Nickel sulphate combines with many metallic sulphates to form double salts, and also forms additional compounds with ammonia, aniline and hydroxylamine. The *nitrate,* $Ni(NO_3)_2{\cdot}6H_2O$, is obtained by dissolving the metal in dilute nitric acid and concentrating the solution between 40° and 50° C. It crystallizes in green prisms which deliquesce rapidly on exposure to moist air.

**Nickel Carbonyl,** $Ni(CO)_4$, is obtained as a colourless mobile liquid by passing a carbon monoxide over reduced nickel, at a temperature of about 80° C. (*see* above). It boils at 43° C. (751 mm.), and sets at −25° C. to a mass of crystalline needles. It is readily soluble in hydrocarbon solvents, in chloroform and in alcohol. Its critical pressure is 30 atmospheres and its critical temperature is in the neighbourhood of 195° C. It decomposes

with explosive violence when heated rapidly, and is decomposed by the halogens (dissolved in carbon tetrachloride) with liberation of carbon monoxide and formation of a nickel halide. With aromatic hydrocarbons in the presence of anhydrous aluminium chloride, in the cold, there is a large evolution of hydrochloric acid gas, and an aldehyde is formed; at 100° C., on the other hand, anthracene derivatives are produced. Thus by using benzene, benzaldehyde and anthracene are obtained. *Nickel carbonate*, $NiCO_3$, is obtained in the anhydrous state by heating nickel chloride with calcium carbonate in a sealed tube to 150° C. It crystallizes in microscopic rhombohedra insoluble in cold acids. By precipitation of nickel salts with solutions of the alkaline carbonates, basic carbonates of variable composition are obtained. (X.)

### PRODUCTION

The world's chief source of nickel is Canada: in 1913 she contributed 69% of the world's production. The heavy World War demand caused the Canadian output to increase, and by 1918 it had risen from 20,000 tons in 1914 to 41,000 tons in 1918, which latter figure represented 87% of the world's production for that year. The highest percentage was reached in 1920, when Canada produced 88% of the world's supply. As a result of the market being congested with large stocks and accumulated scraps at the end of the war, Canadian production declined, reaching its lowest ebb in 1922, when less than 8,000 tons of Canadian nickel were mined. When the congested supplies had been absorbed, the industry quickly revived; demand soon exceeded production, and a steadily increasing output has since been maintained. The world's output in 1923 was estimated at about 30,000 tons, of which approximately 27,000 tons were produced from the nickel mines in Canada, including a relatively small quantity of nickel recovered as a by-product from the cobalt-silver ores in that Dominion.

With regard to foreign producers of nickel, the most important is the island of New Caledonia, a French possession about 1,250 m. north-east of Australia. This island's output, in spite of the increased demand for the metal between 1914 and 1918, has since then gradually fallen, being in 1921 only about 14% of the world's output. Norway, which in the earliest days of the industry held a monopoly of the world's supply, closed down her mines in 1921 for economic reasons. In the United States the nickel deposits are nowhere being worked for the metal, though a small quantity is incidentally recovered there each year in the process of electrolytic refining of blister copper. Under the exigencies of war Germany produced from her own low-grade mines a small tonnage of nickel ore, but since the close of hostilities she has reverted to the practice of importing refined metal. Besides the above, there have been obtained from time to time small supplies of ore from Greece, Tasmania, Sweden, etc.

Practically the whole of the Canadian output is obtained from the Sudbury district in the Province of Ontario, relatively small quantities being obtained from the deposits 150 m. due north of Sudbury in the Temiscaming district, and from the cobalt-silver area in the same province. Other occurrences are known in the townships of MaCart, Munro, Strathy and near Lake Shebendowan in the district of Thunder Bay, Ontario, and nickeliferous pyrrhotite associated with copper occurs in the Gabbro copper mines, Vancouver Island, British Columbia.

*World's Production of Nickel Ore*
Long Tons

| | 1913 | 1918 | 1923‡ | 1925 |
|---|---|---|---|---|
| Canada | 22,177 | 41,298 | 27,881 | 32,972*** |
| Germany | 267 | 1,841 | 3** | .. |
| Greece | 943 | 658 | .. | .. |
| Norway | 492 | 238 | 61 | .. |
| Sweden | .. | 24 | .. | .. |
| New Caledonia* | 8,098 | 2,666 | 2,624 | 3,320 |
| United States† | 214 | 394 | 89 | 243 |

*Exports.
†Produced as by-product in electrolytic refining of copper.
**Ore, nickel content not stated.
‡Italy produced 44 tons in this year and 6 tons in 1925.
***This figure is not comparable with the preceding columns owing to the adoption of a new method of computing the metal content of ores.

For nickel plating *see* ELECTRO-PLATING.

BIBLIOGRAPHY.—A. P. Coleman, "The Nickel Industry," *Rep. Mines Branch, Ottawa, Canada*, No. 170 (1913); B. Dunstan, "Queensland Industrial Minerals: Nickel," *Queensland Government Min. Journ.*, vol. 18 (1917) and vol. 22 (1921); *Report of the Royal Ontario Nickel Commission* (Toronto, 1917); T. G. Trevor, "Nickel," *South African Journ. Industry*, vol. 1 (1918); W. Versfield, "The base metal resources of the Union of S. Africa," *Mem. Dept. Mines and Industry, Union of S. Africa*, No. 1 (1919); L. Gillet, "Le Nickel, sa métallurgie, ses emplois," *Le Génie civil*, vol. 75 (1919); C. W. Knight, "Windy Lake and Other Nickel Areas," *Ann. Report Ontario Bureau of Mines*, vol. 42 (1921); G. V. Wilson, "The Lead, Zinc, Copper and Nickel Ores of Scotland." Special Reports on the mineral resources of Great Britain. *Memoirs Geol. Surv. Scotland*, vol. 17 (1921). For bibliography *see* Imperial Mineral Resources Bureau, *The Mineral Industry of the British Empire and Foreign Countries, 1913–20*, pp. 46–55 (1922); W. G. Rumbold, *Nickel Ores*, Imperial Institute *Monographs on Mineral Resources* (1923). (N. M. P.)

**NICKEL-CHROMIUM STEEL,** an alloy of iron, nickel, chromium and carbon. Nickel strengthens the alloy and increases its toughness. Chromium unites first with the carbon to form complex carbides, and forms a material that, after quenching even at a slow rate, is hard both at the surface and inside. The two elements in one steel seem to intensify these respective effects, and after proper heat treatment produce unexampled alloys, strong, hard, tough, with great resistance to shock, penetration and repeated stresses. Nickel-chromium steel for armour plate is made as follows: a steel ingot containing 0.40% carbon, 3.75 to 4.0 nickel and 1.5 to 2.0 chromium after forging into a thick slab is placed in a carbonizing furnace, covered with a pile of charcoal and heated for several days until the steel at the surface has absorbed an additional 1% carbon, gradually tapering off to the original content at a depth of about $1\frac{1}{4}$ inches. It is later given a complex heat treatment designed to produce maximum toughness at the back and maximum hardness at the carbonized surface. Even more intricate and skilful heat treatment is required for armour-piercing shells, with their glass hard piercing point (often protected by a soft wrought iron cap) and a tough body which will retain its shape and contents of high explosive even after passing through a 12 in. plate. Such alloy steels must be very carefully made of clean raw materials—acid open-hearth and electric furnaces are preferred (although American armour is usually basic steel). Since chromium is oxidized readily, and its oxides are quite detrimental to the steel, the ferro-chromium is added near the end of the heat after the bath has been thoroughly deoxidized. Ingots are cast of cool metal, stripped and placed in soaking pits as soon as possible. Air-hardening steels such as these are "tender" in the ingot; surface cracks are frequent and must be carefully chipped out of the billet. Reheating of large masses must be very deliberate to avoid interior cracks.

Nickel-chromium steels now hold first place in use in the United States for important parts which are to be case-hardened, or for highly stressed forgings. About $2\frac{1}{2}$ times as much nickel as chromium seems to withstand best the normal variations in commercial heat treatments. Some 25 analyses current in the United States fall within the following ranges:—

| | Society of Automotive Engineers' Code No. | Chemical analysis | | |
|---|---|---|---|---|
| | | Carbon | Nickel | Chromium |
| | series | | | |
| Low alloy | 3100 | 0·10 to 0·45 | 1·0 to 1·5 | 0·45 to 0·75 |
| Medium alloy | 3200 | 0·10 to 0·55 | 1·5 to 2·0 | 0·90 to 1·25 |
| High alloy | 3300 | 0·07 to 0·45 | 3·25 to 3·75 | 0·25 to 1·75 |
| | 3400 | 0·10 to 0·55 | 2·75 to 3·25 | 0·60 to 0·95 |
| | 4300* | 0·15 to 0·45 | 1·50 to 2·00 | 0·50 to 0·80 |

*Plus 0.30% molybdenum.

Gradation in carbon content from surface to interior of a carburized piece is gradual, and thus avoids spalled surfaces during heat treatment or use. It is important that all nickel-chromium steels be cooled quickly after the drawing heats; air or furnace cooling is liable to cause them to lose their toughness.

Series 3100 with carbon about 0.35% is used for high quality

forgings, because it can be water quenched from a fairly wide temperature range and is somewhat cheaper than the 3½% nickel steel (*q.v.*). After a deliberate drawing operation such forgings machine easily and uniformly. Principal uses are for automobile steering knuckles, connecting rods, crank and drive shafts, axes, chisels and locomotive and car axles. Physical properties of medium size forgings after the respective draws are:

| | Drawn at 600° F | Drawn at 900° F | Drawn at 1,200° F |
|---|---|---|---|
| Ultimate strength, lb. per sq. in. | 230,000 | 165,000 | 115,000 |
| Elastic limit, lb. per sq. in. | 200,000 | 145,000 | 95,000 |
| Elongation, per cent | 10 | 15 | 22 |
| Reduction in area per cent | 32 | 50 | 61 |
| Brinell hardness | 430 | 320 | 230 |

The excellence of these steels is more than is indicated in the above table, for they have great toughness against repeated shock.

Heat-treated castings have given satisfaction when made of about 0·45% carbon, 2·6 nickel and 0·75 chromium. They can compete with cast manganese steel for street railroad crossings and special track-work because they are about as durable under traffic, cheaper and can be machined in the usual way. Joints can be welded satisfactorily with thermit and the battered points rebuilt by fusion welding. An important European use of such material in hardened and tempered condition is for railroad car couplings.

While a demand to reduce alloy costs has required as low an alloy in heat treated machine parts as will give the required strength, toughness, and hardness (supplemented by furnace and heat treating practices to give proper grain size control), the combination of nickel and chromium is again found in high alloy steels to resist various chemical reagents, atmospheric corrosion, and high temperature oxidation. Chromium is the principal ennobling element, and about 18% is the minimum for severe services. Eight per cent or more nickel causes this alloy to become austenitic (*see* STEELS, ALLOY), ductile and not hardenable by heat treatment. This austenitic alloy is unstable in certain temperature ranges, that is, its microstructure changes enough to impair its excellent qualities. To mitigate this action, carbon is kept very low and molybdenum is frequently added. The latter also improves the creep resistance (strength at high temperature). These high nickel-chromium steels are not only pleasing and useful for decorative and domestic purposes, but are indispensable to many chemical and food processes, paper manufacturing, and petroleum refining. (*See* ALLOYS; IRON AND STEEL.) (E. E. T.)

**NICKEL SILVER.** An alloy of nickel, copper and zinc, also known as German silver or argentan. The proportions of the three metals used in the alloy vary greatly in different grades, a good quality, as specified by a British government department, having 19% nickel, 59% copper and 22% zinc. Nickel silver is used as the base of the best silver-plated ware, and is also used unplated for cheap table-ware and ornaments.

**NICKEL STEEL,** an alloy of iron, carbon and nickel; nickel primarily conferring strength and toughness. Experience gained with ordnance steels resulted in the present large use of alloy steels for making case hardened parts, for high strength castings, boiler plate, bridge steel, forgings and for special electrical alloys. High grade nickel steel is now made in the open-hearth furnace. Nickel oxide is not stable at any stage of the process, consequently nickel in the scrap steel charged is completely recovered and the shot nickel needed for correct analysis may also be added at any time. Surface conditions of alloy steel ingots, slabs, and forgings are especially important. Ingots are stripped as soon as solidified and placed immediately in a hot soaking pit. Billets are cooled, any surface defects chipped out, then reheated slowly and rolled to final dimensions. Nickel steel boiler plate or structural shapes to be used without heat treatment must be finished slightly above the transformation range, and slowly cooled in a pile protected from drafts. While chromium steels were the first alloy steels to be used for hard parts, nickel was first in the field to toughen steels. Plain nickel steels now in use ordinarily contain less of the alloy than their progenitors, whose general excellence is so well known that they are frequently quoted as a standard of comparison for newer alloy combinations. In addition to the steels mentioned below, nickel-chromium steels (*q.v.*), with or without molybdenum, are used in large tonnages. Nickel is also an essential component of high nickel-chromium stainless and heat resisting steels and alloys.

Nickel (*a*) forms a solid solution with either gamma or alpha iron; (*b*) strengthens and toughens this solid solution; (*c*) slows down the speed of the carbon reactions, and reduces the temperature at which they occur. These effects are a desirable combination in the use of nickel steels for case-hardening purposes. The following represent the wide range of these steels used in the U.S.:—

| | Low nickel | | Medium nickel | High nickel |
|---|---|---|---|---|
| | A | B | C | D |
| | % | % | % | % |
| Carbon | 0·10–0·20 | 0·15 | 0·10–0·20 | Max 0·17 |
| Manganese | 0·30–0·60 | 0·50–0·80 | 0·50–0·80 | 0·30–0·60 |
| Nickel | 0·40–0·60 | 1·65–2·00 | 3·25–3·75 | 4·50–5·25 |
| Molybdenum | .. | 0·25 | .. | .. |

Steel A is an inexpensive water hardening steel for parts of moderate importance. Steel B can be oil quenched direct from the carburizing heat for a tough core and file-hard case; it has good machining properties and is widely used for roller bearings, gears, piston pins, and drive shafts. Steel C usually is given a more elaborate heat treatment for a strong, tough core; it is used for gears, shafts, and machine parts requiring extra toughness as well as surface hardness and constancy of dimension. Steel D is hard to work, but after proper case hardening gives parts having extreme hardness and resistance to shock.

A very useful, all-purpose, series of steels contains 3 to 3·5% nickel and 0·20 to 0·55% carbon; it goes into heat-treated forgings, heat-treated castings and high strength structural and boiler steels. A 0·45% carbon, 3·5% nickel steel forging of moderate size oil quenched from 1,450° F will have the following properties after the respective draws:—

| | Drawn at 600° F | Drawn at 900° F | Drawn at 1,200° F |
|---|---|---|---|
| Ultimate strength | 230,000 | 160,000 | 118,000 |
| Elastic limit | 210,000 | 150,000 | 100,000 |
| Elongation in 2 inches | 13 | 18 | 25 |
| Reduction of area | 43 | 57 | 63 |
| Brinell hardness | 450 | 320 | 240 |

Annealed eye-bar tension members (carbon 0·37%, nickel 3·3%) were first used in 1902 on a cantilever bridge across the East river, New York. The physical properties of this material in 16 by 2½ in. bars were:—

| | Specified minimum | Average |
|---|---|---|
| Ultimate strength | 85,000 | 95,000 |
| Elastic limit | 45,000 | 55,000 |
| Elongation in 8 inches | .. | 23 |
| Elongation in 18 feet | 9 | .. |

Design stresses on this bridge were 30,000 lb. per square inch; 50% more than customary for regular carbon steel eye-bars. Structural shapes with slightly lower carbon have been used in many long bridges since. High-pressure locomotive boilers of nickel steel are used on Canadian and American railroads. Properties in comparison with plain carbon steel boiler plate follow:—

| Physical properties | Nickel steel | Carbon steel |
|---|---|---|
| Ultimate strength, lb. per sq.in. | 77,880 | 59,200 |
| Yield point, lb. per sq.in. | 47,550 | 36,200 |
| Elongation in 8 in. per cent | 26·3 | 28·6 |
| Izod impact, ft.-lb. | 63·4 | .. |

Nickel steels are also utilized in chemical equipment for sub-zero operation, since they resist embrittlement by cold.

Many high nickel alloys with iron have important magnetic and

electrical properties. "Fernico" (28% nickel, 18% cobalt) has the same coefficient of expansion as glass, and is used for lead-in wires and glass-metal seals in electric light globes and radio tubes. "Nickeloy" (50% nickel) has high magnetic permeability, and is used for radio transformer cores. Permalloy (78% nickel) is discussed under TELEPHONE. Invar (35% nickel) is treated under INVAR. (*See* also ALLOYS; IRON AND STEEL.)

*See* J. S. Marsh, *Alloys of Iron and Nickel.* (E. E. T.)

**NICOBAR ISLANDS,** a group of 12 inhabited and 7 uninhabited islands in the Bay of Bengal, between Sumatra and the Andaman Islands (*q.v.*). The Andaman and Nicobar Islands together constitute a chief commissioner's province of British India. The aggregate area of the Nicobars is 635 sq.mi., Great Nicobar (*Loöng*), the largest and southernmost of any size, covering 333 sq.mi. Principal of the central group of islands are Camorta and Nankauri, between them being a magnificent landlocked shelter called Nankauri harbour. Chief island of the northern group is Car Nicobar (*Pu*), area 49 sq.mi., on which is the headquarters of the administration. Some of the islands have mere flat, coral-covered surfaces; others, again, are hilly, the Great Nicobar rising to 2,105 ft. On that island there are considerable and beautiful streams, but the others generally are badly off for fresh surface water. The marine surveys of these islands are still meagre and unsatisfactory. In 1941 the inhabitants of the Nicobar Islands numbered 12,452 (6,586 males and 5,866 females), Car Nicobar being by far the most densely populated island.

**Geology.**—The Nicobars form part of a great submarine chain, of which the Andamans are a continuation. Elaborate geological reports were issued by a Danish scientific expedition in 1846 and an Austrian expedition in 1858. Dr. Rink of the former considered that the islands belong to the Tertiary age. Von Hochstetter of the Austrian expedition classified the most important formations thus: eruptive, serpentine and gabbro; marine deposits, probably late Tertiary, consisting of sandstones, slates, clay, marls, and plastic clay; recent corals. He considered the whole group connected geologically with the great islands of the Malay Archipelago farther south. Earthquakes of great violence were recorded in 1847 and 1881 (with tidal wave), and mild shocks were experienced in December 1899.

The climate is unhealthy for Europeans. The islands are exposed to both monsoons, and smooth weather is only experienced from February to April, and in October. Rain falls throughout the year, generally in sharp, heavy showers. The rainfall varies from 90 to 135 in., and the shade temperature from 64° to 92° F.

**Flora and Fauna.**—The vegetation of the Nicobars has not been subjected to a systematic examination by the Indian Forest Department like that of the Andamans, and indeed the forests are quite inferior in economic value to those of the more northerly group; besides fruit trees—such as the coco-nut (*Cocos nucifera*), the betel-nut (*Areca catechu*), and the mellori (*Pandanus leeram*)—a thatching palm (*Nipa fruticans*) and various timber trees have some commercial value, but only one timber tree (*Myristica irya*) would be considered first-class in the Andamans. The palms of the Nicobars are, however, exceedingly graceful. The mammals are not numerous. In the southernmost islands are a small monkey, rats and mice, tree-shrews (*Cladobates nic.*), bats, and flying-foxes, but it is doubtful if the "wild" pig is indigenous; cattle, when introduced and left, have speedily become "wild." There are many kinds of birds, notably the megapod (*Megapodius nic.*), the edible-nest-building swift (*Collocalia nidifica*), the hackled and pied pigeons (*Calaenas nic.* and *Carpophaga bicolor*), a paroquet (*Palaeornis caniceps*) and an oriole (*Oriolus macrourus*). Fowls, snipe and teal thrive after importation or migration. Reptiles—snakes, lizards and chameleons, crocodiles, turtles and an enormous variant of the edible Indian crab—are numerous; butterflies and insects, the latter very troublesome, have not yet been systematically collected. The fresh-water fish are reported to be of the types found in Sumatra.

**Natives.**—The Nicobarese may be best described as a Far Eastern race, having generally the characteristics of the less civilized tribes of the Malay Peninsula and the south-eastern portion of the Asiatic continent, and speaking varieties of the Mon-Annam group of languages, though the several dialects that prevail are mutually unintelligible. Though short according to the standard of whites (average height, man, 5 ft. 3¾ in.; woman, 5 ft.), the Nicobarese are a fine, well-developed race, and live to seventy or eighty years of age. Their mental capacity is considerable, though there is a great difference between the sluggish inhabitant of Great Nicobar and the keen trader of Car Nicobar. The religion is an undisguised animism, and all their frequent and elaborate ceremonies and festivals are aimed at exorcising and scaring spirits. On the whole the Nicobarese are a quiet, inoffensive people, friendly to each other, and not quarrelsome, and by inclination friendly and not dangerous to foreigners. Such government as there is, is by the village. The clothing, when not a caricature of European dress, is of the scantiest, and the waggling tags in which the loin-cloths are tied behind gave rise to fanciful stories that the inhabitants were naked and tailed. The houses are good, and often of considerable size. The natives are skilful with their lands, and though they never cultivate cereals, exercise some care and knowledge over the coco-nut and tobacco, and have had much success with the foreign fruits and vegetables introduced by the missionaries. The staple article of trade has always been the ubiquitous coco-nut, of which it is computed that 15 million are produced annually. There is an old-established internal trade, chiefly between the older islands and Chowra, for pots (which are only made there) and racing and other canoes.

**History.**—The situation of the Nicobars along the line of a very ancient trade route has caused them to be reported by traders and seafarers through all historical times. In the 17th century the islands began to attract the attention of missionaries. At various times France, Denmark, Austria and Great Britain all had more or less shadowy rights to the islands, the Danes being the most persistent in their efforts to occupy the group, until in 1869 they relinquished their claims in favour of the British, who at once began to put down the piracies of the islanders, and established a penal settlement, which was withdrawn in 1888. Car Nicobar and Camorta are the principal ports of the group. In 1942, during World War II, the Nicobar Islands were occupied by Japanese forces.

**Ethnology.**—The Nicobarese inhabitants are probably of mixed Malay and Indonesian origin, with hair generally straight, sometimes wavy. The Shom Pen tribe of Great Nicobar differs from or perhaps is merely purer blooded than the coastal tribes. The use of cloth waist-belts with the end pulled between the legs under the belt, behind which it hangs down at the back has given rise to stories of tailed men. There are six tribes said, like the sexes, to be distinguishable by their smell, the natives of Chowra being malodorous on account of eating dog flesh. The marriage tie is loose, the *couvade* (*otô*) is practised, the head is flattened in infancy, the teeth blackened and the ears distended. Betel is chewed, pandanus fruit used as food, and the people dislike milk. Pigs and fowls are fed on coco-nut. Houses are built on piles; a benign Creator is believed in; disease is ascribed to sorcerers and treated by expulsion of devils or by pretended extraction of foreign matter palmed by the sorcerer. Villages are protected by scare-devils. The cross-bow is used.

*See* C. B. Kloss, *In the Andamans and Nicobars* (1903); G. Whitehead, *In the Nicobar Islands* (1924); the annual *Administration Report* of the Chief Commissioner.

**NICOLAI, CHRISTOPH FRIEDRICH** (1733–1811), German author and bookseller, was born on March 18, 1733 at Berlin, son of the well-known bookseller, Christoph Gottlieb Nicolai (d. 1752). Nicolai's *Briefe über den jetzigen Zustand der schönen Wissenschaften in Deutschland,* published anonymously in 1755 and reprinted by G. Ellinger in 1894, were directed against both Gottsched and Gottsched's Swiss opponents, Johann Jakob Bodmer and Johann Jakob Breitinger; his enthusiasm for English literature won for him the friendship of Lessing and Moses Mendelssohn. In association with Mendelssohn he established in 1757 the *Bibliothek der schönen Wissenschaften;* and with Lessing and Mendelssohn *Briefe, die neueste Literatur betreffend* (1759); from 1765 to 1792 he edited the *Allgemeine deutsche Bibliothek.* The *Bibliothek* served as the organ of the so-called

"popular philosophers," who warred against authority in religion and against what they conceived to be extravagance in literature, and Nicolai showed a complete incomprehension of the new movement of ideas represented by Herder, Goethe, Schiller, Kant and Fichte. He died in Berlin on Jan. 11, 1811.

*See* his *Bildniss und Selbstbiographie* ed. M. S. Löwe in the *Bildnisse jetzt lebender Berliner Gelehrter,* in 1806. *See* also L. F. G. von Göckingk, *F. Nicolai's Leben und literarischer Nachlass* (1820); J. Minor, *Lessings Jugendfreunde,* in J. Kürschner's *Deutsche Nationalliteratur,* vol. lxxii. (1883); M. Sommerfeld, *F. Nicolai und der Sturm und Drang* (Halle, 1921).

**NICOLAÏ, OTTO** (1810–1849), German composer, was born on the 9th of June in Königsberg. He studied music in Berlin and in 1833 became organist to the German embassy in Rome. There his operas *Enrico II.* (1839) and *Il Templario* (1840) were produced, besides some church music, a series of songs, and a number of compositions for the pianoforte. He was Kapellmeister of the court opera in Vienna from 1841 to 1847, when he was appointed Hof Kapellmeister at the Berlin Opera House. There, only two days before he died (on the 11th of March, 1849), was performed his famous opera, *The Merry Wives of Windsor.*

**NICOLAS, SIR NICHOLAS HARRIS,** G.C.M.G., 1840 (1799–1848), English antiquary, fourth son of John Harris Nicolas (d. 1844), was born at Dartmouth on the 10th of March 1799. Having served in the navy from 1812 to 1816, he studied law and was called to the bar at the Inner Temple in 1825. His work as a barrister, however, was confined principally to peerage cases before the House of Lords, and his time was mainly devoted to genealogical and historical studies. He died near Boulogne on Aug. 3, 1848.

The most important of the works of Nicolas is his *History of the Orders of Knighthood of the British Empire; of the Order of the Guelphs; and of Medals, Clasps, etc., for Naval and Military Services* (1841–42).

*See* E. S. P. Haynes, *Personalia* (1918).

**NICOLAUS DAMASCENUS,** Greek historian and philosopher of Damascus, flourished in the time of Augustus and Herod the Great, with both of whom he was on terms of friendship. He instructed Herod in rhetoric and philosophy, and had attracted the notice of Augustus when he accompanied his patron on a visit to Rome. Later, when Herod's conduct aroused the suspicions of Augustus, Nicolaus was sent on a mission to bring about a reconciliation. He survived Herod, and it was through his influence that the succession was secured for Archelaus; but the date of his death, like that of his birth, is unknown. Fragments of his universal history (Ἱστορία καθολική), from the time of the Assyrian empire to his own days, his autobiography, and his life of Augustus (Βίος Καίσαρος) have been preserved, chiefly in the extracts of Constantine Porphyrogenitus.

Fragments in C. Müller, *Fragmenta historicorum Graecorum,* iii.; *see* also F. Navet, *Nikolaus von Damascus* (1853), containing an account of his life and writings, and translation of the fragments.

**NICOLAUS OF LYRA** (*c.* 1265–1349), French commentator, was born in Lire, now Vieille-Lyre (Eure). He entered the Franciscan order at Verneuil about 1300, and studied at Paris, where, becoming a doctor some time before 1309, he taught for many years. From 1319 he was provincial of his order in France, and was present in that capacity at the general chapter at Pérouse (1321). In 1325 he was provincial of Burgundy, and as executor of the estate of Jeanne of Burgundy, widow of King Philip VI., he founded the college of Burgundy at Paris, where he died in the autumn of 1349, being buried in the chapter hall of the convent of the Cordeliers.

Among the authentic works of Nicolaus of Lyra are: (1) two commentaries on the whole Bible, one (*Postilla litteralis,* 1322–31) following the literal sense, the other (*Postilla mystica seu moralis,* 1339) following the mystic sense. There are numerous editions (Rome, 1471–72; Douai, 1617; Antwerp, 1634). (2) *Tractatus de differentia nostrae translationis* (*i.e.,* Vulgate) *ab Hebraica veritate,* 1333. (3) Two treatises against the Jews. (4) A theological treatise on the Beatific Vision, directed against pope John XXII. (1334), unpublished. (5) *Contemplatis de vita S. Francisci,* a book of devotions.

In addition to the notices in Wadding, du Moustier, Sbaraglia and Fabricius, *see* C. Siegfried, in *Archiv. f. wissenschaftliche Erforschung des A.T.,* vols. i., ii.; A. Merx, *Die Prophetie des Joel und ihre Ausleger* (1879, pp. 305–366); M. Fischer in *Jahrbücher f. protestantische Theologie,* xv.; F. Maschkowski, in *Zeitschrift f. alttestamentliche Wissenschaft,* xv.; Neumann in *Revue des études juives,* vols. 26 and 27; H Labrosse in *Positions des thèses de l'École des Chartes* (1906).

**NICOLE, PIERRE** (1625–1695), one of the most distinguished of the French Jansenists, was the son of a provincial barrister, and was born at Chartres. Sent to Paris in 1642 to study theology, he soon entered into relations with the Jansenist community at Port Royal (*q.v.*) through his aunt, Marie des Anges Suireau, who was for a short time abbess of the convent. For some years he was a master in the "little school" for boys established at Port Royal, and taught Greek to young Jean Racine, the future poet. With Antoine Arnauld, he acted as general editor of the controversial literature put forth by the Jansenists. He had a large share in collecting the materials for Pascal's *Provincial Letters* (1656); in 1658 he translated the *Letters* into Latin, under the pseudonym of Nicholas Wendrock. In 1664 he himself began a series of letters, *Les Imaginaires,* intended to show that the heretical opinions commonly ascribed to the Jansenists really existed only in the imagination of the Jesuits. His letters being violently attacked by Desmaretz de Saint-Sorlin, an erratic minor poet who professed great devotion to the Jesuits, Nicole replied to him in another series of letters, *Les Visionnaires* (1666). In the course of these he observed that poets and dramatists were no better than "public poisoners."

About the same time Nicole became involved in a controversy about transubstantiation with the Huguenot Claude; out of this grew a massive work *La Perpétuité de la foi de l'église catholique touchant l'eucharistе* (1669), the joint effort of Nicole and Antoine Arnauld. But Nicole's most popular production was his *Essais de morale* (14 vols., 1671 *seq.*), a series of short discussions on practical Christianity. In 1679, on the renewal of the persecution of the Jansenists, Nicole was forced to fly to Belgium in company with Arnauld. But the two soon parted. Nicole was elderly and in poor health; the life of a fugitive was not to his taste, and he complained that he wanted rest. "Rest," answered Arnauld, "when you have eternity to rest in!" In 1683 Nicole made a rather ambiguous peace with the authorities, and was allowed to come back to Paris. There he continued his literary labours; he was writing a refutation of the new heresy of the Quietists when death overtook him on Nov. 16, 1695. (*See* PORT ROYAL.)

Several abridgments of the *Essais* exist, notably a *Choix des essais de morale de Nicole,* ed. Silvestre de Saci (1857).

Nicole's life is told at length in the 4th volume of Sainte Beuve's *Port-Royal.*

**NICOLL, ROBERT** (1814–1837), Scottish poet, was born on Jan. 7, 1814, at the farm of Little Tullybeltane, in the parish of Auchtergaven, Perthshire. At sixteen the boy was apprenticed to a grocer and wine-merchant at Perth. In 1833 he began to contribute to *Johnstone's Magazine* (afterwards *Tait's Magazine*), and in the next year his apprenticeship was cancelled. In 1836 he became editor of the *Leeds Times.* He died at the house of his friend William Tait, at Trinity, near Edinburgh, on Dec. 7, 1837, in his twenty-fourth year. He had published a volume of *Poems* in 1835; and in 1844 appeared a further volume, *Poems and Lyrics,* with an anonymous memoir of the author by Mrs. C. I. Johnstone. The best of his lyrics are those written in the Scottish dialect.

*See* P. R. Drummond, *Life of Robert Nicoll, Poet* (1884).

**NICOLL, SIR WILLIAM ROBERTSON** (1851–1923), Scottish Nonconformist divine and man of letters, was born at Auchindoir, Aberdeenshire, on Oct. 10, 1851, the son of a Free Church minister. He graduated M.A. at Aberdeen in 1870, and studied for the ministry at the Free Church college there until 1874, when he was ordained minister of the Free church at Dufftown. Three years later he moved to Kelso, and in 1884 became editor of the *Expositor.* In 1886 he founded the *British Weekly,* a Nonconformist organ which obtained great influence over opinion in the free churches. Robertson Nicoll helped to make the fortunes of the paper by the papers which he contributed over the signature of "Claudius Clear." He also founded and edited the *Bookman* (1891, etc.), and acted as chief literary adviser to the publishing firm of Hodder and Stoughton. He edited *The*

*Expositor's Greek Testament* (1897, etc.), and a series of *Literary Lives* (1904, etc.). He was knighted in 1909, and died on May 4, 1923. *See* T. H. Darlow, *William R. Nicoll* (1925).

**NICOLLS, RICHARD** (1624–1672), American colonial governor, was born probably at Ampthill, Beds., England, in 1624. He commanded a royalist troop of horse during the Civil War, and on the defeat of the king went into exile. Soon after the Restoration he entered the service of the duke of York, through whose influence he was appointed in 1664 on a commission to conquer New Netherland from the Dutch and to regulate the affairs of the New England colonies and settle disputes among them. The expedition set sail from Portsmouth on May 25, 1664, and New Amsterdam was surrendered to Nicolls on Sept. 8. Under authority of a commission from the duke of York, Nicolls assumed the position of deputy governor of New Netherland (New York). His policy was vigorous but tactful, and the transition to the new regime was made smoothly and with due regard to the interests of the conquered people. The English system of law and administration was at once introduced into Long Island, Staten Island and Westchester, where the English element already predominated, but the change was made much more slowly in the Dutch sections. A code of laws, known as the "duke's laws," drafted by the governor with the help of his secretary, Matthias Nicolls (*c.* 1630–1687), was proclaimed in 1665 and continued in force until 1683. Nicolls returned to England in the summer of 1668 and continued in the service of the duke of York. He was killed in the naval battle of Southwold bay May 28, 1672.

*See* J. R. Brodhead, *History of the State of New York* (rev. ed., 1872); and Woodrow Wilson, *A History of the American People*, vol. i. (1902). For the "Duke's Laws" see *Laws of Colonial New York*, i. 6–100.

**NICOMACHUS,** a Neo-Pythagorean philosopher and mathematician, born at Gerasa in Arabia Petraea, flourished about 100 A.D. Two treatises by him are extant: (1) The *Introductio arithmetica* sets out the elementary theory and properties of numbers. Numbers are no longer denoted by lines as in Euclid, but are written in the ordinary notation; hence general principles can only be stated with reference to particular numbers taken as illustrations. Nicomachus states a rule about cubes which enables us to sum any number of forms of the series of natural cubes beginning from 1; otherwise the book is mathematically unimportant. It had, however, great vogue ("you count like Nicomachus" says a character in Lucian). A Latin translation by Apuleius of Madaura (born about 125 A.D.) is lost; but we have Boëtius's version. The commentators include Iamblichus, Heronas, Asclepius of Tralles, Joannes Philoponus, Proclus. The Greek text has been edited by R. Hoche (Teubner, 1866) and the commentaries of Iamblichus and Philoponus by Pistelli (Teubner, 1894) and Hoche (Leipzig, 1864, and Berlin, 1867) respectively. There is an elaborate English edition by F. E. Robbins and L. C. Karpinski (New York, 1926). (2) The *Enchiridion Harmonices* (edited by Jan in *Musici Scriptores Graeci*, 1895) is on the Pythagorean theory of music. Nicomachus is also said to have written *Theologumena arithmetices* (in two books) on the properties of numbers, of which the *Theologumena arithmeticae* edited by Ast (1817) contains no more than fragments, at most.

(T. L. H.)

**NICOMACHUS,** of Thebes, Greek painter, active *c.* 390–340 B.C., was a contemporary of the greatest painters of Greece; Vitruvius observes that if his fame was less than theirs, it was the fault of fortune rather than of demerit. Pliny (xxxv. 108) gives a list of his works; among them a "Rape of Persephone," "Victory in a Quadriga," a group of Apollo and Artemis, and the "Mother of the Gods seated on a Lion." Pliny tells us that he was a very rapid worker and used but four colours.

**NICOMEDES I,** king of Bithynia (*c.* 278–248 B.C.). He made himself master of the whole country and put to death his brother, who had set himself up as an independent ruler. He enlarged and consolidated the kingdom, founded the city of Nicomedia as the capital, and fought successfully for some time with Antiochus of Syria. Nicomedes II, king of Bithynia (149–91 B.C.), was fourth in descent from Nicomedes I. A popular ruler, he adhered steadily to the Roman alliance. His son, Nicomedes III, ruled until 74 B.C.

**NICOMEDIA:** *see* Ismid.

**NICOPOLIS** ("Victory-City"), **ACTIA,** an ancient city of Epirus, founded 31 B.C. by Octavian (Augustus) in memory of his victory over Antony and Cleopatra at Actium. The colony, composed of settlers from many neighbouring towns, succeeded and became the capital of southern Epirus and Acarnania, with the right of sending five representatives to the Amphictyonic council. On the spot where Octavian's tent had stood he built a sanctuary to Neptune adorned with beaks of captured galleys, and instituted the Actian games in honour of Apollo. The city was restored by the emperor Julian, and again (after the Gothic invasion) by Justinian; but in the middle ages it was supplanted by Prevesa. The ruins, now known as Palaeoprevesa (Old Prevesa), lie about 3 m. north, on a small bay at the narrowest part of the peninsula which separates the Gulf of Arta (Sinus Ambracius) from the Ionian Sea. The most conspicuous objects are the acropolis, two theatres and an aqueduct.

**NICOSIA,** the capital of Cyprus, situated in the north central part of the island. Pop. (1940) 23,679. Its earliest name was Ledra, but Leucos, son of Ptolemy Soter (280 B.C.), is said to have changed its name to Leucotheon, corrupted into mediaeval Greek *Leucosia* and Frankish *Nicosia*. A mile south-west of the town lies the very large Bronze age necropolis known as Hagia Paraskevi. The principal monuments of the Lusignan period are the fine Gothic cathedral of St. Sophia, now a mosque, and the church of St. Catherine, now the Haidar Pasha mosque. Adjoining St. Sophia is an early church, later used as a grain store, mistakenly identified in modern times as the church of St. Nicolas of the English. The Famagusta Gate was originally known as Porta Giuliana, named for its builder, the Venetian engineer Giulio Savorgnano. In 1567 he reduced the circuit of the city from 9 mi. to 3, constructing a circular earthwork fortification with 11 heart-shaped bastions. Nicosia was captured by the Turks in 1570 after a famous siege of seven weeks. The weaving of silk and other textiles by hand is still of importance. Most of the government offices and English residences are located without the walls. There is a narrow-gauge railway connecting Nicosia with the seaport of Famagusta, 37 mi. distant.

*See* R. Gunnis, *Historic Cyprus* (1936).

**NICOSIA,** city and episcopal see (since 1816), Sicily, Italy, province of Enna, 21 mi. north of the railway station of Leonforte (which is 49 mi. west of Catania), 2,840 ft. above sea-level. Pop. (1936) 15,382 (town), 17,479 (commune). The town retains a mediaeval appearance, with a Norman cathedral and other interesting churches, among them S. Maria Maggiore, with a reredos by Antonio Gagini. A Lombard dialect is still spoken here.

**NICOTERA, GIOVANNI** (1828–1894), Italian patriot and politician, was born at San Biagio on Sept. 9, 1828. Joining the party of Young Italy he was among the combatants at Naples in May 1848, and was at San Pancrazio with Garibaldi during the defence of Rome. After the fall of Rome he fled to Piedmont, where he organized the expedition to Sapri in 1857, but shortly after his arrival there he was defeated and severely wounded by the Bourbon troops. Condemned to death, but reprieved through the intervention of the British minister, he remained a prisoner at Naples and at Favignana until 1860, when he joined Garibaldi at Palermo. Sent by Garibaldi to Tuscany, he attempted to invade the Papal States with a volunteer brigade, but his followers were disarmed and disbanded by Ricasoli and Cavour. In 1862 he was with Garibaldi at Aspromonte; in 1866 he commanded a volunteer brigade against Austria; in 1867 he invaded the Papal States from the south, but the defeat of Garibaldi at Mentana put an end to his enterprise. His parliamentary career dates from 1860. During the first ten years he engaged in violent opposition, but from 1870 onwards he joined in supporting the military reforms of Ricotti. Upon the advent of the Left in 1876, Nicotera became minister of the interior, and governed with remarkable firmness. He was obliged to resign in December 1877, when he joined Crispi, Cairoli, Zanardelli and Baccarini in forming the "pentarchy" in opposition to Depretis, but he only returned to power thirteen years later as minister of the interior in the Rudini cabinet of

1891. On this occasion he restored the system of uninominal constituencies and resisted the socialist agitation. He fell with the Rudini cabinet in May 1892, and died at Vico Equense, near Naples, on June 13, 1894.

*See* V. Giordano, *La Vita ed i discorsi di Giovanni Nicotera* (Salermo, 1878); Mauro, *Biografia di Giovanni Nicotera* (Rome, 1886; German trans., Leipzig, 1886); and Mario, *In memoria di Giovanni Nicotera* (Florence, 1894).

**NICOTIANA,** a genus of plants of the nightshade family (Solanaceae), comprising about 45 species of herbs and shrubs, native chiefly to tropical America. They are strongly-scented, annuals or perennials, possessing narcotic-poisonous properties. They have alternate, simple, usually entire but sometimes wavy-margined, large leaves, and white, yellow, greenish or purple, fragrant flowers, with a long, tubular, five-lobed corolla, usually opening at night. Besides *N. Tabacum,* important as the source of commercial tobacco (*q.v.*), several other species are cultivated as ornamental plants. Some 10 species are found in the southern and western parts of the U.S., *N. glauca* (tree tobacco) a slender evergreen shrub native to Brazil, has become widely naturalized on the Pacific coast. *N. rustica,* one of the plants known as wild tobacco, formerly cultivated by the Indians of the eastern states, is of uncertain origin, but is thought to be the source of the first tobacco taken from tropical America to Europe, and popularized by John Nicot, for whom the genus was named.

**NICOTINE,** a volatile liquid, is the principal alkaloid (*see* ALKALOIDS) of tobacco, in which it occurs to the extent of 4 to 5% along with minute amounts of closely related alkaloids. Nicotine is still used in medicine to a small extent, but the principal demand for it is as a horticultural insecticide. It is prepared by adding lime or caustic soda to a filtered, concentrated, aqueous extract of tobacco (stalk and other tobacco refuse is generally used) and recovering the alkaloid so set free, by extraction with a suitable solvent or by steam-distillation. This crude alkaloid is freed from water by a chemical drying agent, such as solid potash, and then fractionally distilled. Pure nicotine, $C_{10}H_{14}N_2$, is a highly poisonous colourless liquid, with an unpleasant odour; it boils at 246–274° C, $[\alpha]$, −168.5°, and is soluble in most solvents including water. The picrate crystallizes in short, yellow prisms, melts at 218° C and is characteristic of the alkaloid. Nicotine was synthesized in the year 1904 by Pictet, Crepieux and Rotschy.

**NICTHEROY,** officially **NITERÓI,** a city of Brazil and capital of the state of Rio de Janeiro, on the E. shore of the Bay of Rio de Janeiro, opposite the city of that name. Pop. (with municipal district), 1940, 143,394. A railway connects the city with the interior, with Macaé, on the coast, and with the lines of Minas Gerais. Niterói is practically a residential suburb of Rio de Janeiro. It occupies, in great part, the low alluvial plain that skirts the shores of the bay and fills the valleys between numerous low wooded hills. The site is shut off from the sea-coast by a range of high rugged mountains. The shore line of the bay is broken by large, deeply indented bays.

The city consists of a number of these partially separated districts—Praia Grande, São Domingos, Icaraí, Jurujuba, Santa Rosa, São Lourenço, Ponta d'Areia and Barreto—all together covering 8 or 9 m. of the shore. An electric street railway connects all the outlying districts with the ferry stations of Praia Grande and São Domingos. The city is characteristically Portuguese in the construction and style of its buildings—low, heavy walls of broken stone and mortar, plastered and coloured outside, with an occasional facing of glazed Lisbon tiles, and covered with red tiles. Among the public buildings are several churches and hospitals (including the Jurujuba yellow-fever hospital and the Barreto isolation hospital), the Government palace, a municipal theatre and a large Salesian college situated in the suburbs of Santa Rosa on an eminence overlooking the lower bay. Several large islands fill the upper bay near the eastern shore; some are used as coal deposits for the great steamship companies, and one (Flores) is used as an immigrants' depôt. Manufactures include cotton and woollen fabrics, tobacco, spirits, soap and tiles.

The first settlement on the east side of the Bay of Rio de Janeiro dates from 1671, when a chapel was erected at Praia Grande, in the vicinity of an Indian village. The settlement did not become a village until 1819, when it was named Villa Real da Praia Grande. In 1834 the city and municipal district of Rio de Janeiro were separated from the province, and Praia Grande became the capital of the latter in the following year. In 1836 it was raised to the dignity of a city and received the appropriate name of Niterói, from the Indian name *Nyterõi,* "hidden water." In the naval revolt of 1893–94 the older districts of the city suffered much damage from desultory bombardments, but the insurgents were too few to take possession. Soon afterwards the seat of government was removed to Petrópolis, but restored in 1903.

**NIDAROS:** *see* TRONDHJEM.

**NIEBUHR, BARTHOLD GEORG** (1776–1831), German statesman and historian, son of Karsten Niebuhr (*q.v.*), was born at Copenhagen on Aug. 27, 1776. After studying at the university of Kiel, he became private secretary to Count Schimmelmann, Danish minister of finance, but in 1799 entered the state service. He was chief director of the National Bank from 1804 to 1806 when he took a similar appointment in Prussia. He accompanied the Prussian government to Königsberg, where he rendered considerable service in the commissariat, and was afterwards still more useful as commissioner of the national debt and by his opposition to ill-considered schemes of taxation. In 1810 he was made royal historiographer and professor at Berlin university, and two years later published two volumes of his *Römische Geschichte* (Eng. trans., 1847–51). In 1816, while on his way to Rome to take up the post of ambassador, he discovered in the cathedral of Verona the long-lost *Institutes* of Gaius, afterwards edited by Savigny, to whom he communicated the discovery under the impression that he had found a portion of Ulpian. During his residence in Rome Niebuhr discovered and published fragments of Cicero and Livy, aided Cardinal Mai in his edition of Cicero *De Republica,* and shared in planning the great work on the topography of ancient Rome by von Bunsen and Platner (1773–1855), to which he contributed several chapters. In 1823 he resigned the embassy and established himself at Bonn, where he died on Jan. 2, 1831.

Niebuhr's *Roman History,* to which he added a 3rd vol. (1832), counts among epoch-making histories both as marking an era in the study of its special subject and for its momentous influence on the general conception of history. "The main results," says Leonhard Schmitz, "arrived at by the inquiries of Niebuhr, such as his views of the ancient population of Rome, the origin of the plebs, the relation between the patricians and plebeians, the real nature of the ager publicus, and many other points of interest, have been acknowledged by all his successors." He was the first to deal with the ancient history of Rome in a scientific spirit and introduced new principles into historical research. He suggested the theory of the myth; he brought in inference to supply the place of discredited tradition and showed the possibility of writing history in the absence of original records; he drew attention to the importance of ethnological distinctions, and laid stress on institutions, and social traits to the neglect of individuals.

*See* Niebuhr's *Politische Schriften* edited by G. Küntzel in 1923 and his *Briefe* by D. Gerhard (1926 foll.); D. Hensler, *Lebensnachrichten über B. G. Niebuhr, aus Briefen desselben und aus Erinnerungen einiger seiner nächsten Freunde* (3 vols., 1838–39, Eng. trs. 1852); J. Classen, *B. G. Niebuhr, eine Gedächtnisschrift* (1876), G. Eyssenhardt, *B. G. Niebuhr* (1886); J. E. Sandys, *History of Classical Scholarship* (1908), iii.; C. Seitz, *L'historien Niebuhr* (1909).

**NIEBUHR, KARSTEN** (1733–1815), German traveller, was born at Lüdingworth, Lauenburg, Holstein, on March 17, 1733, the son of a farmer. He worked as a peasant in his early years, but managed to learn surveying. In 1760 he was invited to join the expedition which was being sent out by Frederick V. of Denmark for the scientific exploration of Egypt, Arabia and Syria. He studied mathematics and Arabic for a year and a half before the expedition set out. The expedition sailed in January 1761, and, landing at Alexandria, ascended the Nile. Proceeding to Suez, Niebuhr visited Mount Sinai, and in October 1762 the expedition sailed from Suez to Jeddah, journeying thence overland to Mocha. Here in May 1763 the philologist of the expedition, van Haven, and the naturalist Forskål, died. Sana, the capital

of Yemen, was visited, but the remaining members of the expedition were obliged to return to Mocha. Niebuhr saved his life and restored his health by adopting native dress and food. From Mocha the ship sailed to Bombay; the artist of the expedition and the surgeon died. Niebuhr was now the only surviving member of the expedition. He stayed fourteen months at Bombay, and then returned home by Muscat, Bushire, Shiraz and Persepolis, visited the ruins of Babylon, and thence went to Baghdad, Mosul and Aleppo. After a visit to Cyprus he toured Palestine, crossing Mount Taurus to Brussa, reaching Constantinople in February 1767 and Copenhagen in the following November. He married in 1773, and held a post in the Danish military service and lived at Copenhagen. In 1778 he accepted a position in the civil service of Holstein, and went to reside at Meldorf, where he died on April 26, 1815.

He published *Beschreibung von Arabien* (1772); *Reisebeschreibung von Arabien und anderen umliegenden Ländern* (2 vols., 1774–78) besides papers in *Deutsches Museum*. He also edited Forskål's *Descriptiones animalium, Flora Aegyptiaco-Arabica,* and *Icones rerum naturalium* (1775–76).

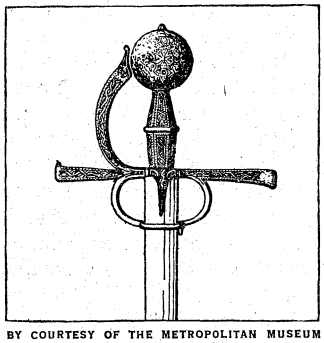
French and Dutch translations of his narratives were published during his lifetime, and a condensed English translation, by Robert Heron, of the first three volumes in Edinburgh (1792). His son Barthold (*see* above) published a short *Life* at Kiel in 1817; an English version was issued in 1838 in the *Lives of Eminent Men,* published by the Society for the Diffusion of Useful Knowledge. *See* D. G. Hogarth, *The Penetration of Arabia* ("Story of Exploration" series) (1904).

**NIEDERWALD,** a broad hill in Germany, in the province of Hesse-Nassau, opposite Bingen, forming the south-western apex of the Taunus range (*q.v.*). Its summit is clothed with dense forests of oak and beech, while its southern and western sides, which descend sharply to the Rhine, are covered with vineyards. On the hill above Rüdesheim, stands the national monument of the war of 1870–71. Cog railways run up the hill.

**NIEHAUS, CHARLES HENRY** (1855–1935), American sculptor, was born at Cincinnati, O., on Jan. 24, 1855. He was a pupil of the McMichen school of design, Cincinnati, and also studied at the Royal Academy, Munich, returning to America in 1881. In 1885, after several years in Rome, he established his studio in New York city. In 1906 he became a National Academician. His principal works are a statue of President Garfield, for Cincinnati; the Hahnemann memorial, in Washington; "Moses" and "Gibbons," for the congressional library, and "James A. Garfield," "John J. Ingalls," "William Allen" and "Oliver P. Morton," for Statuary hall, the Capitol, Washington; "Hooker" and "Davenport," State House, Hartford, Conn.; the Astor memorial doors, Trinity church, New York; "General Forrest," Memphis, Tenn.; Generals Sherman and Lee, and William the Silent; "The Scraper, or Greek Athlete using a Strigil"; statues of Lincoln, Farragut and McKinley, at Muskegon, Mich.; a statue of McKinley and a lunette for McKinley's tomb, at Canton, O.; "The Driller," at Titusville, Pa., in memory of Col. E. L. Drake, who, in 1859, originated the petroleum industry of America; "Francis Scott Key," at Baltimore; and the war memorials at Newark and Hackensack, N.J.

**NIEL, ADOLPHE** (1802–1869), marshal of France, was born at Muret on Oct. 4, 1802, and entered the École Polytechnique in 1821, whence he passed to the engineer school at Metz, becoming lieutenant in the Engineers in 1827 and captain in 1833. He served with distinction in Algeria and in the Crimean War. Niel commanded the IV. corps in the war against the Austrians. (*See* ITALIAN WARS.) On the field of battle of Solferino he was made a marshal of France. After service in a home command, he became minister of war (1867). He drafted and began to carry out a far-reaching scheme of army reform, based on universal service and the automatic creation of large reserves. He also rearmed the whole of the army with the chassepôt rifle. He died on Aug. 13, 1869, in Paris.

**NIELLO** (the Italian form of Lat. *nigellum,* diminutive of *niger,* "black"), a method of producing delicate and minute decoration on a polished metal surface by incised lines filled in with a black metallic amalgam. In some cases it is very difficult to distinguish niello from black enamel; but the black substance differs from true enamel in being metallic, not vitreous. Our knowledge of the process and materials employed in niello-work is derived mainly from four writers, Eraclius the Roman (a writer probably of the 11th century), Theophilus the monk, who wrote in the 12th or 13th century, and, in the 16th century, Benvenuto Cellini and Giorgio Vasari. The design was cut with a sharp graving tool on the smooth surface of the metal, which was usually silver, but occasionally gold or even bronze. An alloy was formed of two parts silver, one-third copper and one-sixth lead; to this mixture, while fluid in the crucible, powdered sulphur in excess was added; and the brittle amalgam, when cold, was finely pounded, and sealed up in large quills for future use. A solution of borax to act as a flux was brushed over the metal plate and thoroughly worked into its incised lines. The powdered amalgam was then shaken out of the quills on to the plate, so as to cover completely all the engraved pattern. The plate was now carefully heated over a charcoal fire, fresh amalgam being added, as the powder fused, upon any defective places. When the powder had become thoroughly liquid, so as to fill all the lines, the plate was allowed to cool, and the whole surface was scraped, so as to remove the superfluous niello, leaving only what had sunk into and filled up the engraved pattern. Last of all the nielloed plate was very highly polished, till it presented the appearance of a smooth metal surface enriched with a delicate design in fine grey-black lines. This process was chiefly used for silver work on account of the vivid contrast between the whiteness of the silver and the darkness of the niello. As the slightest scratch upon the metal received the niello, and became a distinct black line, ornament of the most minute and refined description could easily be produced.



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

VENETIAN SWORD HILT OF THE EARLY 16TH CENTURY

The earliest specimens of niello belong to the Roman period. Two fine examples are in the British Museum. One is a bronze statuette of a Roman general, nearly 2 ft. high, found at Barking hall in Suffolk. The dress and armour have patterns partly inlaid in silver and partly in niello. The dark tint of the bronze rather prevents the niello from showing out distinctly. This statuette is apparently a work of the 1st century. The other example is not earlier than the 4th century. It is a silver casket or lady's toilet box, in which were found an ampulla and other small objects, enriched with niello-work.

From Roman times till the end of the 16th century the art of working in niello seems to have been constantly practised in some part at least of Europe, while in Russia and India it has survived to the present day. From the 6th to the 12th century a large number of massive and splendid works in the precious metals were produced at Byzantium or under Byzantine influence, many of which were largely decorated with niello; the silver dome of the baldacchino over the high altar of S. Sophia was probably one of the most important of these. Niello is frequently mentioned in the inventories of the treasures belonging to the great basilicas of Rome and Byzantium. The Scala d'Oro in S. Mark's, Venice, 10th century, owes much of its refined beauty to niello patterns in the borders. This art was also practised by Bernward, artist-bishop of Hildesheim (11th century). In France, too, judging both from existing specimens of ecclesiastical plate and many records preserved in church inventories, this mode of decoration must have been frequently applied all through the middle ages: especially fine examples once existed at Notre Dame, Paris, and at Cluny, where the columns of the sanctuary were covered with plates of silver in the 11th century, each plate being richly ornamented with designs in niello. Among the early Teutonic and Celtic races, especially from the 8th to the 11th centuries, both in Britain and other countries, niello was frequently used to decorate the very beautiful personal ornaments of which so many specimens enrich the museums of Europe. The British Museum

possesses a fine fibula of silver decorated with a simple pattern in niello and thin plates of repoussé gold. This, though very similar in design to many fibulae from Scandinavia and Britain, was found in a tomb at Kerch (Panticapaeum). Several interesting gold rings of Saxon workmanship have been found at different times, on which the owner's name and ornamental patterns are formed in gold with a background of niello. One with the name of Ethelwulf, king of Wessex (836–858), is now in the British Museum. Another in the Victoria and Albert Museum has the name of Alhstan, who was bishop of Sherborne from 823 to 867. The metal-workers of Ireland, whose skill was quite unrivalled, practised largely the art of niello from the 10th to the 12th century, and possibly even earlier. Fine croziers, shrines, fibulae and other objects of Irish workmanship, most skilfully enriched with elaborate niello-work, exist in considerable numbers. From the 13th to the 16th century but little niello-work appears to have been produced in England. It is, however, in Italy that the art of niello-work was brought to greatest perfection. During the whole mediaeval period it was much used to decorate church plate, silver altar-frontals and the like. The magnificent frontals of Pistoia cathedral and the Florence baptistery are notable instances of this. During the 15th century, especially at Florence, the art of niello-work was practised by almost all the great artist-goldsmiths of that period. The British Museum possesses the finest existing example of 15th-century German niello. It is a silver beaker, covered with graceful scroll-work, forming medallions, in which are figures of cupids employed in various occupations.

BIBLIOGRAPHY.—*The Archaeological Journal* of 1862 (vol. xix., p. 323) has an excellent monograph on the subject, *see* also vol. xii., p. 79 and vol. iv., p. 247; Labarte, *Arts of the Middle Ages* (1855); Texier, *Dictionnaire de l'orfèvrerie*, p. 1822 (Paris, 1857); Lessing, *Collectaneen zur Literatur* (vol. xii., art. "Niellum"); C. Davenport in *Journal of Soc. of Arts*, vol. xlviii. (1901).

**NIEM** [NYEM, or NIEHEIM], **DIETRICH OF** (*c.* 1345–1418), mediaeval historian, was born at Nieheim, a small town subject to the see of Paderborn. He became a notary of the papal court of the rota at Avignon, and in 1376 went with the Curia to Rome. Urban VI. made him an abbreviator to the papal chancery. His chief importance lies in the part he took in the controversies arising out of the Great Schism. He accompanied Gregory XII. to Lucca in May 1408, and, having in vain tried to make the pope listen to counsels of moderation, he joined the Roman and Avignonese cardinals at Pisa. He adhered to the pope elected by the council of Pisa (Alexander V.) and to his successor John XXIII., resuming his place at the Curia. In view of the increasing confusion in the Church, however, he became one of the most ardent advocates of the appeal to a general council. He was present at the council of Constance as adviser to the German "nation." He died at Maastricht on March 22, 1418.

Niem's most important works are the *Nemus unionis*, a valuable collection of papal documents; and the *De schismate*, giving the history of events from 1376 to 1410, when he completed the work. It was continued in the *Historia de vita Johannis XXIII.*

For bibliography *see* Potthast, *Bibl. hist. medii aevi* (2nd ed., Berlin, 1896), p. 1,051, *s.v.* "Theodoricus de Niem"; and generally *see* the article on Niem by Theodor Lindner in *Allgemeine deutsche Biographie* (Leipzig, 1886); and Erler, *Dietrich von Nieheim* (Leipzig, 1887).

**NIEMCEWICZ** (nyĕm-tsā'vĭch), **JULIAN URSIN** (1757–1841), Polish scholar, poet and statesman, was born in 1757. In the earlier part of his life he acted as adjutant to Kosciusko, was taken prisoner with him at the fatal battle of Maciejowice (1794), and shared his captivity at St. Petersburg. On his release he travelled for some time in America, where he married. After the Congress of Vienna he was secretary of state and president of the constitutional committee in Poland, but in 1830–31 he was again driven into exile. He died in Paris on the 21st of April 1841. Niemcewicz wrote comedies, novels and historical works, but he is best remembered by his *Historical Songs of the Poles* (Warsaw, 1816), a series of lyrical compositions in which the chief heroes are of the golden age in Polish history.

His collected works were published in 12 vols. at Leipzig (1838–40).

**NIEPCE** (nē-eps'), **JOSEPH NICEPHORE** (1765–1833), French physicist, and one of the inventors of photography, was born at Châlon-sur-Saône on March 7, 1765. He served in the army and was *administrateur* of the district of Nice from 1795 to 1801. Returning in that year to his birthplace, he devoted himself along with his elder brother Claude (1763–1828) to mechanical and chemical researches. In 1813 the idea of obtaining photographs first suggested itself to him, and in 1827 he succeeded in producing a photograph on a metal plate. Niepce learned that L. J. M. Daguerre was working in the same direction, and in 1829 the two united their forces "pour coopérer au perfectionnement de la découverte inventée par M. Niepce et perfectionnée par M. Daguerre" (*see* also PHOTOGRAPHY). Niepce died at Gras, his property near Châlon, on July 3, 1833.

**NIERSTEIN,** a village of Germany, in the *Land* of Hesse, on the left bank of the Rhine, 8 m. S. from Mainz by the railway to Worms. Pop. (1933) 4,807. Nierstein was originally a Roman settlement, and was a royal residence under the Carolingian rulers. Later it passed from the emperor to the elector palatine of the Rhine. It contains an old Roman bath—Sironabad—and sulphur springs. It is famous for its wines.

**NIETZSCHE, FRIEDRICH WILHELM** (1844–1900), German philosopher, born Oct. 15, 1844 at Röcken near Lützen, in the Prussian province of Saxony, came of a family of clergymen. Both his father and his grandfather were Protestant pastors, while his paternal grandmother and his mother, née Oehler, were also pastors' daughters. They were honourable, pious people, cheerful and happy, with a social life embellished by poetry and music; while their official standing secured them from the petty cares of existence. Nietzsche's forbears also enjoyed singular bodily vigour, which they retained in all its freshness to old age. Nietzsche's father, who died prematurely from a fall down a flight of steps, was an exception. In his joy over the birth of a son, this father inserted in the Church register of Röcken at Friedrich's christening the question from Luke i., 66, "what manner of child shall this be?"

**Wagner and Schopenhauer.**—The boy was educated at Naumburg and at the famous old Fürstenschule of Pforta, which he left with an excellent leaving certificate (with only one "unsatisfactory," in mathematics). In the autumn (1864) he was entered at the University of Bonn, as a student of theology and classical philology. As, however, he found at Bonn an exceptionally gifted teacher of classical philology in Ritschl, he soon, to the great grief of his family, abandoned theology and devoted himself exclusively to philological studies. In fact, the undergraduate Nietzsche severed himself not only from theology but from Christianity; the determining influence in this change was his reading of Schopenhauer, whose great work, *The World as Will and Idea,* had fallen into his hands by accident.

His enthusiasm for Schopenhauer and for music—an art which Nietzsche loved and practised throughout his life—brought him into touch with Richard Wagner, who was then living at Triebschen on the Lake of Lucerne. Nietzsche, as a young student of 25, had, on Ritschl's recommendation, been appointed professor at Basel; and close personal intercourse with Wagner followed. The two men agreed in their judgment of their own time, and in their appreciation of antiquity; Nietzsche combined Wagner's views and his own researches on Greek artistic achievement in *Die Geburt der Tragödie* (1870–71). But the book was severely condemned by the official German school, under the leadership of Ulrich v. Wilamowitz, and Nietzsche as a classical scholar was outlawed.

He clung all the more closely to Wagner, at whose side he waged war against German lack of culture. The four *Unzeitgemässen Betrachtungen,* devoted to this struggle, were intended to restore Germany, whose development Nietzsche felt had been jeopardized by the victories of 1864, '66 and '70, to intellectual pursuits. These four polemical works (1873–76) are entitled *David Strauss, der Bekenner und Schriftsteller; Vom Nutzen und Nachteil der Historie für das Leben; Schopenhauer als Erzieher;* and *Richard Wagner in Bayreuth.*

In working on the last of these, Nietzsche began to be conscious of reservations both on the cultural value of Wagner's creations, and on his personality; during the Bayreuth Festival, these reser-

vations led to estrangement and ultimately to passionate renunciation. (See *Der Fall Wagner, Nietzsche contra Wagner,* 1888.) Nietzsche held that Wagner's art was nothing more than the dope required by a decadent generation, and the whitewashing of Schopenhauer's pessimism. In both his models, Schopenhauer and Wagner, he began to discern tendencies towards Christian and Buddhistic negation, and therefore, though with much pain, broke loose from them. The first expression of this emancipation is found in *Menschliches all-zu Menschliches* (2 vols. 1878), in which Nietzsche enters on his essentially negative critical period. In 1879, probably owing to the pain caused by his violent separation from his friends and masters, Nietzsche's health became so bad that he had to resign his professorship at Basle. Thenceforward, he lived chiefly in northern Italy, the Engadine, or the French Riviera, on the small pension granted him by the university of Basle.

**Maturity.**—From this time onwards, he devoted himself wholly to philosophy, and with the gradual improvement in his health, entered the third and mature period of his creative life, during which his best works were given to the world. In *Morgenröte* (1880–81) and *Die fröhliche Wissenschaft* (1881–82), he fought romanticism in all its manifestations, and revealed art, religion and philosophy as illusions invented by man as weapons in his struggle for development, for prevailing over himself and his fellows.

In the years 1883–85, he produced work which he himself regarded as his highest achievement. Written in the style of an Old Testament prophet, this work which was his own New Testament, the gospel of the superman and the eternal recurrence, was entitled *Also Sprach Zarathustra. Ein Buch für Alle und Keinen.* Nietzsche provided a valuable interpretation of this work, parts of which even to-day are difficult to understand, in the two volumes of *Jenseits von Gut und Böse* (1885–86) and *Genealogie der Moral* (1887). He then planned a greater work, *Der Wille zur Macht: Versuch zur Umwertung aller Werte.* It was never finished, but contains no less than 1,052 valuable aphorisms: its two volumes (Vols. xiv. and xv. in the English works) are divided into the following sections:—(1) European Nihilism, (2) A Criticism of the Highest Values that have prevailed hitherto, (3) The Principles of a New Valuation, (4) Discipline and Breeding. The three fine and stimulating books, *Götzendämmerung, oder wie man mit dem Hammer philosophiert, Der Antichrist,* and the autobiography *Ecce Homo,* date from his last and exceptionally productive period, the year 1888.

At the turn of the year (1888–89) Nietzsche broke down, probably from overwork; for, outwardly calm as his life had been, the philosopher had suffered most violent moral upheavals, and had moreover recorded his innermost experience in a brief space of time in a number of carefully thought out works. Another cause of his breakdown was probably his extreme loneliness; only in the last year of his conscious life was he "discovered" by the Danish-European critic and author, Georg Brandes; he himself had neither followers nor disciples. We may take him at his word when, on July 8, 1886, he writes to his sister:—"My health is really quite normal—only my soul is so sensitive and so full of longing for good friends of my own kind. Get me a small circle of men who will listen to me and understand me—and I shall be cured." Nietzsche lived on for another 12 years, first with his mother at Naumburg and, after the latter's death, with his widowed sister, Elizabeth Förster-Nietzsche at Weimar, where he died on Aug. 25, 1900. He was buried in the churchyard of Röcken.

**The Message.**—In order to understand Nietzsche's philosophy, which departs conspicuously from the orthodox and academic, it is necessary once more to make a profound study of his development. Nietzsche, it must be remembered, did not spin his view of life out of his inner consciousness, but lived and suffered it—a fact which explains both his language, free from learned jargon, and his half pathetic, half ironical style, which is yet always so full of poetry and metaphor.

Nietzsche, as we have seen, started his philosophical career with Schopenhauer—the philosopher who took such a gloomy and despondent view of life that, at last, in wrath over his own aversions, he denied the will to life altogether. In the end Nietzsche came to regard Schopenhauer's principal work as the outpourings of a melancholy young man. Its author never fought his way through to cheerful maturity, but remained fettered to the doctrines he had laid down early in life. Nietzsche, whose motto was, "Only he who altereth remains unalterably mine," condemned this lack of capacity for development.

The changes in Nietzsche's own nature took place under the influence of Pre-Socratic antiquity; by this standard he weighed both Schopenhauer's and every other philosophy which either denied or was hostile to life. He saw that pagan antiquity had said "yea" to life; but that there had been, and now existed, other and different judgments and valuations of existence and "things." The attitude of civilization towards existence and "things," depended upon that civilization's values; and values may be either life-promoting or life-arresting.

**The Good, The True and The Beautiful.**—What are the ruling values of our civilization? Nietzsche replies, the ruling values of our civilization are those of the good, the true and the beautiful; which have ruled for thousands of years. All thinkers, including Plato, have acknowledged them as the highest. Nietzsche condemns these values as life-arresting; they are moreover quite illusory, for there is no instinct for goodness, truth and beauty. What does exist is another instinct—the will to power, the will to a stronger and higher existence. This will to power designates as good, true and beautiful, whatever is useful to the individual, whatever serves his advancement and enables him to establish his type by victory over others and using those others for his ends. Not goodness, truth or beauty *per se* determines what is good, true and beautiful, but something which lies behind goodness, truth and beauty, something which is higher, deeper, more important and more mighty than any of them, and uses "good," "true" and "beautiful," merely as means, as weapons to affirm and promote its own life and the lives of those that are like it—to wit, the will to power.

Good, true and beautiful are therefore not fixed values; they are relative, and there always stands behind them some human type, which by means of them is furthering its own ends. How came they to prevail as absolute values? How came they to prevail to such an extent that ultimately they were imposed upon all? "*Cui bono* were these values proclaimed?" Nietzsche asks. And he replies, "Even these, our present values, are the expression of a will to power—but of the will of the impotent, the humble, the feeble, the subjected, the peaceloving, who by means of these values wished to predominate and—have succeeded."

Our values "good," "true" and "beautiful," which led to Schopenhauer's philosophy and to the gloomy and disintegrated state of the world, came, according to Nietzsche, from the Jews. Among the Jews, the slave people of antiquity, arose the values which, with the help of religion and its moral content, still rule our present-day world. It is true that the Jews themselves once maintained a yea-saying attitude to the world. In the days of their prosperity, when they were still a triumphant and warlike people, ruled by capable kings, they too called "good" everything that was "bold," "vigorous," "joyful," "cruel" and "self-reliant." But ultimately these Jews fell under the heel of various foreign invaders, and their faith in the old natural values declined —but not their will to live, which now they fostered under a table of values and judgments the reverse of those they had formerly held.

Thenceforward they gradually and systematically demonetized "good." They called good all that was "cautious," "clever," "humble," "pacific," "mendacious" and "adaptable"; while their "evil" became everything that was "strong," "hard," "upright," "energetic," "exuberant" and "self-respecting." Thus, in the end, the Jews transvalued all values; thus they corrupted the master morality into the slave morality. "The Jews," says Nietzsche, "performed the miracle of the inversion of valuations; they led the slave-insurrection in morals. Jesus of Nazareth, this 'Redeemer,' bringing salvation and victory to the poor, the sick, the sinful—was he not really temptation in its most irresistible form, tempta-

tion to seize hold of those very Jewish values and new ideals? *'Sub hoc signo'* Israel, with its slave morality, triumphed over the noble ideals of master morality. Under Israel's flag the people have triumphed, or the slaves, or the populace, or the herd, or whatever name you care to give them. The 'masters' have been done away with; the morality of the common man has triumphed."

**Levelling.**—The Jews thus bequeathed the values of their decadence to Christianity, and the latter, for its part, accentuated them, and spread them all over the world through many centuries of preaching and propaganda. Since the Crucifixion of Christ the noble have only been able to assert themselves for brief periods in Europe; *i.e.*, at the Renaissance, under Louis XIV., and under Napoleon I. They were immediately suppressed by the Reformation, the French Revolution and the so-called Wars of Liberation against the "Corsican invader." All this occurred gradually, without mankind becoming aware of what had happened, so that the world never obtained a clear conception of how thoroughly it had been Semitized.

The 19th, Nietzsche's own century, which he assailed most wrathfully, had, according to him, finally let loose all these Christian instincts. These instincts, in their political disguise, dominate all modern movements—the labour, pacifist and feminist movements. "All distinctions must be removed," is the order of the day, even the natural distinction between man and woman. Yet, according to Nietzsche, the emancipation of woman can lead only to her enfeeblement and the destruction of her charm; and, therefore, only to defective offspring. If healthy children are to be produced, the differences between the sexes should be maintained, even deepened. But modern democracy will have nothing to do with differences, and in this demand is it not the legatee of Christianity? Christianity claims the equality of men before God, democracy, the equality of all men before the law. And as democracy derives from Christianity, so does socialism, which is little more than the Gospel in modern dress. For the Gospel was originally "the announcement that the road to happiness lies open to the poor and lowly—that all that is necessary is emancipation from institutions, tradition, and the tutelage of the ruling classes.

"This Christianity is no more than the typical teaching of the Socialists. Property, acquisition, fatherland, rank and position, courts of law, the police, State, Church, education, art, militarism: all these are so many obstacles in the way of happiness, so many mistakes, snares, and devil's artifices, on which the Gospel passes sentence—all this is typical of socialistic doctrine." (*Der Wille zur Macht,* Aphorism 209.)

**The Will to Power.**—Is there then no escape from this topsy-turvy world? Is there no hope that other than Semitic values will once again prevail, and that other than "herd" men will be born? Are the "meek and the poor in spirit" always to be allowed to "have their say," and thus continue to "torture" the ears of him who "remembers with a shudder that mankind's fate depends upon the success of its highest types?"

To the anxious enquirer who puts this question, Nietzsche replies:—"Yes, there is a way, but new Gods, or resuscitated old Gods can no longer be of any avail. Our only hope lies in new men." And, according to him, these new men are already in process of formation. "The aspect of the European of to-day," says our philosopher, "makes me very hopeful. A daring and ruler race is building itself up, upon the foundation of an extremely intelligent gregarious mass. . . . The same conditions which go to develop the gregarious animal also force the development of the leaders." (*Der Wille zur Macht,* Aph. 955–56.) "While, therefore, the democratization of Europe will tend to the production of a type prepared for slavery in the most subtle sense of the term, the strong man will necessarily, in individual and exceptional cases become stronger and richer than he has perhaps ever been before. . . . The democratization of Europe is at the same time an involuntary preparation for the rearing of tyrants—taking the word in all its meanings, even in its most spiritual sense.". . .

For Nietzsche saw great dangers threatening both the 20th century and its successor. With them would come the classical era of great wars and revolutions, says this poet-philosopher, who, incidentally, was also a true prophet. In these wars and revolutions (which by-the-bye he only foresaw and did not bring about as Allied War propaganda alleged), he welcomed a means for the masculinization of the world, the rearing of a higher type of man, and the creation of a new ruler caste.

For these, and these alone, he demanded emancipation from the Judaeo-Christian morality. Only to these higher and stronger men, from whom ultimately Superman was to spring, did he grant and recommend his famous formula of the transvaluation of all values:—"The aim should be to prepare a transvaluation of values for a particularly strong kind of man, most highly gifted in intellect and will, and, to this end, slowly and cautiously to liberate in him a whole host of slandered instincts, hitherto held in check: whoever meditates about this problem belongs to us, the free spirits—though not to that kind of 'free spirit' which has existed hitherto: for these desired practically the reverse." (*Der Wille zur Macht,* Aph. 957.) And in the very next aphorism he adds: "I am writing for a race of men which does not yet exist: for the lords of the earth.". . . "Live dangerously!"—this motto, which he himself lived up to, Nietzsche addresses to these future lords of the earth, while gladly conceding to others the right to strive for happiness and safety, and to cultivate domestic virtues. For, in all his writings, the philosopher emphasized that he had set up no moral code for the generality of men, and that he had no wish to lead lesser men away from their virtues and their duties. "I am a law only for mine own; I am not a law for all. He, however, who belongs to me must be strong of bone and light of foot,"—(*Also Sprach Zarathustra*).

**The Rejection of Nietzsche.**—An aristocratic doctrine like this, addressed to a self-confident democracy, inevitably met in the first place with misunderstanding, or, rather, with silence, then contempt, and finally with rejection. It was rejected all the more firmly, when, despite Nietzsche's warning, many uninvited guests pressed into his garden, and indulged their chaotic and rebellious instincts "beyond good and evil." Nietzsche himself had forseen these unwanted disciples, and had warned the world as follows:—"The first followers of a Creed prove nothing against it." To these false followers, Nietzsche preferred his adversaries, among whom the true believers were by no means the worst.

But those he esteemed least were his former colleagues; for the ears of scholars and university professors were least attuned to his message. To these men, as has been well said, the new teaching was a "bolt from the blue": although even this was not entirely true; for, like every other thinker, Nietzsche of course had his predecessors, whom he expressly mentioned by name—Heraclitus, Empedocles, Spinoza and Goethe.

His doctrine fared just as badly with the politicians whom he offended, without exception, the conservatives by his revolutionary views, and the socialists by his conservatism. He arraigned no less all the religious sects and classes. Jew and gentile, man and woman, patriot and pacifist, were all criticized; for the roller of equality had levelled everything and everybody, and property constituted the only distinction—not, however, in Nietzsche's eyes; for he saw and asked: "Mob above, mob below! what to-day means poor or rich?" Thus, for the first 50 years after it was expounded, the teaching, despite the recognition of individuals, fell, as it were, between all stools; while its messenger by his countless opponents in every country, including Germany, was branded as misanthropist, madman, promotor of wars, infidel, dysangelist and corruptor of morals.

**Nietzsche's Contribution.**—A further and more dispassionate study of his philosophy must, however, lead to a different conclusion, particularly on the charge of irreligion, although it must be admitted that the firm rejection of Nietzsche's teaching by those who clung to the old beliefs is quite comprehensible. Nietzsche was a destructive genius of the first order, and his revolutionary movement could not but arouse suspicion and misunderstanding at the time. Men felt, if only unconsciously, the unprecedented acuteness and the novelty of his attack; for Nietzsche's vigilant eye descried all his opponents' weak points, and his psychological ruthlessness tore veil after veil from ideals cherished for centuries. Where his predecessors had seen vices, he saw virtues, or the possibility of virtues; and where they had

seen virtues, he saw vices, or the possibility of vices. His attack on Christianity was much more thorough than that of Voltaire, whose *"écrasez l'infâme!"* had really done no more than assail the out-works of the Christian stronghold, its dogmas and ceremonies, without however aiming at the inner core of the Faith, the Christian ideal itself. Thus Nietzsche's rejection of all the values which had been held most sacred for centuries, inevitably made him the great solitary that he was. Such daring and scornful condemnation, such glacial negation, could not be understood at once, or greeted with applause, especially as at first his very motives remained obscure. Nobody understood in the early days that his teaching against pity sprang from his love of healthy life, against morality, from his love of a higher ethic, and against patriotism from his desire for a united Europe.

Late and slowly the world began, or is beginning to change its mind about "the anti-antichrist," and to perceive that he was not merely "anti"; but that the destroyer of the old tables of values was also a creator of new values. For in Nietzsche, destruction was accompanied by creation, wrath by blessing, and his vehement nay by an equally emphatic yea. His nay was directed at sickness, weakness and decadence, while his yea was for all those healthy instincts slandered and suppressed by the religion and morality up to his day. Nietzsche became the redeemer of these honest and virile instincts, and endeavoured to make their corresponding lordly virtues contribute to a great vision which he had had of the future. This vision, conceived in ecstasy, he depicted with the versatile talent of a scholar, a musician and a poet, and left to posterity a series of works which bear witness to his profound morality, and are to be regarded in the highest sense of the word, as religious.

BIBLIOGRAPHY.—*Translations:—The Authorized English Translation of Nietzsche's Works,* by Oscar Levy (1909–13, 18 vol.). A selection from the five-volume German edition of Nietzsche's letters, published under the title of *Selected Letters of Friedrich Nietzsche* (1921); Elizabeth Förster-Nietzsche, *The Young Nietzsche* (Eng. trans. by A. M. Ludovici, 1912), *The Lonely Nietzsche* (Eng. trans. by Paul V. Cohn, 1915); Daniel Halévy, *La vie de Nietzsche* (1909; translated by J. M. Hone, as *The Life of Nietzsche,* 1911).

*Books about Nietzsche.* The number of books written about Nietzsche in various languages is so vast that it is only possible to select a few, some of which will be found to take up a critical attitude towards the philosopher:—H. Lichtenberger, *La Philosophie de Nietzsche* (1898) trans. J. M. Kennedy as *The Gospel of the Superman* (2nd edition 1926); O. Levy, *The Revival of Aristocracy* (1906); J. M. Kennedy, *The Quintessence of Nietzsche* (1909); M. Mügge, *Nietzsche, his Life and Work* (1909); A. M. Ludovici, *Who is to be Master of the World?* (1909); A. M. Ludovici, *Nietzsche, his Life and Works* (1910); G. Chatterton Hill, *The Philosophy of Nietzsche* (1912); Georg Brandes (trans. by A. G. Chates), *Friedrich Nietzsche* (1914); A. Wolf, *The Philosophy of Nietzsche* (1915); J. N. Figgis, *The Will to Freedom, or the Gospel of Nietzsche and the Gospel of Christ* (1917); W. M. Salter, *Nietzsche, The Thinker* (1917); Charles Andler, *Nietzsche, sa vie et sa pensée,* 6 vols. (1920–28); J. Lavrin, *Nietzsche and Modern Consciousness* (1922); M. Havenstein, *Nietzsche als Erzieher* (1922); Amance, *Divinité de Frédéric Nietzsche: germe d'une religion d'Europe* (1925); Jules de Gaultier, *Nietzsche* (1926); Fritz Krökel, *Europas Selbstbesinnung durch Nietzsche* (1929).

(O. L.)

**NIEUPORT** (Flem. *Nieuwpoort*), a town of Belgium in the province of West Flanders. Pop. (1939) 5,426. It was the port of Ypres, and is situated on the Yser about 10 mi. S. of Ostend. At one time Lombartzyde was the port of the Yser, but in the course of the 12th century mud was silted up, and ships went further south to Sandeshove, where it was more navigable. This place became the "Novus portus": Nieuport. It was strongly fortified in the middle ages and its siege by the French in 1488–89 is an episode of its heroic period. Under its walls in 1600 Maurice of Nassau defeated the archduke Albert and the Spaniards. It contains an ancient cloth market, a fine town-hall and an old church, and outside is a lighthouse dating from 1289. More than once in the course of its history, the town has been completely rebuilt, hence its draughtsboard plan, preserved even after the wholesale destruction of 1914–18.

Nieuport has one of the main artificial drainage outlets of the low country, the locks of Palingbrug. After World War I they were rebuilt in the form of six locks debouching on the canal of the Yser. They played an important part in the war, being the instrument of the famous flooding of the front on the Yser on Oct. 29, 1914; all that was necessary to submerge a large part of the district, under the enemy's fire, was to reverse the normal process, *i.e.,* to close the locks to the lower and open them to the higher water, so as to allow the tide to flow inland.

Nieuwpoort Bad, 2 mi. from the town, is a fashionable seaside resort dating from 1869.

**NIÈVRE,** a department of France, formed from the old province of Nivernais with a small part of the Orléanais. It is bounded north-west by Loiret, north by Yonne, east by Côte d'Or, east and south-east by Saône-et-Loire, south by Allier and west by Cher. Pop. (1936) 249,673. Area 2,660 sq. miles. Nièvre falls into three regions. In the east are the granitic mountains of the Morvan, one of the most picturesque parts of France, containing Mont Prénelay (2,789 ft.) and several lesser heights. The north and centre are occupied by plateaux of Jurassic limestone with a maximum elevation of 1,400 feet. The west and south-western part of the department is a district of plains, composed mainly of Tertiary formations with alluvial deposits, and comprising the valleys of the Loire and the Allier. The lowest level of the department is 446 ft., at the exit of the Loire. Eastern Nièvre belongs to the upper basin of the Yonne, a tributary of the Seine, followed by the southern part of the Nivernais canal; western Nièvre drains towards the Loire, which crosses its south-western corner and then forms its western boundary.

The principal cereals are oats and wheat; potatoes and various kinds of forage are also largely grown. On the extensive pastures much cattle is fattened. The Nivernais and Charolais are the chief breeds. The rearing of sheep and draught-horses is also important. Vines are grown in the Loire valley and near Clamecy. The white wines of Pouilly are widely known. Nièvre abounds in forests, the chief trees being the oak, beech, hornbeam, elm and chestnut. Coal is mined at Decize, and gypsum, building stone, and kaolin are quarried. The best-known mineral springs are those of Pougues and St. Honoré. Nièvre is famous for iron-works, the most important being those of Fourchambault. At Imphy there are large steel-works. The government works of La Chaussade at Guérigny make chain-cables, anchors, armour-plates, etc. There are also manufactories of agricultural implements and hardware, potteries, manufactories of porcelain and faïence (at Nevers) and glass works, tile-works, chemical works, paper-mills and saw-mills, as well as tanneries, boot and shoe factories, cask manufactories and oil works (colza, poppy and hemp). In the Morvan district the timber industry is important.

Much of the traffic is by water: the canal along the Loire runs through the department for 38 m., and the Nivernais canal for 78 miles. The chief railway is that of the P.L.M. company, whose main line to Nîmes follows the valley of the Loire and Allier. Nièvre is divided into 3 arrondissements (Nevers, Château-Chinon and Clamecy being their capitals), 25 cantons, 313 communes. It forms the diocese of Nevers under the archbishop of Sens and part of the académie (educational district) of Dijon and of the region of the VIII army corps. The chief towns are Nevers, the capital, Clamecy, Fourchambault, Cosne, La Charité and Decize. The appeal court is at Bourges.

**NIFO, AGOSTINO** [AUGUSTINUS NIPHUS] (1473?–1538 or 1545), Italian philosopher and commentator, was born at Japoli, Calabria. He lectured at Padua, Naples, Rome and Pisa, and was deputed by Leo X. to defend the Catholic doctrine of Immortality against the attack of Pomponazzi and the Alexandrists. In return for this he was made Count Palatine, with the right to call himself by the name Medici. He edited (1495) the works of Averroes; with a commentary compatible with his lately acquired orthodoxy. In the great controversy with the Alexandrists he opposed Pomponazzi's theory that the death of the body means the death of the soul. He insisted that the individual soul, as part of absolute intellect, is indestructible, and on the death of the body is merged in the eternal unity.

His principal philosophical works are *De immortalitate animi* (1518 and 1524); *De intellectu et daemonibus; De infinitate primi motoris quaestio* and *Opuscula moralia et politica.* His numerous commentaries on Aristotle were frequently reprinted, the best-known edition being printed at Paris in 1654 in 14 vols.

**NIĞDE** (Arab. *Nakidah*), the chief town of a vilayet in Turkey, situated on the Kaisarieh-Cilician Gates road. It is remarkable for the beauty of its buildings, dating from almost all ages of the Seljuk period. After the fall of the sultanate of Rum (of which it had been one of the principal cities), Niğde became independent, and, according to Ibu Batuta, ruinous, and did not pass into Ottoman hands till the time of Mohammed II. It represents no classical town, but, with Bor, has inherited the importance of Tyana, whose site lies about 10 mi. S.W. A Hittite-inscribed monument, brought perhaps from Tyana, has been found at Niğde. Pop. (1935), 59,289; of the vilayet, 251,858.

**NIGEL** (d. 1169), bishop of Ely, head of the exchequer in the reigns of Henry I. and Henry II., was brought into the exchequer in early life (1130). Soon after his uncle Roger of Salisbury secured him the bishopric of Ely, much to the disgust of the monks. Nigel incurred the suspicion of leaning towards the Angevin interest, when Roger of Salisbury and Alexander of Lincoln were arrested by Stephen (Jan. 1139). He attempted to maintain himself in his see by force of arms, but he was forced to fly to the empress at Gloucester. He was reconciled to Stephen in 1142 and restored to his see; but he now quarrelled with Henry of Winchester and was forced to go to Rome. Fortunately, he secured the strong and uniform support of the Roman Curia. At the accession of Henry II. (1154) Nigel was summoned to reorganize the exchequer. He was the only surviving minister of Henry I., and his knowledge of the exchequer business was unrivalled. This was the great work of his life. To the work of his son Richard, the *Dialogus de Scaccario,* we owe our knowledge of exchequer procedure as it was left by Nigel. The bishop took little part in politics, except as an administrator. In 1166 his health was broken by a paralytic seizure.

*See* F. Liebermann, *Einleitung in den Dialogus de Scaccario* (1875); J. H. Round, *Geoffrey de Mandeville* (1892).

**NIGER,** a great river of West Africa, inferior only to the Congo and Nile among the rivers of the continent. Rising within 150 m. of the sea in the mountainous zone which marks the north-east frontiers of Sierra Leone and French Guinea, it traverses the interior plateaux in a vast curve, flowing north-east, east and south-east, until it finally enters the Gulf of Guinea through an immense delta. Its total length is about 2,600 miles. About 250 m. from its mouth it is joined by the Benue, coming from the east from the mountainous region of Adamawa. From its mouth to the limit of navigability from the sea the Niger is in British territory; above that point it flows through French territory. The area of the Niger basin is calculated at 580,000 sq.m. at least.

The source of the Niger lies in 9° 5′ N. and 10° 47′ W.; the most northerly point of the great bend is about 17° N. and the mouth is in 4° 30′ N. 6° E. The river is known locally under various names, the most common being Joliba (a Mandigo word meaning great river) and Kworra or Quorra. By the last name the Niger was known in its lower reaches before its identity with the upper river was established. The Tembi, the stream considered the chief source of the Niger, issues from a deep ravine 2,800 ft. above sea-level where, from a moss-covered rock a spring issues and has made a pool below. The overflow forms the Tembi, which within a short distance is joined by two other rivulets, the Tamincono and Falico, which have their origin in the same mountainous district. After flowing north for about 100 m., the river turns eastward and at its confluence with the Tankisso (a northern tributary), 210 m. from its source, has attained dimensions sufficient to earn for itself the title Joliba. Taking at this point a decided trend northward, the Niger, 100 m. lower down, at Bamako has a depth of 6 ft. with a breadth of 1,300 feet. Seven or eight miles below Bamako the Sotuba rocks mark the end of what may be considered the upper river. Thirty miles below Sotuba are the rapids of Tulimandio; a little lower down is Kulikoro, from which point the bed of the stream for over 1,000 m. is fairly free from impediments.

**Middle Niger and Lake Region.**—The Niger here turns more directly to the east and increases in volume and depth. Below Sansandig the banks of the river become low and the Niger is split up into a number of channels. Mopti is at the junction of the main stream with a large right-hand backwater or tributary, the Bani or Mahel Balevel, on which is situated the important town of Jenné. Below Mopti is a swampy and treeless region and the first of a series of lakes (Debo) is reached. These lakes are chiefly on the left of the main stream, with which they are connected by channels conveying the water in one direction or the other according to the season. At high water most of these are united into one general inundation. The largest lake, Faguibini, is nearly 70 m. long by 12 m. broad, has high shores and reaches a depth exceeding, in parts, 160 feet. It is not until Kabara, the port of Timbuktu, is reached, a distance of 450 m. from Sansandig, that the labyrinth of lakes, creeks and backwaters ceases. Below Kabara the river reaches its most northerly point. Here, and for some 500 m. down stream the river is bordered on the north by the Sahara; in places it is desert on both sides, with long lines of sand dunes. At Bamba it is shut in by steep banks, and narrows to from 600 to 700 yd., again spreading out some distance down. At Tosaye (about 250 m. from Timbuktu) the stream turns distinctly south-east and preserves that direction throughout the remainder of its course. Here, just before the bend becomes pronounced, the Baror and Chabar rocks reduce the width of the river to less than 500 ft., and at low water the strength of the current is a serious danger to navigation.

At Ansongo, 430 m. below Timbuktu, the navigable reach of the middle Niger, in all 1,057 m., ends. Four huge flint rocks bar the river at Ansongo and effectually prevent further navigation except in very shallow draught vessels. From Ansongo to Say, some 250 m., the river presents a labyrinth of rocks, islands, reefs and rapids. From Say, where the stream is about 700 yd. in breadth, to Bussa, there is another navigable stretch extending 300 miles. After the desert region is past the Niger receives the waters of the river Sokoto, a considerable stream flowing from the north-east. Some distance below this confluence are the Bussa rapids. These rapids are of a more dangerous character than any encountered between Ansongo and Say. "In one pass, some 54 yd. wide, shut in between two large reefs, a good half of the waters of the Niger flings itself over with a tremendous roar" (Hourst). The rapids extend for 50 m. or more; in a less obstructive form they continue to Rabba.

**Lower River and Delta.**—A little above Rabba the river makes a loop south-west, at the head of the loop being (right bank) Jebba. Here there is an island in midstream, taken advantage of in the bridging of the river by the railway from Lagos. Sixty miles lower down is the mouth of the (left hand) tributary the Kaduna, a river of some magnitude whose head waters are not far from Kano. In 7° 50′ N. 6° 45′ E. the Niger is joined by its great tributary the Benue. At their confluence the Niger is about ¾ m. broad and the Benue rather more than a mile. The united stream forms a lake-like expansion about 2 m. in width, dotted with islands and sandbanks; the peninsula at the junction is low, swampy and intersected by numerous channels. The stream, as far south as Iddah (Ida), a town on the east bank, rushes through a valley cut between the hills, the sandstone cliffs at some places rising 150 ft. high. Between Iddah and Onitsha, 80 m., the banks are lower and the country flatter, and to the south of Onitsha the whole land is laid under water during the annual floods. Here may be said to begin the great delta of the Niger, which, extending along the coast for about 120 m., and 140 or 150 m. inland, forms one of the most remarkable of all the swampy regions of Africa. The river breaks up into an intricate network of channels, dividing and subdividing, and intercrossing not only with each other but with the branches of other streams, so that it is exceedingly difficult to say where the Niger delta ends and another river system begins. The Rio Nun is a direct continuation of the line of the undivided river, and is thus the main mouth of the Niger. From the sea the only indication of a river mouth is a break in the dark green mangroves which here universally fringe the coast. The crossing of the bar—where the depth of water is but 12 or 13 ft.—requires considerable care, and as other branches of the Niger afford better access the Nun mouth is now little used. East of the

Nun the estuaries known as the Brass, Sombrero, New Calabar, Bonny, Opobo (or Imo), etc. (with the exception, perhaps, of the first-named), seem to derive most of their water from independent streams. West of the Nun all the estuaries up to the Forcados seem to be true mouths of the great river. The Forcados has supplanted the Nun river as the chief channel of communication by water with the interior. The mouth of the Forcados is 2 m. wide, the bar, formerly but ¾ m. across, had by 1927 grown to 2¼ m. across, but the depth of water allowed vessels of 18 ft. draught to enter the river; within the bar is a deep water natural harbour of 3 to 4 square miles. Five miles up stream is the port of Burutu. From the mouth of the Forcados to the main stream is 105 m., with a minimum depth in the dry season of seven feet. The other western mouths of the Niger have as a rule shallow and difficult bars. The delta is the largest in Africa and covers 14,000 square miles, a larger area than the more famous Nile delta.

**The Benue.**—The Benue is by far the most important of the affluents of the Niger. The name signifies in the Batta tongue "Mother of Waters." The river rises in Adamawa in about 7° 40′ N. and 13° 15′ E., at a height of over 3,000 ft., being separated by a narrow water parting from one of the head-streams of the Logone, whose waters flow to Lake Chad. In its upper course the Benue is a mountain torrent falling over 2,000 ft. in some 150 miles. With the Chad system it is connected by the Kebbi or Mayo Kebbi, a river which issues from the south-west end of the Tuburi marshes, and eventually joins the Benue. The Tuburi marshes occupy an extensive depression in the plateau east of the Mandara hills, and are cut by 10° N., 15° E. The central part of the marshes forms a deep lake, whence there is a channel going northward to the Logone.

Below the Kebbi confluence the Benue, now a considerable river, turns from a northerly to a westerly direction and is navigable all the year round by boats drawing not more than 2½ feet. At Yola, a town some 850 m. by river from the sea and at an altitude of 600 ft., the width of the stream at flood time reaches to 1,000 or 1,500 yd., and though it narrows at the somewhat dangerous rapids of Runde Gilla to 150 or 180 yd., it soon expands again. About 50 m. above Yola the Benue is joined by the Faro, a river rising in the Adamawa hills, and some 50 m. below Yola the Benue receives, on the right bank, the Gongola, which rises in the Bauchi highlands and after a great curve north-east turns southward. It is over 300 m. long, and at flood time is navigable for about half of its course. In its lower course the Benue is joined by several other streams; its valley is bordered by ranges of hills.

As the Niger and the Benue have different gathering grounds, they are not in flood at the same time. The upper Niger rises in June and decreases in December. The middle Niger, however, reaches its maximum near Timbuktu only in January and April–July is the low water season. The Benue reaches its greatest height in August or September, begins to fall in October, falls rapidly in November and slowly in the next three months, and reaches its lowest in March and April. The flood rises with great rapidity, and reaches 50, 60 or even 75 ft. above the low-water mark.

Below the Benue confluence the Niger is at its lowest in April and May; in June it is subject to great fluctuations; about the middle of August it usually begins to rise; and its maximum is reached in September. In October it sinks, often rapidly. A slight rise in January, known as the *yangbe,* is occasioned by water from the upper Niger. Between high and low-water mark the difference is as much as 35 ft.

**History and Exploration.**—Vague ideas of the existence of the river were possessed by the ancients. The great river flowing eastward reached by the Nasamonians as reported by Herodotus can be no other than the Niger. Pliny mentions a river Nigris, of the same nature with the Nile, separating Africa and Ethiopia, and forming the boundary of Gaetulia; and it is not improbable that this is the modern Niger. In Ptolemy, too, appears along with Gir (possibly the Shari) a certain Nigir (Νίγειρ) as one of the largest rivers of the interior; but so vague is his description that it is impossible definitely to identify it with the Niger. Arabian geographers, such as Ibn Batuta, who were acquainted with the middle course of the river, called it the Nile of the Negroes. At the same time contradictory opinions were held as to the course of the stream. It was supposed by some geographers to run west, an opinion probably first stated by Idrisi in the 12th century. Idrisi gave the Nile of Egypt and the Nile of the Negroes a common source in the Mountain of the Moon. Fountains from the mountain formed two lakes, whence issued streams which united in a very large lake. From this third lake issued two rivers—the Nile of Egypt flowing north, and that of the Negroes flowing west (*see* R. Dozy and M. J. de Goeje's *Edrisi,* Leiden, 1866: Premier Climat, 1st four sections). From Idrisi's description it would appear that he regarded the Shari, Lake Chad, the Benue, Niger and Senegal as one great river which emptied into the Atlantic. From 1405 to 1413 a Frenchman, Anselme d'Isalguier, lived at Gao, a city on the Niger 400 m. below Timbuktu; the account of his travels was never printed and is lost. Knowledge of his adventures, never widely known, was completely forgotten until brought to light by Ch. de la Roncière (*see* his *Découverte de l'Afrique au Moyen Âge,* vol. iii., Cairo, 1927). Leo Africanus visited the Niger regions in 1513–15 without settling the question as to the direction of the river. The belief that a western branch of the Nile emptied itself into the Atlantic was held by Prince Henry of Portugal, who instructed the navigators he despatched to Guinea to look for the mouth of the river, and when in 1445 they entered the estuary of the Senegal, the Portuguese were convinced that they had discovered the Nile of the Negroes (*see* Azurara's *Discovery and Conquest of Guinea,* Beazley and Prestage's translation, vol. ii., London, 1899, chap. lx. and lxi., and introduction and notes). The Senegal being proved an independent river and the eastward flow of the Niger assumed, the theory that it ran into the Nile was revived.

That the vast network of rivers on the Guinea coast, of which the Nun was the chief, known as the Oil rivers, formed the delta of the Niger does not appear to have been suspected before the beginning of the 19th century. Consequently it was from the direction of its source that the river was first explored in modern times. In 1795 Mungo Park (*q.v.*), sent out by the African Association, landed at the Gambia, and struck the Niger near Segu on July 20, 1796, where he beheld it "glittering in the morning sun as broad as the Thames at Westminster and flowing slowly to the eastward" (*Travels,* 1st ed., p. 194). He descended the river some distance, and on his return journey went up stream as far as Bamako. In 1805 Park returned to Africa for the purpose of descending the Niger to its mouth. From Bamako he sailed down the river for over 2,000 miles and on the eve of the successful accomplishment of his undertaking lost his life during an attack on his boat by the natives at Bussa (Nov. or Dec. 1805). Park held to the opinion that the Niger and Congo were one river, though in 1802 C. G. Reichard, a German geographer, had suggested that the Rio Nun was the mouth of the Niger. Owing to Park's death the results of his second journey were lost, and the work had to be begun afresh. In 1822 Maj. A. G. Laing (who had reached Timbuktu by way of Tripoli) obtained some accurate information concerning the sources of the river, and in 1828 the French explorer René Caillié went by boat from Jenné to the port of Timbuktu. In 1826 Bussa was reached from Benin by Hugh Clapperton, and his servant Richard Lander. On Clapperton's death Richard Lander and his brother John led in 1830 an expedition which went overland from Badagry to the Niger. Canoeing down the river from Yauri—60 m. above Bussa—to the mouth of the Rio Nun they finally settled the doubt as to the lower course of the stream.

Heinrich Barth (1851–54) made known to Europe the course of the river from Timbuktu to Say. Later, the extension of French influence throughout the western Sudan led to an accurate knowledge of the river above Timbuktu. From 1880 onwards Col. (afterward General) Gallieni took a leading part in the operations on the upper river, where in 1883 a small gunboat, the "Niger," was launched for the protection of the newly

established French posts. In 1885 a voyage was made by Capt. Delanneau past the ruins of Sansandig, as far as Diafarabe. In 1887 the "Niger" made a more extended voyage, reaching the port of Timbuktu. A more important expedition was that of Lieut. Hourst, who, starting from Timbuktu in Jan. 1896, navigated the Niger from that point to its mouth, executing a careful survey of the river and the various obstructions to navigation.

In addition to the main stream, the Niger basin was made known during the last quarter of the 19th century and the early years of the 20th. The journeys of the German traveller G. A. Krause (north from the Gold Coast, 1886–87) and the French Capt. Binger (Senegal to Ivory Coast, 1887–89) first defined its southern limits by revealing the unexpected northward extension of the basins of the Guinea coast streams, especially the Volta and Komoe, a fact which explained the absence of important tributaries within the Niger bend. The exploration of the Benue dates from the middle of the 19th century. In 1851 Barth crossed the Benue at its junction with the Faro, but the region of its sources was first explored by the German E. R. Flegel (1882–84), who traversed the whole southern basin of the river and reached Ngaundere. The Benue itself had been ascended 400 m. by the "Pleiad" expedition in 1854 and in 1889 the river was traced to 13½° E., and Kebbi to Bifara by Maj. (afterwards Sir Claude) Macdonald, further progress towards the Tuburi marsh being prevented by the shallowness of the water. In 1903, a French officer, Capt. E. Lenfant (who had in 1901 succeeded in navigating the Bussa rapids on the Niger) ascended the Kebbi and discovered the Lata fall, continuing up the river to its point of issue from Tuburi. Crossing the marshes he found and navigated the narrow river leading to the Logone. Save for the portage round the Lata fall the whole journey from the mouth of the Niger to Lake Chad was made by water.

From Kulikoro (which is connected by railway with the port of Dakar) downward, the French have undertaken works on the Niger with a view to deepening the channel, and they maintain a regular steamer service to the port of Timbuktu. In 1910 the British began dredging with the object of obtaining in the lower river a minimum depth of 6 ft. of water; however, while there is still a large river traffic the building of railways in Nigeria has deprived the lower Niger and the Benue of their importance as highways of commerce to the far interior.

BIBLIOGRAPHY.—Mungo Park, *Travels in the Interior Districts of Africa . . . in the Years 1795, 1796 and 1797* (London, 1799). A geographical appendix by Maj. James Rennell summarizes the information then available about the Niger. R. and J. Lander, *Journal of an Expedition to Explore the Course and Termination of the Niger . . .* (London, 1833); H. Barth, *Travels and Discoveries in North and Central Africa . . .*; vol. iv. and v. (London, 1857–58); Gen. J. S. Gallieni, *Mission d'exploration du Haut Niger . . .* (Paris, 1885); E. Caron, *De Saint Louis au Port de Timbouktou; Voyage d'une cannonière française* (Paris, 1891); M. Hourst, *Sur le Niger et au pays des Touaregs* (Paris, 1898), English trans., *French Enterprise in Africa . . . Exploration of the Niger* (London, 1898). Col. J. K. Trotter, *The Niger Sources . . .* (London, 1897); E. Lenfant, *Le Niger; voie ouverte à notre empire africain* (Paris, 1903), chiefly a demonstration that the Bussa rapids are not an absolute bar to navigation; K. Nichoff, "Oberflächengestaltung . . . des Nigers . . ." in *M. Deutschen Schutzgebieten* (1917); P. Germann, *Mungo Park* (Leipzig, 1924).

For the Benue *see*, besides Barth's *Travels*, A. F. Mockler Ferryman, *Up the Niger; Narrative of Major Claude Macdonald's Mission to the Niger and Benue Rivers . . .* (London, 1892); L. Mizon, "Itinéraire de la source de la Benoué au confluent des rivières Kadeï et Mambéré" and other papers in the Bull. Soc. Géog. Paris, for 1895 and 1896; E. Lenfant, *La Grande Route du Chad* (Paris, 1905); B. Alexander, *From the Niger to the Nile*, vol. i. (London, 1907). An *Atlas du cours du Niger de Timbouktou aux rapides de Boussa* in 50 sheets on the scale of 1:50,000, by Lieut. Hourst and others, was published in Paris in 1899. (F. R. C.)

**NIGERIA,** a British colony and protectorate in West Africa, occupying the basin of the lower Niger and adjacent regions. Area 338,593 sq.mi.; pop. (1931 census) 19,928,171. Administratively attached to Nigeria is that part of the Cameroons under British mandate, which has an area of some 34,081 sq.mi. and a population of about 797,000. Nigeria is bounded south by the Gulf of Guinea; west by Dahomey, north by the French Niger Colony; and east by the French sphere of the Cameroons. It includes the former British colony and protectorate of Lagos (*q.v.*), and is nearly seven times the size of England. The following particulars do not include the British sphere of the Cameroons (*q.v.*).

**Physical Features.**—Nigeria is divisible, broadly, into zones parallel with the coast: (1) the delta, (2) forest region, (3) a zone of comparatively open country giving place to (4) the plateau region. The coast-line, some 500 m. in length, extends along the Gulf of Guinea from 2° 46′ 55″ E. to 8° 45′ E., ending at the Rio del Rey, where the great bend eastwards of the continent ceases and the land turns south. The Niger (*q.v.*), which enters the country at its north-west corner and flows thence south-east to the Atlantic, receives, 250 m. from the sea, the Benue, which, rising in the mountains of Adamawa south of Lake Chad, flows west across the plateau. Into the huge delta of the Niger several other rivers (the "Oil Rivers") empty themselves; the chief being, on the west, the Benin (*q.v.*), and, on the east, the Brass. East of the Niger delta is that formed by the Imo or Opobo, Bonny and other streams, and still farther east is the Calabar estuary, mainly formed by the Cross river (*q.v.*).

The delta region is swampy, and forms, for a distance of from 20 to 60 m. inland, a network of interlacing creeks and broad sluggish channels fringed with monotonous mangrove forests. Beyond the delta firm ground takes the place of mud and the mangroves disappear. The land rises gradually at first, becoming, however, in many districts very hilly, with heights of 3,000 ft., and is covered with dense evergreen or rain forests which give place to deciduous forest as the rainfall decreases. The evergreen and deciduous forests form part of the great West African forest belt; the trees are straight, tall and cylindrical and there is little undergrowth, though often bound together by creepers. The forest belt extends 50 to 100 m. and is succeeded by park-like land, the savannah and orchard forests much more extensive than the dense forest, with strips of deciduous forest going through it along the river banks.

North of the Niger-Benue confluence, which is but 250 ft. above sea-level, are hills forming the walls of the plateau which extends over the major part of the country and is part of the great plateau of North Africa. This plateau, broken only by the valleys of the rivers, does not attain an elevation approaching that of the plateaux of South Africa, the culminating point (apart from particular mountain districts), situated in about 10° N., reaching a height of 3,000 ft. only. The valleys of the Niger and Benue, especially the latter, are much lower, the town of Yola on the Benue, some 400 m. inland, lying at an altitude of little over 600 feet. The surface is generally undulating, with isolated "table mountains" of granite and sandstone often rising abruptly from the plain. It is clothed largely with thin forest, but becomes more open to the north until, towards the French frontier, the arid steppes bordering the Sahara are reached. Much of the country north of Zaria (11° N.) is covered with heavy, loose sand. The most mountainous districts are northern Bauchi (a little N. of 10°), where there are heights rather above 4,000 ft.; parts of Muri, along the north bank of the Benue; and the southern border of the Benue basin, where the hills consist of ironstone, quartz and granite. On the east the plateau sinks to the plains of Bornu (*q.v.*), which extend to Lake Chad. Tributaries of the Niger traverse the western portion of the country, the most noteworthy being the Gublin Kebbi, or Sokoto, river and the Kaduna, which flows through a valley not more than 500 ft. above the sea. The north-eastern part of the country drains to Lake Chad by the Waube or Yo, an intermittent stream, which in its lower course forms the Anglo-French boundary. The western portions of Lake Chad (*q.v.*) belong to the protectorate, which contains no other large lake. The water parting between the Chad and Niger systems runs north-west and south-east from about Katsina in 13° N. to the Bauchi hills.

**Geology.**—Except in the coast belt, which is composed of superficial deposits, crystalline rocks are the fundamental formation. From the edge of the coast belt to near the Niger-Benue confluence, these rocks are overlain by unfossiliferous sandstones, lying undisturbed, and possibly of the age of the sandstone of the

Congo basin. Much of the plateau—with its flat-topped hills and red earths—consists of what is called the fluvio-volcanic series. The alluvial deposits here are often unconnected with the present drainage lines. On the Bauchi plateau are large deposits of cassiterite (tin) mostly found in the detrital deposits resulting from the great denudation over the plateau. Limestones, with fossils indicating a Tertiary age, have been found near Sokoto. Recent alluvium and a thick deposit of black earth border the upper reaches of the Benue and cover wide areas around Lake Chad. Coal measures are found in the Enugu district east of the Niger and south of the Benue, and in the Bende district near the Cross river; there are large deposits of lignite in the younger Tertiary group in the Niger valley and in the neighbourhood of the Benue, where they are interstratified with white clays; rock phosphates are found north of Lagos and there is a belt of auriferous country north of Minna (towards the Kaduna river).

**Climate.**—Though Nigeria lies wholly within the tropics, there is a distinct difference in the climate of the northern and southern regions. In the south the climate is typical of the tropics; in northern Nigeria it resembles that of Egypt and may be described as sub-tropical. In the south the temperature varies comparatively little, from 70° to 100° F, and averages over 80° F. The air is both hot and humid; the rainy season is sometimes prolonged to ten months or more, the rainfall in the delta being from 100 to 140 or more inches a year. (At Bonny in 1923 the fall was 150·59 in., rain occurring on 151 days.) The prevailing wet season wind is from the south-west. From November to March the *harmattan,* a dry, dust-laden north-east wind, coming from the Sahara, blows intermittently, and this is the dry season, when at Lagos humidity has been known to fall to 26% against a mean of 90%. At Lagos the usual rainfall is 77 in. a year. Tornados occur at the beginning and end of the *harmattan.* Malaria is still a scourge in these southern districts and the country is unhealthy for Europeans. In the north the temperature is still high, but for nine months of the year the air is dry, "the dry air of the desert, the intense parching dryness of which is almost inconceivable by anyone who has not experienced it" (O. T. Faulkner, director of agriculture, Nigeria). July–September are the rainy months in the north, the fall being usually 25 to 30 in. a year, though in places it is as much as 60 inches. The *harmattan* begins in the north in October and lasts till April. In this season variations in temperature are great. At Hadeija, in 1922, a minimum of 35° F and a maximum of 115° F were recorded. In some parts of the plateau Europeans can live in comparative comfort, the climate resembling that of an unusually fine English summer, often with cool nights. Between the southern and northern regions there is an intermediate zone with a normal rainfall of from 40 to 50 in. a year and still considerable humidity.

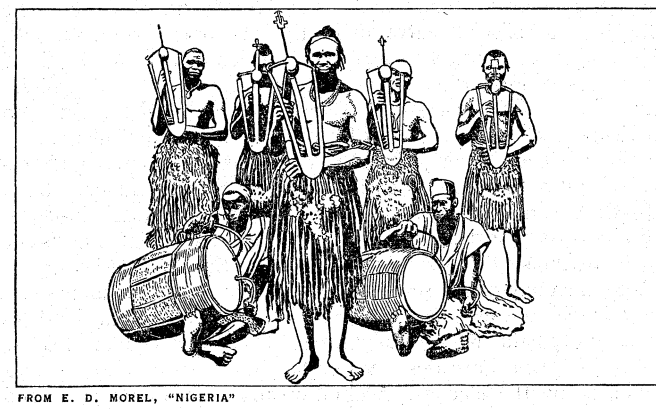
**Fauna and Flora.**—There are many large and small mammals. They include the elephant, lion, leopard, giraffe, West-African buffalo, many kinds of antelope and gazelle and smaller game. The chimpanzee, the drill ape, the baboon and many kinds of monkeys are found in the forests and snakes are common. There are many varieties of squirrel, some finely coloured. The camel is found in the northern regions. In the rivers are rhinoceros, hippopotamus and crocodile. The manatus is also found. The birds include the ostrich, marabout, vultures, kites, hawks, ground hornbill, great bustard, guinea fowl, partridge, lesser bustard, quail, snipe, duck widgeon, teal, geese of various kinds, paraquets, doves, blue, bronze and green pigeons and many others. Domestic animals include the horse and donkey in the plateaux, but baggage animals are rare in the coast-lands, where the tsetse fly is found. Mosquitoes are abundant throughout the delta. There are the remarkable hammer-headed fruit-bat and other varieties of bats and a curious kind of dormouse. Many species of butterfly and spiders are recorded.

The mangrove is the characteristic tree of the swamps. North of the swamps the oil palm (*Elaeis guineensis*) flourishes abundantly. It is common as far as about 7° N. The evergreen and deciduous forests contain a great wealth of timber. Among the trees are mahogany, cedars and scented cedars, walnut, rosewood, satinwood, ebony, African teak and other valuable species. There are also African maple, shingle-wood, cork-wood, cotton-wood and other general utility woods, including the *abura* whose timber is acid resisting. Rubber vines are also found in these forests. Other trees found, chiefly on the plateaux, are the baobab, the shea-butter tree, the locust tree, gambier, palms, including the date and dum palm (Hyphaene), the tamarind, and, in the arid regions, the acacia and mimosa.

**Inhabitants.**—The vast majority of the inhabitants are typical negroes. In the south-west the Yorubas (*q.v.*) are the chief race. They occupy the country behind the coast-lands, from Dahomey to Benin, and have a considerable degree of civilization. In the delta district and the forest zone, besides the people of Benin, are the Jekri, living on the lower part of the Benin river and akin to the Yorubas, the Ijos, living in the delta east of the main mouth of the Niger, and the Ibos, occupying a wide tract of country just above the delta and extending east from the Niger to the Cross river. South of the Ibos live the Aros, a tribe of relatively great intelligence, who dominated many of the surrounding tribes and possessed an oracle or *ju-ju* of reputed great power. On the middle Cross river live the Akuna-kunas, an agricultural race, and in the Calabar region are the Efiks, Ibibios and Kwas. All these tribes are fetish worshippers, though Christian and Muslim missionaries have made numerous converts. The Efiks, a coast tribe which early came into contact with white men, have adopted several European customs, and educated Efiks are employed in Government service. The great secret society called Egbo is an Efik institution.

In the northern parts of Nigeria the inhabitants are of more mixed blood, owing to the invasion of Fula, Berber and Arab or Arabized people. But the bulk of the people are negroes. The most important of these negro peoples are the Hausa (*q.v.*), among whom the superior classes adopted Mohammedanism in the 13th and 14th centuries. The Hausa are keen traders and make excellent soldiers. **The Fula tribe,** besides providing the ruling families in many of the Hausa States, form a separate caste of cattle-rearers. Arab merchants live in some of the larger Hausa towns.

In general, the people living in the river valleys have been little or not at all affected by Muslim propaganda, either in blood or religion. Thus along the banks of the Niger, Benue and other streams, the inhabitants are negro and pagans, and generally of a primitive though often rather fine type. Of these the Munshi, who inhabit the district nearest the junction of the Benue with the Niger, were long noted for their intractability and hostility to strangers, whom they attacked with poisoned arrows. The Yorag-



FROM E. D. MOREL, "NIGERIA"

A GROUP OF HAUSAS CARRYING THE SHORT-HANDLED HOES IN THE ANCIENT HOE DANCE

hums, their neighbours, were cannibals. Nearer Yola live the Battas, who also had a bad reputation. In the central hilly region of Kachia are other pagan tribes. When first met by Europeans they wore no clothes, and their bodies are covered with hair. South of the Benue, near the Niger confluence, dwell the Okpotos, Bassas and other tribes, which had a reputation for savagery and war-lust. In the districts of Illorin and Borgu, west of the Niger, the inhabitants are also negroes and pagan, but of a more advanced type than the tribes of the river valleys. According to some native traditions, the people of Borgu claim to have a Coptic

origin. In Bornu (*q.v.*) the population consists of (1) Berberi or Kanuri, the ruling race, containing a mixture of Berber and negro blood, with many lesser indigenous tribes; (2) so-called Arabs, and (3) Fula.

A complete list of the tribes in Nigeria would run into many scores, and each has its separate language. In the old province of Bauchi alone as many as 60 different languages are spoken. The most widely diffused languages are Hausa and Yoruba. Arabic is the court and official language in the Fula emirates. In the ports many natives speak English.

The European inhabitants number (1929) some 5,000. They are chiefly officials, traders and missionaries. On the tin-fields are some 700 whites including over 100 women.

**Chief Towns.**—A large proportion of the people are town-dwellers. The ports, with the exception of Lagos, are all on the rivers. From west to east the ports reached by ocean steamers are Lagos (*q.v.*), the capital of Nigeria; Forcados, at the mouth of the Forcados branch of the Niger and the main port of entry for the river, having 18 ft. of water over the bar; Burutu, 5 m. above Forcados and the port of the Niger Co.; Warri 30 m. above Forcados; Koko and Sapele, on the Benin river, but reached by way of Forcados. All these ports are west of the Nun mouth of the Niger, where on the west bank is Akassa (14 ft. of water). East of the Nun mouth are Brass town (on the Brass river) and Bonny, at the mouth of the Bonny river. The three last-named ports, once flourishing, are now little used. Some 40 m. up the Bonny river is Port Harcourt (*q.v.*), second in importance of the ports of Nigeria. Farther east are Opobo (13 ft. of water), on the Imo river, richest of the oil-rivers of Nigeria, Degema (18 ft.), and Calabar (*q.v.*). On the river Niger, at the head of the delta, are Asaba (west bank) and Onitsha (east bank); farther north is Idah (east bank) in the palm-oil zone; Lokoja (*q.v.*) is at the Niger-Benue confluence; Baro, 70 m. above Lokoja, is on the railway system; and still farther north, on the river, are Egga, Jebba and Bassa (*q.v.*).

The largest cities are found in Yorubaland. Of these Ibadan (pop., 1931, 387,133), the largest native city in Africa, Ilorin and Abeokuta are separately noticed. Other Yoruba cities are Ogbomosho (pop. 86,744), Oshogbo (pop. 49,599), Iwo (57,191), Ede (52,392) and Ogo (48,733). Other towns in the south are Benin (*q.v.*), west of the Niger and Bende, and Enugu, east of the river. Enugu (pop. 40,878) is the centre of the Udi coalfield.

In northern Nigeria, where the larger towns have generally a population of from 40,000 to 50,000, the chief city is Kano (*q.v.*), the commercial capital, situated in 12° N., 8° 32′ E. Sokoto, the religious and political centre of the Fula, is some 220 m. W.N.W. of Kano. Katsina (*q.v.*), near the frontier and 84 m. N.W. of Kano, has a reputation as an educational centre; other chief Hausa towns are Zaria (*q.v.*), Bauchi (or Yakoba); Beda; and Yola (*q.v.*). The chief towns of Bornu are Kukawa or Kuka (*q.v.*), near Lake Chad, Maidugari and Dikwa (Dikoa). The administrative capital of northern Nigeria is Kaduna; Jos, a modern town with European amenities, is the centre for the Bauchi tin-fields.

**Communications.**—Railways are now the chief means of transport, the shallowness of the Niger and Benue for a large part of the year rendering them an uncertain means of communication. There is still, however, a considerable river traffic, and in the delta the rivers remain the great highways. There is a regular steamer service between Forcados and Lagos, and between Lagos and Dahomey by the lagoons. From Forcados two steamers ascend the main Niger to Jebba, a distance of 530 miles. On the Benue there is steamer traffic as far as Yola. But between May and October navigation is only possible to vessels drawing not more than 3 ft. of water. There are navigable stretches of several other rivers—the Cross river can be ascended for 240 miles. For the main part the river services are (except in the delta) auxiliary to the railways.

Railway building began in 1896, with a line from Lagos to Ibadan, a distance by rail of 123 miles. This line was finished in 1900. In 1906 a forward policy was adopted, and since then progress has been rapid. The railways have been built and are owned and worked by the Nigerian Government and are of the standard African 3 ft. 6 in. gauge, unless otherwise stated. In 1929 some 1,900 m. of railway were open, the system consisting of:—(1) A western line running from Lagos to Kano (705 m.), via Abeokuta, Ibadan, Ilorin, Kaduna and Zaria. The Niger is crossed at Jebba —where there is an island—by two bridges, together 1,795 ft. long. The bridges, the last part of the line to be built, were completed in 1914. A branch line (111 m.) runs from Minna to Baro, on the Niger. Another branch line runs from Zaria, by Guasu to Kaura Namoda (142 m.), and in 1928–29 the main line was extended from Kano to Hadejia (102 miles). (2) An eastern line (built 1913–26) from Port Harcourt to Enegu, for the Udi coalfields, and Kaduna (569 m.), where it joins the western railway. The Benue is crossed at Makurdi, pending the completion of a bridge, by train ferry. A short branch line running to Jos, for the tin-fields, was opened in April 1927, and since then all the tin is sent to Port Harcourt. Jos was formerly served by a light line (2 ft. 6 in. gauge) from Zaria, on the western railway. This light line now carries cotton. In 1928 the building of a trunk railway to Lake Chad, at an estimated cost of some £5,000,000, was sanctioned. The capital cost of the railways, up to March 1928, had been £18,104,000 of which sum £15,245,000 had been raised by loan on the London market, at an average rate of interest under 5%. The railways are worked as a business concern, but the ultimate profits go to the colonial treasury. Motor traffic has to a large extent superseded other methods of road travel. Some 3,000 m. of all-the-year-round motor roads were being maintained in 1928 by the Public Works Department alone. There are, additionally, many miles of dry-season motor roads in the north.

There is regular steamship communication by several lines between Europe and Lagos and other Nigerian ports; direct cable communication with Europe and South Africa, an extensive system of inland telegraphs, and a wireless station at Lagos. The principal passenger and mail service is by the Elder Dempster line from Liverpool to Lagos, the voyage taking 15 days. A regular service between British ports and Nigeria has been maintained since 1852.

**Administration.**—The country is divided into three parts; the colony of Nigeria (the old Lagos colony) with an area of 1,400 sq.m. only; and the northern and southern provinces (78,600 sq.m. and 255,700 sq.m. respectively) which form the Protectorate of Nigeria. At the head of the administration is a governor; there is a lieut.-governor for the northern and for the southern provinces, and, since Oct. 1927, a separate administrator for the colony. Certain important services, *e.g.*, the railways, function throughout Nigeria. The governor, whose headquarters are in Lagos, is aided by an executive council of officials, and for the colony and the southern provinces there is a legislative council on which, since 1923, elected members have sat to represent the towns of Lagos and Calabar. (The franchise is conferred on adult males with an income of £100 a year or more.) On the council are also members nominated by various commercial bodies and others nominated to represent African interests. The legislative council is given control of expenditure in the northern provinces derived from the revenues of the central Government. The number of provinces has varied from time to time. As far as possible the system of indirect rule is observed; that is, the native governments existing before the British occupation are retained, each with its own treasury and judiciary, the rulers being guided by the advice of a British resident, under whom are district officers. This indirect rule prevails in almost all the northern provinces and also in Yorubaland. In these native states direct taxation and a fixed income for the emirs and other paramount chiefs has led to the abolition of many abuses. Fifty to 70% of the direct tax goes to the native treasuries.

Education and health are departments of primary value. There are Government elementary and technical schools, and King's college, Lagos, founded 1909, provides secondary education. At Katsina is a training college for native teachers, opened 1922, and there are training colleges in southern Nigeria, including two for women teachers. Education remained, however, chiefly in the hands of Christian missions; the Hope Waddell institute at Calabar, a Scottish missionary enterprise, has a high reputation for

industrial training. Both the missions and State schools now pay special attention to practical agricultural training. Some of the native administrations have their own schools. The Yoruba have for long shown an eagerness for education; after the World War the demand for education among the natives generally greatly increased. The health department has done a great and successful work in fighting malaria, dysentery, yellow fever and plague, and in insisting upon better housing and better food for Europeans. As one result the death rates of whites fell between 1903 and 1926 from over 20 per 1,000 to under 9 per 1,000.

Before amalgamation the administration of northern Nigeria required grants-in-aid to meet expenses, which were partly furnished by her richer neighbour, southern Nigeria. Since amalgamation, Nigeria has been self-supporting, though revenue in some years falls short of expenditure. In 1914 revenue was £3,048,000 and expenditure £2,967,000; in 1923–24 revenue had risen to £6,260,000 and expenditure to £5,501,000. The figures for 1926–27 were, revenue £7,734,000, expenditure £7,584,000. Revenue is derived from customs duties on imports fixed at 15% *ad valorem* in 1922; on the chief exports (this duty was first imposed in 1916); by direct taxation; and, in the colony only, and since 1927, income tax. It may be noted that a special West African currency is in circulation and that for purposes of trade between natives it has been necessary to mint a coin valued at one-tenth of a penny. The Bank of British West Africa and the Colonial Bank have agencies in the chief towns. British weights and measures are in use.

**Economic Conditions.**—There is a very large internal trade, as to which no statistics are available, but it is believed to exceed in value the external trade. The great majority of the people are agriculturists, including, in the north, cattle-rearing. Native manufactures are of minor importance—they include in the Hausa States the making of "Morocco" leather; mining (tin and coal) owes its development to the British. Fishing is largely followed in the delta. In a broad generalization the products of southern Nigeria are sylvan, palm oil and palm kernels taking the leading place. Cocoa and cotton are other products. From the middle belt come benniseed and shea-butter—both adding to the oil output. From northern Nigeria come groundnuts (a basis for margarine), hides and skins, cattle, and, in increasing quantities, cotton. (Cotton and maize are the only crops common to the northern and southern provinces.) Add to the products named coal and tin and timber, and the leading exports have been stated.

The coast peoples, since the 15th century, had traded directly with the European merchants who came to their ports, but the dense forest belt cut off intercourse with the interior—though the Niger and Benue might have afforded means of penetration. But up to the middle of the 19th century the trade of Hausaland and Bornu (that is northern Nigeria) was either with the Mediterranean by caravan across the Sahara, or east and west to other parts of the Sudan. Direct, but, at first, very limited, trade with the interior followed the efforts of the British government and merchants to open up the country by sending expeditions up the Niger and Benue. Modern developments date from the founding of the Royal Niger company by Sir George Goldie and the conquest of the Fula emirates by Sir F. D. (Lord) Lugard. (*See* p. 442, *History.*) The trade of Lagos and the oil rivers, the last the eastern part of southern Nigeria, partly through having been long established, was, up to 1928 at least, more valuable than that of northern Nigeria, which contains large areas sparsely peopled and little cultivated, and was not fully opened to trade with the south until the beginning of the 20th century. (This trade via the Gulf of Guinea, together with minor causes, almost killed the trade via the Sahara.) In 1901 when the total external trade of the southern regions was valued at over £4,000,000 that of northern Nigeria was probably (statistics are lacking) not £250,000. With the completion of the railway to Kano in 1911, there was a great increase in trade in the north. Since the amalgamation of southern Nigeria (including Lagos) with northern Nigeria in 1914 statistics are given for the country as a unit. In that year the imports were valued at £6,276,000 and the exports at £6,420,000. In 1924, when normal conditions following the World War were considered to be restored, the figures were:—imports £10,948,000; exports £14,460,000. In 1927 the external trade was nearly £30,000,000—imports being £14,146,000 and exports £15,654,000. These figures exclude specie.

Almost all sylvan and agricultural work in Nigeria is done by native owners, peasant farmers with small holdings, usually about 3 acres. The main concern of the farmer is to produce food crops—guinea corn and millet, yams and bananas, and maize—for himself and his family; he works for sale only in his spare time and to get luxuries. The great occupation in the delta is the production of palm oil and palm kernels. The yearly export is about 100,000 tons of oil and double that weight of kernels. Native methods of treating the fruit waste about half of the oil; up to 1928 only one factory had been started to deal with the fruit. Cocoa plantations were started in south Nigeria about 1905; the production of cocoa grew by 1928 to 40,000 tons in the year. Cotton growing for export dates from the early years of the 20th century; in 1912 an American variety of cotton was introduced and found suitable. In the centre and south a native cotton is also grown for export. By 1925 the export had reached 35,000 bales; two or three poor seasons followed; the 1925 output was nearly reached again in 1928, and the acreage under cotton increased. Many ginneries have been set up. The cultivation of groundnuts in northern Nigeria—climate and soil are well suited to the crop—grew rapidly with increased transport facilities. In the year 1927–28 (April and March inclusive) the railways carried 96,000 tons of nuts as against 4,800 tons of cotton. Generally, farming in Nigeria is not on a high level, partly because fertilizers are not used. The exhaustion of much land within easy reach of transport caused grave concern to the Government which from 1926 onward took measures to instruct the farmers in the use of manures and other fertilizers. There are, however, good stock farms in the north with large herds of cattle and flocks of sheep and goats.

The chief industries which are owned by Europeans are the tin and coal mines. The ascertainment of the richness of the tin-fields in Bauchi in 1902 led to a speedy development of the mines (which employ 30,000 to 35,000 natives), and the output of coal from Ude, which began in 1915, is of much importance. The coal mines are worked by the railway department for the Government; they supply the fuel for the tin mines, for their own railway and for the Gold Coast railways, and still have a surplus for the Government marine and the shipping companies. The output for the year ended March 31, 1928, was 345,000 tons. The tin-fields (*see* BAUCHI) are worked by private enterprises, mostly for companies registered in London. The timber-cutting concessions are also in the hands of Europeans. There are 200,000 sq.m. of forest in Nigeria; the timber exported is mainly mahogany, cedar and walnut, the mahogany chiefly from the Benin forests. Gum arabic is obtained from Bornu and other northern provinces. "Wild" rubber is still tapped, and plantation rubber is exported. The relative value of the chief exports is shown in the following figures for 1927:—Palm oil, £3,617,000; palm kernels, £4,574,000; groundnuts £1,633,000 (£2,342,000 in 1926); cocoa, £1,968,000; cotton lint, £611,000 (£1,182,000 in 1926); tin, £2,403,000.

The imports are of a most miscellaneous character; they may be classed under the main heads of cigarettes, cotton goods (both from the United Kingdom), provisions, hardware, salt, kola nuts (from the Gold Coast), petrol, and alcoholic liquors (mostly gin from Holland). (Though the import of "trade spirits" has been prohibited since 1919, and no alcoholic liquors, save for Europeans, are allowed into northern Nigeria, the growing wealth of the natives of southern Nigeria led to an increased demand for ordinary spirits and beer.) With regard to the direction of trade the figures for 1927 showed that 53·5% was done with the United Kingdom—which supplied 62% of the imports and took 45·6% of the exports. In that year Germany had 15% and the United States 10% of the total trade. Of the exports the palm kernels—largely used as cattle food—go to Germany and England, and the groundnuts to Germany, 60%, and France. The United States supplies kerosene, petrol and unmanufactured tobacco, and takes about 25% of the palm oil, and 30% of the cocoa.

BIBLIOGRAPHY.—*Handbook for Nigeria*, 7th ed. (1926), Sir W. M. N. Geary, *Nigeria under British Rule* (1927); the annual reports published by the Colonial Office, London; *The Times* West African Supplement, Oct. 30, 1928. (F. R. C.)

**Defence.**—With a population approaching 19,000,000, order is maintained in Nigeria, and defence provided for the colony, by the Nigeria regiment of the West African frontier force (*see* GREAT BRITAIN: *Colonial Forces*). This force, which was raised in 1901, consists of officers and non-commissioned officers of the British Army and other ranks recruited locally for 6 years with the colours and 3 in the reserve, with facilities for re-engagement. Training is on the lines of the British army. Regimental transport is by native carriers; transport animals are not used. The Nigeria regiment includes 1 battery of artillery (3·7 inch howitzers), 4 battalions of infantry, 1 light mortar unit, a signal school, and a depot. The establishment is 3,599, with a reserve of 682. There are also armed police with an establishment of 1,260 in the northern provinces, 2,105 in the southern. These police are liable for military service, and distributed in 7 territorial divisions, each under a senior commissioner.

*See* also League of Nations *Armaments Year-Book* (Geneva, 1928). (G. G. A.)

## HISTORY

Of the early history of the races inhabiting the coast lands little is known. The Beni appear to have been the most powerful race at the time of the discovery of the coast by the Portuguese in the 15th century, and the kings of Benin in the 17th century ruled a large part of the south-western portion of the existing British protectorate (*see* BENIN). The Benin influence does not seem to have reached east of the Forcados mouth of the Niger. In the greater part of the delta region each town owned a different chief and there was no one dominant tribe. Among these people, who occupied a low position even among the degenerate coast negroes and who were constantly raided by the more virile tribes of the interior, trading stations were established by the Portuguese, and later on by other Europeans, British traders appearing as early as the 17th century. There was no assertion of political rights by the white men, who were largely at the mercy of the natives and who rarely ventured far from their ships or the "factories" established on the various rivers.

By the end of the 18th century British enterprise had almost entirely displaced that of other nations on the Niger coast. But the principal trade of all Europeans was still in slaves. After the abolition of the slave-trade in the 19th century palm oil formed the staple article of commerce, and the various streams which drain the Niger coast near the mouth of the great river became known as the "Oil rivers." The opening up of the interior was in the meantime promoted, chiefly by the efforts of British travellers and merchants. Mungo Park traced the Niger from Segu to Bussa, where he lost his life in 1805. From Bussa to the sea the course of the river was first made known in 1830 by the brothers Richard and John Lander. Maj. Dixon Denham and Capt. Hugh Clapperton entered the country now known as Northern Nigeria from the north in 1823, crossing the desert from Tripoli. Clapperton in 1826–27 made a second journey, approaching the same territory from the Guinea coast. Dr. Barth, travelling under the auspices of the British Government, entered the country from the north and between 1852 and 1855 made the journeys whose record still remains the principal standard work for the interior. Macgregor Laird first organized in 1832 the navigation of the River Niger from its mouth to a point above the Benue confluence. During the next 25 years expeditions were despatched into the interior and a British consul was posted at Lokoja. Possession was also taken, in 1861, of Lagos island, with the object of checking the slave traffic still being carried on in that region. But the deadly climate discouraged the first efforts of the British Government, and, after the parliamentary committee of 1865 had recommended a policy which would render possible the ultimate withdrawal of British official influence from the coast, the consulate of Lokoja was abandoned, but re-established a few years later to meet the still steadily growing requirements of British trade upon the river.

**The Royal Niger Company.**—In 1880 the international "scramble for Africa" led to the establishment under the recognized protection of the French Government of two French firms which opened upwards of 30 trading stations on the Lower Niger. The establishment of these firms was admittedly a political move which coincided with the extension of French influence from Senegal into the interior. Nearly at the same time a young Englishman, George Goldie-Taubman, afterwards better known as Sir George Goldie (*q.v.*), having some private interests on the Niger, conceived the idea of amalgamating all local British interests and creating a British province on the Niger. To effect this end the United African Company was formed in 1879 and trade was pushed upon the river with an energy which convinced the French firms of the futility of their less united efforts. They yielded the field and allowed themselves to be bought out by the United African Company in 1884. At the Berlin Conference held in 1884–85 the British representative was able to state that Great Britain alone possessed trading interests on the Lower Niger, and in June 1885 a British protectorate was notified over the coast lands known as the Oil rivers. Germany had in the meantime established itself in Cameroons, and the new British protectorate extended along the Gulf of Guinea from the British colony of Lagos on the west to the new German colony on the east, where the Rio del Rey marked the frontier. In the following year, 1886, the United African Company received a royal charter under the title of the Royal Niger Company. The territories which were placed by the charter under the control of the company were those immediately bordering the Lower Niger in its course from the confluence at Lokoja to the sea. On the coast they extended from the Forcados to the Nun mouth of the river. Beyond the confluence European trade had not at that time penetrated to the interior.

The interior was held by powerful Mohammedan rulers who had imposed a military domination upon the indigenous races and were not prepared to open their territories to European intercourse. To secure British political influence, and to preserve a possible field for future development, the Niger Company had negotiated treaties with some of the most important of these rulers, and the nominal extension of the company's territories was carried over the whole sphere of influence thus secured. The movements of Germany from the south-east, and of France from the west and north, were thus held in check, and by securing international agreements the mutual limits of the three European Powers concerned were definitely fixed. The principal treaties relating to the German frontiers were negotiated in 1886 and 1893; the Anglo-French treaties were more numerous; those of 1890 and 1898, which laid down the main lines of division between French and British possessions on the northern and western frontiers of Nigeria, having been supplemented by many lesser rectifications of frontier. It was not until 1909 that the whole of the frontier between Nigeria and the French and German possessions had been definitely demarcated. Thus, mainly by the action of the Royal Niger Company, and with the employment of a force of 500 Hausa trained under European officers, a territory of vast extent, into which the chartered company itself was not able to carry either administrative or trading operations, was secured for Great Britain.

**The Protectorate.**—Owing to pressure of foreign nations on the company's frontiers, a situation had arisen which the resources of a private company were inadequate to meet. In 1897 relations with France on the western border became so strained that Mr. Chamberlain, who was then secretary of state for the colonies, thought it necessary to raise a local force, afterwards known as the West African Frontier Force, for the special defence of the frontiers of the West African dependencies. In these circumstances it was arranged that in consideration of compensation for private rights the company should surrender its charter and transfer all political rights in the territories to the Crown. The transfer took place on Jan. 1, 1900, from which date the company, which dropped the name of "royal," became a purely trading corporation. The southern portion of the territories was amalgamated with the Niger Coast protectorate, the whole district taking the name of the Protectorate of Southern Nigeria,

while the northern portion, extending from a line drawn slightly above 7° N. to the frontier of the French possessions on the north and including the confluence of the Niger and the Benue at Lokoja, was proclaimed a protectorate under the name of Northern Nigeria.

The company, during its tenure of administrative power under the charter, had organized its territories south of the confluence into trading districts, over each of which there was placed a European agent. The executive powers in Africa were entrusted to an agent-general with 3 provincial and 12 district superintendents. There was a small judicial staff directed by a chief justice, and there was a native constabulary of about 1,000 men, trained and drilled by white officers. The company kept also upon the river a fleet of about 30 steamers. The entire direction of the proceedings of the company was, however, in the hands of the council in London, and the administrative control of the territories was practically from first to last vested in the person of Sir George Goldie. The local work of the representatives of the company was mainly commercial.

*Southern Nigeria, 1885–1906.*—While the development of the Royal Niger Company's territories was proceeding in the manner described, the regions under direct British control were also being opened up and law and order introduced. In 1893, when the title Oil Rivers Protectorate was changed to that of Niger Coast Protectorate, a regular administration was established (subject to the Foreign Office in London) under Sir Claude Macdonald, who was succeeded as commissioner and consul-general in 1896 by Sir Ralph Moor (1896–1904). Under these officials peace was gradually established between various tribes, trade routes opened, and progress made in civilization. The work was one of extreme difficulty, largely because there was no central native authority with which to deal. Small military expeditions had constantly to be employed to break up slave-raiding gangs or reduce to order tribes which blocked trade routes or made war on other tribes living peaceably under British protection. The most serious military operations were against the Beni, a peaceful mission to the king of Benin having been massacred in the bush in Jan. 1897. The operations were completely successful and the Benin country was added to the protectorate (*see* BENIN). The administration improved the condition of the natives without undue interference with customary law. The submission of the Aros to the Government in 1902 brought to an end the system of tribal warfare for the purpose of making slaves, while a proclamation of 1901 prohibited the buying, pawning, or selling of slaves. Trade steadily developed, and owing to the large sums paid as duty on imported spirits the revenue of the protectorate was sufficient to cover the expenditure.

*Northern Nigeria.*—In Northern Nigeria at the time of the transfer (1900) British authority had still to be established. The man selected for the post of first high commissioner was Colonel (Lord) Lugard, who had conducted one of the Royal Niger company's most successful expeditions into the western portion of the interior and had already been employed by the British Government to raise and organize the West African Frontier Force.

On Jan. 1, 1900, the Union Jack was hoisted at Lokoja, and the formation of a local administration was entered upon. The headquarters of the West African Frontier Force had been at Jebba, not far from the point at which Mungo Park had lost his life upon the river. Neither Jebba nor Lokoja was considered suitable for the permanent capital of the protectorate and survey parties were sent out to find a more suitable site, with strict orders to avoid conflict with the nominally friendly natives. This was selected on a branch of the Kaduna river in the south-western corner of the province of Zaria, at a place of which the native name of Zungeru was retained. The ruler of Zaria, while professing friendliness, was, however, unable or unwilling to restrain the rulers of Kontagora and Nupe from aggression. These two potentates raided for slaves to the borders of the rivers and openly threatened the British position on the Niger. The Ashanti War of 1900 claimed the despatch of a strong detachment of the West African Frontier Force, and it was not until the return of the troops in Feb. 1901 that Nupe and Kontagora could be effectively dealt with. In that year both provinces were subdued, their emirs deposed, and letters of appointment given to new emirs, who undertook to rule in accordance with the requirements of humanity, to abolish slave-raiding and slave dealing, and to acknowledge the sovereignty of Great Britain. Illorin and Borgu with a portion of Kabba were already under British rule. The rulers of other neighbouring provinces offered their allegiance, and by the end of the year 1901 nine provinces, Illorin, Kabba, Middle Niger, Lower Benue, Upper Benue, Nupe, Kontagora, Borgu and Zaria had accepted the British occupation. An initial system of administration was organized and British residents were appointed to each province. Seventeen legislative proclamations were enacted in the first year dealing with the immediate necessities of the position and providing for the establishment of a supreme and provincial court of justice, for the legalization of native courts of justice, and for regulating questions of slavery, importation of liquor and firearms, land titles, etc. In the autumn of 1901 the emir of Yola (the extreme eastern district in the territories bordering upon the Benue) was, in consequence of the aggressions upon a trading station established by the Niger Company, dealt with in the same manner as the emirs of Nupe and Kontagora, and a new emir was appointed. In 1902 Bauchi and Bornu were brought under British rule. Military stations were established in each and both were included in the system of British administration. Later in the same year an act of treachery culminating in the murder of a British resident, Captain Moloney, in the province of Nassarawa, led to the military subjugation of that province. By the end of the year 1902 British administration had been extended to the whole of the provinces in the south, east, and west of the protectorate. The important Mohammedan states of Sokoto, Gando, Kano, and Katsena remained independent. These states were regarded as the stronghold of Fula supremacy. The emir of Sokoto held the position of religious as well as political head of all the lesser states of Northern Nigeria, and in response to friendly overtures on the part of the British administration had declared that between Sokoto and Great Britain there could be nothing but war. Katsena was the centre of local learning, while Kano was at once the commercial and the military centre of power. By the end of 1902 it had become evident that a trial of strength between the Mohammedan powers and the new British administration was inevitable. The Mohammedan rulers were themselves of comparatively recent date. In fighting them there was no question of fighting the whole country. On the contrary it was presumed with justice that their overthrow would be hailed with satisfaction by many of the subject peoples. Every attempt was made to settle the question at issue by conciliatory methods, but, these having failed, a campaign against Kano and Sokoto was entered upon in Jan. 1903. It was entirely successful. The capital of Kano, a walled and fortified town of great extent and formidable strength, fell to a British assault in Feb. 1903. Sokoto submitted after a battle which took place on May 17. The sultan fled, and on May 21 a new sultan, chosen by the council of elders, was installed by the British high commissioner, after he had publicly accepted the conditions imposed by the British Government, namely, that all rights of conquest acquired by the Fulani throughout Northern Nigeria passed to Great Britain, that for the future every sultan and emir and principal officer of state should be appointed by Great Britain, that the emirs and chiefs so appointed should obey the laws of the British Government, that they should no longer buy and sell slaves, nor enslave people, that they should import no firearms, except flintlocks, that they should enforce no sentences in their courts of law which were contrary to humanity, and that the British Government should in future hold rights in land and taxation. When these conditions were accepted by the Fulani chiefs the supremacy of Great Britain was established over the entire country. Katsena and Gando followed the example set for them by Kano and Sokoto. After the conquest of the Hausa states in 1902–3 the King's writ ran—with the exception of a few districts inhabited by primitive savages—through the whole area known as Northern Nigeria.

## THE AMALGAMATION OF NIGERIA

*Union of Lagos and Southern Nigeria.*—In 1904 it was decided to unite the two Nigerias and Lagos under one government, and as a first step in that direction Sir Walter (then Mr.) Egerton was appointed both governor of Lagos and high commissioner of Southern Nigeria. This was followed in Feb. 1906 by the amalgamation of these two administrations under the style of "the Colony and Protectorate of Southern Nigeria," with headquarters at Lagos town. The former colony and protectorate of Lagos (*q.v.*) became the western or Lagos province of the new administration. In the year of amalgamation the revenue reached a record figure, the amount collected being £1,088,000, to which Lagos province contributed £424,000. Over 80% of the revenue was derived from customs. In the same year the expenditure from revenue was £1,056,000.

*Northern Nigeria Railway.*—Northern Nigeria continued to be a separate protectorate, and in 1907 Sir Frederick Lugard was succeeded as high commissioner by Sir Percy Girouard. In August of that year the British Government, on administrative, strategic, and commercial grounds decided on a railway to give the cities of Zaria and Kano direct communication with the perennially navigable waters of the Lower Niger. In view of the approaching unification of Southern and Northern Nigeria, the money needed, about £1,250,000, was raised as a loan by Southern Nigeria. The route chosen for the line was that advocated by Sir Frederick Lugard. This important work, essential for the welfare of the northern territories, was begun under the superintendence of Sir Percy, the builder of the Wadi Halfa-Khartoum railway. At the same time the Lagos railway was extended to join the Kano line near Zungeru, the Niger being bridged at Jebba.

*Land Tenure.*—Sir Percy Girouard gave much attention to the land tenure, probably the most important of administrative questions in West Africa. He adopted the land policy of Sir Frederick Lugard and recommended "a declaration in favour of the nationalization of the lands of the protectorate." This was in accord with native laws—that the land is the property of the people, held in trust for them by their chiefs, who have not the power of alienation. In 1909 he was succeeded as Governor (the title High Commissioner having been changed) by Sir H. H. J. Bell; and meanwhile the secretary for the colonies had appointed a strong committee, which, after hearing much evidence, issued a report in April 1910 in substantial agreement with his recommendations. This policy was adopted by the Colonial Office and the natives of Nigeria were secured in the possession of their land—the Government imposing land taxes, which are the equivalent of rent. The exclusion of the European land speculator and denial of the right to buy and sell land and of freehold tenure was held by all the authorities to be essential for the moral and material welfare of the inhabitants of a land where the duty of the white man is mainly that of administration and his material advantages lie in trade.

*Amalgamation of Northern Nigeria.*—The constitution of Southern Nigeria (1906) left the protectorate still divided into two very different, and, for political purposes, distinct dependencies of the Crown. Southern Nigeria, with an area of about 76,000 sq.m., stretched inland from the Guinea coast through a tropical belt of generally dense forest land to a line irregularly corresponding with the latitude of 7′10″ N. Northern Nigeria, with an area of 255,700 sq.m., composed largely of open prairie, hill country, and dry desert plains, extended from the latitude of 7′10″ to the frontiers of the French and Zinder territory on the north, to French Dahomey on the west, and to the German Cameroons on the east. The population of Southern Nigeria was about 8,000,000 and the population of Northern Nigeria, with more than three times the area, was about 9,000,000. In both divisions primitive and very backward races had been overrun and influenced by civilizations of a higher type. In the south the new civilization had been European and Christian; in the north, Arab and Mohammedan.

The interdependence of these two regions was obvious and their amalgamation had long been urged upon the Imperial Government. It was not, however, until 1911 that the secretary for the colonies, Mr. L. V. Harcourt, determined to adopt the policy. Sir F. (Lord) Lugard, who had been the first high commissioner for Northern Nigeria, was asked to initiate and carry out a scheme of amalgamation, being in 1912 appointed governor at the same time of both Southern and Northern Nigeria. The preliminary work was completed in about 18 months, and on Jan. 1, 1914, the governments of Southern and Northern Nigeria were formally amalgamated, Sir Frederick Lugard receiving the personal title of governor-general. The geographical divisions of north and south were maintained. Two lieutenant-governors were appointed, one for the northern and one for the southern province. An administrator was appointed to the colony, the executive council of which became the executive council of the protectorate, while the jurisdiction of the legislative council was confined to the narrow limits of the colony's 1,400 sq.m.

At the time of amalgamation Northern Nigeria was divided into 12 provinces, the native communities being for the most part each under its native ruler, the five principal native states being known as first-class emirates, while each independent chieftainship, however small, retained its treasured liberty, and this system of government was maintained. The southern provinces at that period consisted of three divisions under provincial commissioners. They were the territories east of the Niger, west of the Niger, and the hinterland of Lagos. The native races in the hinterland of Lagos and to the east of the Niger were in a much less advanced state of tribal organization than were the tribes in the north and scarcely fitted for any form of enlightened self-rule. Fetish worship, cannibalism, and barbarous practices were rife. On the west of the Niger, however, three native states, Yoruba, Egbe, and Benin, were strongly organized. They were induced to renounce the exceptional position they enjoyed, under treaties made with Great Britain, and to accept conditions similar to those of the first-class emirates of the north. The introduction of the new system was accompanied by some difficulty, and in 1918 an easily suppressed rising in Egbeland gave momentary uneasiness. Indirect rule has now been fully accepted in both Egbeland and Yorubaland and the report of 1924 stated that it was working admirably in Benin. The way for the extension of such indirect rule as might be found possible was prepared by the division of Southern Nigeria into nine provinces (later increased), each under a British resident, as in the north.

**The World War.**—The outbreak of the World War within seven months of amalgamation postponed the consolidation of the new system. Patriotic sentiment in the protectorate ran high. Every department was depleted by volunteers for active service, and it was with difficulty that the administrative machine was held together with the remnant of overworked staff retained. For four years, the first thought of every Englishman in Nigeria was given to the war. And not of the Englishmen only. The War served at once to test and to exemplify the solid results of British rule. Throughout the War period the great native chiefs of the north were constant and unflagging in their loyalty.

The native troops of the West African Frontier Force did gallant service, both in the arduous campaign carried out under the leadership of Generals Dobell and Cunliffe in the Cameroons, and in what was to them foreign service in East Africa. The Cameroons campaign which opened in August and September 1914, with reverses all along the British line, at Mora (Aug. 25) and Garua (Aug. 29) in the north, and at Nsanakang (Sept. 6) in the south, lasted until Feb. 1916. It was a severe test for the troops engaged. The fighting was heavy, but they stood it well. Early in 1915 the campaign, in which French troops took an active part, was reorganized. British forces in the north were placed under the command of General Cunliffe, and the final taking of Garua and the storming of Banyo Hill under his leadership on Nov. 6, 1915, in face of a hail of dynamite bombs, was a feat of which any regiment might be proud. The conquered territory was divided between France and Great Britain, to be administered under mandate according to the provisions of the Treaty of Versailles. The portion taken by Great Britain was 31,000 sq.m., with an estimated population of 600,000 (*see* CAMEROONS).

*Reforms.*—While the War by arresting material development also delayed the application of schemes for the moral welfare of the native population, some progress was made. The judicial and legal systems of the two protectorates were, on amalgamation, combined. One chief justice for the whole of Nigeria and four puisne judges were appointed, and each lieutenant-governor was provided with a legal adviser. The reorganization of the two systems and the revision of the laws of the two protectorates, was a long and heavy job. The first reforms were initiated in 1914. Notwithstanding the difficulties of the moment, an education ordinance was promulgated in 1916 having for its object the reform and co-ordination of the systems of the north and south. It set a definite standard, of which the principal aim was to substitute self-discipline and the formation of character for set examinations in literary subjects, and generally to fit local education to local needs. A forestry ordinance of the same year (1916) dealt with the rapid destruction of the forests, which constitute the principal wealth of the southern provinces.

Not the least achievement of the War period was the elimination of the traffic in foreign "trade spirits," on which the revenue of the southern provinces had largely depended. It was the declared policy of the amalgamated Government to kill this trade by gradually raising the duty. Conditions of war hastened the process. Before the War the revenue from this traffic formed 34·26% of the revenue of Southern Nigeria. By the end of the War it had fallen to a proportion of 1·23. It was held that this result established two important conclusions. First, that the Government of Nigeria could dispense with revenue derived from spirits; secondly, that the produce trade could be conducted successfully without them. As from Feb. 1, 1919, the importation of trade spirits was formally prohibited in all the West African colonies and protectorates.

*Constitutional Changes.*—Sir F. (later Lord) Lugard retired at the end of the War, and Sir Hugh Clifford succeeded him as governor of Nigeria in July 1919. It was an era of prosperity, and at the end of Clifford's term of governorship great economic progress had been made. Sir Hugh's tenure of office was also notable for two modifications in the system of administration. The first was the extension and reorganization of the central secretariat, a step which in practice tended to curtail the responsibility and initiative of the lieutenant-governors and residents of provinces. The second was the abolition of an advisory Nigerian council established under the amalgamation scheme, and the restoration of the jurisdiction of the legislative council for the colony over the whole of the southern provinces. In the new and enlarged council the elective principle was introduced. The introduction of this elective principle, of which experience in the West Indies has not been altogether encouraging, was new to West Africa, though it has since been applied to Sierra Leone and the Gold Coast. The new council retains an official majority, but includes three elected unofficial members representing the municipal area of Lagos, and one elected unofficial member representing the municipal area of Calabar. The unofficial element also includes members chosen by the three Chambers of Commerce (Lagos, Port Harcourt, and Kano) and the Chamber of Mines, two members representing respectively the banking and shipping interests, and eight the otherwise unrepresented African population of the colony and the southern provinces. The first elections for this council were held in Sept. 1923, and the council was inaugurated by the governor on Oct. 1, 1923. The governor retains the power to legislate for the northern provinces, but the council may discuss affairs of interest to any part of Nigeria. In Sept. 1925 Sir Hugh Clifford was succeeded as governor by Sir Graeme Thomson.

*Improvement of Communications.*—During his first year of office Sir Graeme made extensive tours, in one of which he traversed the protectorate from Lagos to Lake Chad, the whole distance being covered for the first time by motor; and in Feb. and March, 1926, Mr. W. G. A. Ormsby-Gore, the under-secretary of state, visited Nigeria. Later in the year proposals for the improvement of communications were submitted by the governor and approved in general by the secretary of state. In his address to the legislative council on Feb. 1, 1927, Sir Graeme outlined a large programme of accelerated road and railway construction. In the next five years the Nigerian Government proposed to increase the 2,970m. of then existing roads by 200m. per annum, and to add to the 1,597m. of railways then open, new branch lines (to feed the main trunk lines) at the rate of 150m. a year.

The necessity for a big improvement in the transport facilities was emphasized by the condition of the cotton industry. In the years 1906–1926 the value of the external trade of Nigeria rose from 5 to 34 millions sterling. More than half of the exports (of the total value of £16,888,361 in 1926) are palm oil and kernels, but among other industries cotton growing, introduced by the British Cotton Growing Association in 1902, is notable, as affording a prospect of mutual benefit to the Africans of the protectorate and to Britain. It is only in recent years, however, that the production of lint for export has been replaced largely by the growing of the long staple American cotton. In the season 1924–25 the amount of American cotton exported was 28,100 bales, and in 1925–26 it rose to 38,350 bales. When in this hopeful stage of development the industry was threatened with disaster by the fall of the world-price of raw cotton in 1926.

To meet the danger the Government carried cotton on the railways at nominal rates, and, in response to Sir Graeme's appeal, the British Cotton Growing Association reduced the ginning charges and Messrs. Elder Dempster their sea-freights. Six months later he was able to announce the success of these measures to a Manchester audience. "A practicably established but growing industry," he said on Sept. 3, had been saved "from a very serious set-back." At the same time, in view of the relative failure of the American cotton when grown in mixture with other crops (as is customary among the African farmers), the Agricultural Department of Nigeria is trying to produce a strain of native cotton with the long fibre required by the Lancashire cotton spinners. If such strains can be produced in sufficient quantities, it is believed that the area under cotton will be largely extended in the near future.

BIBLIOGRAPHY.—H. Barth, *Travels and Discoveries in North and Central Africa* (1857–58); C. H. Robinson, *Hausaland* (1896); S. Vandeleur, *Campaigning on the Upper Nile and Niger* (1898); E. D. Morel, *Affairs of West Africa* (1902), and *Nigeria* (1912); Lady Lugard, *A Tropical Dependency* (1905); C. Partridge, *The Cross River Natives* (1905); A. G. Leonard, *The Lower Niger and its Tribes* (1906); B. Alexander, *From the Niger to the Nile* (1907); C. Larymore, *A Resident's Wife in Nigeria* (1908); E. Dayrell, *Folk Stories from Southern Nigeria* (1910); N. W. Thomas, *Reports: Edo-speaking Peoples of Nigeria* (1910), and *Ibo-speaking Peoples of Nigeria* (1913); J. D. Falconer, *The Geology and Geography of Northern Nigeria* (1911); P. A. Talbot, *In the Shadow of the Bush* (1912), and *Life in South Nigeria* (1923), and *Peoples of Northern Nigeria* (1926); G. T. Basden, *Ibos of Nigeria* (1920); C. K. Meek, *Northern Tribes of Nigeria* (1925); the annual *Reports* on Southern and Northern Nigeria issued by the Colonial Office. Maps of the country on the scale of $\frac{1}{1,000,000}$ and $\frac{1}{250,000}$ are published by the War Office. The Blue Books, Cd. 2,325 (1904), 2,787 (1905) and 4,523 (1909), deal with railway construction, harbours, and river navigation.

(F. L. L.; W. B. W.)

**NIGHT,** that part of the natural day of 24 hours during which the sun is below the horizon, the dark part of the day from sunset to sunrise (*see* DAY). The word in O. Eng. takes two forms *neaht* and *night,* the latter form apparently being established by about the 10th century. The word is common in varying forms to Indo-European languages. The root is usually taken to be *nak-,* to perish, the word meaning the time when the light fails (cf. Gr. *νέκυς,* Lat. *nex,* death; *nocere,* to hurt). It was customary to reckon periods of time by nights, and "fortnight" (O. Eng. *feowertyne niht,* fourteen nights) is still used, but "se'n-night" (seven nights) has been displaced by "week" (*q.v.*).

**NIGHT CLUB.** Webster's dictionary describes a night club as "a resort in the guise of a social club, frequented by pleasure seekers at night"; a cabaret as "a café or restaurant where patrons are entertained by performers who dance or sing, after the practice of certain French taverns."

Night clubs have mainly developed for two reasons—the desire for conviviality as expressed in the coffeehouse, the teahouse, the wine and beer gardens of many countries, and the various curfews that governments have imposed from time to time which

caused people to group together in clubs where they would be unaffected by early closing laws imposed on licensed premises.

**Development in the United States.**—In the early days of the 20th century entertainment in the United States was largely a private affair with elaborate parties given at home or in private rooms of public places. The cabaret period may be said to have begun in 1911. Dancing was becoming popular. Vernon and Irene Castle (1912) showed that spectacular dancing could be done in a small space. The Bustanoby brothers provided dancing with supper. Dancing became a craze.

By 1915 there was an attempt to divorce dancing from restaurants and eating from drinking. New York passed a 1 o'clock curfew for all restaurants selling liquor and having music and entertainment. This started the era of the small "clubs." These clubs could run on charters and stay open for "members." Now that dancing was restricted it became more popular than ever. Small side-street restaurants offered dancing. Rudolph Valentino taught the tango. Reisenweber imported five men from New Orleans, La., who were the Original Dixieland Jazz band. Jazz was the rage and "night spots" and cabarets began to glitter.

The excitement of World War I added to the craze. Florenz Ziegfeld had his Follies. Les Fleurs opened in West 45th street, New York city, with an orchestra and Clifton Webb and his partner dancing. A "reservation charge" of $2 was "to ensure a high type of clientele." Many planned "great shows."

But the reformers were busy. By 1916 enquiries had been made into "club" charters. A 20% tax was imposed on receipts. Many clubs closed. Others abandoned their plans for expansion. Some withdrew to smaller quarters. Still others continued as before. But in general, the cabaret, as it had been, vanished although the name persisted into the '20s and continued for licensing purposes. Then came prohibition.

*Prohibition.*—The better-known clubs of the pre-prohibition period built their reputations on good food and tastefully presented entertainment. With their tremendous real estate investments they could not stand prohibition. A new type of night life came along. Rector's became the Café de Paris, the Folies Bergère entertained large crowds nightly, Jules Ansandi combined the old high-grade cabaret restaurant with a team of featured dancers to form a place of restricted exclusive membership. The Palais Royal had Paul Whiteman, the Moulin Rouge was in its prime. There were the Bal Tabarin, Beaux Arts café, Montmartre—all different from the old cabaret and from the night club that was to come later.

During this prohibition period all sorts of people went into the night club business. Generally the men controlling the liquor supply were the big cabaret owners. But a group of society women opened the Lido-Venice in East 53rd street, New York city. Wealthy men backed clubs to ensure the serving of good liquor. There were smart clubs like the Mirador, Moritz and the Deauville. There were racketeer clubs. The hostess racket had its inception. Prices soared.

Clifton Webb and Mary Hay danced at Ciro's; the Club Durant took its name from the comedian, Jimmy Durante, and the Club Richman from the singer, Harry Richman. None of these places was of the quality of Reisenweber's; few even had good cooks. A gay show, fast dance music and no curfew were the main attractions. The Chinese chop suey cafés of New York city moved uptown with dancing, a show of sorts and a dinner for $1.50.

There were many raids and closings, changing ownerships, changing locations. The hotels began to adopt a table d'hôte dinner. Courts upheld cover charges. The old-time cabaret had made way for the speak-easy. A secret estimate by New York police made just before the return of 3.2% beer stated 9,000 places were selling liquor in New York city, including the small cordial shops. Then came repeal.

*Repeal.*—With repeal, many of the old speak-easy owners became the new "smart" night club owners. Typical of these were the Stork, La Rue, Versailles and Coq Rouge.

But a new trend appeared. During prohibition, drinking, because it was wicked, had been enough. With repeal, just drinking lost its charm. This, combined with the death of vaudeville and the financial depression, starting in 1930, led to the "theatre restaurant," the big Broadway place which served food, had a floor show, provided space and music for dancing, and had no cover charge. One of the illustrious of these was the Paradise, which combined eating and dancing with a chorus floor show. The Cotton club moved down from Harlem. Billy Rose started his Casino de Paree in an old theatre, and had 1,200 chairs to fill—twice each night. There were the Casa Manana and the Diamond Horseshoe. These places would gross more than the small smart places but would net less because of their high entertainment costs. But they were depression successes.

A new type of ownership came about. More and more old vaudeville performers and theatre operators got into the field, to be followed by business men who saw a lucrative field. In 1934, the Rainbow room opened on the 65th floor of Radio City, done on the scale of pre-World War I and reminiscent of Hollywood's version of glamorous night life.

The Central Park casino, in a beautiful setting, with good food and music, found high favour among discriminating pleasure seekers. It later was closed by Mayor Fiorello La Guardia.

For the later hours, there were the "swing spots" along 52nd street like the Onyx, the Famous Door and Hickory House; and, of course, the dance halls like Roseland.

*In 1944.*—As the food in night clubs improved, hotels began to feel the competition. To meet it, they had to add the "something else" the night clubs and theatre restaurants were providing with dinner. Gradually they set aside special rooms for dinner entertainment. These were rooms usually listed as night clubs —the Waldorf's Sert room, the Plaza's Persian room, the Iridium at the St. Regis. These tended to have "select" entertainment, such as the Persian room's Hildegarde. Others competed with the big theatre restaurants of Broadway. The Lexington had a Hawaiian floor show and the New Yorker Terrace room presented an ice show.

Socialite singers appeared. Cobina Wright Jr. sang at the Sert room of the Waldorf. Others were Alice Marble and Adelaide Moffatt, Sally Clark, Eve Symington, Gay Adams, Teddy Lunch and Bobby La Branch.

Night clubs became more elaborate in *décor*. Artists like Norman Bel Geddes were called in. Many night clubs cost more to build than theatres. Shreve, Lamb and Harmon, architects of New York city's Empire State, tallest building in the world, supervised the decoration of the Stork club.

First, the drink was the admission price to the show. Gradually this admission was increased, by means of cover charges, minimum charges and location charges. In the smarter places, the same charge was made for a Coca-Cola as for a Scotch and soda or an elaborate cocktail. Some places had no dancing. The show was the thing. In the better places, the customers themselves were the show.

From a start with music only, by 1944 practically all vaudeville talent was in use. There were at that time an estimated 30,000 performers in the night club field paying well over $1,000,000 a year in withholding taxes. Night clubs nationally were buying more talent than any other entertainment medium, including the theatre. Where vaudeville performers formerly boasted of a 40-week engagement, their contracts under night club auspices might run up to two years. Good places paid a minimum of $100 a week for principals, $55 to the chorus. Xavier Cugat turned down $5,000 a week to play in New York. Entertainment in the big places, including music, might run from $12,000 to $15,000 a week. And business was booming.

*Statistics of the Night Club Business.*—Night clubs in 1944 operated under cabaret licences but cabaret licences included everything down to little bars with juke boxes. There were then 1,100 cabaret licences issued in New York. It was estimated that of these, 150 could be classed as real or representative night clubs—meaning those with "live" entertainment. This estimate was made after a number had closed by reason of the 30% tax in April 1944 (reduced to 20% in July 1944). This included night clubs in hotels.

At the same time there were an estimated 10,000 night clubs in the U.S. even after 2,500 had closed because of the tax. These 10,000 included only the real cocktail lounges and cafés with "live" entertainment. It was estimated that there were 70,000 cabarets of all descriptions catering to night life and including the juke box places.

While New York city had been known for years as the entertainment centre of the United States, there were proportionately more night clubs in other cities that did not have as many, or any, legitimate theatres. Every large city had at least a dozen night clubs and another 100 or so places ranging from cocktail lounges down to taverns and bars with juke boxes.

The estimated gross number of patrons frequenting night clubs in the United States in 1944 was 200,000,000 (including repeat visits). The estimated average check was $3.00.

Actual gross receipts of night clubs (this included hotel "rooms") for the year July 1, 1942, to July 1, 1943, were $600,000,000.

Tax receipts by the federal government, of course, depended on the rate in effect. At the 20% rate, tax receipts were around $120,000,000 annually. Actual tax receipts for certain periods were as follows:

*United States Government Tax Receipts*

| | | | |
|---|---|---|---|
| April | 1943 | $1,680,000 | (5% rate in effect) |
| Sept. | 1943 | 1,590,000 | same |
| Jan. | 1944 | 1,912,000 | same |
| Feb. | 1944 | 1,629,000 | same |
| March | 1944 | 1,694,000 | same |
| April | 1944 | 1,772,000 | (30% rate in effect) |
| May | 1944 | 4,504,000 | same |
| June | 1944 | 4,920,000 | same |
| July | 1944 | 5,085,000 | (20% rate in effect) |
| Aug. | 1944 | 5,222,000 | same |
| Sept. | 1944 | 4,165,000 | same |

United States government tax receipts from night clubs in New York city during April 1943 were $227,248; for March 1944, $204,084; and for April 1944, $575,150.

In addition to these tax receipts, there were, of course, income taxes on owners, withholding taxes from employees, liquor taxes, etc.

*Income and Outgo of Certain Representative Night Clubs.*—Gross receipts of night clubs could run as high as $100,000 a month or more. For the period March 1 to March 25 of 1944, the Boston Latin Quarter did a gross of nearly $57,000 and Billy Rose's Diamond Horseshoe in New York city did nearly $107,000.

A large theatre-restaurant type place in New York city, with clubs in other cities, gave the following figures: For every $1,000,000 gross business, the operator spent $300,000 on food, $150,000 on drink, $300,000 on music and actors, $150,000 on taxes (this was during the 5% federal rate), $60,000 for overhead, leaving $40,000 for profit. He started with a $75,000 investment, grossed $5,000 one Saturday night in 1943. His average check that year was $4.25.

In a typical night club in Chicago, Ill., in 1940 the figures were as follows: monthly gross was $30,000. Salaries took $15,000, of which $9,000 went to the floor show and orchestra, $6,000 to other salaries; food, liquor, light, gas, coal and laundry cost $9,000; taxes and advertising $4,500; gross profit averaged 5%, or $1,500, which was considered excellent.

Liquor sales brought in 58% of the income, and on them was made a 300% gross profit over cost; food brought in 40%. The rest was made up from tips, which ran almost $300 a week and paid the rent twice over. These came from the doormen, flower and cigarette girls, the astrologer and photographer. Two other concessions brought in about $15 weekly.

The doormen were paid $20 and $25 a week and turned in all tips. Hat check girls were paid $20, $22 and $25 and also turned in all tips. Bartenders were paid $40 a week, the chef $85, cooks $50 and $35. The waiter captain received $40 and the headwaiter $40; both kept their tips. Waiters were paid $2 a night and kept their tips. The powder room girl got $18 a week. The astrologer gave readings for $1.00 a customer and gave the club 25%. The photographer paid the club the same percentage.

In other salaries, $700 went to the orchestra each week, $140 to the relief music trio, $200 to the soloist, $150 for the dance team, $65 for the spotlight electrician, $150 to the strip-teaser, $50 each to two tap dancers, $300 to the comedian, $50 each to two stooges, and $350 to the dance directress, who paid the chorus girls and provided their costumes.

The list of night clubs below gives only a few in a few cities of the United States. It does not, in most instances, include the names of leading hotel rooms such as those previously mentioned in New York city.

Probably the Hollywood-Los Angeles, Calif., night clubs were least like others in the United States, since they depended mainly on the good will of the movie colony for their business. Unless they could attract famous movie stars, the crowds would not come. The Florentine Gardens, in spite of big, flashy shows, never attracted the movie people.

Earl Carroll's theatre restaurant was one of the most famous of the large places, with its Wall of Fame made of concrete blocks autographed by movie stars.

In New York the smart clubs included the Stork club, Café Society, La Rue, Bertolotti's, Ruban Bleu and the Blue Angel. The Stork club, leader of the smart night clubs after prohibition, characterized as the "world's most famous night club," was favoured by famous people of the stage, screen, political and financial worlds.

The younger set liked Le Coq Rouge, Tony's Trouville and Armando's where there was little entertainment but excellent food. El Chico was considered the most authentic of the Spanish type. The Diamond Horseshoe represented lavish entertainment of the theatre-restaurant type, and Café Zanzibar was known for its Negro talent.

*Night Club Historians.*—The rise of night clubs in New York paralleled the growth of a special chronicling of the clubs and their patrons. Broadway columns started, grew, and through syndication reached hundreds of newspapers over the country. Dean of the columnists in this particular field, and arbiter of the doings of night club customers was Walter Winchell, whose first recognition came as a chronicler of Broadway.

His approval of a particular club made that club notable. His regular newspaper "beat," as those of the columnists who followed in his pattern, included the "top" places. His particular coign of vantage was a regal spot in a commanding corner of the Cub room of the Stork club.

Other outstanding columnists who reported on the night club scene and kindred matters included Ed Sullivan, Dorothy Kilgallen, Louis Sobol, Earl Wilson and Leonard Lyons.

Among night clubs in New York and other U.S. cities in 1944 were:

*New York:* Bertolotti's, Blue Angel, Café Society, Café Zanzibar, Casino Russe, Copacabana, Diamond Horseshoe, 18 Club, El Chico, El Morocco, Greenwich Village Inn, Gay Nineties, Havana Madrid, La Conga, Latin Quarter, Leon and Eddie's, Monte Carlo, Rainbow Room, Ruban Bleu, Spivy's Roof, Stork Club, Tony's, Versailles, Village Barn and Wivel. *Miami Beach:* Bali Club, Beachcomber, Bill Jordan's Bar of Music, Clover Club, Don Lanning's, Kitty Davis', Latin Quarter, Monte Carlo, Mother Kelly's. *Detroit:* Bowery Club, Brass Rail, Club Casanova, Club 509, Famous Door, Gay Haven, Mayfair Club, Mickey's Show Bar, Stevadora. *Boston:* Latin Quarter, Mayfair, Shangri-La, Silver Dollar. *Chicago:* Blackhawk, Boulevard Room, Chez Paree, Empire Room, Latin Quarter, Mayfair Room, Pan-American Room, Panther Room—College Inn, Pump Room and the Buttery, Rio Cabana, Walnut Room. *Los Angeles-Hollywood:* Dave Chasen's, Earl Carroll's, Mocambo's, Slapsie Maxie's. *Philadelphia:* Bill Hopkins, Embassy Club, Latin Casino, Swan Club. *Pittsburgh:* Mercur's Music Bars, Yacht Club. *Baltimore:* Club Charles. *Cleveland:* Normandy. *San Francisco:* Bal Tabarin. *Seattle:* The Ranch. *Washington:* Troika.

**England.**—The government's early curfew on the buying of drinks in licensed premises gave rise to the so-called "bottle clubs" or "bottle party clubs" in London. These were clubs composed of members who paid an initiation fee and dues, registered at a neighbouring wine shop, and had liquor held for them in their lockers in their names. Thus they could drink their own liquor at any time. A typical pre-World War II evening in London might have included dinner at the Savoy, gaiety at the Café de Paris, and the wee hours at the Embassy.

The Embassy is probably the most famous of the London bottle

clubs. Formed in 1919 at a cost of $90,000, it was taken over a year later for a third of that amount by Luigi Naintre. Naintre later sold the club but stayed on as manager. From 1920 to 1928 the club made a net profit of $600,000 on a yearly gross of around $500,000. In 1928 the club was again sold for $600,000, and Naintre went with it at a salary of $30,000 a year. Ten years later, the Embassy had run down hill, was closed, again changed hands and reopened.

When Naintre bought the Embassy it had 375 members. During the 1920s it became the "ritziest" club in London and by 1928 had 2,500 members who paid 20 guineas to join and 8 guineas a year. Royalty and world statesmen were members. The duke of Windsor, a frequent visitor, like many other members of royalty, paid no dues but only for his food and drink.

The Embassy did not go in for regular entertainment since its patrons were too regular. But it was there that Irene Castle with Billy Reardon in 1922 made a "smashing hit," and London paid for standing room to see her. Her salary was the largest ever paid a night club entertainer to that time. Rudyard Kipling and Sir James Barrie and most of Europe's kings were frequent customers.

Most of the night clubs and bottle clubs in London were in an area of a square mile between Charing Cross and Regent street. London spent $2,000,000 on entertainment talent in 1939 in its West End "night spots." The Embassy talent bill ran around $750 a week, the Café Anglais $600, and the Café de Paris around $3,000. Many of them, because of the limited drinking hours, could not hope to spend the amount of money clubs do in the United States. Probably the most lavish productions were put on at the London Casino, a theatre-restaurant which, before World War II, was spending up to $7,500 a week to entertain, and in 1939 grossed up to $35,000 a week.

Night life in London, as in many countries, got its impetus in World War I, was aided by American tourists during the '20s, and again in 1945 was booming.

There were the expensive Cocoanut Grove, Murray's club, and the Nut House with its comic murals. In London's Harlem there were the Nest, Florence Mills, Frisco's and Moody's London Harlem. The nude or semi-nude included the Cabaret, Cuba club, Paradise and the Kit-Kat.

The Café de Paris, seating 200 and classed as an air-raid shelter, continued popular. So did the "400," the millionaires' bottle club. There were the Lansdowne and L'Apéritif. And newly opened in 1944 was the Milroy club, which was bomb-proof, and the Astor, reported to be selling whisky and gin at $18 a bottle.

**Poland.**—In many European countries family life was lived in the coffee houses, cafés and beer gardens. Perhaps Poland was as typical as any of this great love for café life, as necessary to the Pole as the club to the Englishman. Café life began at 10 A.M. and continued until 2 A.M. the following day. First came the journalists and professors for breakfast and reading the morning papers. In the afternoon the professional people, government and business men came to the cafés for coffee and talk; from 5 to 8 everyone came to be happy and read the evening papers, to listen to music and admire the women's dress; and from 11 P.M. to 2 A.M. there was dancing, and the cafés became night clubs. And always there was politics, in a bright and cheerful atmosphere.

Every class had its café, from the cabinet ministers who went to the Café Europe, to the beggars who had their *kawiarnia* on Okopowa street in Warsaw for coffee or tea or a little alcohol. There was the historic Café Lourse for men of science and education, and the Café Artystyczna for artists and writers. Polish society danced on the parquet floor of the Café Adria, and musicians went to the Napoleonka, formerly on the Kresowa.

**Berlin.**—After World War I Berlin had the most spectacular night life of any city in Europe, mainly to attract tourists. Hitler stopped much of the bawdiest of this but as the German middle class had always preferred its vaudeville in the music hall to gay night life, there was no grumbling. Furthermore, Berliners were never keen on dancing in restaurants. They preferred to eat and then go on to a night club from 10 P.M. to 3 A.M. (curfew).

For those who wished a still later night life, there was membership in the "early clubs" such as the Artists' Corner or Henry Bender's.

During the early '30s Berlin night life was very depressed but by 1939 it was humming. Some of the sparkle had gone because Hitler had prohibited Negro or jazz music and replaced Hungarian musicians with German. But there was plenty of business. In 1939 the elite of Berlin were going to Ciro's or to the exclusive small "spot"—Koenigin. For the dancers there were the big dance bars. And on or near the Kurfuerstendamm were the Atlantic, Barberina, Rio Rita, Cascade, Femina, Texas Bar, Quartier Latin, or the expensive Bar-Kakadu with the "longest rail." There was the Jockey club for the fashionable and the artists.

Two new big dance halls had opened that year too. There was the Berolina, seating 1,200, whose *décor* was the humours of old Berlin, and another, consisting of two halls seating jointly 2,500. One of these halls was the White Horse inn, the other, called Schoenbrunn in Berlin, was decorated in Viennese baroque.

And there was the Alten Ballhaus, the cheap family dance place, where waltzing was inexpensive and tourists were not encouraged. And for the tourists, especially Americans, there was the Haus Vaterland restaurant which held three or four thousand people and had 800 waiters and separate restaurants for countries all over the world. Berliners went there only to show the place to out-of-towners.

**Budapest.**—Prewar Budapest was particularly fond of chorus girls kicking their legs while lying on props shaped like huge slices of melon. Their Arizona night club at one time featured a baby elephant doing the Lambeth Walk. Cancan dancers and gypsy music were popular. So were girls on a whirling globe and sinking and rising dance floors. Their clubs were modelled on their idea of the American version, and a night out in 1939 would cost about $25. Girls sat with the customers, encouraging them to drink, and lived on their tips.

**Geneva.**—Geneva in the middle '30s would find dignitaries going dancing at the dull Macmahon, while those in search of more gaiety would go to the Brasserie Bavaria with its Derso and Kelen caricatures, or to Maxim's or to the Moulin Rouge.

**Moscow.**—By the middle '30s Russia began to look with favour on night clubs and jazz and dancing between the tables. The Moscow Cocktail hall on Gorki street was modelled on the United States version, and cowboy cocktails cost 90 cents.

**Sweden.**—In Sweden, as in England, the early government curfew caused the forming of small membership clubs. Also as in England, a representative one was the Embassy but unlike England, Swedish members actually incorporated their club and bought shares of stock nightly. Seven nights a week a shareholders' meeting was held till 7 A.M. Liquor was kept in each member's locker. Liquor was bought at specified liquor stores and purchases were carefully checked.

The regular licensed cafés had to close by 11 P.M. or, by special extra licensing, might sometimes stay open until midnight. Typical prewar clubs of this type were the Adlon, the Cecil and the Fercentza.

**France.**—In France, too, the café life was the family life and the family club for beer, wine, coffee, gossip and the forming of opinion. But prewar France also had a night life. The fact that it served as a model is shown by the number of cities all over the world that boast their Maxim's, internationally famous, their Café de Paris, their Moulin Rouge or their Montmartre. And of course, World War I and the tourists of the '20s gave it added impetus. In the spring, late-hour pleasure-seekers flocked to the Bois de Boulogne, to the d'Armenonville and the Pré-Catelan.

In the Champs-Elysées district there was what was known as one of the oldest night clubs in Paris, the Boeuf sur le Toit, famous among the intelligentsia, featuring a Negro band in a pit. The Ray-Ventura had a good orchestra. For those who wanted an *intime* atmosphere there was Au Chapeau Rouge and La Boite à Sardines.

In Montmartre there was the smart Chez Florence, frequented by the famous; and the exclusive, expensive Shéhérazade of Russian atmosphere. Chez O'Dett was popular, and Bal Tabarin had its cancan dancers and the Parisian floor show. The Casanova was Russian and classic, and the Don Juan was chic. There was Monte Cristo, and the Bagatelle supper club with an American orchestra. And, of course, there was Zelli's.

In Montparnasse was the old-time Coupole, modernized in the '30s, and Bricktop, famous hostess of post-World War I Paris. And La Rotonde, popular with tourists and students, said to be the place where the Russian world revolution was planned. And the Jockey, the Poisson d'Or, La Boule Blanche, the Joker and the nudist Cabaret des Fleurs.

In the Opera district were the Café de la Paix and Le Bosphore with lots of French fun; La Vie Parisienne and the Casino de Paris where Josephine Baker from Harlem, New York city, made a hit before she opened her own place in the Champs-Elysées.

There were Casanova and the Café de Paris, Caprice Viennois, Le Grand Jeu and Chez Frisco.

And again in World War II they were booming—Moulin de la Galette, Lapin Agile, Ciro's, Le Beaulieu, Sa Majesté, Le Tyrol and Le Jardin de Montmartre.

**Miscellaneous.**—One might have gone to the Café Josty in Vienna or the Excelsior Palace at Lido Island in Venice or the respectable Colorado in Bucharest or Chicote's in Madrid or the Café El Greco in Rome, which in 1940 changed its name to Café Albania, noted as the favourite café of Mark Twain and Keats and Shelley.

**Mexico City.**—Mexico City progressed in the night club business when World War II sent tourists that way. L'Escargot in 1944 did a huge tourist business. Sans Souci opened in 1944 and was owned by Cubans who ran one by the same name in Havana, Cuba. Ciro's in the Reforma hotel was decorated with nudes by Diego Rivera, and served French champagne. El Patio was for the people. It was the biggest and practically the only one in business before World War II. It boasted two orchestras and a revolving stage. The Casanova was the most intimate and catered to the native café society. The Jockey club was part of the new racetrack, and the new Minuit had prices comparable to "21" or the Stork club.

Aside from the tourist-type night club, the native Mexican often went to the cantina. It was the European coffeehouse. The Mexican talked and drank tequila and might have a poker game at the Flame of the Revolution or the Candle of Hatred or the Lion of the Mountains. And for the poor there was the pulqueria like Dust on a Corpse, where pulque was 2 cents a glass and talk was free.

**Rio de Janeiro.**—One of the three gayest night clubs in Rio was the Copacabana Casino where Theodora Roosevelt (daughter of Archie) made her professional debut as a danseuse in the Golden room in 1942. The Copa also had gaming rooms and was frequented by notables. It had a great deal of United States talent and some Brazilian. Biggest and gaudiest was the Casino da Urca with elevator stages, rink and sliding floor panels; foreigners danced on its glass dance floor. And there were the Atlantic Casino with an American girl chorus, and the Quitandinha-Petropolis with four orchestras and 2,000 customers of a Saturday night.

**Buenos Aires.**—Tavaris was Buenos Aires' biggest night club and like the Copacabana in New York city. "Swankiest" would be the Alvear Palace Hotel roof, corresponding to the St. Regis. La Fantasia, on the outskirts of the city, was fancy. Mexican and Brazilian entertainers were the most popular in Buenos Aires, but American talent was also used. Argentines can handle American music better than other Latin Americans. Outside the city at Mar del Plata, a resort, there was legal gambling at the casino and night life at Puerreydon, the Auto club, the Hindu and Club Nautico.

**Japan.**—The Florida was considered the best night club in Tokyo in the '30s with its Brooklyn Negro band and tango orchestra. Bars such as Black Cat, Morocco and the Avalon had only phonograph jazz, but were popular. All served western cocktails.

**China.**—China has long lived in its teahouses—drinking tea and nibbling pumpkin seeds. Chinese night life in public places was mainly that of the foreigners. There was roulette in Farren's on the edge of the French concession in Shanghai. Sir Victor Sassoon's Tower night club had a bomb-inspired floor show called Shrapnel Swing after its bombing in 1937. There was the Park hotel's Sky Terrace and the Shanghai club. American talent was evident until the exchange rate made it impossible to pay enough to attract performers from the United States. Russian talent was probably next most plentiful.

**Manila.**—Before World War II the Jai-Alai club was the most glamorous and fashionable. Quezon often danced at the Santa Ana cabaret.

**Cairo.**—Dolls, Trocadero, Dugout, Cabaret Badias, Casino Mogador and the Continental roof garden all had floor shows—the latter with Hekmet, a dancer who was arrested as a spy. And, of course, there was Shepheard's as part of the night life.

SOURCES: Stanley Walker, *The Night Club Era; The New Yorker; Time; Life; Fortune; Saturday Evening Post; Variety.* Various newspapers; foreign correspondents' reports; statements of Noah Braunstein, counsel for Café Owner's Guild. (S. BY.)

**NIGHTHAWK,** an insect-hunting bird closely related to the goatsuckers of the old world, and less closely to the swifts and humming birds. The nighthawk (*Chordeiles virginianus*) belongs to the family Caprimulgidae, goatsuckers, so called from the fancy that they sucked the milk of goats. The wide skull, soft plumage, noiseless flight and nocturnal vision connect these birds with the owls. The nighthawk wanders in migration from the Arctic ocean to southern South America, and breeds in eastern North America from Florida to Labrador. The eggs are laid on the ground or on the flat roof of a building. The Texan nighthawk (*Ch. acutipennis texensis*) has rusty-brown spots on the flight feathers.

**NIGHTINGALE, FLORENCE** (1820–1910), English hospital reformer, younger daughter of William Edward Nightingale, of Embley Park, Hampshire, and Lea Hurst, Derbyshire, was born at Florence, Italy, on May 12, 1820, and named after that city, but her childhood was spent in England, mainly in the country at one of her father's houses, but with periodical visits to London. Sidney Herbert was a neighbour of the Nightingales in Hampshire, and both he and his wife were Florence's friends. She received a good classical and mathematical education at home under her father's guidance. She began to visit the hospitals in 1844, as she was not content merely to lead the ordinary social life of a girl of her class. In the winter of 1849–50 she made a tour in Egypt with friends, travelling by way of Paris. On the journey she met two sisters of St. Vincent de Paul, who gave her introductions to their order in Alexandria, where she visited their schools and hospital. From the sisters she learned the importance of formal discipline in hospital nursing. She then visited the Institute of Protestant Deaconesses at Kaiserswerth, returning the next year, when she remained for four months to study the organization, and to undergo a regular course of training as a nurse. She then studied the London and Edinburgh hospitals, and in 1853 was in Paris, studying nursing organization there. On her return to England she became (Aug. 1853) superintendent of the Hospital for Invalid Gentlewomen in Chandos street, London, which she moved to Harley street.

In the year 1854 England was stirred profoundly by the report of the sufferings of the sick and wounded in the Crimea. There was an utter absence of the commonest preparations to carry out the first and simplest demands in a place set apart to receive the sick and wounded of a large army. The condition of the large barrack-hospital at Scutari was abominable. A royal commission of enquiry was appointed, a patriotic fund opened, and money flowed in fast. To Florence Nightingale this proved the opportunity for which she had systematically prepared herself. She wrote to her friend Sidney Herbert, secretary at war, and offered her services. Her letter crossed with one from him inviting her to proceed to the Crimea. "My question simply is," he wrote, "would you listen to the request to go out and supervise the

whole thing? You would, of course, have plenary authority over all the nurses, and I think I could secure for you the fullest assistance and co-operation from the medical staff, and you would also have an unlimited power of drawing on the Government for whatever you think requisite for the success of your mission."

She set out on Oct. 21 with a staff of 38 nurses. They reached Scutari on Nov. 4 in time to receive the Balaklava wounded. A day or two later these were joined by 600 from Inkerman. The story of Florence Nightingale's labours in the huge insanitary barrack-hospital at Scutari became a legend in her lifetime, a legend diffused over the English-speaking world by Longfellow's verses on "Filomena." She gave herself, body and soul, to the work. She would stand for 20 hours at a stretch to see the wounded accommodated. She regularly took her place in the operation room, to hearten the sufferers by her presence and sympathy, and at night she would make her solitary round of the wards, lamp in hand, stopping here and there to speak a kindly word to some patient. Soon she had 10,000 men under her charge, and the general superintendence of all the hospitals on the Bosporus. But the actual superintendence of the hospitals and of the nursing was only part, perhaps only the smaller part, of the work. She wrestled daily and successfully with the military authorities, especially with the commissariat, who naturally regarded her as a dangerous innovator, and indeed thwarted her efforts to break through the mazes of the red-tape methods of administration.

In the end her firmness and, at need, her anger, won. The death-rate in the hospitals was 42% in Feb. 1855; in June it was 2%. She had secured by superhuman effort and the force of a dominating personality a measure of sanitation and decent conditions. Even her energy would hardly have triumphed but for the backing she received from Sidney Herbert. Things were going well enough in the summer to allow her to leave Scutari to visit the hospitals at Balaklava. There she caught Crimean fever and herself lay dangerously ill in a hospital for 12 days. She refused to leave her post, and remained alternately at Balaklava and Scutari until Turkey was evacuated by the British in July 1856. A man-of-war was ordered to bring her home and London prepared to give her a triumphant reception; but she returned quietly in a French ship, crossed to England, and escaped to her country home before the news of her return could leak out. She visited Queen Victoria at Balmoral in September, and laid before the queen and her husband a plan of the urgent reforms needed in the military hospitals. The queen's comment on the visitor was: "Such a head! I wish we had her at the War Office."

The experiences of the terrible months in the Crimea permanently affected Florence Nightingale's health, but the quiet life she afterward led was a busy one. Blue Books and statistics were her daily food; she was always ready to confute the war office from its own records. With the £50,000 raised in recognition of her services she founded the Nightingale Home for training nurses at St. Thomas's hospital. She watched over the growth of the new institution and each year addressed the nurses. The example of St. Thomas's was followed by others. Florence Nightingale was, indeed, the effective founder of the nursing system in England. She also turned her attention to the question of army sanitary reform and army hospitals, and to the work of the Army Medical college at Chatham. She wrote a candid official report on the working of the army medical department in the Crimea, and in 1858 printed her *Notes on Matters affecting the Health, Efficiency and Hospital Administration of the British Army*. The 800 pages of these notes formed the basis of the royal commission to enquire into the health of the army, and are a classic in the literature on army medicine.

Although Florence Nightingale lived a life of the strictest retirement she was consulted constantly by the authorities, and expressed her views with great clearness and vigour. The foundation of the hospital schools of nursing in London was followed, at her suggestion, by the formation of a school at Liverpool infirmary (1862). She helped to establish various institutions for nursing, from the East London Nursing society in 1868 to the Queen's Jubilee Nursing institute in 1890. She would have liked to have gone out to India during the Mutiny. She was not invited to go, but she took the deepest interest in the progress of sanitation and of health measures in India, and was constantly in correspondence with the secretary of state for India, and with high officials in India up to 1872.

In her later years, from 1872, when, as she says, she "went out of office," she made a close study of Plato, under the direction of her friend Benjamin Jowett, and of the Christian mystics. She still maintained an enormous correspondence with the heads of the nursing profession and with members of the rank and file. She sought to promote rural hygiene, and was indefatigable in demanding health missionaries for Indian villages. Generally she was a prisoner in her room, where she received favoured visitors from time to time, but she never went out except occasionally for a drive in the park in the early morning. She was 87 when the Order of Merit was brought to her in 1907. Three years later she died in her house at South street on Aug. 13, 1910, and was buried at East Wellow, Hampshire, on Aug. 20.

*See* Sir E. Cook, *Life of Florence Nightingale* (2 vols., 1913); M. A. Nutting and L. L. Dock, *History of Nursing* (New York, 1907), which contains a bibliography of Miss Nightingale's writings; and a sketch by Lytton Strachey in *Eminent Victorians* (1918).

**NIGHTINGALE,** the bird celebrated beyond all others by European writers for the vocal powers which, contrary to usual belief, it exercises at all hours of the day and night during some weeks after its return from its winter quarters in the south. The song itself is indescribable, though several attempts, from the time of Aristophanes to the present, have been made to express in syllables the sound of its many notes. Poets have descanted on the bird (which they nearly always make of the feminine gender) leaning its breast against a thorn and pouring forth its melody in anguish. But the cock alone sings, and there is no reason to suppose that the cause and intent of his song differ in any respect from those of other birds' songs (*see* SONG). In great contrast to the nightingale's voice is the inconspicuous coloration of its plumage, which is alike in both sexes, and is of a reddish-brown above and dull grayish-white beneath, the breast being rather darker and the rufous tail showing the only bright tint.

The range of the European nightingale, *Luscinia megarhyncha*, is peculiar. In Great Britain it is abundant in suitable localities to the southeast of a line stretching from the valley of the Exe, in Devonshire, to York, but it does not visit Ireland, Wales or Scotland. On the continent of Europe it does not occur north of a line stretching irregularly from Copenhagen to the northern Urals, and it is absent in Brittany; over south Europe otherwise it is abundant. It reaches Iran, and is a winter visitor to Arabia, Nubia, Abyssinia, Algeria and as far south as the Gold Coast. The larger eastern *L. philomela* is russet-brown in both sexes, and is a native of eastern Europe. *L. hafizi* of Iran is probably the Perso-Arabic bulbul of poets.

The nightingale reaches its English home about the middle of April, the males (as is usual among migratory birds) arriving some days before the females. Poets and novelists are apt to command at will the song of this bird, irrespective of season. If the appearance of truth is to be regarded, it is dangerous to introduce a nightingale as singing in England before the 15th of April or after the 15th of June. The "early nightingale" of newspaper paragraphs is generally a thrush. On the cocks being joined by their partners, the work for which the long and hazardous journey of both has been undertaken is speedily begun, and before long the nest is completed. This is of a rather uncommon kind, being placed on or near the ground, the outworks consisting chiefly of a great number of dead leaves ingeniously applied together so that the plane of each is mostly vertical. In the midst of the mass is wrought a deep cuplike hollow, neatly lined with fibrous roots, but the whole is so loosely constructed, and depends for lateral support so much on the stems of the plants among which it is generally built, that a very slight touch disturbs its beautiful arrangement. Herein from four to six eggs of a deep olive colour are duly laid, and the young hatched. The nestling plumage of the nightingale differs much from that of the adult, the feathers above being tipped with a buff spot, just as in the young of the

redbreast, hedge sparrow and redstart, thereby showing the natural affinity of all these forms. Toward the end of summer the nightingale disappears to its African winter haunts.

The name nightingale has been applied to several other birds. The so-called "Virginian nightingale" is a species of grosbeak (*q.v.*); the "Pekin nightingale" or "Japanese nightingale" is a small babbler (*Liothrix luteus*) of the Himalayas and China.

The nightingale holds a place in classical mythology. Procne and Philomela were the daughters of Pandion, king of Attica, who in return for warlike aid rendered him by Tereus, king of Daulis in Thrace, gave him the first-named in marriage. Tereus, however, being enamoured of her sister, feigned that his wife was dead, and induced Philomela to take her place. On her discovering the truth he cut out her tongue to hinder her from revealing his deceit; but she depicted her sad story on the robe which she sent to Procne; and the two sisters then contrived a horrible revenge for the infidelity of Tereus, by killing and serving to him at table his son Itys. Thereupon the gods interposed, changing Tereus into a hoopoe, Procne into a swallow, and Philomela into a nightingale, while Itys was restored to life as a pheasant, and Pandion (who had died of grief at his daughters' dishonour) as a bird of prey (*see* OSPREY). The fable has several variants. Ovid's version may be seen in the 6th book of his *Metamorphoses* (lines 412–676).

**NIGHTJAR** or **GOATSUCKER** (*Caprimulgus europaeus*, Linn.), a bird erroneously believed since very ancient days to have the habit implied by its second name. It is characterized by its flat head, wide mouth fringed with bristles, large eyes, soft plumage and consequently noiseless flight. It arrives in Europe from Africa late in the spring, returning in the early autumn. Its food consists of insects, chiefly moths and cock-

FROM KOEHLER, "MEDIZINAL PFLANZEN"

DEADLY NIGHTSHADE OR DWALE (ATROPA BELLADONNA), SHOWING BRANCH WITH FLOWERS AND FRUIT

chafers, which it catches on the wing at night. When resting on a bough the nightjar sits along its length. In this position the cock bird utters his curious burring note. The eggs are laid on the ground, and number two; the young are clad in dark-spotted down, rendering them, like their parents, exceedingly difficult to see when crouching on the ground.

A second species, *C. ruficollis*, occurs in Spain and Portugal and others are found throughout the old world. In America their place is taken by the allied genus, *Antrostomus*, one member of which, *A. vociferus*, is the whip-poor-will (*q.v.*). The nighthawk (*q.v.*) is another common American species, with a voice quite different from that of the whip-poor-will.

The family Caprimulgidae is almost cosmopolitan, but is not represented in New Zealand and Polynesia.

**NIGHTSHADE**, a general term for plants of the botanical genus *Solanum* (family Solanaceae). The species to which the name of nightshade is commonly given in England and North America is *Solanum Dulcamara* which is called also bittersweet or woody nightshade. It is a common plant in damp hedgebanks and thickets, scrambling over underwood and hedges. It has slender slightly woody stems, with alternate lanceolate leaves

WOODY NIGHTSHADE OR BITTERSWEET (SOLANUM DULCAMARA)

more or less heart-shaped and auriculate at the base. The flowers are arranged in drooping clusters and resemble those of the potato in shape, although much smaller. The flower clusters spring from the stems at the side of, or opposite to, the insertion of a leaf. The corolla is rotate, of a lilac-blue colour with a green spot at the base of each segment, or sometimes white, and bears the yellow sessile anthers united at their margins so as to form a cone in the centre of the flower. The flowers are succeeded by ovate scarlet berries, ½ in. long, which in large doses appear to be poisonous or, to say the least, dangerous to children, cases of poisoning by them having occurred. The plant derives its names of "bittersweet" and *Dulcamara* from the fact that its taste is at first bitter and then sweet. It is a native of Europe, North Africa and temperate Asia, and is widely naturalized.

The black nightshade, *S. nigrum*, differs from *S. Dulcamara* in having white flowers in small umbels and globose black berries. It is a common and well nigh cosmopolitan weed in gardens and waste places, growing about 12 or 18 in. high, and has ovate, entire or sinuate or toothed leaves. The berries have been known to produce poisonous effects when eaten by children, and owe their properties to the presence of solanine. In most tropical countries the leaves are eaten as a pot herb. (*See* SOLANUM.)

Deadly nightshade, dwale or belladonna (*Atropa belladonna*) is a tall bushy herb of the same plant family. It grows to a height of 4 or 5 ft., having leaves of a dull green colour, with a black, shining, berry fruit, about the size of a cherry, and a large tapering root. The plant is a native of central and south Europe,

extending into Asia, and is found locally in England, chiefly on chalk and limestone, from Westmorland and southwards. The entire plant is highly poisonous, and accidents not infrequently occur through children and unwary persons eating the attractive-looking fruit. Its leaves and roots are largely used in medicine, on which account the plant is cultivated, chiefly in south Germany, Switzerland and France.

The name nightshade is applied to plants of different genera in other countries.

**NIGRA, COSTANTINO,** COUNT (1828–1907), Italian diplomatist, was born at Villa Castelnuovo, in the province of Turin, on June 11, 1828. During the war of 1848 he interrupted his studies to serve as a volunteer against Austria, and was wounded at the battle of Rivoli. On the conclusion of peace he entered the Piedmontese foreign office; he accompanied Victor Emmanuel and Cavour to Paris and London in 1855, and in the following year he took part in the conference of Paris by which the Crimean War was brought to an end. After the meeting at Plombières between Cavour and Napoleon III. Nigra was sent to Paris as an agent of Cavour. After the breach with Napoleon he was secretary of state to the prince of Carignano, viceroy of the Neapolitan provinces. When Napoleon recognized the kingdom of Italy in 1861, Nigra returned to France as minister-resident, and for many years played a most important part in political affairs. In 1876 he was transferred to St. Petersburg with the rank of ambassador, in 1882 to London, and in 1885 to Vienna. In 1899 he represented Italy at the first Hague Peace Conference. In 1904 he retired, and he died at Rapallo on July 1, 1907. He was created count in 1882 and senator in 1890.

**NIHILISM,** the name commonly given to the earliest Russian form of revolutionary anarchism. It originated in the early years of the reign of Alexander II. The term was first used by Turgeniev in his celebrated novel, *Fathers and Children,* published in 1862. (*See* RUSSIA: *History,* and ANARCHISM.)

**NIIGATA,** the chief town and capital of the prefecture of Niigata, Japan. Pop. (1940) 150,903. It occupies an area of rather more than 1 sq.mi., and consists of five long parallel streets intersected by cross streets, which in most cases have canals running down the middle and communicating with the river, so that the internal traffic of the city is mainly carried on by water. The town has been brought within the railway circuit, and the production of petroleum has been developed in the district. There is a large manufacture of lacquer ware in the town, and since 1931 modern industries have been developed.

The prefecture of Niigata has an area of 4,914.55 sq.mi. and a population (1940 census) of 2,064,402.

**NIJAR,** a town of south-eastern Spain, in the province of Almería; on the southern slope of the Sierra Alhamilla, and on the small river Artal, which flows into the Mediterranean sea 6 mi. S.W. Pop. (1940) 1,925 (mun., 10,071). Lead, iron and manganese are mined nearby; the fertile plain watered by the Artal yields an abundance of wheat, fruit, olives and esparto grass; fine porcelain and woollen and cotton goods are manufactured there.

**NIJMEGEN,** or NIJMWEGEN, a residential town in the province of Gelderland, Holland, on the left bank of the Waal, 24½ mi. E. by S. of Tiel by rail. Pop. (1940), 94,103. It has regular steamboat communication with Rotterdam, Cologne and Arnhem, and is very prettily situated on the slopes of five low hills rising from the riverside. Steps are necessary to lead to the higher portions of the town. In 1877–1884 the old town walls were demolished, a promenade and gardens taking their place, and subsequently a new quarter grew up on the south side with a fine open place called the Emperor Charles's plain. On the east of the town is the beautiful park called the Valkhof, which marks the site of the old palace of the Carolingian emperors. The palace was ruined by the French bombardment of 1794, and only two portions of it remain. These are a part of the choir of the 12th century palace-church, and a sixteen-sided baptistry originally consecrated by Pope Leo III in 799 and rebuilt in the 12th or 13th century. Close by is the lofty tower of the Belvedere, dating from 1646. The *Groote Kerk* of St. Stephen forms with its tall square tower one of the most striking features of the town. Originally built about 1272, it dates in its present condition mainly from the 15th and 16th centuries. The interesting Renaissance town hall was built in 1554 (restored in 1879). There is also an interesting museum of antiquities. Other buildings of note include the old weigh-house and Flesher's hall, probably built in 1612 and restored in 1885. Nijmegen is the seat of a Roman Catholic university.

Beer, Prussian blue, leather, tin, pottery, cigars and gold and silver work are the chief industrial products. The town was occupied by Germany during World War II.

**NIJNI-NOVGOROD** (now called GORKY), chief town of Gorky region, Russian S.F.S.R., at the confluence of the Oka and Volga rivers in 56° 24′ N., 44° E. Pop. (1939) 644,116. The city owes its importance to its position at the junction of the navigable rivers between which, to the west of it, was the flourishing Moscow region, though the development of its trade, at first mainly in furs, was much hampered by Tatar raids, which did not cease until the second half of the 16th century. After the last raid in 1536 it became a depot for goods brought from the southeast, and the conquest of Kazan in 1552 and of Astrakhan in 1556 opened free navigation on the Volga. The thick forests of the district provided material for shipbuilding and a yearly "caravan" of boats under military protection began to carry the products of Moscow and the north to the Caspian and to return laden with the products of the south and east.

**The Fair.**—From remote antiquity Russian merchants were wont to meet in summer with those from the east at different places on the Volga between the mouths of the eastward flowing Oka and the westward flowing Kama, the fair changing its site with the increasing or decreasing power of the nationalities which struggled for the possession of the Middle Volga. Bolgari, Nijni-Novgorod, Kazan and Vasilsursk have been successively the site of the fair since the 10th century. From 1641 its seat was at a monastery 55 m. below Nijni and close to Makaryev; this situation later proved inconvenient, and after the destruction of the shops by fire, the fair was transferred to Nijni in 1817 and has remained there ever since.

The long distances in Russia, the poor network of communications, the seasonal nature of production and river transport, the dependence of the peasant on handicrafts as a supplement to agriculture, the close link between Russia and the Orient, are some of the factors which have tended to preserve the importance of fairs as a medium of exchange and barter. In the more industrialized regions of the south and west, with their better railway facilities and higher level of literacy, fairs are gradually dying out, but in other regions they are still of the greatest importance for home trade. The state grants special customs exemptions to goods destined for the Nijni fair and gives cheaper transport facilities and special credits to traders. Products of the peasant home industries from every region in which they are at all developed are increasingly taking an important place in the fair.

Until the '80s Russian manufacturers depended largely on barter trade in tea from Kiakhta and its price at the fair regulated output. Later the price of raw cotton and madder from Asia at the fair influenced the output of the growing textile industry of the central productive region. The owners of the iron works in the Ural district sent "caravans" of boats laden with iron goods to Nijni, where the purchases of iron made for Asia and Middle Russia determined the amount of credit on which they could depend for the next year's work. Similarly the corn and salt trade of the south and the general trade of Siberia and Turkistan depended on the prices obtaining at the fair.

The fair reached its highest development between 1880 and 1884, when the turnover was 21·5 million pounds. In 1910 the turnover was 15·9 million pounds. During the 1914–1922 war and civil war, the trade of Nijni was interrupted, and when the fair re-opened in 1923, conditions had altogether changed. Private trade, though not entirely suppressed, had been markedly reduced and the various State Trading Departments and local goods exchanges had taken over much of the regulation between supply and demand, formerly largely dependent on the fair. Only 647 firms took part in the 1923 fair and the turnover was small, but

trade has gradually adapted itself to the changed conditions and in 1927 the turnover was 20,300,000 lb., and the number of firms taking part was 2,549.

Trade with the Ural metal region via the Kama, with Siberia and with the corn, salt, wine and naphtha regions of the Caspian has revived. The duration of the fair is fixed for Aug. 1 to Sept. 15. A horse fair is held in June, and one in January on the ice of the river Oka for wooden goods made by the peasants, the river being frozen from November to April.

In addition to its trading activities the town has shipbuilding and repair yards and manufactures machinery, telephones, chemicals, sewn goods, matches, bricks, flour, confectionery and alcoholic drinks. These industries are now supplied with electricity from the Balakhna peat fuel plant. Another established industry is the making of radio sets, in connection with which there is an experimental station. The town has railway links through Vyatka with Perm and Sverdlovsk, and also with Kotlas, which will probably be linked with Murmansk via Soroka at no distant date, with Moscow, and, by a branch line to Arzamas, with the trans-Siberian railway. There is also a short branch to Pavlov. Steam navigation on the Volga began in 1821, and developed rapidly after 1845. A bi-weekly air service between Moscow and Nijni-Novgorod was established, with daily services during the period of the fair.

**The Town** consists of three parts. The upper city is built on three hills on the right bank of the rivers (490 ft.). On one of them is the ancient citadel or Kremlin, first erected as a palisaded fort in the second half of the 14th century, and rebuilt in the early 16th century, with a wall 2,300 yards long, 65 to 95 ft. high and having 11 towers. Within it are the law courts, the former governor's residence, the arsenal, barracks, etc., a museum and the Preobrazhensky and Archangel cathedrals, dating from 1225 and 1222 respectively, but much spoilt by later restorations. Kozma Minin Sukhorukov, a cattle-dealer of the town, who organized the army that saved Moscow from Polish dominion in 1612, is buried in the Preobrazhensky cathedral, and a square in the Kremlin contains a monument to Minin and Pozharsky erected in 1826. The view from the Kremlin of the broad Volga with its low-lying and far-spreading left bank is very striking. Near the Kremlin are two monasteries, the Pechersky, built in the first half of the 16th century to replace one founded in 1330 and destroyed by a landslip in 1596, and the Blagovyeshchensk (1370, rebuilt 1647). Five descents lead to the lower town, the Nijni bazaar, built on the alluvial terrace 30 to 35 ft. above the banks of the Oka and Volga.

The fair is held on the flat sandy tongue of land between the rivers, connected with the town by a bridge of boats, 1,500 yards long, which is taken to pieces in winter. The shops of the fair, 4,000 in number, built of stone in regular rows, are surrounded by a canal and cover half a square mile, and there are more than 4,000 other shops outside this inner fair. There are salt, grain and timber wharves and rough goods are landed on an island in the Volga. Tea boxes and temporary shelters for the tea tasters accumulate in the Siberian harbour during fair time. The point of the peninsula is occupied by the storehouses of the steamboat companies, while metal wares and corn are discharged on a long island in the Oka, at the iron harbour, and in the Grebnovskaya harbour. The railway from Moscow has its terminus close to the fair buildings, to the south of which is the Kunavino pleasure suburb. On the fair side are the Alexander Nevsky cathedral (1881) and the "Fair" cathedral (1822). The climate is harsh and continental, average January temperature 10.6° F., July 64° F., extreme readings −40° F. and +104° F.

**History.**—The confluence of the Oka and the Volga, inhabited in the 10th century by Mordvinian tribes, began to be coveted by the Russians as soon as they had occupied the upper Volga, and as early as the 11th century they established a fort, Gorodets, 20 mi. above the mouth of the Oka. In 1221, the people of Suzdal, under Yuri Vsevolodovich, prince of Vladimir, erected a fort on the hill now occupied by the Kremlin. Until the beginning of the 14th century Nijni-Novgorod, which grew rapidly as the Russians colonized the banks of the Oka, remained subject to Suzdal; it enjoyed, however, almost complete independence, being ruled by its popular assembly. Until 1390, it elected its only princes. Ill-protected by its palisaded walls, it was plundered in 1377 and 1378 by the Tatars, supported by the Mordvinians.

In 1390 Prince Vasili of Moscow, in alliance with Toktamish, khan of the golden horde of the Mongols, took Nijni and established his own governors there; in 1417 it was definitely annexed to Moscow, becoming a stronghold for the further advance of that principality toward the east. It was fortified in 1508–1511, and was able to repel the Tatars in 1513, 1520 and 1536. In 1606–1611 the trading classes took an active part in the expeditions against the revolted serfs. A Nijni cattle-dealer, Sukhorukov, helped to deliver Moscow from the Poles in 1612. In 1667 the city withstood an attack by Stenka Razin. During the 17th century the country became the seat of a vigorous religious agitation, and in its forests the Raskolniks established hundreds of their monasteries and communities, those of the Kerzhenets playing an important part in the history of Russian nonconformity.

Nijni-Novgorod had some part in the literary movement of the end of the 18th century; its theatre also was of some importance in the history of the Russian stage. It has a growing university and a Workers' Scientific institute opened since the 1917 revolution.

The city was renamed Gorky in 1932 after the writer Maxim Gorky, born in Nijni-Novgorod on March 16, 1868.

**NIKĒ,** the goddess of victory (Gr. *νίκη,* Lat. *Victoria*). She does not appear personified in Homer. In Hesiod (*Theog.* 384) she is the daughter of the giant Pallas and Styx, and is sent to fight on the side of Zeus against the Titans. Nikē does not appear to have been the object of a separate cult at Athens. She was at first inseparably connected and confounded with Pallas Athena, the dispenser of victory, but gradually separated from her. As an attribute of both Athena and Zeus she is represented as a small figure carried by those divinities in their hand. Athena Nikē was always wingless, Nikē alone winged. In works of art she appears carrying a palm branch or a wreath (sometimes a Hermes staff as the messenger of victory) erecting a trophy or recording a victory on a shield, or, frequently, hovering with outspread wings over the victor in a competition, since her functions referred not only to success in war but to all other human undertakings. In fact, Nikē gradually came to be recognized as a sort of mediator of success between gods and men.

At Rome Victoria was worshipped from the earliest times. Evander was said to have erected a temple in her honour on the Palatine before the foundation of Rome itself (Dion. Halic. i, 32, 33). She was identified with the obscure Sabine goddess Vica Pota and others. Special games were held in her honour in the circus, and generals erected statues of her after a successful campaign. She came to be regarded as the protecting goddess of the senate, and her statue (originally brought from Tarentum and set up by Augustus in memory of the battle of Actium) in the Curia Julia (Dio Cassius li. 22; Suetonius, *Aug.* 100) was the cause of the final combat between Christianity and paganism towards the end of the 4th century. Victoria had altars in camp, a special set of worshippers and colleges, a festival on Nov. 1, temples at Rome and throughout the empire. Representations of Nikē-Victoria in art are very numerous. *cf.* GREEK ART (fig. 3).

*See* L. R. Farnell, *Cults of the Greek States,* i (1896); G. Wissowa, *Religion und Kultus* (2nd ed. 1912) (bibl.); Roscher's *Lexikon,* arts. "Niké," "Victoria."

**NIKISCH, ARTHUR** (1855–1922), Hungarian conductor, was a precocious child, making a public appearance as a pianist at eight years old. He studied at the Vienna Conservatoire from 1866 to 1873, and while there he composed a symphony and other works. In 1877 he began as assistant conductor at the Leipzig opera and two years later became chief conductor. His brilliant success in Leipzig gave him a world-wide reputation. Nikisch was conductor of the symphony orchestra at Boston, U.S.A., from 1889 to 1893; and subsequently, after having been director at the Budapest opera, at the Leipzig Gewandhaus. He died in Leipzig on Jan. 23, 1922.

*See* F. Pfohl, *Arthur Nikisch* (Hamburg, 1925).

**NIKKO,** a small town in Tochigi prefecture. One of the chief centres of pilgrimage and sightseeing in Japan, it lies 91 mi. N. of Tokyo by rail, in a valley below the range called Nikko-Zan (Mountains of the Sun's Brightness). Its natural beauties and the splendour of its monuments gave rise to a popular saying: "Do not say 'splendid' (*Kekkō*) until you have seen Nikko." A Shinto shrine seems to have existed from time immemorial and in 767 its first Buddhist temple was founded by Shōdō Shōnin (the subject of many legendary adventures); but the main celebrity of the place is due to the sepulchres and sanctuaries of Iyeyasu and Iyemitsu, the first and third shoguns of the Tokugawa dynasty. Iyeyasu was buried with amazing pomp in 1617, and Iyemitsu, his grandson, was slain in 1650 while visiting his tomb. From 1644 to 1868 the "abbots" of Nikko were always princes of the imperial blood; thirteen of them are buried within the sacred grounds.

**NIKOLAYEV,** a seaport of the Ukrainian S.S.R., situated a little above the confluence of the Ingul and Bug rivers, at the head of the Bug estuary in 46° 58′ N., 31° 58′ E. Pop. (1939) 167,108. Vessels have to pass the bar of the Dnieper to reach the Ochakov channel, and dredging has been carried out to a depth of 25 ft., so that vessels of 24 ft. draught can pass without lightening their loads. Two icebreakers are now working so as to keep the estuary of the Dnieper and the channel of the Bug open for navigation from the Black sea to Nikolayev all the year round. There is a government commercial quay and a harbour for coasting vessels. The Varvarovka jetty was damaged during the civil war. There are floating elevators and a railway grain elevator. The chief imports are cement, iron, steel, machinery and general merchandise, and the exports are grains, oilseeds, sugar, wool, iron ore, manganese and timber.

In common with other Black sea ports, Nikolayev suffered from the effects of the civil war and the war of intervention and from the decrease in Black sea trade due partly to change of frontiers and partly to war damage and loss of ships and the cessation of repairs and construction until 1923. The town has ship yards where steamers for the admiralty and for the commercial fleet are built, the construction of armoured ships and torpedo boats dating back to 1870, and being carried out mainly along the bank of the Ingul river. Ochakov and Kimburn are potential forts to protect the double estuary in case of attack. The industrial enterprises of Nikolayev include the manufacture of machinery, ploughs, nails, glass, footwear, macaroni, tobacco and alcoholic drinks. The town is linked by rail with the general railway net to the north, and also has a branch to Kherson.

The remains of the Greek colony *Olbia* have been discovered close to the confluence of the Ingul with the Bug, 10 m. S. of Nikolayev. After the fall of Ochakov, Prince Potemkin established (1789) a wharf on the Ingul which received the name of Nikolayev.

**NIKOLAYEVSK:** *see* PUGACHEVSK.

**NIKON** [NIKITA MININ] (1605–1681), 6th patriarch of Moscow, Russian reformer and statesman, son of a peasant farmer named Mina, was born on May 7, 1605, in the village of Valmanovo, 90 versts from Nijni-Novgorod. Misery pursued the child from his cradle, and prematurely hardened a character not naturally soft; he ran away from home to save his life from an inhuman stepmother. He took orders, and became a popular preacher in Moscow, then, seeing in the loss of his three little children a providential warning to seek the higher life, he first persuaded his wife to take the veil, and then withdrew himself first to a desolate hermitage on the isle of Anzersky on the White Sea, and finally to the Kozhuzersky monastery, in the diocese of Novgorod, of which he became abbot in 1643. On becoming a monk he took the name of Nikon. In his official capacity he had frequently to visit Moscow, and in 1646 made the acquaintance of the pious and impressionable Tsar Alexius, who fell entirely under his influence. Alexius appointed Nikon archimandrite, or prior, of the wealthy Novospassky monastery at Moscow, and in 1648 metropolitan of Great Novgorod. Finally (Aug. 1, 1652) he was elected patriarch of Moscow. It was only with the utmost difficulty that Nikon could be persuaded to become the archpastor of the Russian Church, and he only yielded after imposing upon the whole assembly a solemn oath of obedience to him in everything concerning the dogmas, canons and observances of the Orthodox Church.

Ecclesiastical reform was already in the air. A number of ecclesiastical dignitaries, known as the party of the protopopes (deans), had accepted the responsibility for the revision of the church service-books inaugurated by the late Patriarch Joasaf, and a few other very trivial rectifications of certain ancient observances. Nikon was bolder and more liberal. He consulted the most learned of the Greek prelates abroad; invited them to a consultation at Moscow; and finally the scholars of Constantinople and Kiev opened the eyes of Nikon to the fact that the Muscovite service-books were heterodox, and that the ikons actually in use had very widely departed from the ancient Constantinopolitan models, being for the most part imitations of later Polish and Frankish (West European) models. He at once (1654) summoned a properly qualified synod of experts to re-examine the service-books revised by the Patriarch Joasaf, and the majority of the synod decided that "the Greeks should be followed rather than our own ancients." A second council, held at Moscow in 1656, sanctioned the revision of the service-books as suggested by the first council, and anathematized the dissentient minority, which included the party of the protopopes and Paul, bishop of Kolomna. Heavily weighted with the fullest oecumenical authority, Nikon's patriarchal staff descended with crushing force upon the heterodox. His scheme of reform included not only service-books and ceremonies but the use of the "newfangled" ikons, for which he ordered a house-to-house search to be made. His soldiers and servants were charged first to gouge out the eyes of these "heretical counterfeits" and then carry them through the town in derision. He also issued a *ukaz* threatening with the severest penalties all who dared to make or use such ikons in future. This ruthlessness goes far to explain the unappeasable hatred with which the "Old Ritualists" and the "Old Believers," as they now began to be called, ever afterwards regarded Nikon and all his works.

From 1652 to 1658, Nikon was not so much the minister as the colleague of the tsar. Both in public documents and in private letters he was permitted to use the sovereign title. Such a free use did he make of his vast power, that some Russian historians have suspected him of the design of establishing "a particular national papacy"; and he himself certainly maintained that the spiritual was superior to the temporal power. He enriched the numerous and splendid monasteries which he built with valuable libraries. His emissaries scoured Muscovy and the Orient for precious Greek and Slavonic mss., both sacred and profane. But his severity raised up a whole host of enemies against him, and by the summer of 1658 they had convinced Alexius that the sovereign patriarch was eclipsing the sovereign tsar. Alexius suddenly grew cold towards his "own familiar friend." Nikon thereupon publicly divested himself of the patriarchal vestments and shut himself up in the Voskresensky monastery (19th of July 1658). In February 1660 a synod was held at Moscow to terminate "the widowhood" of the Muscovite Church, which had now been without a pastor for nearly two years. The synod decided not only that a new patriarch should be appointed, but that Nikon had forfeited both his archiepiscopal rank and his priest's orders. Against the second part of this decision, however, the great ecclesiastical expert Epifany Slavenitsky protested energetically, and ultimately the whole inquiry collapsed, the scrupulous tsar shrinking from the enforcement of the decrees of the synod for fear of committing mortal sin.

For six years longer the Church of Muscovy remained without a patriarch. Every year the question of Nikon's deposition became more complicated and confusing. At last the matter was submitted to an oecumenical council, which opened its sessions on Nov. 18, 1666, in the presence of the tsar. On Dec. 12 the council pronounced Nikon guilty of reviling the tsar and the whole Muscovite Church, of deposing Paul, bishop of Kolomna, contrary to the canons, and of beating and torturing his dependants. His sentence was deprivation of all his sacerdotal functions;

henceforth he was to be known simply as the monk Nikon. The same day he was sent as a prisoner to the Therapontov Byelozersky monastery. Yet the very council which had deposed him confirmed all his reforms and anathematized all who should refuse to accept them. Nikon survived the tsar (with whom something of the old intimacy was resumed in 1671) five years, expiring on Aug. 17, 1681.

*See* R. Nisbet Bain, *The First Romanovs* (1905); S. M. Soloviev, *History of Russia* (Rus.), vol. x. (1895, etc.); A. K. Borozdin, *The Protopope Avvakum* (Rus.) (1898); V. S. Ikonnikov, *New Materials concerning the Patriarch Nikon* (Rus.) (Kiev, 1888); William Palmer, *The Patriarch and the Tsar* (1871–76). (R. N. B.)

**NIKOPOLI** or **NICOPOLIS** (Bulgarian *Nikopol*), the chief town of a sub-prefecture in the district of Plevna (Pleven), Bulgaria. Population 4,936. Nikopoli is picturesquely situated on the south bank of the Danube, where it receives the Osem. The chief industries are tanning and fishing. As a military post the town has for centuries been important. A ruined castle still dominates the place, and fortifications stretch down to the river.

Nikopoli occupies the site of the ancient Asamus, but by some mediaeval confusion bears the name of Nicopolis ad Istrum, which was founded by Trajan several miles down the river, at the inflow of the Iatrus or Yantra, at the spot still called Nikup. The following are the chief points in the modern history of the place: —capture of the fortress by Sigismund of Hungary in 1392 and 1395; defeat of Sigismund and his hosts in 1396 by Bayezid I.; siege of the town by King Ladislaus I. of Hungary in 1444; defeat of the Turks by Bathori in 1595 and by Michael of Walachia in 1598; capture of the town by Pasvan-oglu in 1797; occupation of the fortress by the Russians under Kamensky in 1810; destruction of the Turkish flotilla by Govarov in 1829; capture and burning of the town by the Russians under Krüdener, June 15, 1877.

**NIKŠIĆ** (pronounced Nikshich), a romantically situated town of Montenegro, Yugoslavia, in the valley of the Zeta, which forms the main source of communication between north and south Montenegro. Pop. (1931) 4,164. Wheat, maize, rye and potatoes are cultivated, and there are two breweries, cloth and cotton mills in the town, which is an important mart for timber, hides, farm produce and livestock. The chief road, to Podgorica (*q.v.*), is entered by a long viaduct, the gift of Russia, to obviate the flooding which formerly often rendered it impassable. The town, of white houses, is built round a square with four radiating streets, and is dominated by the pale yellow cupola of the Byzantine cathedral, another gift from Russia. Close by stands a royal palace and on one of the heights are the ruins of an old Turkish fortress. Nikšić was occupied by Italian troops in 1941. About 12 mi. S.E. is the famous shrine of Ostrog (*see* MONTENEGRO).

**NILE,** the longest river of Africa, and second in length of all the rivers of the globe, draining a vast area in north-east Africa, from the East African lake plateau to the shores of the Mediterranean. Although falling short of the length of the Mississippi-Missouri (4,194 m. according to the estimate of General Tillo), the Nile is at the head of all rivers as regards the length of its basin, which extends through 35° of latitude or 2,450 m. in a direct line, with a waterway of about 4,000 m. The Nile proper, *i.e.*, from the outlet at Victoria Nyanza to the sea, is 3,473 m. long.

The early Egyptians called this river by a name which was probably pronounced Hapy. This survived as a religious designation down to the fall of paganism. The "great river" was also a frequent name for the main stream, and this became the usual name of the Nile in late times as Ier-'o and continued in use amongst the Copts. In the Bible the Nile is regularly named Yeōr (יְאֹר, יְאוֹר), from the contemporary Egyptian Yor, "river." The origin of the Greek and Roman name Νεῖλος, *Nilus,* is quite unknown. Αἴγυπτος in the *Odyssey* is the name of the Nile (masc.) as well as of the country (fem.). The Arabs preserved the classical name of the Nile in the proper name En-Nīl النيل, or Nīl-Misr نيل مصر, the Nile of Misr (Egypt). The same word signifies indigo.

The modern Egyptians commonly call the river El-Bahr, "the sea," a term also applied to the largest rivers, and the inundation "the Nile," En-Nīl; they also call the river Bahr-en-Nīl, "the river Nile."

**Basin of the River.**—The Nile system is a simple one with three principal divisions: (1) the main stream running south to north, and fed by the great lakes of East Central Africa; (2) the equatorial tributary rivers draining the country north-east of the Congo basin; (3) the Abyssinian affluents. The extent of the basin of the Nile is clearly indicated on the map. Its area is estimated at 1,107,227 sq.m., which compares with the 1,425,000 sq.m. area of the Congo basin. The smaller basin of the longer river is due to its narrowness when north of Khartoum. Southward the basin includes the northern part of the plateau between the two "Rift" valleys which traverse that part of Africa, and also that portion of the Albertine (or western) "Rift" valley which lies north of the Mfumbiro mountains. That part of the plateau within the Nile basin is occupied by the Victoria Nyanza and its affluents. These affluents drain a comparatively small part of this plateau, which stretches south to Lake Nyasa. The most remote feeder of the Nile in this direction does not extend farther than 3° 20′ S.W. and W.S.W. of Victoria Nyanza, however, the Nile basin reaches 3° 50′ S. (264 m. south of the equator) and 29° 15′ E., following the crest of the hills which dominate the north-eastern shores of Lake Tanganyika and the eastern shores of Lake Kivu. Turning north-westward from this point the Nile basin crosses the mountainous region of Mfumbiro and includes that of Ruwenzori. Its limit is marked by the western wall of the Albertine Rift valley, in which lie the Albert and Edward lakes. For a considerable distance the water-parting between the Congo and the Nile is close to the Albert Nyanza and to the Nile as it flows from that lake, but not far north of Wadelai (2° 46′ N.) the hills recede and the Nile basin expands westward, over the wide area drained by the Bahr-el-Ghazal and its tributaries. In this region there is no well-marked watershed between the Congo and Nile systems, which interlace. Farther north the limit of the basin is marked by the hills of Darfur. Below that point the valley of the Nile extends but a mile or two from the river banks.

The south-eastern limits of the Nile basin extend nearly to the western escarpment of the eastern Rift valley—the dividing plateau being a narrow one. North of the equator a bend is made westward to Mt. Elgon, which on the north-east sends its water towards Lake Rudolf. From Mt. Elgon the Nile watershed is some distance to the west of that lake, while to its north a turn is made again, the watershed including a great part of the Abyssinian highlands. Beyond 15° N. it follows a line generally parallel to the west shore of the Red Sea, except where diverted to the west by the basin of the Khor Baraka.

**Sources of the Nile.**—The question of the sources of the Nile opens up a time-honoured controversy (*see* under *Story of Discovery* p. 455). Victoria Nyanza (*q.v.*) is the great reservoir whence issues the Nile on its long journey to the Mediterranean. But if the source of the river be considered to be the most remote headstream (measured by the windings of the stream), the distinction belongs to one of the upper branches of the Kagera. Among the feeders of Victoria Nyanza the Kagera is the most important, both for length of course and volume of water carried, draining the region of greatest rainfall round Lake Victoria.

Three chief branches unite to form the Kagera, and of these the most important for the volume of water carried is said to be the Nyavarongo. (i.) The Nyavarongo is formed by the union of various mountain streams, the Rukarara and the Mhogo being the chief. The Rukarara rises in about 2° 20′ S., 29° 20′ E., at an elevation of some 7,000 ft., in a picturesque and bracing region immediately east of the Albertine Rift valley. The Nyavarongo first flows north to about 1° 40′ S., then turning in a sharp bend east and south, and on again reaching 2° 20′ S., unites with the Akanyaru just west of 30° E. (ii.) The Akanyaru, which comes from the south-west, has been sometimes considered the larger stream, but according to Dr. Richard Kandt it carries decidedly less water, while its course is shorter than that of the Nyavarongo. The combined stream takes an easterly and southerly direction, flowing in a swamp valley and joining a little west of 31° E. the third branch of the Kagera, the Ruvuvu, coming from the south.

(iii.) The source of the Ruvuvu is in about 2° 55′ S., 29½° E., but its most southern tributary, and the most distant stream sending its waters towards the Nile, is the Lavironza. The Lavironza rises in about 3° 45′ S., 29° 50′ E., and flows north-east, joining the Ruvuvu, which has hitherto had an easterly direction, in about 30° 25′ E., 3° 10′ S. From this point the Ruvuvu flows east and north to its junction with the Nyavarongo.

From this confluence the combined stream of the Kagera flows north and north-west in a level valley strewn with small lakes until almost 1° S., when it turns east, and finally empties itself into Victoria Nyanza just north of 1° S., the mouth forming a small projecting delta. Its lower course is navigable by shallow draught steamers. The total length of the Kagera, reckoning from the source of the Nyavarongo, is some 430 miles. The average volume discharged is estimated, from measurements which have been made to be about 350 cu. metres per second. All the other feeders of Victoria Nyanza are small and often intermittent rivers, the largest being probably the Nzoia, which enters on the north-east from the plateaus south of Mount Elgon.

**The Victoria or Somerset Nile.**—The ridge of high land which forms the northern shore of Victoria Nyanza is broken at its narrowest part, where the pent-up waters of the lake have forced a passage at the northern end of a beautiful bay named Napoleon Gulf. At this spot, 30 m. north of the equator, at an altitude of 3,704 ft., the Nile issues from the lake between cliffs 200 and more ft. high with a breadth of some 500 yds. The scene is one of much grandeur. The escaping water precipitates itself over a rocky ledge with a clear fall of 16½ ft. The falls, some 300 yds. across, and divided into three channels by two small wooded islands, are named the *Ripon Falls*, after Earl de Grey and Ripon (afterwards 1st marquess of Ripon), president of the Royal Geographical Society in 1859.

The Victoria or Somerset Nile, as this section is called, has at first the character of a mountain stream, racing swiftly through a rocky channel often walled in by cliffs (at times 180 ft. high) and broken by picturesque islands and countless rapids. It receives the waters of several streams, which, rising within a few miles of the Victoria Nyanza, flow north. For 133 m. its course is north-north-west, when, on being joined by the river Kafu (on which Fort Mruli stands), about 1° 39′ N., 32° 20′ E., it takes the north-east direction of that channel, and it is not till 2° N. that the river again turns westward towards Lake Albert. Seventy miles below the Ripon Falls the Nile enters a marshy lake of irregular outline, running mainly east and west, and known as Kioga (or Choga). The current of the Nile is clearly discernible along the western shore of this lake, which is 3,514 ft. above the sea. Eastwards the lake breaks into several long arms, which receive the waters of other lakes lying on the plain west of Mount Elgon. One of these, named Lake Salisbury, lies in 1° 40′ N. and 34° E.; east of this lake and connected with it is Lake Gedge. Lake Kioga also receives the Mpologoma, a river which rises in the foothills of Elgon and flows east and north, attaining a width of 1½ m.; and from the south (west of the Nile) a broad lacustrine river, the Seziwa. The Kioga lake system, lying north of the ridge which separates it from Lake Victoria, owes its formation in part to the waters pouring down from the Nyanza, and is in the nature of a huge Nile backwater. The lake itself is rarely more than 20 ft. deep; its greatest length is 85 m.; its greatest width 10 m.

Below Mruli, the fall in the bed levels of the Nile, which up to this point has been comparatively gradual, increases considerably. At Karuma, where the western bend to Lake Albert is made, the river falls over a wall-like ledge of rock, 5 ft. high, which extends across its bed. But the great feature of the Victoria Nile is the *Murchison Falls* (named by Sir Samuel Baker, their discoverer, after Sir Roderick Murchison, the geologist), situated in 2° 18′ N. and 31° 50′ E. At this point the river rages furiously through a rock-bound pass, and, plunging through a cleft less than 18 ft. wide, leaps about 130 ft. into a spray-covered abyss. Downstream from these falls the river flows for some 14 m. between steep forest-covered hills, a wide and noble stream with a current so slow and steady that, at certain seasons, it is only from the scarcely perceptible drifting of the green water-plants called *Pistia stratiotes* that it can be observed. About 24 m. below the Murchison Falls and 254 m. from Lake Victoria the river enters, through a wide delta, and across a formidable bar, the north-east end of Lake Albert. In its passage from the one lake to the other the Nile falls altogether about 1,400 ft. Taking its name from a fort which once existed there, the delta district is known as Magungo.

**From Lake Albert to the Plains.**—Issuing from the north-west corner of Lake Albert some 5 m. from the spot where it entered that lake, the Nile, which is now known as the *Bahr-el-Jebel*, or Mountain river, flows in a generally northerly direction. As far as Dufile, 130 m. below Magungo, it has a gentle slope, a deep channel and a current generally slight. It forms a series of lake-like reaches often studded with reedy islands. Immediately below Dufile the Kuku mountains on the west and the Arju range on the east close in upon the river, which, from an average width of 700 yd., narrows to 230 yd. Here the hills cause the stream to make a sharp bend from the north-east to the north-west. Four or five miles lower down the river widens to 400 yd., and a large island divides the stream, the eastern channel carrying the main volume of water.

This island marks the beginning of the *Fola Rapids*. At its southern end the water falls some 20 ft., and then, like a gigantic mill-race rushes through a gorge 330 ft. long and nowhere more than 52 ft. wide, to leap into a deep cavity not more than 40 ft. across. Escaping from this cauldron, the waters thunder on in a succession of rapids, which extend beyond the northern end of the island. In all the Fola Rapids are nearly 2 m. long. For the next 80 m. the Nile, save for the great volume of water, resembles a mountain torrent, its course interrupted by continual rapids. The last of these occurs at Bedden, where the river breaks through a line of low hills running athwart its channel.

Below Bedden various stations are established upon the river. Fort Berkeley, in 4° 40′ N. (on the right bank), is the nearest to the rapids. Then follow Rejaf (left bank), Gondokoro (right bank) and Lado (left bank), all within 30 m. of one another. A striking feature of the scenery at Rejaf is a cone-shaped hill, about 370 ft. high, crowned by rocks which have the appearance of the ruins of an ancient castle. At Gondokoro the Nile is clear of the hill country, and enters a vast swamp-like expanse through which it flows with a very low slope and a very tortuous channel.

Between Lake Albert and the swamp region the Bahr-el-Jebel is joined by many streams. The most important of these affluents is the Asua (nearly 200 m. long), which enters the main stream from the east in 3° 50′ N. (19 m. N. of Dufile), but has little water in the dry season. The Asua and its subsidiary streams rise on the western versant of the Karamojo plateau and among the mountain ranges which run off from that plateau to the north-west, the most remote head-stream running originally due south.

**The Region of Swamps.**—The wide valley which the Nile enters at Gondokoro slopes so gradually towards the north that the river falls only some 182 ft. in a stretch of 475 m. Through this valley the river winds in an extremely tortuous course, and its banks are very low in the middle and lower reaches, so that the overflow has caused extensive swamps which are covered by a mass of papyrus and tall reeds, in which are numerous shallow lagoons or "mayyas." The shape of these lagoons is constantly altering, as also is that of the channels connecting them with the river. About 8 m. below Bor, many of the eastern "spills" unite and form a stream of considerable breadth, with a strong current. This stream, which is known to the Dinkas as the Atem, follows a course generally parallel to the Jebel, being bounded eastward by forest land. Opposite Kanisa (6° 46′ N.), on the main river, the Atem divides into two channels, marshy land extending at this point a great distance to the east. The western branch, or Awai, rejoins the Jebel near Shambe 7° 6′ N. The eastern branch or Myding continues through the marshes, eventually joining the Bahr-el-Zeraf (*see* p. 453) in its lower course.

Except for the Atem divergence the Nile, despite the swamps through which it passes, maintains a fairly definite course, with a considerable depth of water as far as Shambe, where, on the west, is a large lagoon. Five miles lower down the river splits into two great channels. That to the left, the main stream, continues to be

known as Bahr-el-Jebel, but is sometimes called by its Dinka name Kir. The right branch, or *Bahr-el-Zeraf* (Giraffe river), has a more easterly direction, and does not rejoin the main river until 50 m. below its confluence with the *Bahr-el-Ghazal* (*q.v.*). From the point of bifurcation the Bahr-el-Jebel flows for 230 m. in a general north-westerly direction until it is joined by the Bahr-el-Ghazal coming from the south-west. At the junction of the Bahr-el-Ghazal and the Bahr-el-Jebel in 9° 29′ N. the permanently submerged area is usually named Lake No, but the Arabs call it *Moghren-el-Bohur* (meeting of the rivers). Lake No in the rains covers about 50 sq.m.

In the Bahr-el-Jebel occur the great accumulations of "sudd" (*q.v.*), closely packed masses of floating vegetation which obstruct and, if not removed, prevent navigation (*see* p. 455). The aspect of the river throughout the sudd region is monotonous and depressing. On all sides stretch reaches of the reed known as *um suf* or mother of wool (*Vossia procera*), ambach, "bus" and papyrus. These grasses rise 15 to 20 ft. above the water, so as often to close the view like a thick hedge. The level of the flat expanse is broken only at intervals by areas of higher ground on which are mounds of earth erected by the white ants and covered with a clump of brushwood or trees; the moisture in the air is excessive; mosquitoes and other swamp flies swarm in myriads. Yet touches of beauty are not wanting; water lilies (*Nymphaea stellata* and the sacred lotus of Egypt, *Nymphaea Lotus*)—white, blue and crimson—often adorn the surface of the stream. Occasionally the rare and odd-looking whale-headed stork or *Balaeniceps rex* is met with among the reeds, and at night the scene is lit up by innumerable fire-flies.

**The White Nile.**—From the confluence with the Bahr-el-Ghazal at Lake No, the main stream, which here takes the name of *Bahr-el-Abiad,* or White river, adopts the easterly course of the tributary stream. Forty miles below the point where the Bahr-el-Zeraf reunites with the main branch, the Nile receives its first great eastern affluent—the Sobat (*q.v.*), whose head-streams rise in the mountains of south-west Abyssinia and the region north of Lake Rudolf. Just above the Sobat junction the Nile resumes its northern course. It passes through a great alluvial plain, stretching from the spurs of the Abyssinian highlands in the east, to the hilly districts of Kordofan in the west, and covered with high grass and scattered bush.

About 56 m. below the Sobat mouth, in 9° 55′ N., lies (on the left bank) Kodok (known as Fashoda until 1904), an Egyptian town founded in 1867 on the site of Denab, the old "capital" of the Shilluks, and famous for the crisis between England and France in 1898 through its occupation by the French officer Marchand. For the next 270 m. the scenery takes on a very monotonous appearance. The river flows in a wide channel bordered by a belt of forest on either bank. At Abu Zeid (about 13° 5′ N.) for a distance of nearly 4 m. the river is extremely broad and shallow, being fordable at low water. Fifteen miles lower down, at Goz Abu Goma—which is the northern limit of the sudd vegetation—the river is divided into two channels by Abba Island, wooded, narrow and 28 m. long. On Abba Island lived, for some years before 1881, Mohammed Ahmed, the Mahdi. The White Nile with its volume of about 1,500 cu. metres per sec. in Oct., diminishing to about 550 cu. metres in May, is the main supplier of water to Egypt in the spring and early summer.

**The Blue Nile.**—Five hundred and twenty miles below the Sobat mouth and 1,652 m. from Ripon Falls, in 15° 37′ N., the White Nile is joined by its greatest eastern confluent the *Bahr-el-Azrak* or Blue Nile. In the fork of the two rivers stands Khartoum, the capital of the Anglo-Egyptian Sudan, whilst on the western bank of the White Nile is Omdurman, the former Mahdist capital. At Khartoum the water of the one river is of a greenish-grey colour, that of the other is clear and blue, except when in flood, when it gains a chocolate brown from the mineral matter in suspension. The Blue Nile, or Abai as it is called in Abyssinia, rises in the Gojam highlands in 11° N. and 37° E., and flowing northwards 70 m. enters Lake Tsana (*see* TANA) near its south-west corner, to issue again at the south-east end. The Abai and its tributaries drain a great part of the Abyssinian plateau. The complicated river system is best understood by a study of the map. The Abai itself on leaving Lake Tsana makes a great semicircular sweep south-east to north-west, from the highlands of Ethiopia to the plains of Sennar. In this section of its course its swirling waters rush over a long series of cataracts and rapids, descending from a height of 5,770 ft. at the outlet to about 1,400 ft. at Fazokl or Famaka (11° 17′ N., 35° 10′ E.), where it crosses the Abyssinian frontier and flows through the plains of Sennar to its confluence with the White Nile at Khartoum, 1,300 ft. above sea-level.

Of the tributaries of the Abai the majority join it on its left bank. The Bashilo, Jamma and Muger, which reach the Abai in the order named, drain the country east of the main stream between the basins of the Takazze and the Hawash. The Guder, with a south to north course, rises in the mountains which form the watershed between the Nile and the Lake Rudolf basin. Next comes the Didessa, a large stream rising near the head-waters of the Baro (the main upper branch of the Sobat) and flowing north-west to the Abai, the confluence being in about 10° N., 35° 40′ E. It has an early rise and a long flood period, being by far the most important tributary of the Blue Nile. The Dabus or Yabus rises about 9° N., 34° 30′ E., and flowing north joins the Abai near the spot where that river breaks through the Abyssinian hills. All these affluents are perennial, as is the Bolassa or Yesien, a right-hand tributary which reaches the Abai below the Yabus.

Four miles below Famaka the river is joined on its left bank by the auriferous Tumat, an intermittent stream. In Sennar it receives on its right bank two considerable tributaries from the Abyssinian heights, the Dinder, a very long but not perennial stream, and the Rahad, waterless in the dry season, copious and richly charged with sediment during the rains from June to Sept. At this period the discharge of the Blue Nile rises from less than 200 to over 6,000 cu. metres per sec., thus greatly exceeding that of the White Nile itself, which is only from about 900 to 1,500 cu. metres during the flood. The length of the Blue Nile is about 850 m. The country, El Gezira, enclosed in the triangle formed by the junction of the White and Blue Niles forms the most fertile portion of the Sudan, and the portion now irrigated from the Blue Nile is producing excellent cotton crops and durra.

**The Atbara.**—Two hundred miles below Khartoum—at Ed-Damer—the Nile is joined by the last of its tributary streams—the Atbara or Bahr-el-Aswad (Black river). The Atbara, some 800 m. long, rises in the tableland north of Lake Tsana, being formed by the junction of the Angreb, Salaam, Aradeb, Goang and other mountain streams. Making its way towards the Nubian plains, the river flows in a north-westerly direction, joining, in 14° 10′ N., 36° E., the Bahr Setit or Takazze (*see* ABYSSINIA), a river coming from the east and having a volume of water as large as, if not larger than, the Atbara. The united stream preserves, however, the name of Atbara, and at its confluence with the Nile has a breadth in flood time of over 600 yd. and a volume which exceeds 2,000 cu. metres per sec. in August. The Atbara and its tributaries, like many of those which feed the Blue Nile, rapidly dwindle after the rains. In its lower course the Atbara runs completely dry, but higher up water may be found in deep pools. These pools are full of fish, turtles, crocodiles and hippopotami, which remain imprisoned until the return of the flood. The country between the Nile proper, the Atbara and the Blue Nile is identified with the island of Meroë of ancient history.

**The Cataracts.**—Below the Atbara junction the Nile continues its course to the Mediterranean, traversing a distance of over 1,600 m. without receiving a single tributary on either bank. Below Khartoum the river makes a great **S**-shaped bend, and leaving behind the cultivable land, traverses the Nubian desert. In its progress the volume of water suffers continual diminution from evaporation, owing to the extreme dryness of the air. The valley of the river is here very narrow, and the desert land in places comes right to the water's edge. Elsewhere high and barren cliffs shut in the valley. Between Khartoum and Wadi Halfa (the northern end of the great bend), a distance of over 900 m., occurs a series of cataracts, known as the 2nd, 3rd, 4th, 5th and 6th (the 1st cataract is lower down the river at Assuan). That first met with on descending the river from Khartoum is the 6th (or

Shabluka) cataract. The river here (50 m. below Khartoum) is picturesque, flowing rapidly in a narrow gorge for 8 m., but the fall is only 2 ft. After 188 m. of smooth water the 5th cataract is reached. It begins 28 m. below Berber (a town on the right bank at the head of a caravan route to the Red Sea), and with three principal rapids extends for 100 m.—the drop in this distance being rather more than 80 ft. At the foot of this cataract is the town of Abu Hamed, at the eastern end of the middle of the **S** bend. The 4th cataract begins 60 m. down stream from Abu Hamed. It is 80 m. long and has a drop of 110 ft. Between the 4th and 3rd cataracts there is a stretch of 200 m. on a very gentle slope ($\frac{1}{12,000}$). This reach constitutes the province of Dongola, and here the cultivable land on the western side of the river is of greater extent than usual in the desert zone. The 3rd cataract, 45 m. long, has a drop of some 36 ft. After another smooth reach extending 73 m. the 2nd cataract, which ends just above Wadi Halfa, the northern frontier town of the Anglo-Egyptian Sudan, is reached. This cataract is 124 m. long and has a fall of 216 ft. Between the 2nd cataract and Assuan are 214 m. of smooth water with a scarcely perceptible slope, $\frac{1}{12,500}$. The average breadth of the river here is 1,640 ft.

**Lower River and Delta.**—For some distance above Assuan the river is studded with islands, including those of Philae and Elephantine. The rapids south of the town used to form the 1st cataract, where, in a length of 3 m., the river fell 16½ ft. Since the completion of the great dam and locks at the head of these rapids they have to a certain extent disappeared, and a navigable channel has been formed. The dam, pierced by 180 sluices, stretches across the river—a wall 2,000 yd. long below which the water rushes between rocks in many channels (these being the relics of the cataract). Upstream from the dam a lake some 100 m. in length has been formed. The Assuan Dam was opened on Dec. 10, 1902 (*see* under IRRIGATION). A ladder of four locks on the western side of the dam permits navigation between the upper and lower reaches. At Assuan the banks of the river are bordered by high granite hills. From this point to the apex of the delta the length of the Nile is 605 m. with a slope ($\frac{1}{13,000}$) even slighter than that above Assuan. The valley is comparatively narrow, being an almost level depression in a limestone plateau and the area of fertility ends where the land ceases to be irrigated by the river. At Esna, 100 m. below Assuan, a barrage, known as the Esna barrage, regulates the flow of the water, and at Assiut, 345 m. below Assuan, is another barrage fulfilling the same purpose, and a third at Nag Hamadi, about 215 m. below Assuan was under construction in 1928. Cairo stands on the eastern bank of the Nile 12 m. south of the apex of the delta.

At the beginning of the delta the Nile separates into two channels, the *Rosetta* and the *Damietta*, which join the Mediterranean at its south-east angle. In ancient times the delta was watered by seven branches; five of these branches are now canals not always navigable. The ancient branches were, beginning at the west, the Canopic, Bolbitine, Sebennytic, Phatnitic, Mendesian, Tanitic and Pelusiac, of which the modern Rosetta and Damietta branches represent the Bolbitine and Phatnitic. At the head of the river is a double barrage, by means of which the water can be dammed to the height required for forcing the water into the canals which irrigate the delta. Of the two branches the Damietta is the more easterly. Both are about the same length—146 m. Behind the coast-line, which is low and sandy, are a number of salt marshes or lagoons. Whilst the Damietta branch is gradually silting up, the Rosetta branch is scouring out a wider channel. At full flood the depth of water in either branch is about 23 ft.

**Hydrography.**—The fertility and prosperity of Egypt and the northern part of the Sudan being entirely dependent on the irrigation of the land by the waters of the Nile, the variation in the supply at different seasons of the year is of vital importance. (In Egypt the height of the flood has been recorded annually, as the chief event of the year, since at least 3600 B.C.) Above the Sobat confluence the Nile traverses a region of heavy rainfall and the water-supply is super-abundant. It is from Victoria, Albert and Edward lakes and their feeders, and in a very small degree from the Bahr-el-Ghazal, that this river obtains its constant supply of water throughout the year. The great lakes retaining a large proportion of the water they receive, act as natural reservoirs and prevent the lower Nile from ever running dry in summer. The Abyssinian affluents are the source of the Nile flood. In the equatorial regions rainfall varies from 30 to 80 in. during the year with a mean of about 50. It is heaviest in the months of Jan., Feb., March and April, and again in Oct. and November. The most rainy portions of the lake plateau (where alone occurs a rainfall of 60 in. and over) lie along the eastern edge of the Albertine Rift valley, and west and north of Victoria lake. These rains feed Edward and Albert lakes, and, through the Kagera, supply a great part of the water of Victoria lake. The water in Lake Victoria begins to rise in Jan., the rise becomes marked in June, is at its height in July, the level of the water reaching its lowest at the end of November. The Bahr-el-Jebel is at its lowest in March and April and at its highest in September. The seasonal supply of the Bahr-el-Ghazal hardly varies, the maximum levels occurring in Nov. and Dec., and it has but a slight discharge. The Sobat, from Dec. to March, is at its lowest, and is in flood from June to Oct., during which period the water (milky coloured) which it pours into the Nile is two or three times the volume of the main stream. It is the colour of the Sobat water which gives its name to the White Nile. The Blue Nile, at its confluence at Khartoum, begins to rise in June and is in flood from July to Oct.; the Atbara is also in flood during the same months. The great difference in the supply of water from the equatorial regions and from Abyssinia arises from the fact that the first-named district is one of heavy rain practically all the year round, whereas in Abyssinia the season of heavy rain is usually limited to the months of June to September. Reduced to its simplest expression, the Nile system may be said to consist of a great steady flowing river fed by the rains of the tropics, controlled by the existence of a vast head reservoir, and annually flooded by the accession of a great body of water with which its eastern tributaries are flushed.

At Khartoum the Nile is lowest in April and May and highest in Aug. and September. Its minimum depth is 18 ft. and its maximum depth 25 ft. At Assuan the Nile is at its lowest at the end of May, then rises slowly until the middle of July, and rapidly throughout Aug., reaching its maximum at the beginning of Sept.; it then falls slowly through Oct. and November. At Cairo the lowest level is reached about the middle of June, after which the rise is slow in July and fairly rapid in Aug., reaching the maximum at the beginning of October. By using the water stored by the Assuan dam in the months following high Nile, the river lower down has been, since 1902, replenished at times of low water to meet the needs of cultivators (*see* IRRIGATION: *Egypt*). At Assuan the average rise of the Nile is 26 ft., at Cairo it is 23 ft. A rise of 21 ft. only at Assuan is a "bad Nile"; on the other hand, a rise of 30 ft. causes a danger of flood, or rather it used to do so previous to the building of the dam.

When the Nile below the swamps is at its lowest, the water acquires a green colour and a putrid taste and smell due to innumerable microscopic green algae, which grow freely in the conditions of heat and nearly stagnant water which prevail in some reaches of the river at low stage. This "green water" is seen at Cairo about the end of June or beginning of July, and passes away with the first rise in the later month, the algae being unable to live in turbid water. By Aug. the river in lower Egypt is full of dark red-brown sediment brought down by the Blue Nile and the Atbara from the plateaus of Abyssinia. It is estimated to be then carrying 8 cu.yd. per sec.; by Sept. this has been reduced to half the amount, and then diminishes rapidly. It has been calculated[1] that the time taken by the water to travel from Khartoum to the delta barrage varies from 14 days in Sept. to 42 in May.

On the island of Elephantine at Assuan is the famous Nilometer, dating from ancient Egyptian times, altered and extended in Roman times and repaired in 1870 by the Khedive Ismail. It is a stairway in the river quay wall built of hewn stones, marked with scales to record the level of the water of the river. The

[1] By Sir Hanbury Brown, inspector-general of irrigation, Lower Egypt, 1892–1903.

remains of other ancient Nilometers exist at Philae, Edfu and Esna, together with inscriptions recording about forty high Niles in the XXVth Dynasty, discovered on a quay wall of the temple of Karnak. The data furnished by these give about 4½ in. per century as the average rate at which the Nile is silting up its bed north of the 1st cataract. The present level of high Nile at the Semna rapids, between the 2nd and 3rd cataracts is 24 ft. lower than that indicated by the marks sculptured *c.* 2500 B.C. This fall is attributed to the erosive action of the water as it passes over the hard gneiss which at Semna forms a barrier across the stream. The vertical extent of such erosion is equal to about two millimetres a year. There are now gauges for registering the rise of the water at Cairo, Assuan, Berber and Khartoum on the main river; at Wad Medani, Sennar and Roseires on the Blue Nile; El Duem and Malakal on the White Nile; Nasser on the Sobat; Mongalla on the Bahr-el-Jebel; and Ugowe, Jinja and Entebbe on Victoria Nyanza.

**Navigation.**—At high Nile there is uninterrupted water-communication from the sea to Fort Berkeley in 4° 40′ N.—a distance of 2,900 m. Owing to the cataracts, navigation between Assuan and Khartoum is impossible during low Nile, and from March 1st to Aug. 1st the upper courses of the Damietta and Rosetta branches are closed to navigation; the water being utilized for summer irrigation in the delta. As far as Mansura (60 m.) on the Damietta branch and Kafr-el-Zayat (70 m.) on the Rosetta branch, and between Khartoum and Fort Berkeley (1,090 m.) the river is navigable all the year round, though between the Sobat confluence and Bor, navigation is dependent on the channel being kept clear of sudd. Above Fort Berkeley navigation is interrupted by the rapids and cataracts which extend to Dufile, but from the last-named town to Fajao at the foot of the Murchison Falls (a distance of 150 m.) the river is navigable throughout the year. There is a further navigable stretch between Foweira (just above the Karuma rapids) and the southern end of Lake Kioga. The Blue Nile is navigable for steamers during flood time from its confluence at Khartoum to Roseires at the foot of the Abyssinian hills, a distance of 426 m. At low water small boats only can go upstream. The Atbara is never navigable, the current during flood time being too swift for boats. Including the Sobat and the Bahr-el-Ghazal the navigable waters of the Nile and its affluents exceed 4,000 m. (W. E. G.; F. R. C.)

## HISTORY

**Story of Discovery.**—Few problems in geographical research exercised for so long a period so potent an influence over the imaginations of man as that of the origin of the Nile. The ancient Egyptians, as is apparent from the records on their monuments, were acquainted with the main stream as far south as the junction of the White and Blue Niles. They appear also to have known the Blue Nile up to its source and the White Nile as far south as the Bahr-el-Ghazal confluence. Beyond that point the sudd probably barred progress. The knowledge acquired by the Egyptians passed to the Persians and Greeks. Herodotus (about 457 B.C.) ascended the Nile as far as the First Cataract. He was led to believe that the source of the river was far to the west—in the region of Lake Chad. Eratosthenes, superintendent of the Alexandrian library, in a map made about 250 B.C., showed, with fair accuracy, the course of the river as far as where Khartoum now stands. He showed also the Atbara and Blue Nile. Eratosthenes was the first writer to hint at equatorial lakes as the sources of the river. Juba II., king of Mauretania (who died about A.D. 20), in his *Libyca,* quoted by Pliny, makes the Nile rise in western Mauretania, not far from the ocean, in a lake presenting characteristic Nile fauna, then pass underground for several days' journey to a similar lake in Mauretania Caesariensis, again continue underground for twenty days' journey to the source called Nigris on the borders of Africa and Ethiopia, and thence flow through Ethiopia as the Astapus. This remarkable story received considerable credence, and may be connected with the theory which made the Niger a branch of the Nile (*see* below). Strabo (a contemporary of Juba), who ascended the river as far as Syene, states that very early investigators had connected the inundation of the Lower Nile with summer rains on the far southern mountains, and that their theory had been confirmed by the observations of travellers under the Ptolemies. About the same time Dalion, a Greek, is believed to have ascended the White Nile. Nero despatched two centurions on an expedition for the express purpose of exploring the Nile, and Seneca states that they reached a marshy impassable region, which may be easily identified with the country of the White Nile above the mouth of the Sobat. To what they referred when they reported a great mass of water falling from between two rocks is not so readily determined. During this period more accurate knowledge concerning the Nile sources was obtained from the reports of Greek traders who visited the settlements on what is now called the Zanzibar coast. A merchant named Diogenes returning (about A.D. 50) from the east coast of Africa told a Syrian geographer, Marinus of Tyre, that journeying inland for twenty-five days he reached the neighbourhood of two great lakes and a range of snow mountains whence the Nile drew its sources. Marinus published this report in his geographical works. This book is lost, but the information is incorporated in the writings of Ptolemy, who in his book and map sums up all that was known or surmised of the Nile in the middle of the 2nd century of the Christian era. Ptolemy writes that two streams issuing from two lakes[1] (one in 6° and the other in 7° S.) unite in 2° N. to make the Nile, which, in 12° N., receives the Astapus, a river flowing from Lake Coloe (on the equator). His two southern lakes, he conceived, were fed by the melting of snows on a range of mountains running east and west for upwards of 500 m.—the Mountains of the Moon, *τὸ τῆς σελήνης ὄρος, Lunae Montes.* It will be seen that, save for placing the sources too far to the south, Ptolemy's statements were a near approximation to the facts. The two southern lakes may be identified with the Victoria and Albert Nyanzas, and Lake Coloe with Lake Tsana. The snow-capped range of Ruwenzori occupies—at least in part—the position assigned to the Mountains of the Moon, with which chain Kilimanjaro and Kenya may also be plausibly identified. On all the subsequent history of the geography of the Nile Ptolemy's theory had an enormous influence. Mediaeval maps and descriptions, both European and Arabian, reproduce the Mountains of the Moon and the equatorial lakes with a variety of probable or impossible modifications. Even Speke (*see* p. 456) congratulated himself on identifying the old Ptolemian range with the high lands to the north of Tanganyika, and connected the name with that of Unyamwezi, the "country of the moon."

In the fourteen centuries after Ptolemy virtually nothing was added to the knowledge of the geography of the Upper Nile. Arab writers of the 12th and 13th centuries make mention of the great lakes, and their reports served to revive the interest of Europe in the problem of the Nile. Idrisi made both the Nile and the Niger issue from a great lake, the Niger flowing west, the Nile north. Hence arose much confusion, the Senegal estuary being regarded by its discoverers (1445) as the mouth of a western branch of the Nile. Even until the early years of the 19th century the belief persisted in a connection between the Nile and the Niger (*see* further NIGER). Portuguese explorers and missionaries, who in the 15th and 16th centuries visited the east coast of Africa and Abyssinia, gained some information about the equatorial lake region and the Nile, the extent of the knowledge thus acquired being shown in the map of Africa of Filippo Pigafetta, Italian traveller and historian (1533–1603) published in 1580. It was not, however, till the 17th century that the sources of the Blue Nile were visited by Europeans. In 1615 Pedro Paez, a Portuguese priest, was shown them by the Abyssinians. Ten years later another Portuguese priest, Jeronimo Lobo, also visited the sources and left a vivid description of the rise of the river and its passage through Lake Tsana. An English version of the accounts of Paez and Lobo—written by Sir Peter Wyche—was published in 1669 by order of the Royal Society, of which Sir Peter was an original Fellow. Between 1625 (the date of Lobo's visit) and 1770, some attempts were made by French and other

[1] The two lakes afterwards received the names Lake of Crocodiles and Lake of Cataracts.

travellers to explore the Blue Nile, but they ended in failure. In the last-named year James Bruce (*q.v.*) reached Abyssinia, and in Nov. 1772 he arrived in Egypt, having visited the source of the Blue Nile and followed it, in the main, to its confluence with the White Nile. On returning to Europe Bruce was mortified to find that whilst he was still in Egypt the French geographer D'Anville had (1772) issued a new edition of his map of Africa in which by a careful study of the writings of Paez and Lobo he had anticipated Bruce's discoveries, D'Anville's map is singularly accurate, if we remember the scanty information at his disposal. To Bruce, nevertheless, belongs the honour of being the first white man to trace the Blue Nile to its confluence with the White Nile. He himself, considering the Blue Nile as the main branch of the river, claimed to be the discoverer of the long-sought *caput Nili.*

From the time of Bruce, interest in the Nile problem grew rapidly. The Englishman, W. G. Browne (*q.v.*) when in Darfur (1794–1796) heard that the Abiad rose far south in the Mountains of the Moon, but he makes no mention of the great lakes, and in Major Rennell's map of 1802 there is no hint of equatorial lakes at the Abiad sources. During the French occupation of Egypt the river from the sea to Assuan was accurately surveyed, the results being embodied in Jacotin's *Atlas de l'Égypte* (1807). In 1812–1814 J. L. Burckhardt, the Orientalist, went up the Nile to Korosko, travelled thence across the desert to Berber and Shendi, and crossing the Atbara made his way to the Red Sea. It was, however, due to the initiative of Mohammed Ali, Pasha of Egypt, that the White Nile was explored. In 1820–22 a military expedition under Ismail Pasha, a son of Mohammed Ali, which was joined by the French scientist Frédéric Cailliaud (who had visited Meroë in 1819) ascended the river to the confluence of the White and Blue Niles, founded the city of Khartoum, and ascended the Blue Nile to Fazokl. In 1827 Adolphe Linant, a Belgian in the service of the British African Association, ascended the White Nile 132 m. above Khartoum, being the first white man to do so since the 1st century A.D. Then followed three Egyptian expeditions sent in 1839–41 and 1842 by Mohammed Ali up the White Nile. The first expedition reached, on Jan. 28, 1840, a point 6° 30′ N., the second and third pressed further south, reaching 4° 42′ N.—or the foot of the rapids above Gondokoro. A Turkish officer, Selim Bimbashi, commanded the expeditions, and among the members were the Frenchmen Thibaut (a convert to Islam and for nearly forty years French consular agent at Khartoum), D'Arnaud and Sabatier, and a German, Ferdinand Werne. The last-named wrote a scientific account of the second expedition and drew a map of the Nile between Khartoum and Gondokoro. An Austrian Roman Catholic mission was established in the Sudan, and in 1850 one of its members, Dr. Ignatz Knoblecher, sent to Europe reports, gleaned from the natives, of the existence of great lakes to the south. About the same time two Protestant missionaries, Ludwig Krapf and John Rebmann, stationed on the Zanzibar coast, sent home reports of a vast inland sea in the direction where the Nile sources were believed to be. This sea was supposed to extend from 0° 30′ N. to 13° 36′ S. These reports revived interest in Ptolemy's Geography. The exploration of the Bahr-el-Ghazal by John Petherick, Miss Tinné and her companions, and others followed the opening of the White Nile (*see* BAHR-EL-GHAZAL). The result of the work carried on from the north was that by 1858 the Nile system was known as far south as the rapids at Bedden.

On Aug. 3, 1858 the English explorer J. H. Speke (*q.v.*) discovered the large *nyanza* (lake), which he rightly conceived to be the head reservoir of the White Nile, and which in honour of the queen of England he named Victoria Nyanza. Captain (Sir Richard) Burton and Speke had gone inland from Zanzibar to investigate the reports concerning the vast lake which Rebmann and Krapf had called the Sea of Unyamwezi. These reports proved to be exaggerated accounts of three distinct lakes—Nyasa, Tanganyika and Victoria Nyanza. In 1860 Speke returned to Zanzibar accompanied by J. A. Grant (*q.v.*), bent on solving the problem of the Nile. In spite of great difficulties he made his way to Uganda, on the north-west of Victoria Nyanza and (without exploring the lake) succeeded in reaching its outlet. On the 28th of July 1862 Speke stood by the Ripon Falls—the birthplace of the Nile. In his journey he had discovered the Kagera river, now known to be the most remote headstream of the Nile, a fact of which Speke was uncertain, though he recognized that it was the largest river entering the nyanza. Speke and Grant paddled down the Nile a short distance, but before reaching Lake Kioga they were stopped by hostile natives and compelled to go westward to Unyoro. There they heard of another great lake farther west, but the king of Unyoro refused them permission to visit it. In the end they descended the Kafu river to its confluence with the Nile and then down the main stream to the Karuma Rapids. Here Speke and Grant left the river, and travelled overland east of the stream, which they did not strike again until just above the Ausa confluence. Thence they travelled down the Nile to Gondokoro, reached on Feb. 15, 1863.

This remarkable journey virtually solved the Nile problem so far as the source of the main stream was concerned, but there remained much to be done before the hydrography of the whole Nile basin was made known. At Gondokoro, Speke and Grant met Mr. (afterwards Sir Samuel) Baker and his wife—a Hungarian lady—who had journeyed thither to afford the explorers help. To Baker, Speke communicated the news he had heard concerning the western lake, and this lake Baker determined to find. On the 26th of March 1863 Baker and his wife left Gondokoro, and despite much opposition, especially from slave-dealers, followed, in the reverse direction, the route of Speke and Grant as far as Unyoro, whence they journeyed west. On March 14, 1864, they struck the lake (Albert Nyanza) on its south-east side. They paddled up the lake to the point where a large river coming from the east poured its waters into the lake. This stream, which they rightly conjectured to be Speke's Nile, they followed up to the Murchison Falls. Thence they went overland to the Karuma Rapids, and so back to Gondokoro by their old tracks. It fell to the lot of General C. G. Gordon (when that officer administered the Egyptian Equatorial provinces) and his assistants to fill up the gap left by Speke and Baker in the course of the main stream. In 1874–75 two English engineer officers—Lieut. (afterwards Colonel Sir Charles M.) Watson and Lieut. H. Chippendall—followed the river between Gondokoro and Albert Nyanza; in 1876 an Italian, Romolo Gessi Pasha, circumnavigated that lake, proving Baker's estimate of its size to be vastly exaggerated; Gordon in the same year traced the river between Murchison Falls and Karuma Rapids, and an American, Colonel C. Chaillé-Long followed (1874) the Nile from the Ripon Falls to the Karuma Rapids, discovering in his journey Lake Kioga (which he named Ibrahim). In this manner the identity of the Victoria Nile with the river which issued from the Albert Nyanza was definitely established.

In 1874 H. M. Stanley (*q.v.*) went to Africa with the object of completing the work left unfinished by David Livingstone, who believed, erroneously, that the ultimate sources of the Nile were far to the south (*see* CONGO). Stanley, in 1875, circumnavigated Victoria Nyanza, setting at rest the doubt thrown on Speke's statement that it was a huge sheet of water[1], but proving Speke mistaken in believing the Nyanza to have more than one outlet. On the same journey Stanley encamped at the foot of the Ruwenzori range, not knowing that they were the "Mountains of the Moon," whose streams are the chief feeders of Albert Nyanza. (At the time of his visit the snow-peaks and glaciers were hidden by heavy clouds.) In 1888, however, Stanley saw the mountains in all their glory of snow and ice, discovered Albert Edward Nyanza, and traced the river (Semliki) which connects it with Albert Nyanza. The Semliki had been discovered, and its lower course followed in 1884 by Emin Pasha. Thus at length the riddle of the Nile was read, though much was still to do in the matter of scientific survey, and in the exploration of the valley of the Sobat (*q.v.*). The Kagera had been partly explored by Stanley (1875), by whom it was called the Alexandra Nile, and between 1891–98 its various branches were traced by the German travellers Oscar Baumann, Richard Kandt and Captain H. Ramsay, and by Lionel Dêcle, a Frenchman. A British officer, Colonel C. Delmé-Radcliffe, made the first accurate survey (1900–1901) of the

[1] In the map issued in 1873 to illustrate Schweinfurth's book, *The Heart of Africa,* Victoria Nyanza is shown as five small lakes.

Nile between Albert Nyanza and Gondokoro. In 1903 an Anglo-German commission under Colonel Delmé-Radcliffe and Captain Schlobach made a detailed survey of the Kagera from 30° E. to its mouth. The Kioga system was surveyed in 1907–08 by Lieut. C. E. Fishbourne. A trigonometrical survey of the upper river was begun by Colonel M. G. Talbot, director of Sudan surveys, in 1900, and since then much has been done by the Sudan Survey Department and the Irrigation Service.

**The Removal of Sudd.**—The sudd (*see* p. 452, *The Region of Swamps*) above the Sobat confluence seems to have stopped the Roman centurions sent by the emperor Nero to explore the Nile. When the river above the Sobat was again reached by white men (1840) the stream was clear of sudd, and so continued until 1863–1864, when both the Bahr-el-Jebel and the Bahr-el-Zeraf became blocked by floating masses of vegetation. When Baker proceeded to Gondokoro in 1870 he thus described the increase that neglect had caused in the obstruction: "The immense number of floating islands that were constantly passing down the stream of the White Nile had no exit; thus they were sucked under the original obstruction by the force of the stream, which passed through some mysterious channel, until the subterranean passage became choked with a wondrous accumulation of vegetable matter. The entire river became a marsh, through which, by the great pressure of water, the stream oozed through innumerable small channels. In fact, the White Nile had disappeared." Baker, who had to cut through 50 m. of sudd in his passage to Gondokoro, urged the Khedive Ismail to reopen the Nile. This work was efficiently done by Ismail Ayub Pasha, and the White Nile was clear for large vessels when Gordon reached Khartoum in 1874. The river did not long remain free, for in 1878 Emin Pasha was unable to ascend the Bahr-el-Jebel from the south on account of sudd. It was cleared in 1879–80 by officials in the Egyptian service, but had again accumulated in 1884. In consequence of the Mahdist movement nothing could then be done to clear the river, and the work was not taken in hand again until 1899, when, by direction of Sir William Garstin, the under secretary of state for public works in Egypt, an expedition under Major Malcolm Peake, R.A., was sent to cut through the sudd, which then extended from the Bahr-el-Ghazal confluence almost to Gondokoro. During 1900 a channel was cut through the northern and heaviest portion of the sudd. The work was one of much difficulty, some of the blocks being 1 m. long and 20 ft. deep; the water beneath flowed with great velocity. To remove the obstruction the surface was first burnt; then trenches were cut dividing the sudd into blocks 10 ft. square, and each of these was hauled out with wire hawsers and chains by gunboats working from below. For a distance of 172 m. north of Shambe (*i.e.*, about midway between the Ghazal confluence and Gondokoro) the true bed of the river could not, in many places, be found, but Major Peake forced a passage to Gondokoro through a spill channel or series of shallow lakes lying west of the main stream. In 1901 Lieut. Drury, a British naval officer, removed many of the remaining blocks of sudd, opening to navigation a further 147 m. of the river. Beyond this point for a distance of 25 m. the Bahr-el-Jebel could not be traced, so completely was the channel choked by sudd. In 1902, however, Major G. E. Matthews discovered the true bed of the river, which by 1904 was completely freed from obstructions, and freedom of navigation between Khartum and Gondokoro was permanently secured. The effect of the sudd-cutting operations on the supply of water available for irrigation purposes in the lower river was slight but it has made it available for transport, and communication up to Rejaf is now regularly maintained.

**Political Relations.**—Explored in part by Egyptian government expeditions, the upper Nile as far south as Albert Nyanza became subject, between 1840 and 1882, to Egypt. Possession of the greater part of the river above Wadi Halfa then fell to the followers of the Mahdi. In 1896–98 an Anglo-Egyptian army reconquered the country, and from Victoria Nyanza to the Mediterranean the main river came under British or Egyptian administration. The west bank of the Bahr-el-Jebel, as far north as 5° 30′ N., was in 1894 taken on lease from Great Britain by the Congo Free State during the sovereignty of Leopold II., the territory leased being known as the Lado enclave (*q.v.*), but the lease was terminated in 1910.

BIBLIOGRAPHY.—For the story of exploration, *see* the works of Bruce, Speke, Grant, Baker and other travellers (whose books are mentioned in the biographical notices). Their achievements, and those of ancient and mediaeval explorers, are ably summarized in *The Story of Africa*, vols. ii. and iii., by Dr. Robert Brown (1893–94), and *The Nile Quest*, by Sir Harry Johnston (1903). *See* also J. Partsch, *Des Aristotel's Buch: "Über das Steigen des Nil"* (Leipzig, 1909). For the Kagera region consult *Caput Nili*, by Richard Kandt (Berlin, 1904). Latest additions to geographical knowledge are recorded in the *Geographical Journal* (London) and the *Cairo Scientific Journal*. For the hydrography, geology and climate see *The Physiography of the River Nile and its Basin*, by Captain H. G. Lyons, director-general, survey department, Egypt (Cairo, 1906), an authoritative work, and numerous other publications of the Survey of Egypt and of the Physical Department; "Notes on the History of the Nile and its Valley," by W. F. Hume, in *Geog. Jnl.* (Jan. 1906); *Egyptian Irrigation* (2nd ed., 1899) and the *Nile Reservoir Dam at Assuan and After* (1901), both by Sir William Willcocks; the *Annual Reports* (1899 and after) of the Egyptian Public Works Department. Of special value is the Blue Book *Egypt No. 2, 1904*, which is a report by Sir William Garstin on the basin of the upper Nile, dealing at length with the lake area, the Nile affluents and the main river as far south as Khartum, from the topographical as well as the hydrographical aspect. Sir W. Garstin and Captain Lyons give full bibliographical notes.

The study of the zoology of the Nile valley was the special object of a Swedish scientific expedition in 1901, under the direction of Prof. L. A. Jägerskiöld. The *Results* were published at Uppsala, pt. iii. appearing in 1909. For the botanical and other aspects of the Nile valley, *see* the works of Petherick, Heuglin, Schweinfurth, Junker and Emin. (F. R. C.)

## DISTRIBUTION OF WATERS

Although the geographical problems connected with the origin of the river have been solved, the Nile continues to offer problems of extraordinary interest in connection with the conservation and distribution of its waters. The energy formerly directed to exploration has only been diverted to a closer and more scientific study of the hydrography of the river, with a view to determining how the available flow of water in its various tributaries can be most advantageously and economically protected from dissipation and wastage in the swamps of the upper river, and stored in reservoirs for utilisation as required. These studies have mostly been directed by the Egyptian Government to increasing the flow of the river in the early summer months, when its natural flow falls short of requirements for irrigation in Egypt; it has come to be realised that the control of the Nile waters is not wholly an Egyptian question but concerns the countries higher up the river.

**The Assuan, Gebel Aulia and Makwar Dams.**—The original Assuan dam, which was opened in 1902, was raised in height by seven metres in 1912 and the storage capacity of the reservoir increased from 1,000 million cu. metres to 2,250 million cu. metres of water. Following on Sir William Garstin's report on the basin of the Upper Nile (British Blue Book, *Egypt No. 2, 1904*), schemes for constructing a large reservoir on the lower White Nile by means of a dam at Gebel Aulia some 20 m. south of Khartoum, and for a canal to irrigate the great Gezira plain between the Blue and White Niles, began to take definite form about 1913. Progress with these schemes was necessarily suspended during the World War, and in the meanwhile the increasing tendency towards the development of an independent existence by the Sudan caused all schemes for the control of the river beyond the limits of Egypt proper to be viewed with some apprehension and mistrust in Egypt. The general position was summed up to date by the then adviser to the Egyptian Ministry of Public Works, Sir Murdoch MacDonald, in *Nile Control* (published by the Egyptian Government in 1920), and an international commission was appointed by the Egyptian Government to report on the proposed works.

The commission reported favourably on the general scheme outlined in *Nile Control*, and pointed out that under a carefully considered scheme of control there was sufficient water to meet any possible developments in both Egypt and the Sudan for many years to come. Financial considerations, complicated by the political position, again led to the temporary suspension of the works and to the preparation of further reports on the irrigation programme by Mr. C. E. Dupuis, formerly adviser to the Egyp-

tian Ministry of Public Works (issued by the Egyptian Government in 1925). The construction of the Gezira canal was then resumed by the Sudan Government, and the canal, with its great dam and reservoir, with a capacity of nearly 500,000 million cu. metres of water, at Makwar, near Senaar, on the Blue Nile, was completed to the extent necessary for the irrigation of 300,000 ac. in 1925, and formally opened in 1926. The Egyptian Government also started preliminary work on the Gebel Aulia dam and reservoir (White Nile), with a storage capacity of about 2,500 million cu. metres of water, and is studying the scheme for the canalization of the river through the swamps, on which some preliminary work was done between 1904 and 1913. (*See* DAMS; IRRIGATION.) At present work at Gebel Aulia has been suspended and the heightening of the Assuan Dam by 8 metres is under consideration.

**Lake Albert.**—It is further recognized that to be fully effective this canalization of the river must be supplemented by further storage works higher up the river, presumably by the conversion of Lake Albert into a reservoir, but this scheme has not yet emerged from the stage of preliminary consideration. The most recent information concerning the physical conditions and régime of the great lakes forming the basin of the upper White Nile, essential to the consideration of this project, has been collected in a report on *The Lake Plateau Basin of the Nile* by Mr. H. E. Hurst (published by the Egyptian Government in 1925).

**Lake Tsana.**—The study of the possibilities of Lake Tsana as a reservoir for the Blue Nile, originally reported on by Mr. C. E. Dupuis in 1903, has been continued by expeditions visiting the lake under Mr. A. B. Buckley in 1916–17, and under Mr. G. W. Grabham in 1920–21. The results of these studies were published by the Egyptian Government and the *Report of the Mission to Lake Tsana in 1920–21* by Messrs. G. W. Grabham and R. P. Black is particularly full and interesting. All reports agree in emphasising the extreme suitability of Lake Tsana for conversion into a reservoir of a capacity of between 3,000 and 4,000 million cu. metres. The political questions arising from the gradual conversion of the Nile from a natural river into an artificially regulated stream, whose flow is controlled by reservoirs at various points on its course in several different countries, have begun to make themselves felt, and a comprehensive solution of the resulting difficulties has yet to be found.

**Navigation and Water Power.**—From the point of view of navigation and trade no new developments have taken place on the Nile in recent years. The river remains a most useful highway for local traffic in the various sections into which its length of 4,000 m. is divided by the occurrence of falls and rapids; but the nature of these breaks is such that the development of through traffic on any scale is never likely to be economically possible. There are considerable possibilities for the development of water-power on the Nile especially at the Ripon and Murchison falls in Uganda; and the utilization of the large amount of power running to waste at the Assuan dam has been repeatedly considered and discussed; but the localities in which these opportunities occur are remote, and no useful application of them to practical purposes has yet been devised; in the case of Assuan the intermittent character of the power obtainable, which though very large when the reservoir is full in the early part of the year is practically nil during the flood season, has hitherto proved an insurmountable objection to economic utilization. (C. E. D.)

**NILE, BATTLE OF THE.** The battle of the Nile was fought in Aboukir Bay, near Alexandria, on Aug. 1, 1798. It arose out of Napoleon's famous Egyptian Expedition, the first news of which had reached Jervis, off Cadiz, earlier in the year, in the shape of rumours of great activity in the port of Toulon. In the previous year the first European coalition against revolutionary France had been finally dissolved by the elimination of Austria, the result being that in 1798 France was at war with England only, and this eastern expedition with its proposed, though unlikely, result of an attack on India, was considered by Napoleon to be the most hopeful means of embarrassing England, while at the same time keeping himself in the limelight. As soon as Jervis heard of the preparations at Toulon, the object of which was, of course, unknown to him, he despatched Nelson with a small force to reconnoitre, and soon afterwards he had an opportunity of reinforcing him. Pitt was trying to build a new coalition against France, and was approaching Austria who made England's re-entry into the Mediterranean, which she had been forced to evacuate, a condition of acceptance. Jervis was thus ordered to send a detachment through the Straits of Gibraltar with instructions to find out whether a re-entry into the Mediterranean was feasible; what he did was to reinforce Nelson so as to bring his strength up to 14 ships, 13 of them seventy-fours and one a fifty.

Before Nelson was joined by his reinforcements and while he commanded only three seventy-fours and some frigates, he was forced from his station, off Toulon, by a gale. He suffered severely in this and—perhaps worst misfortune of all—was separated from his frigates which went to Gibraltar in the expectation that the admiral would go there to refit. The absence of "the eyes of the fleet" during the ensuing search for the French was obviously a great handicap. The remaining ships were repaired somehow and by May 31 they were back off Toulon, having been absent ten days, but the French were gone. The direction of the wind led Nelson to believe that the kingdom of the two Sicilies was the danger-point, and that the French had not made for the Straits of Gibraltar as it was believed in England they would. Consequently he made for the Bay of Naples, and on June 7 was joined by the reinforcements from Jervis. Malta was the next point at which it was decided to aim, but, while the fleet was in the neighbourhood of Cape Passaro, news reached it that the island had fallen to the French. It was this news that shook the public confidence, generally so strong, in Nelson, and for a time it was considered that he was being out-manoeuvred. The problem before him was certainly a hard one. With the intuition, however, for which he was so famous, he decided on Egypt as Napoleon's next stopping-place, and made sail for Alexandria. He found it empty and impetuously left, on June 30, to search elsewhere. On the following day the French arrived, actually sighting the topsails of the last ships of the departing English fleet, which ranged the coast of Asia Minor in its search and finally arrived at Syracuse. Here, by the kind influence of Lady Hamilton with the Neapolitan court, the fleet was entirely revictualled and immediately sailed again for the East. After further searching, Nelson decided to try Alexandria once more, and this time was rewarded by the sight of the republican tricolour floating over the town. A little later the French fleet could be seen anchored in Aboukir Bay. The long search was ended.

Aboukir Bay is situated about fifteen miles north-east of Alexandria and is about fifteen miles wide, extending from Aboukir Point on its westerly side to the Rosetta mouth of the Nile. The bay was silted up and its western curve offered exactly the sort of refuge de Brueys, the French Admiral, was seeking for the protection of his fleet which consisted of nine seventy-fours, three eighties, "L'Orient" of 120 guns, and four frigates. He had hoped to station this fleet in such a manner that it would be impossible for an attacking enemy to do more than fight him from seawards. The curving shoals seemed to offer him such a position, and he had drawn up his fleet facing north and north-west in a very obtuse angle, with his own ship, "L'Orient," at the apex, and the ships at the extremities of the line close to the shallows. The frigates he placed between this line and the shoals. So certain was de Brueys that this arrangement would prevent the British getting between him and the land that his ships were not even prepared for action on the landward side. An ordinary attack on his seaward side would, he thought, favour him, since the enemy would be under sail and, further, he had prepared batteries ashore which would enfilade their position. To Nelson's experienced eye, however, a weakness in these dispositions was at once apparent. The French ships were anchored in such a manner that there was nothing to prevent them swinging, and, as Nelson himself put it, "where there is room for a Frenchman to swing, there is room for a Briton to anchor"; in other words it would, for all de Brueys's care, be possible to attack the French on the landward side, either by cutting in between the leading ship and the shoals, or by breaking through between two ships. The British fleet was approaching from the

north with the wind a little west of north, so that there was nothing to prevent their doing either or both. Nelson's orders were that part of the fleet was to get to landward of the enemy and part was to remain to seaward; the northern end of the line was to be attacked first and the English ships were to anchor only by the stern so that, by merely paying out cable, they would be able, as each French ship was demolished, to move on to deal with others which would, owing to the direction of the wind, have found it impossible to come to the assistance of those attacked first.

It was nearly dark when Captain Foley, of the "Goliath," leading the English line, took his ship between the "Guerrier," the leading French ship, and the shore. Raking the "Guerrier" in passing, he went on to anchor on the port quarter of the next French ship, the "Conquérant." Captain Hood, who followed, in the "Zealous," anchored on the port bow of the "Guerrier." The three following ships, the "Audacious," the "Theseus" and the "Orion" broke through the French line and took up positions between the enemy and the shoals. Next came Nelson, in the "Vanguard," and his was the first ship to take up her station to seaward, anchoring opposite the "Spartiate," the third French ship, which was already receiving the attentions of the "Theseus" on the other side and was thus doomed to an eventual surrender. All the remaining ships took up their positions to seaward of the French, with the exception of the "Majestic" and the "Alexander," which broke through, and of the "Culloden," commanded by Nelson's friend, Troubridge, which was unfortunate enough to run ashore on a projecting sandbank before getting into action. Even this was not without its blessings, since, by hanging out signal lights, Troubridge was able to warn the ships following against suffering a similar fate, and they all escaped it. The enormous "Orient" was engaged first by the "Bellerophon" and then by the "Swiftsure" and "Alexander," which were the last ships into action, one on each side of her. The French flagship fought stubbornly, but she was set on fire and at ten o'clock blew up with a colossal explosion. Surrenders to the British were now becoming frequent, and as each ship was taken, the victors were able to move on and engage others which, no doubt mystified and confused in the darkness, were complacent enough to wait their turn. In this way the entire French fleet was accounted for with the exceptions of the two rear battleships and two frigates which made off in time; it is interesting to note that they were all taken or destroyed in subsequent actions. The victory of the Nile was one of the most complete in the annals of naval history, and was rich in results. It enabled England to capture Minorca and Malta; it completely restored her position and prestige in the Mediterranean; and this, in turn, enabled Pitt to conclude successfully his negotiations for the formation of a new coalition.

*See* Southey, *Life of Nelson,* ed. G. A. R. Callender (1922, bibl.).

(G. A. R. C.; J. G. B.)

**NILES,** a city of Berrien county, Michigan, U.S.A., 93 mi. E. of Chicago, on the St. Joseph river. Four main highways cross in Niles, federal highways 31, 112 and state highways 40 and 60. It is served by the Michigan Central railroad (a division of the New York Central railways), the Big Four railroad and motorbus lines, and has a municipal airport. The population in 1930 was 11,326; in 1940 it was 11,328, 97% white, 2% Negro and 1% foreign, by the federal census. It is in the St. Joseph valley, a rich fruit-growing, farming and dairying region. There are 25 diversified industries which make Niles an important manufacturing centre.

On or near the site of Niles, French Jesuits established a mission in 1690, and the French government in 1697 erected Ft. St. Joseph, which was captured from the English by the Indians in 1763 and in 1781 was seized by a Spanish party from St. Louis. The present city was founded in 1826 and incorporated in 1859.

**NILES,** a city of Trumbull county, Ohio, U.S.A., on the Mahoning river, 10 mi. above Youngstown; served by the Baltimore and Ohio, the Erie and the Pennsylvania railways. Pop. 13,080 in 1920 (25% foreign-born white); and by the census of 1940, 16,273. It is an important industrial centre, manufacturing especially steel sheets, glass and fire-brick, with a factory output in 1937 valued at $15,441,002. Niles was settled in 1832, incorporated as a village in 1865 and chartered as a city in 1895. It was named (1834) after Hezekiah Niles (1777–1839), founder and editor of *Niles's Register* (1811–49); and was the birthplace of President McKinley, to whose memory a memorial has been erected.

**NILGAI** ("blue bull"), the largest antelope (*Boselaphus tragocamelus*) found in India, where it represents the kudu and eland group of Africa. Only the bulls have horns, and these are short. The general colour of old bulls is bluish-grey, but younger bulls and cows are browner. It is about the size of a mule (*see* ANTELOPE).

**NILGIRIS, THE** (Blue Mountains), a system of hills in southern India, which gives its name to a district of the Madras Presidency. The Nilgiris form a plateau rather than a range, rising abruptly from the plains on most sides, with a general elevation about 6,500 ft. above sea-level.

The DISTRICT OF THE NILGIRIS is the smallest administrative district in Madras. It was formerly confined to the plateau, but was increased by the addition of portions of the Wynaad, making a total area of 982 sq.m. The administrative headquarters are at Ootacamund (*q.v.*). There is an abrupt descent of about 6,000 ft. from the plateau to the plains, save on the north, where the base of the mountains rests upon the elevated land of Wynaad, and Mysore, standing between 2,000 and 3,000 ft. above sea-level. The Ochterlony valley and Wynaad country consist of a series of broken valleys, once forest-clad throughout, but now studded with tea and coffee-gardens. The highest peak is Dodabetta, 8,760 ft. There are six well-known passes or *ghats* by which the district communicates with the neighbouring plains, three of which are practicable for wheeled traffic. The chief rivers are the Moyar, Paikara and Calicut, none of which is navigable. The forests consist of fine timber trees, and eucalyptus and Australian wattle have been extensively planted in the higher grounds of the Wynaad. Large game animals of many kinds are numerous. The hill tribes include Todas, Badagas and Kotas. The population of the district in 1921 was 126,519. The commercially important products are coffee, tea and cinchona. The latter is cultivated by the government, and also in private gardens, and there is a government quinine factory. The climate of the Nilgiri hills is extremely equable. A branch of the Madras railway runs from Podanur to Mettupalaiyam, whence a metre-gauge line on the rack principle goes to Coonoor, where there is a silk-farm, and Ootacamund. The Lawrence Memorial School at Ootacamund is maintained by government. The military quarters are at Wellington.

**NILOTES,** certain peoples of the Anglo-Egyptian Sudan, of whom the Shilluk and Dinka, best known representatives of these tall "black"-skinned dolichocephals, have an average stature of about 1·78m. (about 70in.) or perhaps a little more, and a cephalic index which varies around 72. In these tribes, as well as in the Nuer and Anuak, there is an Hamitic element, and although the majority have coarse features, with broad noses, among the Shilluk and probably the Anuak men with shapely features, including thin lips, long, relatively high-bridged, narrow noses, and well modelled foreheads are not uncommon.

The languages of the Nilotes form a sub-group of the family of languages called by Meinhof "Sudanic," characterized by the absence of inflection and grammatical gender and by the use of tone rather than accent, while typically each word consists of one syllable (*see* AFRICAN LANGUAGES). Shilluk so closely resembles Anuak that the two peoples can understand one another, and the same probably holds for Dinka and Nuer.

**Mode of Life.**—The Nilotes are essentially pastoral and largely riverain, their interest in their cattle being so far predominant that they usually grow scarcely enough grain to supply themselves till the next harvest. For the most part the men go absolutely naked, the women wear a pair of leather aprons reaching from waist to knee. The forehead is often scarred, and the lower incisors are generally removed. The skin is commonly smeared with the ash of wood and cattle dung. Ivory armlets are worn and the hair may be worked into elaborate head-dresses. Cannibalism is unknown and human sacrifice is almost entirely absent. The number of cattle constituting the bride price is a matter of

great importance, and this is usually paid in instalments. Certain iron-making groups of Dinka living near the Nile-Congo Divide, having few or no cattle, pay for their wives in iron. Widows are inherited by their husband's heirs, the children that they bear being counted as children of the first husband. Psychically the Nilotes, especially the Dinka, are distinguished from all other groups in their extreme aloofness and pride of race, showing absolutely no desire for European clothes or trade objects.

The social organization of the Shilluk is into a number of exogamous groups, but whether these are totemistic must be left for future investigation. Among the Dinka, who consist of a congeries of independent tribes, there are typical totemistic clans with descent in the male line, the totem being an animal, plant or even a natural object such as a meteor or fire. Almost all the clans whose totem is an animal derive their origin not from the animal itself but from a man born as one of twins, his fellow twin being an animal of the totem species, though sometimes the association is not quite so close, as when the totem animal lays certain commands upon members, offering in return certain privileges.

**Religion.**—Among the Dinka and Shilluk, the only two Nilotic tribes of whose religious ideas there is definite knowledge, the king (Shilluk *ret*) or chief (Dinka *baiñ*) is the rain-maker and belongs to the class of rulers called by Sir James Frazer Divine Kings, *i.e.*, there is immanent in each a divine spirit upon which depends the fertility and well-being of the universe. Such divine kings are not allowed to go to battle and were formerly killed ceremonially with their own consent when they showed signs of ill-health, or sometimes even of diminishing strength, lest the decline in vigour of their body—the living shrine of the divine spirit—should entail the weakness of the latter, when the cattle would sicken and fail to bear their increase, the crops would rot in the fields, and men, stricken by disease, would die in ever increasing numbers. The Shilluk king is indeed the classical example of the divine king, and two stages of his treatment can be traced; the earlier, preserved alone in folklore, refers to a time when anyone could kill the king and become his successor until he in turn was killed by a stronger, while in more recent times the killing of the king has become a ceremonial affair, the leading part being assigned to certain families called the Ororo.

In the case of the Shilluk the divine spirit incarnate in each king is *Nyakang*, the historic founder of the Shilluk kingdom and their culture hero. Like so many divine or semi-divine characters he did not die but vanished in a great storm. He has ten cenotaph tombs, the most sacred perhaps being that of Fenikang, the village in which he lived for a great part of his life. It is the presence of the divine spirit of Nyakang in the ruling king which enables the latter to move the High God, Juok, to send rain.

*See* W. Hofmeyer, *Die Shilluk* (1925); C. G. Seligman, "The Cult of Nyanking," *Fourth Report of the Wellcome Laboratory*, 1911, Vol. B.

(C. G. S.)

**NILSSON, CHRISTINE** (1843–1921), Swedish singer, was born at Wederslöff, near Wexiö, Sweden, on Aug. 20, 1843, of poor parents. She studied in Paris, where she made her début in the rôle of Violetta at the Théâtre Lyrique on Oct. 27, 1864. Between that date and 1872, when she married M. Auguste Rouzaud, she was the leading prima donna. Her first appearance in London was in 1867. A year later, on the 9th of March, she made her first appearance in the Paris Opera house as Ophélie in *Hamlet;* and she visited the United States in 1870. After her marriage her appearances in public were rare. After her second marriage in 1887, with Count A. de Casa Miranda, she retired from the stage.

Madame Nilsson died at Copenhagen on Nov. 22, 1921.

**NIMBUS:** *see* AUREOLA.

**NÎMES,** a city of southern France, capital of the department of Gard, 174 mi. S. by W. of Lyons on the P.L.M. railway, between Avignon and Montpellier. Pop. (1936) 87,145.

Nîmes, the ancient *Nemausus,* was named from the sacred wood in which the Volcae Arecomici (who surrendered to Rome in 121 B.C.) held their assemblies. Strabo states that it was the metropolis of a district containing 24 dependent towns, and that it was independent of the proconsuls of Gallia Narbonensis. Constituted a colony of veterans by Augustus, and endowed with numerous privileges, it built a temple and struck a medal in honour of its founder. The medal, which afterwards furnished the type for the coat of arms granted to the town by Francis I, bears on one side the heads of Caesar Augustus and Vipsanius Agrippa (the former crowned with laurel), while on the other there is a crocodile chained to a palm-tree, with the legend COL. NEM. Agrippa built the public baths, the temple of Diana and the aqueduct of the Pont du Gard. The city walls, erected by Augustus, were nearly 4 mi. in circuit, 30 ft. high and 10 ft. broad, flanked by 90 towers and pierced by ten gates. Hadrian on his way back from Britain erected at Nîmes two memorials of his benefactress Plotina. In the very height of its prosperity the city was ravaged by the Vandals; the Visigoths followed, and turned the amphitheatre into a stronghold, which at a later date was set on fire along with the gates of the city when Charles Martel drove out the Saracens. Nîmes became a republic under the protection of Pippin the Short; and in 1185 it passed to the counts of Toulouse, who enclosed it with ramparts, less extensive than that of Augustus, still to be traced in the boulevards. The city took part in the crusade against the Albigenses in 1207. Under Louis VIII it received a royal garrison into its amphitheatre; under Louis XI it was captured by the duke of Burgundy, and in 1420 was recovered by the dauphin (Charles VII). On a visit to Nîmes Francis I enriched it with a university and a school of arts. By 1558 about three-fourths of the inhabitants had become Protestants, and in 1567 a massacre of Catholics took place on St. Michael's day. From the accession of Henry IV till the revocation of the edict of Nantes (1685) the Protestant community devoted itself to active industry; but after that disastrous event great numbers went into exile or joined the Camisards. Louis XIV built a fortress (1687) to keep in check the disturbances caused by the rival religious parties. Nîmes passed unhurt through the storms of the Revolution; but in 1815 Trestaillon and his bandit followers pillaged and burned and plundered and massacred the Bonapartists and Protestants.

Nîmes lies at the foot of the Garrigues, a range of barren hills on the north and west. The most prominent of these is the Mont Cavalier, on the summit of which is the Tour Magne, a ruined Roman tower. To the south and east the town overlooks the plain of the Vistre, largely used for the vine. The central and oldest part of the town consists of low buildings and is encircled by boulevards, which occupy the site of the old fortifications. Here are to be found the majority of the Roman remains for which Nîmes is remarkable. The most celebrated is the amphitheatre, the best preserved in France. It dates from the 1st or 2nd century A.D. and was used as a fortress for some time during succeeding centuries. Occupied during the middle ages by a special quarter, with a church, it was cleared in 1809. It is built of large stones fitted together without mortar. In form it is elliptical, measuring approximately 440 by 336 ft. externally; the arena is 227 by 126½ feet. The elevation (70 ft. in all) consists of a ground story of 60 arches, an upper story of 60 arches and an attic with consoles pierced with holes for supporting the *velarium* or awning. The building, which was capable of holding nearly 24,000 persons, has four main gates, one at each of the cardinal points; and 124 doorways gave exit from the 35 tiers of the amphitheatre to the inner galleries. Originally designed for gladiatorial shows, naval spectacles, chariot races, wolf or boar hunts, the arena has in recent times been used for bull-fights. The celebrated Maison Carrée, a Roman temple 82 ft. long by 40 wide, is a famous monument, and according to an inscription is dedicated to Gaius and Lucius Caesar, adopted sons of Augustus, and dates from the beginning of the Christian era. In contains a collection of antique sculptures and coins. The so-called temple of Diana, which adjoins the Fountain gardens, was probably connected with the baths of which remains are visible near by. Two Roman gates, the Porte d'Auguste, consisting of two large archways flanked by two smaller ones and dating from A.D. 16, and the Porte de France remain. The Tour Magne (Turris Magna) is still 92 ft. in height, and was formerly higher. It is the oldest monument of Nîmes, but its use it not clear. It was turned into a fortress in the middle ages by the counts of Toulouse. Near the

Tour Magne was discovered the reservoir from which the water brought by the Pont du Gard (*see* AQUEDUCTS) was distributed throughout the city.

With its capital, the temple of Augustus, the basilica of Plotina erected under Hadrian, the temple of Apollo, the baths, the theatre, the circus, constructed in the reign of Nero, the Campus Martius and the fortifications built by Augustus, Nîmes must have been one of the richest of the Roman cities of Gaul. The cathedral (St. Castor), occupying, it is believed, the site of the temple of Augustus, is partly Romanesque and partly Gothic in style. The churches of St. Paul and St. Baudile are modern. The Fountain gardens owe their name to a spring of water which fluctuates considerably in volume, and discharges into the Vistre; the town water comes from the Rhône. Alphonse Daudet and the Provençal poet Jean Reboul were natives of the town.

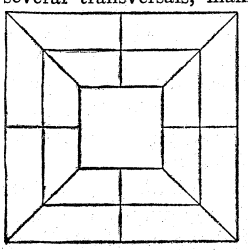
The city is the seat of a bishop under the archbishop of Avignon, a prefect, a court of appeal and a court of assizes, and has tribunals of first instance and of commerce, a board of trade-arbitrators and a chamber of commerce. At the close of the middle ages the industries of Nîmes received an impetus from a colony from Lombardy and Tuscany, and maintained their importance, so that before the revolution about half of the whole community were engaged in manufactures, chiefly that of silk. Upholstery materials, shawls, carpets, handkerchiefs, tapes and braidings, brandy, hosiery, leather, clothes, candles, machinery and boots and shoes are now manufactured, and there are a number of foundries. Nîmes is, besides, a great market for wine and brandy, and there is a good trade in grain, groceries and colonial wares. Quarries of hard limestone, used for the amphitheatre and other Roman buildings, are still worked in the vicinity.

**NIMROD** is described in Genesis x, 8–12 as the first "to be a mighty one in the earth," which Skinner in his commentary paraphrases as "originator of the idea of the military state, based on arbitrary force." Apart from 1 Chron. i, 10, which quotes this description, the only other reference to Nimrod in the Old Testament is Micah v, 6, where Assyria is called the land of Nimrod. Unlike the other names in the Genesis context, which are names of peoples, Nimrod is that of an individual. He is a son of Cush, which cannot mean, as it usually does, Ethiopia, but possibly stands here for the Kashshu, a people who conquered Babylon in the 18th century B.C. The beginning of Nimrod's kingdom is said to be Babel, Erech, Accad and Calneh, in the land of Shinar. Babel is Babylon; Erech, a city of Babylonia, is the present-day Warka; Accad, "Agade," the royal city of Sargon I., was the capital of a district of the same name in N. Mesopotamia; Calneh is unknown. Shinar, which the O.T. sometimes identifies with Babylonia, was, as Egyptian and Hittite records show, a distinct country, probably in N. Mesopotamia, which was prominent 1500–1200 B.C. Nimrod is said to have built Nineveh, Calah, an Old Assyrian town on the left bank of the Tigris, south of Nineveh, Rehoboth-Ir and Resen, both of which are unknown. It is in accordance with historical truth that Assyria was developed from Babylonia. The description of Nimrod as a "mighty hunter before the Lord," that is, a supreme hero of the chase, is an intrusion in this context, but probably, like the historical notices, derived from some old Babylonian saga. The Assyrian kings were noted for their prowess in hunting. But though we may feel reasonably sure that the Nimrod traditions were derived from Babylonian sources no equivalent of the name has yet been found in the cuneiform records. In character there is a certain resemblance between Nimrod and the hero Gilgamesh. Jensen, and later, with some hesitation, Jirku, suggested that the name NIN-IB of a Babylonian god might be read phonetically Namurtu, and compared with Nimrod. But Clay (*The Origin of Biblical Traditions*, p. 22 *seq.*) seems to have demonstrated that the correct reading is Nin-martu. Meyer says that the name Nimrod is common in Libya, but his theory that the saga was Libyan, and came to Israel via Egypt, seems improbable. (W. L. W.)

**NINEBARK,** any shrub of the genus *Physocarpus* of the rose family (Rosaceae). One of the best known is *P. opulifolius*, native from Quebec to Manitoba, south to Georgia and Kansas, and commonly planted for ornament. It grows from 5 to 10 ft. high, with strong, recurving stems, exfoliating bark and small, white or pinkish flowers, in umbel-like clusters, followed by clustered, inflated, reddish follicles. There are variegated and dwarf varieties.

**NINE MEN'S MORRIS,** a game played with counters on a board, also known as Muhle (Germany and Austria), Marelle (France), Mylla (Iceland), Siegen Wulf Myll (Poland) and The Mill, Morelles, Merry Peg, etc., in England.

The board (*see* diagram) comprises three concentric squares and several transversals, making 24 points of intersection. Two players, each provided with nine counters of his own colour, lay pieces alternately upon the points, the object being to get three in a row upon any line. On doing so, the player is entitled to remove from the board one adverse counter, but not one that is in a "mill," a row of three. Having placed all their counters, the players continue moving alternately, with the same object. A "mill" may be opened by moving one piece off the line; returning the piece to its original squares counts as a new "mill." The player who first captures all the adverse pieces wins. A move is limited from one point to the next along a line, but the rule is often made that when a player has only three pieces left he may move them from any point to any point regardless of the lines. In modern play the diagonal lines of the board are usually omitted, to lessen the advantage of the first player.



THE MILL BOARD

In modern play the diagonal lines are usually omitted

The mill board has been found carved or painted on innumerable relics of antiquity—on the steps of the Acropolis at Athens, on a Roman tile dug up at Silchester, England, on the deck of a Viking vessel discovered at Gokstad, on a tombstone in the Isle of Man. The game has been known since ancient times in India and China, among many African tribes, and on the Amazon, where it is called Trique and is held to be of Indian origin. The Greek game Petteia, played with pebbles upon an identical board, was supposed to have been invented by Palamedes prior to the siege of Troy, but later research indicates that this pebble game was played by shepherds in western Asia for centuries before the age of Homer. Some hold that mill, tit tat toe, pachisi, draughts (checkers), and chess all had a common ancestor.

The mill game is often played by shepherds with stones upon a diagram cut into the turf. Shakespeare alludes to this practice in *Midsummer Night's Dream* (Act II, scene I):

> The nine men's morris is fill'd up with mud,
> And the quaint mazes in the wanton green
> For lack of tread are indistinguishable.

This passage made "Nine Men's Morris" the best-known among many English variant names. "Morris" (*i.e.*, Moorish), is the name of a square dance to which the pebble game bears a fanciful resemblance. (G. MH.)

**NINEVEH.** The ancient capital of the Assyrian empire lay on the right bank of the Tigris opposite the modern city of Mosul. It consists of two great mounds, Kouyunjik and that on which today is the reputed tomb of the prophet Jonah (Nebi Yunus). The river has now shifted a short distance to the west so that the mounds are isolated from the present bed, although in ancient times the city abutted on the river. The city is situated on the northwest corner of a plain about 25 by 15 mi. in extent, formed by the Tigris and its tributaries, the Khosr on which Nineveh was built, which bounds the plain on the northwest, the Gomal, which forms the northeastern boundary, and the Upper Zab on the southeast. The western and south flank is protected by the Tigris itself. The whole plain slopes gently to the Tigris and provides a strong position, being protected by the foothills and the Gomal on the northeastern side, and on the south and west by the Tigris and the Upper Zab. The Khosr, although impassable enough when flooded forms at other times no barrier to attack. The position of Nineveh therefore astride this stream at its confluence with the Tigris is of great strategic importance. The Khosr was used to supply water to fill the protective works of the city and elaborate measures of river conservancy were taken to protect the plain against its most destructive inundations. Although the country is a fertile and prosperous wheat growing land, a fact which no doubt accounts for the many ancient cities so close to one another, owing to the slope of the plain the city itself is badly supplied with water and Sennacherib was compelled to build water conduits to conduct water from the hills into the Khosr and its canal system. The city then, although formerly, as is its modern descendant Mosul, the centre of a rich district, was suited particularly to military efficiency.

The city itself was surrounded by immense walls, which enclosed an irregularly shaped space, about three mi. long and about a

mile broad at the north where the walls were double, narrowing to about three quarters of a mile at the southern end. The walls were pierced by 15 gates. As in so many walled cities the actual dwellings did not occupy the whole of the space within the walls, there were parks watered by the elaborate aqueducts which brought water from the Khosr and other open spaces. The two great mounds formed two great fortified strongholds, and were joined together by a wall, part of which formed the west wall of the city. The mound of Kouyunjik, explored by R. Campbell Thompson on behalf of the British Museum contains an important series of buildings. On the north lay the palace of Assur-bani-pal. South of this lay the Temple of Nabu.

On this spot a rectangular building was found, 100×80 ft. which probably included part of the temple buildings and of the courtyard. Directly south of this again is today a broad pit which may possibly represent the site of the temple of Ishtar which is known to have existed on the mound. To the east is a building of Sennacherib, whose purpose does not seem to have been identified. Finally at the southwestern extremity of the mound is the palace of Sennacherib. This palace is of great architectural magnificence and is especially remarkable for the bas-reliefs which have so far been discovered. On the other mound Sennacherib built a military depot; his son Esar-Haddon built himself a palace on this mound, which has not at present been fully explored.

Although the greatness of Nineveh covers a comparatively short period there are indications that the city was Sumerian in origin. and early pottery and obsidian flakes have been found on the site. It has been suggested that possibly the Sumerians occupied this whole area before migrating south. The true history of Nineveh however begins at a comparatively late date. Hammurabi restored a temple of Ishtar, probably in Nineveh and Shalmaneser I, nearly 1,000 years later, about 1300 B.C. restored the temple again but although Sennacherib states that some of his ancestors were buried there the city was small and unimportant. He built the great building and walls which have been described and made a great triumphal way. His son Esar-Haddon rebuilt the temple of Ashur but started to rebuild Babylon, and did not carry out Sennacherib's purpose of making Nineveh the capital city of the Assyrian empire. Assur-bani-pal enriched the city with some of its greatest treasures, including a great library of clay tablets. In 612 B.C. the men of Nineveh were defeated by the Medes and the city was looted and destroyed. It seems probable that Mespila, referred to by Xenophon in the Anabasis refers to this site, and if so the spot was deserted at this time, but the name of Nineveh was applied to the site even in the middle ages, so an ancient tradition must have existed as to the location of the town. The site however did not become of any importance again till the time of the Arab conquest, when it lay on the opposite bank of the Tigris. (For later history *see* MOSUL.) The site has been attacked by numerous excavators from Layard onwards. In 1903–05 it was excavated by L. W. King and R. Campbell Thompson.

BIBLIOGRAPHY.—R. Campbell Thompson, *Cambridge Ancient History* vol. i, 1923 (bibliography). (L. H. D. B.)

**NINGPO** ("City of the peaceful waves"), an important Chinese city and chief commercial centre of the province of Chekiang, lying in a fertile plain backed by mountains on the south side of Hangchow bay, and about 12 mi. upstream from the mouth of the River Yung. The district of Ningpo, covering an area of 21 sq.mi., has a population of about 680,000, of whom 212,397, according to the census of 1928, live in the city. The city is of great antiquity and has occupied its present site since A.D. 713. It was one of the earliest centres of European settlement in China, the Portuguese arriving there about 1520. The early colony, known as Liampo, flourished until 1545, when the traders, owing to their illegalities, were driven out by the Chinese. Subsequent regulations and restrictions made foreign trade with Ningpo virtually impossible. In 1840 British warvessels blockaded Ningpo and the following year, after the fall of Chinhai, a fortified town at the mouth of the Yung river, it was entered without resistance. In 1842, by the treaty of Nanking, Ningpo was opened to foreign trade, and the question then arose as to whether Shanghai or Ningpo should become the commercial metropolis in this region of the coast. Shanghai assumed that rank and since then has impeded the growth of Ningpo's trade. The opening of Wuhu (1877) and Hangchow (1896) also contributed to the diversion of this trade. After World War I, however, the value of the trade increased considerably. After the outbreak of the war in 1937 Ningpo remained one of the few ports in Chinese hands open to trade and while its import trade remained about the same, its export and interport trade increased considerably. Figures for foreign trade are given in Table I.

TABLE I—*Values of Foreign Trade*

| | 1937 | 1938 | 1939 |
|---|---|---|---|
| Imports . . . . | $620,602 (U.S.) | $ 258,907 (U.S.) | $ 198,032 (U.S.) |
| Exports . . . . | 7,507 (U.S.) | 1,018,412 (U.S.) | 1,166,082 (U.S.) |

Table II shows values of interport trade for 1936 and 1939.

TABLE II—*Values of Interport Trade*

| | Imports | Exports | Re-exports |
|---|---|---|---|
| 1936 . . . . . | $5,009,884 (U.S.) | $4,748,101 (U.S.) | $ 20,822 (U.S.) |
| 1939 . . . . . | 4,427,097 (U.S.) | 2,680,949 (U.S.) | 2,271,504 (U.S.) |

Ningpo was formerly the port of shipment for cotton grown in the neighbouring districts; the annual export to Shanghai amounting to about 180,000 bales, for native drugs, tea, and more especially, fish and fish products. It had about 1,500 "couples" of junks engaged in the sea fisheries around the Chusan archipelago and supplied large numbers of fishermen. Ningpo was also noted for its grass mats, made of reed or grass grown locally. These mats found a market even in Japan, despite keen competition, owing to their cheapness. Rush is also specially grown and made into braids for straw hats, while laces are knitted in the neighbourhood and shipped chiefly to Shanghai. On the import side, Shanghai supplied Ningpo with considerable quantities of cotton yarn and cotton piece-goods. There were also large imports of kerosene oil and drugs. The total value of the sugar trade of Ningpo was approximately $1,500,000 a year; 70% of the sugar came from foreign sources and the remainder from Fu-kien province. Inland waterway communication in the vicinity of the city is provided by the Yung and the Fenghwa-kiang, as well as by canals. There was a daily steamer service to Shanghai, and regular sailings to Chusan and as far afield as Wenchow. Railway connection with Hangchow, the capital of Chekiang province and about 100 mi. distant, was made by the Shanghai-Hangchow-Ningpo Railway. The chief crops in the district around Ningpo, in order of importance, are rice, beans, wheat, cotton, rush and reed.

Various modern manufacturing industries had been established in the city. Of the cotton mills the Ho Fêng was the largest, drawing the bulk of its raw cotton supply from the neighbouring district of Yuyao. Its yarns were sold chiefly on the local market or elsewhere in Chekiang. About 1,000 looms in small factories and households produced each year 30–40,000 pieces of silk, the bulk of which was dyed in Shanghai. There were, in addition, electrical supplies, hardware, knitting and sewing companies, candle, soap, and canning factories, and numerous tinfoil makers.

The city is encircled by a fine old wall, having six gates, and from 4–5 mi. in length. Among its most prominent features are the many tall ice-houses, the picturesque T'ien-fêng-t'a or Ningpo pagoda, a tall white tower rising to a height of 160 ft., and the Drum tower, many centuries old. The city has long been famous as a centre of learning and religion, and many temples, monasteries and colleges are representative of old Ningpo.

**NINIAN, ST.,** a Briton, probably from Strathclyde, who was trained at Rome and founded a church at Whithorn on the west side of Wigtown Bay. Whithorn has been identified with the Leukopibia of Ptolemy, but this is uncertain. Bede, writing three centuries after Ninian, ascribes the name Ad Candidam Casam to the fact that the church of Ninian was built of stone. We are told by Bede that St. Ninian dedicated his church to St. Martin of Tours, who died between 397 and 400, but Ailred of Rievaulx is our only authority for the statement that St. Martin supplied him with masons. The legends of his work in Ireland probably

arise from the influence exercised in that country by the church of Whithorn. The date of Ninian's death is given by Archbishop Ussher as 432, but there is no authority for this statement.

*See Bede, Hist. Eccl.* (ed. C. Plummer, Oxford, 1896), iii, iv; Ailred of Rievaulx, "Life of St. Ninian," in the *Historians of Scotland,* vol. v (Edinburgh, 1874); W. F. Skene, *Celtic Scotland* (Edinburgh, 1877), vol. ii, 2 ff.; J. Rhys, *Celtic Britain* (London, 1904), p. 173; and A. B. Scott, *S. Ninian, Apostle of the Britons and the Picts* (1916).

**NIOBE,** in Greek mythology, daughter of Tantalus and Dione, wife of Amphion, king of Thebes. Proud of her sons and daughters (numbers variously given by different authors), she boasted of her superiority over Leto, the mother of only two children, Apollo and Artemis. As a punishment, Apollo slew her sons and Artemis her daughters. Their bodies lay for nine days unburied, for Zeus had changed the people to stone; on the tenth day they were buried by the gods. Out of pity for her grief, the gods changed Niobe herself into a rock on Mt. Sipylus in Phrygia, in which form she continued to weep (Homer, *Iliad,* xxiv, 602–617; Apollodorus iii, 5; Ovid, *Metam.* vi, 146–312). This "Niobe," described by Pausanias (i, 21) and Quintus Smyrnaeus (i, 293–306), both natives of the district, was the appearance assumed by a cliff on Sipylus when seen from a distance and from the proper point of view (*see* Jebb on Sophocles, *Antigone,* 831). It is to be distinguished from an archaic figure still visible, carved in the northern side of the mountain near Magnesia, to which tradition has given the name of Niobe, but which is really intended for Cybele.

The tragic story of Niobe was a favourite subject in literature and art. Aeschylus and Sophocles wrote tragedies upon it; Ovid has described it at length in his *Metamorphoses.* In art, the most famous representation was a marble group of Niobe and her children, taken by Sosius to Rome and set up in the temple of Apollo Sosianus (Pliny, *Nat. Hist.* xxxvi, 4). What is probably a Roman imitation of this work was found in 1583 near the Lateran, and is now in the Uffizi gallery at Florence.

**NIOBIUM,** a metal which occurs associated with tantalum (*q.v.*) in the rare mineral tantalite or columbite. It was given this name (from Niobe, the daughter of Tantalus) by H. Rose (1846), but is now usually called *columbium* (*q.v.*).

**NIORT,** a city of France, chief town of the department of Deux-Sèvres, 42 mi. E.N.E. of La Rochelle by rail to Saumur. Pop. (1936) 27,551. Up to the 7th century the Niort plain formed part of the Gulf of Poitou; and the mouth of the Sèvre lay at the foot of the hills now occupied by the town which grew up round the castle erected by Henry Plantagenet in 1155. The place was captured by Louis VIII in 1224. By the peace of Brétigny it was ceded to the English; but its inhabitants revolted against the Black Prince, and most of them were massacred when his troops recovered the town by assault. In 1373 the French regained the town. Protestantism made numerous proselytes at Niort, and Gaspard de Coligny made himself master of the town, which successfully resisted the Catholic forces after the battle of Jarnac, but surrendered without striking a blow after that of Moncontour. Henry IV rescued it from the league. It suffered severely by the revocation of the edict of Nantes. Niort is on the Sèvre Niortaise. The tower of the church of Notre-Dame (15th and 16th centuries) has a fine stone spire and a north doorway with a carved balustrade. The old Renaissance hôtel-de-ville contains a collection of antiquities. Near Niort are the feudal remains of the fortress of Coudray-Salbart. Niort is the seat of a prefect and a court of assizes. Tanning, currying, shammy-dressing, glove-making and the manufacture of brushes and boots are the staple industries.

**NIPIGON,** a lake and river of Thunder Bay district, Ontario, Canada. The lake is 30 mi. N. of the bay of the same name on Lake Superior, at an altitude of 852 ft. above the sea. It is 70 mi. long and 50 mi. wide; contains more than 1,000 islands, is very deep, and has a much-indented shore line measuring upwards of 580 mi. The river, which drains the lake, descends 250 feet in the 40 mi. of its course and is the largest stream flowing into Lake Superior. It is widely known for its trout fishing.

**NIPISSING,** a lake of the district of the same name in Ontario, Canada, situated nearly midway between Lake Huron and the Ottawa river, at an altitude of 644 ft. above the sea. It is of irregular shape, with bold shores, and contains many islands; from the north it receives the waters of Sturgeon river. It is 50 mi. in length and 20 in breadth; discharges its waters by French river into Lake Huron, and is separated by a low watershed from the Mattawa river, a tributary of the Ottawa. It has been proposed as the summit level of an Ottawa and Georgian Bay canal.

**NIPPON,** the Japanese pronunciation of the Chinese name of Japan, "sun-origin." *See* JAPAN.

**NIPPON GINKO:** *see* JAPAN, BANK OF.

**NIPPON YUSEN KAISYA** (Japan Mail Steamship Company Ltd.). The organization of the Nippon Yusen Kaisya dates back to 1885, when it came into existence as the result of the amalgamation of two separate shipping concerns, *i.e.,* the Mitubisi company and *Kyodo Unyu Kaisya.* The capital of the company was then 11,000,000 yen and the combined fleet comprised 58 steamers of 68,700 gross tons. From 1895 to 1925 the company steadily extended its fleet and services. In 1896 three main services were inaugurated (1) the Yokohama-London-Antwerp line; (2) the Hong Kong-Japan-Seattle line and (3) the Yokohama-Manila-Australia line; the first two were fortnightly and the last-mentioned four-weekly. The company's capital was increased to double the previous amount, viz., 22,000,000 yen. In 1905 the company owned 73 steamers, gross tonnage 250,100. In 1915 the number had risen to 93 steamers with a gross tonnage of more than 428,000, and the capital of the company was increased to 44,000,000 yen.

In 1923 the company formed the *Kinkai Yusen Kaisya* (Near Seas Mail S.S. company); and in 1926 the Nippon Yusen Kaisya took over the *Toyo Kisen Kaisya's* two important Pacific services, namely the Orient-Californian line and South American West Coast line, together with 9 steamers on those services, totalling 115,000 tons gross. In consequence of the merger, the capital of the N.Y.K. line was increased to 106,250,000 yen.

In 1927–30 the company built 9 motor vessels for their principal passenger services, of which three of 17,000 tons gross, namely the m.s. "Asama Maru," m.s. "Kamakura Maru" and m.s. "Tatuta Maru," having a speed of 21 knots, were placed on the Orient-California service.

To keep abreast of the times, the company had in 1939 an extensive shipbuilding program in hand, consisting of: 2 super passenger vessels, each of 26,500 tons, for Orient-California service; 3 passenger vessels, each of 16,500 tons, for Orient-Europe service; 2 passenger vessels, each of 11,400 tons, for Orient-Seattle service; 2 passenger vessels, each of 11,600 tons, for Orient-Australian service; 4 cargo vessels, each of 4,000 tons, for Orient-Shanghai service; in addition to 7 express freighters of 7,000 tons gross. On completion of the above program the total fleet would be 162 vessels of more than 1,000,000 tons gross and the company would rank as one of the largest shipping organizations in the world. (J. BLA.; X.)

**NIPPUR,** an ancient sacred city of Mesopotamia. Nippur lay on the bank of the old course of the Euphrates in 32° N., 45° E. The old bed of the river is represented by present Shatt al Nil, whose dry bed now separates the two main groups of ruins. The city lies in the very heart of Sumeria, between the northern cities of Kish, Cutha and Babylon, to whom it is nearest in position, and the cities of the south. It was the centre of the national cult of the god Enlil, and no doubt owing to its position was the ecclesiastical rival of the southern cities, especially Eridu. The possession of Nippur was an essential for every great dynasty, because the rulers of all the cities throughout the whole of Sumer and Akkad ultimately derived their authority from Enlil, and it is essential in studying the ancient geography of Mesopotamia to remember that the monarchy of the region took its rise from prince-priests, and that even the most powerful monarchs could never afford to separate themselves from the powerful and dominant priesthood. Nippur therefore, although probably never a lay capital, except possibly in later times, throughout its long history always played a very prominent part in Mesopotamian history, and, owing to the passion exercised by the priests for recording every transaction, however minute, on clay tablets, has

left us a most complete record both of its life and of the part which it played in national politics. To-day the wide gap between the two rivers has made the irrigation problem a very difficult one but in ancient times the twin rivers approached one another more closely. The narrow strip between the rivers, scarcely more than thirty miles, could be irrigated by water run from the Euphrates to the Tigris and the land between the Euphrates on which there lay a string of cities and the Tigris was of great agricultural value. Nippur, therefore, apart from its sacred position was a land of great wealth.

The prehistoric city was built on the west bank of the Euphrates, and was grouped about the temple of the earth god. The mound now lies on the east bank of the Shatt al Nil. Extensive remains of cremation have been found in all the earlier pre-Sargonic periods and as a matter of comparison it is interesting to note that in the earliest graves at Ur cremation appears to be a purely ritual survival, and that so far at Kish, even in the earliest graves, no signs of cremation have been found. Painted pottery was also found. In the period of Ur-nina, that is, the end of the fourth millennium B.C., the temple area was enlarged and a great rectangular terrace of plano-convex bricks was built. This terrace extended far beyond the temple area and was large enough to include both the temple and its stage tower (*ziggurat*) at the southern end. There were also store houses, cloisters and priests' rooms on the terrace and a large court north of the temple. This building had an inner court, which was surrounded by thick walls and included rooms in which the temple archives were stored.

The restoration of the original form of the city, especially in later times, is made possible by the discovery of a tablet of the Kassite period, now unfortunately lost, which had upon it a sketch plan of the city. It shows part of the city east of the river and enclosed within its own walls, like the forbidden city of Peking, which lies within its own walls and surrounded by the city itself. This inner city formed an irregular square, with sides about 900 yards long and was surrounded by canals, with quays along the walls. The inner city was itself also divided into two by a canal. The temple enclosure was oriented, its angles pointing towards the cardinal points of the compass. The tower of the pre-Sargonic period was on the north side of the inner court. On the east side, next to the tower, was the temple of Ekur, with its chapels and other buildings.

All the important kings held this temple in great veneration and considered its repair and reconstruction as a very necessary pious duty. Under the Semitic occupation Naram-sin rebuilt the temple and the city walls. His building was partly destroyed by Ur-Engur, whose restoration gave the area the form in which we have it recorded. His terrace of sundried bricks covered an area of about eight acres. The ziggurat at the northwestern edge was approached by an inclined plane on the south-east side and was made of crude bricks faced with burnt bricks, set in bitumen. It contained three stages. The city walls built by Ur-Engur followed the general lines of the walls built by Naram-Sin.

The whole sanctuary was later restored by Assur-bani-pal of Assyria in the 7th century. The city had previous to this time been allowed to fall into comparative decay, partly owing to the predominance of Marduk, the god of Babylon, when that city was politically dominant, but it enjoyed a period of renewed splendour under the Kassite dynasty, but this was only a temporary respite. Assur-bani-pal's restoration however gave it a form in some ways more magnificent than it had ever enjoyed, his great ziggurat measuring 128×190 feet. This was the end of Nippur's glories.

It gradually fell into decay. In the Seleucid period it became a fortress, and was used as such until the close of the Parthian period, in the middle of the third century A.D. From this time onwards the city ceased to be of any importance. It degenerated into a mere village, while some of the old sacred area was used, as in so many Sumerian cities as a cemetery. In the tenth century A.D. the site again became of some importance as a Jewish settlement, although it is possible that there may have been Jews settled on the site even earlier, possibly at the time of the exile. In the 12th century it was the site of a Christian bishopric.

The condition of the ruins is thus described by Langdon: "They are not so extensive as Kish but more compact and massive. . . . The grandeur of these lofty unbroken lines of mountainous ridges, whose concealed buildings lie deep beneath the plain level, cannot be described to conjure sufficiently the imagination of the reader. They do not belie the fame of Nippur in cuneiform inscriptions."

### ANCIENT DOCUMENTS

The excavators of the site were particularly fortunate in the number of ancient documents discovered. The ancient temple library and its archives were not in the temple itself but in a mound to the south. West of the temple there was a commercial and residential quarter, and here, separated from the temple by a canal, were found the important archives of the Kassite kings and business houses of the Neo-Babylonian and Persian periods.

These archives show that the district was a great centre of the cattle industry. Cattle and sheep were driven to Nippur for the different feast days and careful records of every transaction were kept. The details are so full that an issue is recorded of barley porridge to such humble members of the temple staff as the dogs. There were three main sources of revenue for the temple. First there were a series of tolls or dues of various forms. Secondly the temple was a great owner of property and received considerable revenues as rent. Thirdly cattle breeding was carried on. Nippur under the Kassites was an administrative centre, possibly even a capital city. The taxes, which were paid in kind, were either stored here or at the chief city of the district. The record of these taxes is instructive for the side lights thrown on the economic geography of Mesopotamia nearly four thousand years ago. The products which were paid included wheat, sesame, oil, dates, flour and live stock.

The majority of these temple archives of Nippur have been found at Tal Duraihim (Drehem) a city site about six miles south of Nippur, and three miles S.E. of the modern village of Afaj. This city apparently served as the collecting place for the animals used for sacrifices at Nippur. These animals formed part of the taxes payable under the kings of the third dynasty of Ur, and the records are therefore of the greatest value in giving lists of the towns at the time and their assessable value. The ruins of this site consist of a large crescent-shaped mound, some 300 feet from north to south, and 200 feet in width, while the height above the plain is about 40 feet. Langdon is of opinion that whatever the building under this mound may prove to be it is certainly not a temple.

BIBLIOGRAPHY.—J. P. Peters, *Nippur* (1897); H. V. Hilprecht, *Exploration in Bible lands* (Edinburgh 1903); C. S. Fisher, *Excavations at Nippur* (Berlin 1907); A. T. Clay, *Documents from the Temple Archives of Nippur*, Univ. Penns. II. 2 (Philadelphia 1912); E. Chiera, *Legal and Administrative Documents from Nippur*, Univ. Penn. VIII. 1 (Philadelphia 1914); *Cambridge Ancient History* (Vol. I. 1923) Bibliography. (L. H. D. B.)

**NIRVĀNA,** in Buddhist dogmatics, means literally "blowing out," *i.e.*, the blowing out or extinction of the fire of passion in one who attains release. Whether such a person became extinct at death is classed in the Scriptures among the questions which the Buddha refused to answer. The term is probably originally Buddhist, but it is also found in Vedānta to express union with Brahma. (*See* BUDDHA AND BUDDHISM.)

**NISH,** the capital of the Nish department of Serbia, Yugoslavia. Pop. (1931) 35,465, comprising Serbs, Turks, Albanians, Bulgars, Greeks and Jews. The city is not only important commercially, but also strategically since (1) it commands the only two valleys affording easy access from central Europe to the Aegean, (2) it is the meeting-point of several of the chief Balkan highways, and (3) it is the junction on the Belgrade-Nish railway for both Sofia and Salonika, and fortunately, in this respect, is within easy reach of good coal supplies. The town during World War II was one of Yugoslavia's main defense areas and was a principal fortress, the perimeter of the entrenched camp being about 30 m. with outlying modern works. The surrounding heights were fortified after 1886. The Turkish town, on the N. bank of the Nishava, contains the citadel and many mosques and

picturesque old houses among its winding alleys. It is connected by three bridges with the more modern Serbian town on the south bank, which has wide, fairly well-paved streets, a royal palace surrounded by gardens, a cathedral, government offices, banks and several trading associations. Here too, are the government railway repairing sheds, factories for trucks, engines and carriages, an iron foundry, a pork factory, steam flour mills and an electric power station. The barracks are outside the town. Nish is the see of a bishop and the seat of a district prefecture and a tribunal.

The ancient Roman city *Naissus,* which probably superseded a Celtic settlement, was mentioned as an important place by Ptolemy of Alexandria, and the old fortress on the right bank of the river is believed to have been erected on its site. Under its walls in A.D. 269 the Emperor Claudius destroyed the army of the Goths, and within it, in A.D. 274, Constantine the Great was born. The emperor Julian improved its defences but the town was destroyed by the Huns under Attila in the 5th century, and restored by Justinian. In the 9th century the Bulgarians conquered it, but ceded it to the Hungarians in the 11th century, from whom the Byzantine emperor Manuel I. took it in 1173. Towards the end of the 12th century the town was in the hands of the Serbian prince Stephen Nemanya, who there received hospitably the German emperor Frederic Barbarossa and his Crusaders. In 1375 the Turks captured Naissus from the Serbians. In 1443 the Hungarians and the Serbians retook it from the Turks, but in 1456 it again came under Turkish dominion, and remained for more than 300 years the most important Turkish military station on the road between Hungary and Constantinople. In the frequent wars between Austria and Turkey during the 17th and 18th centuries, the Austrians captured Naissus twice (in 1689 and 1737) but were unable to retain it long. In the first Serbo-Turkish rising, the Serbians, defending the approach to Nish in 1809, fired their magazine and destroyed themselves and the enemy. The Turks built a brick tower in which they embedded 900 Serbian skulls. The ruins are still called *Tyele-Koula* (Tower of Skulls). In the Russo-Turkish war (1877–8) the Serbians captured Nish and the town was ceded to them by the treaty of Berlin (1878). Here the National Assembly, before the Constitution of 1901, was regularly held. During World War I the government withdrew to Nish (1915) when Belgrade was occupied by the enemy, but it was not able to stay there. During World War II, the Germans occupied Nish in April 1941.

**NISHAPUR,** a town in the province of Khurasan in Iran, 3,920 ft. above sea level, in 36° 12′ N., and 58° 40′ E., 50 mi. W. of Meshed in one of the most fertile districts of Iran, which produces much grain and cotton. The town, which has shifted its position with the ages, has a circuit of two miles. It has moderately good caravanserais and public baths. Pottery making is a special industry. Nishapur in the old Persian is *Nev-shapur-nev.* The second element of the name is that of its traditional founder Shapur (A.D. 241–272). It was once one of the four great cities of Khurasan (*q.v.*), rivalling Rai (Rhages), but the population is now 22,000 (est.). It was an important place in the 5th century, for Yazdajird (438–457) resided there mostly. During the later Sasanids it is seldom mentioned and when the Arabs came to Khurasan (641–642) it was of so little importance that, as the historian Tabari relates, it did not even have a garrison. But under the Tahirids (820–872) it became a flourishing city and rose to importance during the Samanids (874–999). Toghrul, the first Seljuk ruler, made Nishapur his residence in 1037. In 1153, the Ghuzz Turkmans overran the country and partly destroyed it. In 1208 most of the town was destroyed by earthquake and was hardly rebuilt when it was again destroyed by the Mongols. It was rebuilt, suffered again at the hands of the Mongols (1269) and from another earthquake in 1280, and never rose again to its former greatness.

A few miles to the east stands a fine domed mausoleum, the Gadam Gar (1643). Expeditions of the Metropolitan Museum of Art, New York (1934–40) disclosed rich and significant architectural and artistic remains of both Seljuk and pre-Seljuk times. *See* "Excavations at Nishapur, 1934–35," *Bulletin,* Metropolitan Museum of Art, vol. xxxi; xxxii, sec. 2 (1936); xxxiii, sec. 2 (1937); and vol. xxxvii, (1938–40). Four mi. S.E. of the town, adjacent to the mosque of the Imamzadeh Mahruk (a Moslem saint of the 8th century), is the tomb of the astronomer-poet Omar Khayyam, a fine marble shaft and sarcophagus built in 1934. Nearby is the grave of the celebrated poet and mystic Farid ud Din Attar. At Madan, 32 mi. N.W. of Nishapur, at an elevation of 5,100 ft., are the famous mines which have supplied the world with turquoises for at least 2,000 years.

BIBLIOGRAPHY.—G. N. Curzon, *Persia and the Persian Question* (1892); H. H. Schweinitz, *Orientalische Wanderungen in Turkestan und im nordöstlichen Persien* (1910); P. M. Sykes, "A Sixth Journey in Persia," *Geogr. J.,* xxxvii (1911); H. R. d'Allemagne, *Du Khorasan au pays des Backhtiaris* (1911); A. U. Pope (ed.), *Survey of Persian Art,* vol. ii, pp. 1178, 1212, vol. iv, pl. 488 (1938).

**NISIBIS** (NUSAYBIN), a frontier fortress and trading town of Turkey on the Syrian border about 130 m. N.W. of Mosul, Iraq. It lies on the borderland between the mountains and the plain in 37° N. 41° E. at the point where the Yaghyagha (called in ancient times the Mygdonius) passes through a narrow canyon and enters the plain. In ancient times, and indeed until the 11th century A.D., the plain regions below the town are said to have been wooded and the town was famous for its agricultural products. Strategically, like Edessa (*q.v.*) it commanded the entrance of the valley country from the mountains and has been the site of fighting since Assyrian times to even as late as the 19th century. It also lies on the upper trade route from Mosul to the west and in times of peace has been of importance on this line.

Nisibis has been directed east or west according to the dominant empire of the time. During the Assyrian empire it formed a frontier fort against aggressions from the north, and occupied a similar position in Seleucid times. From the middle of the second century B.C. until the early years of the Christian era it was the residence of the kings of Armenia. Owing to its strength the fortress was of considerable importance during the struggle between Rome and Parthia. It became in early Christian times a religious centre with a Nestorian and a Jacobite bishop. Under the Caliphs it was a frontier fortress and the scene of continuous fighting. Finally it lost most of its prosperity owing to internal troubles, and according to the Arab chroniclers, the compulsory substitution of wheat for fruit crops. It is probable that an insufficient control of the Bedouins of the desert was responsible for much of Nisibis' lost prosperity. It is still a large town of probably over 20,000 inhabitants and the railway to Konia has rendered the site of significance.

**NISI PRIUS,** in English law, a term used to denote generally all actions tried before judges of the king's bench division. For the history and meaning of this term *see* ASSIZE. In the United States a trial at *nisi prius* is a trial of a civil action in a court of record before a judge and jury.

**NISUS,** the name of two Greek legendary figures. (1) Son of Pandion of Athens and king of Megara. He had a purple lock of hair, and as long as it grew on his head the city was safe against all attacks. When Minos (*q.v.*) was besieging the city, Scylla (*q.v.*), daughter of Nisus, was bribed by him or fell violently in love with him, and to gain his favour, cut off the purple lock and gave it to him, thus betraying the city. Nisus fell, or killed himself, during the sack and was turned into a sea-eagle; Scylla swam after Minos' ship, or in punishment for her treachery was tied to the stern and dragged after it, and became a creature called κεῖρις or κίρρις (*ciris*), usually said to be a bird, as yet unidentified, but sometimes a fish; she is constantly pursued by her father. Nisus is the eponym of Nisaea, the harbour of Megara; Scylla is sometimes confused with the monster of the same name (*see* ODYSSEUS); the story is one quite common in Greek and other folklore; a combination of External Soul (*see* Frazer, *Golden Bough* 3rd ed., xi., chap. x.) with Maiden Castle (*see* Rose, *Handbook of Mythology,* chaps. viii., ix.).

*See* Roscher's *Lexikon, s.v.,* for identification of the *ciris;* and D'Arcy Thompson in *Class. Quart.,* xix., 155 ff.

(2) A Trojan, son of Hyrtacus, friend of Euryalus, with whom he is killed in an attempt to get through the besieging force and communicate with Aeneas, Virgil, *Aen.* ix.

**NITERÓI:** *see* NICTHEROY.

**NITHARD** (d 844), Frankish historian, was the illegitimate son of Angilbert, the friend of Charlemagne, by Bertha, a daughter of the great emperor. He was educated at the imperial court and became abbot of St. Riquier *in commendam,* never taking the vows. He fought for Charles the Bald at Fontenoy in June 841, and died as the result of wounds received whilst fighting against the Northmen near Angoulême. The date of his death was probably June 14, 844. In the 11th century his body, with the fatal wound still visible, was found in the grave of his father, Angilbert. Nithard's historical work consists of four books on the history of the Carolingian empire under the turbulent sons of the emperor Louis I, especially during the troubled period between 840 and 843. This *Historiae* or *De dissensionibus filiorum Ludovici pii,* dedicated to Charles the Bald, is valuable for the light which it throws upon the disintegration of the Carolingian empire.

The *Historiae* has been printed several times. Perhaps the best edition is in Band ii. of the *Monumenta Germaniae historica: Scriptores;* it has also been edited by A. Holder (Freiburg, 1882). It has been translated into German by J. von Jasmund (1851; new edition by W. Wattenbach, Leipzig, 1889); and into French in tome iii. of Guizot's *Collection des mémoires* (Paris, 1824). *See* O. Kuntzemüller, *Nithard und sein Geschichtswerk* (Jena, 1873); G. Meyer von Knonau, *Über Nithards vier Bücher Geschichten* (Leipzig, 1866); and W. Wattenbach, *Deutschlands Geschichtsquellen,* Band i. (1904).

**NITHSDALE, WILLIAM MAXWELL,** 5TH EARL OF (1676–1744), Jacobite leader, son of Robert the 4th earl (d. 1696), served the exiled house of Stuart in secret, and was suspected as a Jacobite conspirator. In 1712 he resigned his estate to his son William (d. 1776), reserving a life rent to himself. In 1715 he joined the Jacobite rebels in the north of England and was taken prisoner at Preston, being sent to London for trial. His wife followed him to London. The earl and the other Jacobites were brought to trial in Westminster Hall on Jan. 19, 1716, and condemned to death Feb. 9. The execution was fixed for the 24th. The countess presented a petition to George I. which he refused to receive. With the help of two Jacobite ladies, the countess arranged the escape of her husband from the Tower on the eve of the day fixed for his execution. They lived thenceforward in Rome. The earl died on March 20, 1744, and the countess in 1749.

*See* Sir A. Fraser, *The Book of Carlaverock* (Edinburgh, 1873).

**NITON:** *see* RADON.

**NITRE,** a name given to naturally occurring potassium nitrate; "cubic nitre" is sodium nitrate. The word is adapted from Lat. *nitrum,* which is itself adapted from Gr. *νίτρον.* These terms were originally applied to the naturally occurring sodium carbonate; the connection with potassium nitrate (*sal petrae* or *sal petrosum*) may be traced to Raymondus Lullius's name *sal nitri,* which he distinguished from *nitrum.* In the 16th century the ancient nitrum became altered to natron, a term still used for native sodium carbonate, while *nitrum,* and its adaptation nitre, were retained for potassium nitrate or saltpetre (*q.v.*).

**NITRIC ACID** (*aqua fortis*), an important mineral acid, $HNO_3$. It is mentioned in the *De inventione veritatis* ascribed to Geber, wherein it is obtained by calcining a mixture of nitre, alum and blue vitriol. It was again described by Albert le Grand in the 13th century and by Raimon Lull, who prepared it by heating nitre and clay and called it "eau forte." Glauber devised the process in common use for many years, viz., by heating nitre with strong sulphuric acid. Its true nature was not determined until the 18th century, when A. L. Lavoisier (1776) showed that it contained oxygen, whilst in 1785 H. Cavendish determined its constitution and showed that it could be synthesized by passing a stream of electric sparks through moist air. The acid is found to exist to a slight extent in the free condition in some waters, but chiefly occurs in combination with various metals, as nitrates, principally as nitre or saltpetre, $KNO_3$, and Chile saltpetre, $NaNO_3$. It is formed when a stream of electric sparks is passed through moist air, and in the oxidation of nitrogenous matter in the presence of water.

For experimental purposes it is usually obtained by distilling potassium or sodium nitrate with concentrated sulphuric acid. The acid so obtained usually contains more or less water and some dissolved nitrogen peroxide which gives it a yellowish red colour. It may be purified by redistillation over barium and silver nitrates and then under diminished pressure over urea. On the large scale it is obtained by three methods: (1) from saltpetre and concentrated sulphuric acid; (2) by the catalytic oxidation of ammonia; and (3) by the direct oxidation of nitrogen in the electric arc. In the first and oldest method, Chile saltpetre is distilled with concentrated sulphuric acid in horizontal cast iron stills, the vapours being condensed in a series of stoneware Woulfe's bottles. In practice the theoretical quantity of acid and Chile saltpetre is not used, but the charge is so regulated that the mixture of acid and neutral sodium sulphate formed in the retort remains liquid at the temperature employed, and consequently can be readily removed. (2) The oxidation of ammonia is effected by passing this gas mixed with air or oxygen over a thin coating of spongy platinum deposited on a supporting material and kept at about 600° C. Platinum gauze may replace the sponge, and the gases may be pre-heated at 300–400° C, the heat of reaction then being sufficient to maintain the whole at the required higher temperature. Other catalysts may be used and each has an appropriate suitable temperature; thus, with iron oxide the best temperature is 650–700°. Often a mixture of oxides is more efficient, one acting as a "promoter" for the other. The ammonia must be free from impurities such as phosphine, and a fairly rapid stream of gas is used. The yields may exceed 95% of the theoretical. (3) For the production of nitric acid from air *see* NITROGEN, FIXATION OF. Fuming nitric acid consists of a solution of nitrogen peroxide in concentrated nitric acid and is prepared by distilling dry sodium nitrate with concentrated sulphuric acid.

Nitric acid is a colourless strongly fuming liquid, having a specific gravity of 1·50394 (24·2° C) (V. Veley 1898). It is exceedingly hygroscopic and corrosive. On distillation, the pure acid begins to boil at 78·2° C (W. Ramsay), partial decomposition into water, oxygen and nitrogen peroxide taking place. The acid solidifies when strongly cooled, the solid melting at −47° C. Concentrated nitric acid forms with water a constant-boiling mixture, the composition of which varies according to the pressure at which it is distilled: if distillation is at atmospheric pressure, the resulting acid boils at 120·5° C, contains 68% of $HNO_3$ and possesses a specific gravity of 1·414 (15·5° C). If a more dilute acid than this be distilled, water passes over in excess and the residue in the retort reaches the above composition and boiling point; on distillation of a stronger acid, excess of $HNO_3$ passes into the distillate and the boiling point rises until the values of the constant-boiling mixture are reached. On the hydrates of nitric acid *see* V. Veley, *Jour. Chem. Soc.,* 1903, 83, p. 1015, and F. W. Kuster, *Zeit. anorg. Chem.,* 1904, 41, p. 1. On mixing nitric acid with water there is a rise of temperature and a contraction in volume.

The acid is a powerful oxidizing agent. It attacks most metals readily, usually with production of a nitrate or hydrated oxide of the metal and one or other of the oxides of nitrogen, or occasionally with the production of ammonium salts; magnesium, however, liberates hydrogen from the very dilute acid. Its action on metals depends in most cases on the temperature, strength of the acid, and the nature of the products of reaction. Thus in the case of copper, it is found that the diluted acid acts very slowly upon the metal at first, but as the reaction proceeds the copper dissolves more rapidly up to a certain point and then the rate of solution again diminishes. This is possibly due to the accelerating action of the nitrous acid which is produced in the direct action of the copper on the nitric acid and which, when a certain amount has been formed in the system, begins to decompose, thus

$$3HNO_2 = HNO_3 + 2NO + H_2O.$$

Iron when brought into contact with nitric acid under certain conditions, remains passive to the acid. Thus at 55° C it is passive to an acid of specific gravity 1·42 and at 31° C to an acid of specific gravity 1·38. The cause of this passivity was for long a matter of dispute, but V. R. Evans in 1927 (*J. Chem. Soc.,* p. 1020) succeeded in isolating an actual protective film from passivated iron. Nitric acid is without action on gold, platinum, iridium and rhodium.

A. Hantzsch (*Berichte,* 1925, 55, p. 941) believes that con-

centrated nitric acid is chiefly composed of "nitronium" nitrate, $[N(OH)_3](NO_3)_2$. (*See* also ACIDS.)

The salts of nitric acid, known as *nitrates,* are nearly all readily soluble in water and crystallize well. They are all decomposed when heated to a sufficiently high temperature, with evolution for the most part of oxygen and nitrogen peroxide, leaving a residue of oxide of the metal. They may be recognized by the fact that on the addition of a solution of ferrous sulphate, followed by that of concentrated sulphuric acid (the mixture being kept quite cold), the ferrous sulphate solution becomes of a deep brown colour, owing to the reducing action of the ferrous sulphate on the nitric acid which is liberated by the action of the sulphuric acid on the nitrate. As an alternative method the nitrate may be warmed with some fragments of copper and sulphuric acid which has been diluted with its own volume of water, when characteristic brown vapours will be seen.

Nitric acid finds extensive application in the manufacture of sulphuric acid, certain coal-tar colouring matters, explosives, and in the production of various nitrates.

In medicine, nitric acid is used externally in a pure state as a caustic to destroy chancres, warts and phagadenic ulcers, and diluted preparations are employed in the treatment of dyspepsia, etc. Poisoning by strong nitric acid produces a widespread gastro-enteritis, burning pain in the oesophagus and abdomen and bloody diarrhoea. There may also be blood in the urine. Death occurs from collapse or from secondary destructive changes in the intestinal canal. Characteristic yellow staining of the skin round the mouth from the formation of xanthoproteic acid serves to distinguish it from poisoning by other acids. The antidotes are mild alkalis, together with the use of opium to relieve pain.

(*See* A. Cottrell, *The Manufacture of Nitric Acid and Nitrates,* London, 1923.)

**NITROBENZENE,** the simplest aromatic nitro-compound, $C_6H_5NO_2$, was first isolated in 1834 by E. Mitscherlich, and is prepared commercially by the gradual addition of benzene to a well-cooled mixture of concentrated nitric and sulphuric acids, the oily product being separated, washed with alkali, and then distilled. It is a yellowish liquid possessing a strong smell of oil of bitter almonds. It boils at 209° C, and melts at 5·7° C. The products of its electrolytic reduction vary with the conditions: in sulphuric acid solution it yields para-aminophenol (L. Gattermann, 1893); in alcoholic alkaline solution it yields azoxybenzene; in acid alcoholic solution, benzidine; in ammoniacal alcoholic solution, phenylhydrazine. With chlorine, in the presence of iodine or antimony chloride, it yields meta-chloronitrobenzene. It occasionally acts as an oxidizing agent, as in the preparation of quinoline and fuchsine (magenta, *q.v.*). It is used commercially for the preparation of aniline (*q.v.*) and of benzidine (*q.v.*); and in perfumery (oil of mirbane).

*Dinitrobenzenes,* $C_6H_4(NO_2)_2$.—Ortho-dinitrobenzene, produced in small quantity in the preparation of meta-dinitrobenzene, forms colourless crystals which melt at 116·5° C and boil at 319° C (773 mm.). When boiled with aqueous caustic soda, it yields ortho-nitrophenol. Meta-dinitrobenzene is formed by the direct nitration of nitrobenzene with fuming nitric acid, the product being poured into water and recrystallized from dilute alcohol. It forms practically colourless needles which melt at 89·7° C, and boil at 302·8° C. It is used for the preparation of meta-phenylenediamine. Para-dinitrobenzene results from the action of nitrogen peroxide on an ethereal solution of quinone dioxime; it crystallizes in colourless needles, which melt at 171°–172° C.

*Trinitrobenzenes,* $C_6H_3(NO_2)_3$.—Asymmetrical (1:2:4) trinitrobenzene results from the action of fuming nitric and sulphuric acids on para-dinitrobenzene. It forms yellow crystals, which melt at 57·5° C. When boiled with dilute aqueous caustic soda it yields 2:4-dinitrophenol. Symmetrical (1:3:5) trinitrobenzene is formed by the further nitration of meta-dinitrobenzene with fuming sulphuric and nitric acids; or by the action of water on 2:4:6-trinitrobenzoic acid (German patent 77,353). It crystallizes in prisms which melt at 121° C.

**NITRO-CELLULOSE:** *see* SYNTHETIC FIBRES.

**NITRO-CELLULOSE POWDER:** *see* GUNCOTTON.

**NITRO-COMPOUNDS,** in organic chemistry, compounds containing the univalent radical $NO_2$ directly combined with carbon.

*Aromatic Nitro-compounds.*—The most important nitro-compounds are those of the aromatic series derived from benzene, toluene, xylene and naphthalene, since they find extensive use either in the manufacture of synthetic dyes (*q.v.*) or in the production of high explosives. (*See* articles under EXPLOSIVES and T.N.T.) These aromatic nitro-compounds are manufactured by the direct action of nitric acid on the hydrocarbon, this reaction being generally carried out in the presence of concentrated sulphuric acid which absorbs the water formed during nitration. In this way benzene can be nitrated in three stages to furnish nitrobenzene (*q.v.*), 1:3-dinitrobenzene and 1:3:5-trinitrobenzene. Toluene gives rise to *ortho-* and *para*-nitrotoluene with a small amount of *meta*-nitrotoluene. (*See* CHEMISTRY: *Organic.*) These three isomeric nitro-toluenes undergo further nitration yielding various di- and tri-nitrotoluenes. Of these higher nitration products the most important is 2:4:6-trinitrotoluene or T.N.T.

Naphthalene on nitration yields almost exclusively $\alpha$-nitronaphthalene, and energetic nitration of this product gives 1:5- and 1:8-dinitronaphthalenes. These dinitro-compounds and their higher nitration products have been utilised in explosives. (*See* also NAPHTHALENE.)

Nitrobenzene (*q.v.*) and *ortho*-nitrotoluene (m.p. 10·5° C, b.p. 218° C) are pale yellow oils distilling without decomposition and having characteristic odours (artificial oil of mirbane) recalling that of oil of bitter almonds. *Para*-nitrotoluene melts at 54° C and boils at 230° C.

These nitro-compounds yield on reduction in acid media the aromatic amines, nitrobenzene giving aniline and the nitrotoluenes furnishing the corresponding toluidines. In alkaline media the reduction leads successively to azoxy-, azo- and hydrazo-compounds. Thus nitrobenzene passes successively into azoxybenzene, azobenzene and hydrazobenzene. The last of these on treatment with acid changes into benzidine (*q.v.*). This series of chemical changes constitutes an important use for nitrobenzene, and in a similar manner *ortho*-nitrotoluene is employed in the manufacture of tolidine, a valuable colour intermediate.

The aromatic dinitro-compounds are also reducible to aromatic bases, 1:3-dinitrobenzene giving *meta*phenylenediamine, and 2:4-dinitrotoluene giving 2:4-tolylenediamine. Both these diamines are used in colour making. The partial reduction of 1:3-dinitrobenzene with sodium disulphide gives *meta*nitroaniline, $NO_2{\cdot}C_6H_4{\cdot}NH_2$, this base being useful in the colour industry and also in the production of an exceptionally powerful high explosive, tetranitroaniline or T.N.A., $C_6H(NO_2)_4{\cdot}NH_2$. Nitrobenzene reduced in neutral solution furnishes $\beta$-phenylhydroxylamine, and this is readily transformed to *para*-aminophenol, which is both a colour intermediate and a photographic developer ("Rodinal").

The aromatic nitro-compounds are employed as oxidising agents. Nitrobenzene or *ortho*-nitrotoluene is employed with a ferrous chloride catalyst to oxidise a mixture of aniline and toluidine in the manufacture of magenta. Nitrobenzene and its homologues are also used as the oxidising agent in the Skraup reaction for quinoline and allied bases.

*Aliphatic Nitro-compounds* (Nitro-paraffins).—In this series the nitro-group is attached directly to an alkyl radical. These aliphatic nitro-compounds are chiefly of academic interest but they are also useful in the diagnosis of the various types of alcohols (*q.v.*). They are prepared by the action of alkyl iodides on silver nitrite (V. Meyer, 1874). They are also produced by the action of sodium nitrite on the $\alpha$-halogenated fatty acids; the $\alpha$-nitro- fatty acids first formed readily lose carbon dioxide and yield the nitro-paraffin (H. Kolbe, 1872).

Among the higher paraffins, for example normal hexane and octane, nitro-paraffins are obtainable by direct nitration as in the aromatic series (M. Konowalow, 1892; R. A. Worstall, 1898). The nitro-paraffins are colourless, fragrant liquids distilling without decomposition. Primary and secondary aliphatic nitro-compounds containing respectively the groups $\cdot CH_2{\cdot}NO_2$ and $>CH{\cdot}NO_2$ form metallic derivatives, for example sodium salts, which according to A. Hantzsch are derived from the isomeric *iso*-nitro-compounds, $R{:}NO{\cdot}OH$. This variety is the truly acidic form and the ordinary primary and secondary nitro-paraffins are

to be regarded as *pseudo*-acids. The reactions of the nitro-paraffins with nitrous acid are characteristic and utilisable in discriminating between primary, secondary and tertiary alcohols (V. Meyer, 1875). The alcohols are converted successively into iodides and nitro-paraffins. The primary paraffin yields a colourless *nitrolic* acid, $R{\cdot}C(NOH){\cdot}NO$, which forms a red alkali salt; the secondary paraffin gives a blue *pseudonitrole*, $RR'C(NO_2){\cdot}NO$, whereas the tertiary nitro-paraffin, $RR'R''{\cdot}C{\cdot}NO_2$, is not acted on by nitrous acid and no colour effect is observed.

The nitro-paraffins are reduced by stannous chloride to $\beta$-alkylhydroxylamines and thence to aliphatic amines.

*Nitromethane,* $CH_3{\cdot}NO_2$, a colourless oil boiling at 101° C, is obtained by the action of methyl iodide on silver nitrite.

*Chloropicrin,* $CCl_3{\cdot}NO_2$, a substance employed in chemical warfare (*q.v.*), is a liquid of suffocating odour, boils at 112° C, and is obtained by the action of calcium chlorohypochlorite (chloride of lime) on picric acid.

*Phenylnitromethane,* $C_6H_5{\cdot}CH_2{\cdot}NO_2$, an interesting example of a nitro-compound of mixed aliphatic-aromatic type and isomeric with the nitrotoluenes (*v. supra*), prepared by the action of benzyl chloride on silver nitrite, is a colourless oily liquid boiling at 225–227° C and somewhat soluble in water. It does not give a coloration with ferric chloride. It forms a sodium salt, however, from the aqueous solution of which mineral acid precipitates a solid isomeric form of phenylnitromethane melting at 84° C. This solid form gradually passes into the oily variety. The solid isomeride gives a reddish-brown coloration with ferric chloride and reacts with other reagents which serve to identify the hydroxyl group. Hence it is to be regarded as the *aci*-form of phenyl-nitromethane having the constitution $C_6H_5{\cdot}CH{:}NO{\cdot}OH$, and its existence affords support to Hantzsch's theory that the ordinary primary and secondary aliphatic nitro-compounds are *pseudo*-acids. (G. T. M.)

**NITROGEN,** is a colourless, odourless, tasteless gas, which is incombustible and does not support combustion, and is one of the most widespread and indispensable elements. Symbol N, atomic number 7, atomic weight 14·008. Its existence was first recognized by Scheele (1772) who showed that common air consists of at least two gases, which he called *foul air* and *fire air*. He obtained the foul air (nitrogen) on removal of the fire air (oxygen) by exposure to various combustible or oxidizable substances, and found that the residue would not support respiration or combustion. Lavoisier confirmed Scheele's experiments and gave to foul air the name *azote,* because of its inability to support life. The name nitrogen was introduced later by Chaptal to indicate that the element is a constituent of nitre.

Nitrogen is present in the atmosphere to the extent of approximately 78% by volume and 75·5% by weight, and serves to dilute the oxygen. It is also found in the free state in many meteorites and in volcanic gases, whilst its presence in the atmosphere of the sun and in certain stars and nebulae is revealed by the spectroscope. Large quantities of nitrogen occur in combination with other elements, *e.g.,* in potassium nitrate (nitre or saltpetre), sodium nitrate (Chili saltpetre), ammonium salts, in rain, soil and guano, and as complex organic compounds (proteins) in all living organisms.

**Preparation and Uses.**—Nitrogen may be prepared (1) from the atmosphere by removal of the oxygen, or (2) from its compounds.

(1) The oxygen may be removed from air either by exposure to phosphorus in the cold (burning phosphorus is not so effective), to moist iron filings, an alkaline solution of pyrogallol, an acid solution of chromous chloride or cuprous chloride, or metallic copper in the presence of hydrochloric acid or ammonia, or by passing the air over red-hot copper.

On the large scale nitrogen is manufactured almost entirely by the fractional distillation of liquid air. Since it is more volatile than oxygen it evaporates first, and is marketed in grey cylinders under a pressure of about 120 atm. This gas contains most of the helium and neon present in the air (*see* ATMOSPHERE), but the argon is left with the oxygen. Some industrial nitrogen may be made by passing air over heated copper, the copper oxide being afterwards reduced by heating in a current of water gas.

(2) Pure nitrogen is prepared from its compounds: (*a*) By heating a slightly acid solution of ammonium nitrite (or a mixture of sodium nitrite and ammonium chloride), $NH_4NO_2 = N_2 + 2H_2O$; (*b*) by heating ammonium dichromate, $(NH_4)_2Cr_2O_7 = Cr_2O_3 + 4H_2O + N_2$; or (*c*) by passing a mixture of nitric oxide and ammonia gas over red-hot copper, $6NO + 4NH_3 = 5N_2 + 6H_2O$.

Nitrogen gas is used in filling electric lamps to prevent the blackening of the bulb by volatilized metal from the filament and to enable the latter to be run at a higher temperature, but argon (*q.v.*) is superior for this purpose. High-temperature thermometers are sometimes filled with compressed nitrogen. Large quantities of nitrogen are also employed for the production of synthetic ammonia and other nitrogen compounds which are finally converted into dyes, drugs, explosives or fertilizers.

**Properties.**—Nitrogen gas is only slightly soluble in water, but one volume of liquid oxygen dissolves about 450 volumes of the gas. When the gas is strongly cooled under pressure, nitrogen is obtained as a colourless liquid boiling at $-195{\cdot}81° \pm 0{\cdot}02°$ C (Henning and Heuse, 1924), at which temperature it has a specific gravity 0·8042. The critical temperature is $-147{\cdot}13°$ C and the critical pressure is 33·49 atm. When evaporated quickly under reduced pressure, the liquid yields a colourless solid melting at $-210{\cdot}5°$ C under a pressure of 86mm. The density of pure nitrogen at 0° C and 760mm. pressure is 1·25051gm. per litre (Moles and Clavera, 1924); the mean value of a number of different workers is 1·25056gm. per litre under standard conditions (0° C, 760mm., g=980·665).

The accepted value for the atomic weight of nitrogen is 14·008 (1927, O=16); according to Aston the element has no isotopes and is an exception to the whole-number rule. Rutherford has shown that the nitrogen atom is disintegrated by the impact of swift $\alpha$-particles, and hydrogen atoms are expelled from its nucleus.

Nitrogen gas is somewhat inert, but it can unite directly under certain conditions with several elements: oxygen, hydrogen, boron, silicon, tungsten, titanium, manganese, vanadium, calcium, barium, magnesium, lithium, tantalum and (probably) carbon. The compounds with metals (nitrides) are generally decomposed by water with evolution of ammonia or some other gas.

**The Nitrogen Cycle.**—Nitrogen is an essential constituent of animal and vegetable tissues. Animals derive the nitrogen of their tissue proteins partly from other animal proteins and partly (sometimes wholly) from plant proteins. Plants build up their proteins from inorganic nitrogen compounds in the soil and to some extent from free nitrogen in the atmosphere. Berthelot found that sterilized soils do not take up nitrogen from the air, whilst unsterilized soils do, and he concluded that assimilation is due to micro-organisms. These were found (Winogradsky, 1895; Beijerinck, 1901) to be a *Clostridium* (*C. Pasteurianum*), anaërobic, *i.e.,* incapable of functioning in presence of oxygen unless protected by certain bacteria, and several varieties of bacteria of which the most active is *Azotobacter chroöcoccum.* The amount of nitrogen fixed by these bacteria increases by 30% if certain protozoa are present in the soil, although protozoa feed on bacteria.

Atmospheric nitrogen is also fixed by the co-operative action of bacteria and certain plants, chiefly *Leguminosae,* such as peas, beans and clover. The parasitic bacteria are present in small nodules on the roots of the plants, which are grown on a large scale in order to restore the nitrogen content of soils.

Large quantities of nitrogen are also fixed as oxides by electrical discharges in the atmosphere, and conveyed to the soil as nitric and nitrous acids by rain, nitrates and nitrites being formed in the soil. Altogether about 250,000 tons of nitric acid are said to be formed in this way in 24 hours. Nitrites and ammonium compounds are frequently of little use as plant foods and hence they must first be oxidized to nitrates by special soil bacteria, the process being known as "nitrification." Various other kinds of bacteria bring about denitrification in the soil and by their agency considerable quantities of gaseous nitrogen are returned to the air. The combined nitrogen content of cultivated soil is generally

enriched and renewed by means of nitrogenous fertilizers, such as nitrates and ammonium salts.

**Compounds of Nitrogen and Hydrogen.**—Nitrogen combines with hydrogen to form three compounds—two bases, ammonia (*q.v.*), $NH_3$, and hydrazine, $N_2H_4$; and an acid, hydrazoic acid or azoimide (*q.v.*), $N_3H$. Secondary compounds of ammonia and hydrazine with hydrazoic acid are known, such as $N_4H_4$ and $N_5H_5$.

*Hydrazine* (diamide), $N_2H_4$, was originally obtained by Curtius (1887) from organic compounds containing two nitrogen atoms combined together. It is prepared commercially by a process due to Raschig (1907). Sodium hypochlorite solution is mixed with a small quantity of glue and warmed with an excess of concentrated ammonia. After addition of sulphuric acid and cooling, hydrazine sulphate, $2N_2H_4{\cdot}H_2SO_4$, crystallizes out. When the sulphate is distilled under reduced pressure with concentrated potash solution, a colourless fuming liquid is obtained, called hydrazine hydrate. Anhydrous hydrazine is obtained by distilling the hydrate with solid caustic soda or barium oxide under reduced pressure. It is a colourless liquid, b.p. 113·5° C, which solidifies to white crystals, m.p. 1·4°, is poisonous, decomposes on heating ($3N_2H_4 = N_2 + 4NH_3$), and reacts violently with the halogens. In solution hydrazine acts as a weak base and forms two series of salts, *e.g.*, $N_2H_4{\cdot}HCl$; $N_2H_4{\cdot}2HCl$. Hydrazine and its salts are the most powerful reducing agents known, precipitating many metals from solutions of their salts. It rapidly destroys rubber and cork and when hot attacks glass.

*Hydrazoic acid,* also discovered by Curtius (1890), is formed by the action of an oxidizing agent, *e.g.*, nitric acid, on hydrazine; its sodium salt is formed by passing nitrous oxide over heated sodamide, $NaNH_2 + N_2O = NaN_3 + H_2O$; when pure it is a colourless liquid (b.p. 37°, f.p. −80°) with an exceedingly irritating odour. It is very poisonous and dangerously explosive, decomposing with a blue flash on heating. The solution is strongly acid and dissolves many metals with evolution of hydrogen and ammonia, forming salts called azides. These salts, especially those of the heavy metals, are explosive, and lead azide (*q.v.*) is sometimes used as a detonator. The compounds $N_4H_4$ and $N_5H_5$ are colourless explosive crystals obtained by neutralizing hydrazoic acid with ammonia and hydrazine respectively.

**Oxides of Nitrogen.**—Five oxides of nitrogen are known, and the series is an excellent example of the Law of Multiple Proportions: Nitrous oxide, $N_2O$; nitric oxide, NO; nitrogen trioxide, $N_2O_3$; nitrogen peroxide, $NO_2$ and $N_2O_4$; nitrogen pentoxide, $N_2O_5$. Nitrogen in a still higher state of oxidation exists in an unstable pernitric acid.

*Nitrous oxide,* $N_2O$, was obtained by Priestley (1772) by exposing "nitrous" air (NO) to moist iron filings. A decrease in volume occurred, and the remaining gas supported combustion better than common air. It was studied by Davy (1799), who gave it the name nitrous oxide, prepared it by the method now employed, viz., by heating ammonium nitrate ($NH_4NO_3 = 2H_2O + N_2O$), and also discovered its anaesthetic properties. It is also produced by the reduction of nitric acid under certain conditions, *e.g.*, by the action of zinc on the dilute acid. Pure nitrous oxide may be obtained by mixing solutions of hydroxylamine hydrochloride and sodium nitrite in equimolecular proportions: $NH_2OH + HNO_2 = N_2O + 2H_2O$. Nitrous oxide may be synthesized from the elements under special conditions (Chapman, Goodman and Shepherd, 1926).

The gas is colourless, and has a sweetish odour and taste. Its density is 1·9777 gm. per litre, and at 15° C one volume of water dissolves 0·7778 volume of nitrous oxide. The solution, however, is neutral, showing that the gas is not the true anhydride of hyponitrous acid, $H_2N_2O_2$. It is more soluble in alcohol. Nitrous oxide supports combustion better than air because it decomposes into its elements at moderately low temperatures (beginning at 520° C) and yields a gas of which one-third by volume is oxygen. It is endothermic, that is, contains more energy than the elements from which it is formed, and can be decomposed into nitrogen and oxygen by the explosion of a detonator.

Nitrous oxide on cooling or under a pressure of 50 atm. at 15° C forms a colourless liquid, which boils at −88·7° C and on rapid evaporation yields a white solid, m.p. −102·3° C. The critical temperature is 36·5° C and the critical pressure 71·66 atm. The chief use of nitrous oxide is as an anaesthetic for operations of short duration, but prolonged inhalation causes death. About 22 litres of the gas are required to produce insensibility and if mixed with about one-quarter of its volume of oxygen an intoxicating effect often results, hence the name "laughing gas." The decomposition of ammonium nitrate is usually employed as the manufacturing process but the temperature needs careful regulation to avoid the formation of nitrogen, ammonia and nitric oxide. One kilogram of ammonium nitrate gives 182 litres of the gas, which is purified by passage through solutions of ferrous sulphate, caustic potash and milk of lime. The product is marketed in the liquid form under pressure in steel cylinders.

*Nitric oxide,* NO, was probably first obtained by Van Helmont, but was first recognized as a definite gas by Priestley (1772), who prepared it by the action of dilute nitric acid on copper or mercury: $3Cu + 8HNO_3 = 3Cu(NO_3)_2 + 2NO + 4H_2O$. When prepared in this way the gas is liable to contain free nitrogen and nitrous oxide. The pure gas is obtained by dropping a mixture of potassium nitrite and potassium ferrocyanide solutions into dilute acetic acid: $K_4FeC_6N_6 + KNO_2 + 2CH_3{\cdot}COOH = K_3FeC_6N_6 + 2CH_3{\cdot}COOK + H_2O + NO$. The gas may be collected over water or, if required pure, over mercury. It is colourless and has a density of 1·3402gm. per litre, slightly greater than that of air. At 15° C one volume of water dissolves only 0·051 volumes of the gas. It is not very easily liquefied and has a boiling point of −150·2° C and a melting point of −163·6° C. The critical temperature is −96° and the critical pressure 64 atmospheres.

Nitric oxide is the most stable oxide of nitrogen and is only dissociated into its elements to about 3·5% at 1,000° C. Consequently, burning substances will only continue to burn in the gas if they previously attain this temperature. A mixture of nitric oxide and carbon disulphide vapour burns with a brilliant lilac-coloured flame, very rich in actinic rays. Nitric oxide combines readily with oxygen to form the dioxide, $NO_2$, which appears as red fumes, but a short time of contact between the gases is required for complete oxidation. The oxidation of nitric oxide is of technical importance (*see* NITROGEN, FIXATION OF) and has been the subject of a considerable amount of research. Nitric oxide is absorbed by cold ferrous sulphate solution forming a black compound, but it is readily expelled again by heating. The best absorbent for the gas is a mixture of caustic soda and sodium sulphite solutions, sodium nitrososulphate, $Na_2(NO)_2SO_3$ being formed. Nitric oxide and all the higher oxides of nitrogen are poisonous. At the temperature of liquid oxygen, nitric oxide reacts with fluorine ($4NO + F_2 = 2NO_2F + N_2$) to form *nitryl fluoride,* the only known halide of nitric acid. It melts at −139° C and boils at −63·5° C.

*Nitrogen trioxide* (nitrous anhydride), $N_2O_3$, was discovered by Glauber. When nitric acid (56%) is distilled with arsenious oxide or starch, and the vapours are cooled with a freezing mixture, a dark blue liquid is obtained which is crude nitrogen trioxide: $2HNO_3 + As_2O_3 = As_2O_5 + H_2O + N_2O_3$. On evaporation, the liquid decomposes almost completely into nitric oxide and nitrogen peroxide, but the two gases recombine on cooling: $NO + NO_2 \rightleftarrows N_2O_3$. H. B. Baker has shown that when the liquid is dried by long exposure to phosphorus pentoxide it may be evaporated without decomposition, but the molecules in the vapour are $N_4O_6$. Nitrogen trioxide is the anhydride of nitrous acid, but only traces of this are formed by the action of water, since it is very unstable and the blue solution decomposes, partly into water and the anhydride (to which the colour is due) and partly with evolution of nitric oxide and formation of nitric acid: $3HNO_2 = HNO_3 + 2NO + H_2O$. Although the gas is largely composed of nitric oxide and nitrogen peroxide, it is rapidly absorbed by solutions of alkalis with formation of nitrites, *e.g.*, sodium nitrite, and by concentrated sulphuric acid with formation of nitroso-sulphuric acid ("chamber crystals"), $SO_2(OH){\cdot}O{\cdot}NO$.

*Sodium nitrite,* $NaNO_2$ is an important salt used in many organic preparations, *e.g.*, of dyestuffs, and is manufactured by heating molten sodium nitrate with metallic lead, by reducing sodium nitrate in presence of sodium hydroxide with sulphur

($3NaNO_3+S+2NaOH=Na_2SO_4+3NaNO_2+H_2O$), or, usually, by absorbing higher oxides of nitrogen obtained by the oxidation of air in the arc process or by the oxidation of ammonia, in sodium hydroxide or carbonate solutions. Nitrites are reducing agents, being converted to nitrates, but they also liberate iodine from potassium iodide, being reduced to nitric oxide.

The chloride of nitrous acid, *nitrosyl chloride,* NOCl, is a yellow gas formed by the direct union of nitric oxide and chlorine, by the action of phosphorus pentachloride on sodium nitrite, or by heating nitroso-sulphuric acid with sodium chloride.

*Nitrogen peroxide* (dioxide or tetroxide), $NO_2$ or $N_2O_4$, is formed as a reddish-brown gas by the direct union of nitric oxide and oxygen. The later stages of this reaction are somewhat slow. It is more conveniently obtained by heating lead nitrate, $2Pb(NO_3)_2=2PbO+4NO_2+O_2$, and condensing the nitrogen peroxide to a liquid in a tube cooled in a freezing mixture, or (most conveniently and in a very pure state) by heating chamber crystals with potassium nitrate: $SO_2(OH)\cdot O\cdot NO+KNO_3=KHSO_4+2NO_2$. Nitrogen peroxide in a freezing mixture solidifies to nearly colourless crystals, melting at −9·04°C to a honey-yellow liquid. With rise of temperature this becomes reddish-brown and boils at 21·9° C, giving a reddish-brown vapour. The colour of the gas becomes deeper on heating; at 140°C it is nearly black. These colour changes are due to the existence of two forms of nitrogen peroxide: a colourless form, $N_2O_4$, and a strongly coloured form, $NO_2$. The conversion of $N_2O_4$ into $NO_2$ occurs in the liquid; in the vapour the change may be followed by the decrease in the vapour density due to dissociation: $N_2O_4 \rightleftarrows 2NO_2$. The dissociation is complete at 140°C; at higher temperatures $NO_2$ decomposes into NO and oxygen. On cooling the reverse changes occur.

Nitrogen peroxide supports the combustion of strongly burning phosphorus; it is decomposed at the temperature of the flame with formation of oxygen. A mixture of the gas with hydrogen is reduced to ammonia in contact with heated platinum. In contact with water, nitrogen peroxide is absorbed with the production of nitrous and nitric acids; the former then decomposes with formation of $N_2O_3$ and NO as explained above. The absorption of the gas with the formation of nitric acid, in presence of air or oxygen, which is an important industrial process, is therefore attended with difficulty. In presence of alkalis, nitrogen peroxide is absorbed with production of nitrite and nitrate: $2KOH+N_2O_4=KNO_2+KNO_3+H_2O$. Liquid nitrogen peroxide forms a violently explosive mixture with petrol or other liquid hydrocarbons, and bombs filled with the mixture have been used in aerial bombardment. The gas, largely diluted with air, is used in bleaching flour.

*Hyponitrous acid,* $H_2N_2O_2$, $(HON)_2$, is produced in the form of a salt by reducing nitrites with sodium amalgam (Divers, 1871), $2NaNO_2+4Na+2H_2O=Na_2N_2O_2+4NaOH$. The free acid is obtained in the form of explosive crystals by the decomposition of the silver salt with hydrogen chloride in dry ether. The acid and its salts are powerful reducing agents. Salts of an acid $H_2N_2O_3$ (*nitrohydroxylamic acid*), intermediate between hyponitrous acid and nitrous acid, are also known. There is an isomeride of hyponitrous acid, *nitramide,* $NO_2\cdot NH_2$.

*Nitrogen pentoxide* (nitric anhydride), $N_2O_5$, first prepared by Deville (1849), is best obtained by the removal of water, by means of phosphoric oxide, from cooled, concentrated nitric acid: $2HNO_3=N_2O_5+H_2O$. The product is distilled in a current of ozonized oxygen, dried over phosphoric oxide and condensed in a vessel cooled by solid carbon dioxide and ether. An alternative method is to pass ozonized oxygen through cooled, liquid nitrogen tetroxide: $N_2O_4+O_3=N_2O_5+O_2$. Crystals of nitrogen pentoxide are stable below 0°C but are very hygroscopic. At ordinary temperatures, especially on exposure to light, slow decomposition occurs into nitrogen peroxide and oxygen, while on heating the crystals melt with decomposition at 29·5°C. Sudden heating causes explosion. Nitrogen pentoxide dissolves in water forming nitric acid. Phosphorus and potassium burn in the liquid pentoxide on warming, and charcoal burns if previously ignited.

*Nitroso-nitrogen trioxide* $(N_3O_4)_x$, is a greenish solid obtained by passing nitric oxide through liquid oxygen, or by the action of air on solid nitric oxide at the temperature of liquid air. It decomposes into nitrogen trioxide and nitric oxide above the temperature of liquid air (R. L. Hasche, 1925).

**Nitrogen Halides.**—*Nitrogen trichloride,* $NCl_3$. Nitrogen does not combine directly with halogens, but compounds may be obtained indirectly. Nitrogen trichloride was obtained by Dulong (1811) by the action of chlorine on ammonium chloride solution. It can also be produced by the electrolysis of concentrated ammonium chloride solution or by treating ammonia with excess of chlorine. Gattermann showed that the latter reaction takes place in three stages: $NH_3+Cl_2=NH_2Cl+HCl$; $NH_2Cl+Cl_2=NHCl_2+HCl$; $NHCl_2+Cl_2=NCl_3+HCl$. The intermediate compound $NH_2Cl$, monochloramine, has been isolated and forms colourless crystals melting at −66° C. It is unstable and explosive.

Nitrogen trichloride is a very dangerously explosive, volatile, yellow oil, boiling at 71°C. The vapour has a pungent odour and attacks the eyes and mucous membranes. The liquid explodes on contact with many substances or on exposure to bright light, but its solution in benzene may be safely handled in the dark. It is destroyed by ammonia.

*Nitrogen iodide.* Courtois (1812) obtained a black explosive powder by adding iodine to ammonia solution. This so-called "nitrogen iodine" was proved by Chattaway and Orton (1900) to be really the compound $NI_3\cdot NH_3$ and $NI_3$ is not known. When dry the substance explodes violently even when touched with a feather; in some cases the moist substance also explodes. It is an active oxidizing agent, and in all probability first forms hypoiodous acid, HOI, in presence of water. It is decomposed on exposure to light.

BIBLIOGRAPHY.—Roscoe and Schorlemmer, *Treatise on Chemistry,* vol. i.; Abegg, *Handbuch der anorganischen Chemie,* vol. iii., part 3 (Leipzig, 1907, with bibliography); Partington, *Inorganic Chemistry.* Technical: Worden, *Technology of Cellulose Esters,* vol. i., part 2 (1921); Waeser, trans. Fyleman, *The Atmospheric Nitrogen Industry* (1926); Partington and Parker, *The Nitrogen Industry* (1922) (semi-popular, with descriptions of processes and plates); Hackspill, *L'Azote* (1922) (brief, but covers a wide field); Maxted, *Ammonia and the Nitrides* (London, 1922); Thorpe, *Dictionary of Applied Chemistry,* detailed articles (London, 1921–27); *Report of the Nitrogen Products Committee* (London, 1919), with Supplementary Report, 1921 (mainly statistical). (J. R. P.)

**NITROGEN, FIXATION OF.** Compared with the enormous quantity of nitrogen contained in the atmosphere, estimated at about 5·8 metric tons over each square yard of the earth's surface, the amount circulating in animals and plants is small, perhaps 1 in 500,000. Continual interchange takes place between atmospheric and combined nitrogen; some is returned to the soil as nitric acid in rain, some is fixed by the bacilli in the nodules formed on the roots of leguminous plants. Much of this nitrogen finds its way into the bodies of animals and plants; on the decay of such bodies ammonia is produced, and some of this is acted on by denitrifying bacteria which return the nitrogen to the air in an elementary condition. Until recent years the only artificial nitrogenous fertilizers used on an extensive scale were sodium nitrate from Chile and ammonium sulphate recovered from the ammoniacal liquors of gas-works and coke-ovens.

In ordinary circumstances, nitrogen is somewhat inert, but Henry Cavendish (1785) discovered that it unites with oxygen when electric sparks are passed through a mixture of the gases, and W. F. Donkin later obtained ammonia by the action of a silent electric discharge on a mixture of nitrogen and hydrogen. Any idea of using these reactions technically was abandoned for many years and more attention was paid to the possibility of synthesizing cyanides. As early as 1828 Desfosses found that a cyanide was produced when nitrogen was passed over a heated mixture of carbon and an alkali or alkaline carbonate, $N_2+4C+K_2CO_3=2KCN+3CO$. If baryta be used in place of an alkali, barium cyanide is formed, and since this compound gives ammonia on heating strongly in steam, leaving a residue from which the baryta may be recovered, the reactions afford a possible technical process for the fixation of nitrogen (Margueritte and Sourdeval, 1860).

The establishment of the calcium carbide industry has made it

possible to combine nitrogen with carbon commercially, the calcium cyanamide produced giving calcium carbonate and ammonia as ultimate products of hydrolysis (A. R. Frank and N. Caro, 1895–8), $CaC_2+N_2=C+CaCN_2$ and $CaCN_2+3H_2O=CaCO_3+2NH_3$. This method underwent rapid development after the discovery that calcium cyanamide might be used directly as a nitrogenous fertilizer (1901). Certain metals form compounds with nitrogen which yield hydroxides and ammonia on treatment with water, *e.g.*, (a) $Li_3N+3H_2O=3LiOH+NH_3$; (b) $Mg_3N_2+6H_2O=3Mg(OH)_2+2NH_3$; (c) $AlN+3H_2O=Al(OH)_3+NH_3$. The price of the metals precludes their employment, but the discovery of O. Serpek, that aluminium nitride is formed when aluminium oxide (or bauxite) and carbon are heated in an atmosphere of nitrogen was actually used on a technical scale.

The development of nitrogen fixation during the present century has been made possible by a better understanding of the thermodynamics of chemical change and increased engineering resources. The manufacture of cyanamide was established rapidly as the necessary carbide was available and its production thoroughly understood. The actual reaction between carbide and nitrogen is exothermic (heat is evolved), and when initiated proceeds to completion. Nitrates and nitrites were manufactured on a large scale after 1903 by combining nitrogen and oxygen to nitric oxide at the temperature of the electric arc, and subsequently oxidizing the nitric oxide to nitric acid in the presence of water. Although the nitric oxide formation is endothermic (heat is absorbed), the large supply of energy was obtained at a cheap rate where water-power was available, notably in Norway. The exothermic synthesis of ammonia was the last fixation process to be developed technically; this was due to the slowness of the reaction $N_2+3H_2\rightleftarrows 2NH_3$.

**Production.**—Until the outbreak of the World War, the production of nitrates from ammonia had no apparent technical advantage. W. Ostwald had succeeded in greatly improving the yield of nitric oxide by the combustion of ammonia, $4NH_3+5O_2=4NO+6H_2O$, and, with the shortage of nitrates, the process found adoption. The production of nitric acid from ammonia has now attained great importance, for whilst both ammonium salts and nitrates are used as fertilizers, the latter act more readily and hence enjoy considerable demand. It seems now to be more economical to use a given amount of electrical energy in the synthesis of ammonia and to burn this to nitric oxide rather than to use it in the direct formation of the latter compound. Thus in 1913 the greater portion of the combined nitrogen used in agriculture and the arts was derived either from Chilean nitrate or from ammonia compounds recovered from coke-ovens or gas-works, whilst at the present time synthetic nitrogen compounds predominate. The following figures for production of combined nitrogen are given on the authority of J. H. Lucas, *L'Industrie Chimique* (Jan. 1928, p. 11).

| | 1913–14 | | 1925–26 | | 1926–27 | |
|---|---|---|---|---|---|---|
| | Tons | % | Tons | % | Tons | % |
| Chilean nitrate | 425,000 | 56·66 | 400,000 | 30·0 | 210,000 | 16·8 |
| Recovered ammonia | 265,000 | 35·34 | 345,000 | 25·9 | 345,000 | 27·6 |
| Synthetic compounds | 60,000 | 8·00 | 589,000 | 44·1 | 695,000 | 55·6 |
| | 750,000 | | 1,334,000 | | 1,250,000 | |

The set-back in Chilean nitrate seems to have been temporary, for there was a recovery in consumption in 1928. A further increase took place in the fixation of nitrogen. Statistics given by F. A. Ernst and M. S. Sherman of the U.S.A. Fixed Nitrogen Laboratory (*Industrial and Engineering Chemistry,* Feb. 1927) assign the nitrogen fixed by synthetic processes in 1925 as follows:

| | Tons | % |
|---|---|---|
| By arc process | 41,000 | 6·7 |
| As cyanamide | 188,000 | 30·3 |
| As ammonia | 390,000 | 63·0 |
| | 619,000 | 100·0 |

The figures for cyanamide are possibly too low.

According to Ernst and Sherman, fixation of nitrogen has attained the largest proportions in Germany, where the annual capacity of plants is stated to be:—(a) arc process, 4,500; (b) cyanamide, 94,000; (c) synthetic ammonia, 402,500 in tons of nitrogen. France, Italy, Japan, Norway and Canada are also noted for large plant capacity. Respecting the United States, M. S. Sherman (*Ind. and Eng. Chem.*, Jan. 1928) states that 12,800 tons were fixed in 1926 whilst the probable figure for 1927 is 23,000 tons. Production is rapidly increasing in Great Britain and the Billingham Works which were making about 65 tons of ammonia *per diem* in 1926 are expected to attain an annual output of 750,000 tons of ammonium sulphate (over 150,000 tons of nitrogen) in 1930. The sulphate radicle is now frequently obtained from natural calcium sulphate (anhydrite or gypsum) by utilizing the reaction, $CaSO_4+2NH_3+CO_2+H_2O=CaCO_3+(NH_4)_2SO_4$. Combined nitrogen is also being supplied for agricultural purposes as urea (from ammonia and carbon dioxide) and in many fertilizers containing potash and phosphates.

**Synthesis of Ammonia.**—The combination of nitrogen and hydrogen is accompanied by the evolution of heat, the equation for the formation of ammonia at ordinary temperature being

$$N_2+3H_2=2NH_3+11{,}890 \text{ calories},$$

according to the measurements of Julius Thomsen. (*See* also papers by Haber and his co-workers between 1903 and 1915.) The heat evolved at higher temperatures is progressively less, and the amount of ammonia existing in true equilibrium with a mixture of one volume of nitrogen and three volumes of hydrogen diminishes, as temperature is raised. If ammonia, nitrogen and hydrogen co-exist in an enclosed space, each gas can be considered as occupying the whole volume but exercising a partial pressure proportional to the number of its molecules present. For any given temperature, certain concentrations of the different gases will be in equilibrium when

$$\frac{(p_{NH_3})^2}{(p_{N_2})\times(p_{H_2})^3}=\text{a constant}$$

the $p$'s representing the respective partial pressures of the gases whose formulae are put down as suffixes. It is more convenient in practice to take the square root and write

$$\frac{p_{NH_3}}{p_{N_2}^{\frac{1}{2}}\times p_{H_2}^{\frac{3}{2}}}=K_p.$$

If a mixture of these three gases be compressed, ammonia must be formed in order to preserve the above relationship, so that rise of temperature and of pressure act in contrary directions, the first diminishing the equilibrium amount of ammonia, the latter increasing it.

Since nitrogen and hydrogen react to form ammonia very slowly, no change is observed if these gases are mixed at ordinary temperature and pressure and left for years. In order to get appreciable change the reaction must be accelerated, and the two ways in which this is possible are by increase in temperature and use of a catalyst. In Haber's earlier experiments (with G. van Oordt), ammonia was passed over a heated catalyst and the ammonia which had escaped decomposition absorbed and estimated. The residual nitrogen and hydrogen were passed over another portion of catalyst at the same temperature and the ammonia formed estimated: the two sets of experiments showed fair agreement but were found later to be too high as regards ammonia formation. (Haber and R. le Rossignol, also F. Jost, 1908.) From a knowledge of heats of formation and specific heats of reacting gases, the equilibrium constant can be calculated theoretically.

**Catalysts.**—Ultimately agreement between theoretical and practical results was obtained and it became obvious that, for practical working, a catalyst would have to be found which was sufficiently rapid in its action about 500° C and not too susceptible to "poisoning" by impurities in the gases employed. Theoretically, the following approximate percentages of ammonia may be attained.

| Temperature | 500° | 550° | 600° |
|---|---|---|---|
| At 100 atmospheres | 11·0 | 7·0 | 4·5 |
| At 200 atmospheres | 18·0 | 12·0 | 8·0 |

Haber used various catalysts in the course of his work. In the early stages, osmium and ruthenium were found to give good results but price and rarity preclude their use. The catalysts usually contain iron with a basic oxide (introduced by fusion) as a promoter. A large number of patents have been taken in the first quarter of the 20th century, and the firms concerned do not divulge the nature of the catalysts they employ. The Badische Co. have been supposed to use an iron catalyst with (possibly) molybdenum as promoter. In the war plant of the U.S. Government, pumice was impregnated with nickel or iron sulphate, heated to 550°, reduced by hydrogen and treated with sodium and ammonia gas at 450°; sodamide was formed in the spongy metal, and such a mass is said to act at 500° and 70 atmospheres. Synthetic Ammonia and Nitrates Ltd. claim that calcium ferrite, prepared in the electric furnace, gives an active catalyst on subsequent reduction (Brit. Pat. 237,394). Norsk-Hydro mix compounds of metals of the iron group with cyanides in liquid anhydrous ammonia, remove the excess of ammonia and heat in a non-oxidizing atmosphere (U.S. Pat. 1,570,333). F. Uhde (Brit. Pat. 247,225) carefully avoids water. In an example, anhydrous ferric chloride and potassium ferrocyanide react in glycol solution, the precipitate is dried *in vacuo,* filled into the furnace and treated with nitrogen and hydrogen, first without and then with increased pressure at 350–450°. The hydrogen used in the synthesis is chiefly produced from coke and steam but electrolytic, coke-oven and by-product hydrogen are also used. Nitrogen is obtained by rectification of liquid air or from producer-gas.

**Haber-Bosch Process.**—This process was developed by the Badische Co. (now part of I. G. Farbenindustrie A.-G.) and is carried out at about 500° and 200 atmospheres. The necessary mixture of nitrogen and hydrogen is obtained from water-gas and producer-gas. Air is blown through a coke fire, shut off and steam blown through when the reaction, $C+H_2O=CO+H_2$, takes place. The mixture actually contains about 50% hydrogen, 42–45% carbon monoxide and a small balance, chiefly carbon dioxide and nitrogen. The producer-gas from air and coke contains hydrogen, 5–15%; nitrogen, 65–50%; carbon monoxide, 20–30% and residue of carbon dioxide, methane, etc. Suitable proportions give a gas mixture with 22–23% nitrogen and remainder mostly hydrogen and carbon monoxide. By passage over a catalyst with excess of steam, the reaction $CO+H_2O=CO_2+H_2$ is driven as far as possible to the right to give a gas mixture with about 17% $N_2$, 52% $H_2$, 27 to 29% $CO_2$, 2 to 4% CO and small amounts of argon, methane, etc. The carbon dioxide can be reduced to under 1% by water scrubbing under pressure, the remainder is washed out with cold alkali solution. Removal of carbon monoxide and residual sulphur compounds is essential as they are catalyst poisons; for the former, a solution of cuprous ammonium carbonate (or formate) may be employed. Treatment with ammonia is also used (*e.g.,* Synthetic Ammonia and Nitrates Ltd., Slade and Parkes, Brit. Pat. 240,350; Casale, Brit. Pat. 231,417). F. Uhde finally cleanses and dries the gas-mixture by passage through a melt of sodium amide containing a metal of the alkali or alkaline earth class. 20% sodium and 80% sodamide can be used at 200–250° C, the contact of the gas and melt lasting 20 to 60 seconds. (Brit. Pat. 247,226.)

According to Waeser, the gas mixture passes a three-stage compressor and the reaction is carried out in tubular vessels of special steel. Once the reaction is started, further heating is unnecessary and heat may have to be taken away. The gases leave the catalyst with about 10% of ammonia which is removed after cooling by washing with water.

**Other Processes.**—G. Claude increases the pressure to 600 or 1,000 atmos.; this so displaces the equilibrium towards ammonia formation that higher temperatures (500–600°) can be employed, at which the catalysts are more active and less sensitive to poisoning. Up to 20% of ammonia may be attained and if the issuing gases are cooled under this pressure, the ammonia is mostly liquefied and may be removed in an anhydrous condition. Usually three contact units are used in series. After passage through each unit, the gas is cooled and the liquefied ammonia removed, the remaining nitrogen and hydrogen being passed on to the next unit. A suitable steel for the high pressure apparatus is said to contain Si, 0·018%; S, 0·09%; C, 0·098%; and Mn, 0·93%. Chrome-vanadium steel is also employed for reaction chambers. The process is worked with hydrogen from water-gas or coke-ovens whilst electrolytic hydrogen is also employed, as at Bussi (Italy). Claude gives the following equilibria for ammonia at 536°.

| Atmospheres pressure | 200 | 400 | 600 | 800 | 1,000 |
|---|---|---|---|---|---|
| Ammonia per cent | 12·5 | 21·0 | 28·5 | 36·0 | 41·0 |

Discrepant statements have been made as to the pressure employed by L. Casale in the process named after him; it is probably about 800 atmos., the gases circulating in a closed circuit. A characteristic of the process is that a certain percentage of ammonia is returned with the nitrogen-hydrogen mixture in order to avoid overheating the catalytic mass. Only a portion of the ammonia is removed from the gas after leaving the synthetic tube and uncombined gases are made to pass repeatedly over the catalyst. Many important details have been worked out with respect to heat-interchangers and the maximum temperature of the pressure containers. This process has been largely adopted and is worked with nitrogen from various sources.

**Cyanamide.**—The ultimate raw materials are limestone, some form of carbon (charcoal, anthracite or coke) and atmospheric nitrogen. The limestone is burnt to lime, the latter heated in an electric furnace with carbon and the resultant calcium carbide brought to reaction with nitrogen (99·8% purity). Henri Moissan found that pure calcium carbide did not react with nitrogen on heating but Frank and Caro obtained cyanamide from commercial, impure carbide. The reaction is one which may be catalysed and calcium fluoride has been used for this purpose. Calcium chloride is also effective but undesirable as it attracts moisture.

The ovens in which the reaction between carbide and nitrogen is effected are either discontinuous or continuous in action. In the first case they are usually cylindrical in shape and charged with finely ground carbide around a carbon pencil. The covers are placed in position, nitrogen admitted under slight pressure and the carbon pencil heated electrically. The carbide surrounding the pencil soon attains the necessary temperature; when the reaction has well started further electrical heating is unnecessary and the reaction spreads from the core outwards until the entire charge is converted. This may take 24 to 40 hours.

The crude product contains about 60% calcium cyanamide (21% nitrogen), 20% lime, 12% free carbon and a small amount of aluminium and iron oxides, silica, etc. Cyanamide is manufactured on a large scale in Germany and France and in substantial quantities in other countries. It is largely used as a fertilizer; a certain amount is converted into ammonia and then into ammonium sulphate.

**Oxidation of Nitrogen.**—(*a*) At a high temperature, nitrogen and oxygen partially combine to form nitric oxide, the reaction being reversible.

$$N_2+O_2 \rightleftarrows 2NO.$$

The reaction is endothermic, *i.e.,* heat is absorbed, so that the higher the temperature, the greater the quantity of nitric oxide in equilibrium with nitrogen and oxygen. At ordinary temperatures, the amount of nitric oxide is negligible for true equilibrium, but the rate of decomposition of nitric oxide is so slow that, if the mixture of gases be rapidly cooled, most of the nitric oxide formed at a high temperature may be preserved.

(*b*) Nitric oxide unites directly with oxygen at ordinary temperatures to form nitrogen peroxide, $2NO+O_2=2NO_2$.

(*c*) Nitrogen peroxide reacts with water to form nitric acid and nitric oxide, $3NO_2+H_2O=2HNO_3+NO$. If excess of oxygen be present, the nitric oxide is again oxidized to nitrogen peroxide,

so that the net result will be given by the equation, $4NO_2+O_2+2H_2O=4HNO_3$.

On the theoretical side, the equilibrium between nitrogen oxygen and nitric oxide is given by

$$\frac{[NO]^2}{[N_2]\times[O_2]}=\frac{x^2}{\left(79{\cdot}2-\frac{x}{2}\right)\left(20{\cdot}8-\frac{x}{2}\right)}=\text{constant } k.$$

The square brackets indicate the concentrations of the respective gases and the expression involving $x$ represents the values if atmospheric air be taken as initial material. It is known that $k$ is related to the heat of formation ($q$) thus,

$$\frac{d\log k}{dT}=-\frac{q}{RT^2}$$

so that if $x$ be determined at an absolute temperature $T$, $k$ may be calculated for that temperature and a value of $q$ obtained. W. Nernst used the heat of formation of nitric oxide determined by J. Thomsen, viz.—43,200 cal., and compared theoretical and practical values of $x$. Thus at 1,811°, $x$ was observed to be 0·37 and calculated as 0·35, whilst at 2,675° the respective values were 2·23 and 2·35. Nernst and his fellow-workers used external electric heating, but in 1903 W. Muthmann and H. Hofer had obtained 3·6 to 6·7% of nitric oxide when the air was exposed directly to the arc. 7% would correspond to a temperature of 3,750°, but experiments by Haber and A. Koenig point to a specific influence of the arc; there seems to be an "electric equilibrium" in addition to the thermal equilibrium.

Patents for the synthesis of nitric acid were taken by Mme. Lefebre (1859) and McDougall (1899), but manufacturing on a commercial scale was first started by C. S. Bradley and R. Lovejoy (Brit. Pat. 8,230/1901; U.S.PP. 709,867; 709,869). The air was driven through a vertical iron cylinder containing a rotating steel shaft, both tube and shaft were provided with electrodes and between them, 6,900 arcs were struck and broken per second. The process was not operated after 1904, more efficient processes having made an appearance.

Another method of exposing air to the arc is due to O. Schönherr (1905). An arc (which may be from direct current) of 16 to 23 ft. in length is set up in a vertical tube: the lower electrode is an iron rod which is gradually worn away, the wastage is small and the expense of renewal trifling. A water-jacket surrounding the upper part of the tube serves as the other electrode; since the arc varies in length, it does not always strike the same area and wear and tear are small. Air passes upwards along this tube, returns downwards through a concentric outer tube and serves partially to heat the incoming air.

After leaving the electric furnace, the gases are cooled (much heat may be usefully recovered) and pass on to an oxidation tower. By treatment in a succession of towers with water in counter-current, a weak nitric acid is recovered which may be concentrated or, more usually, neutralized with lime or ammonia for the production of calcium or ammonium nitrate. The former is utilized as a fertilizer, the latter finds a use in explosives. The washing with water does not remove all the oxides of nitrogen; more complete exhaustion is effected by spraying the remaining gas with solution of soda ash, sodium nitrate (fertilizer) or sodium nitrite (dyestuff industry) being recovered.

The Birkeland and Eyde process was established in 1903 and utilized largely by the Norsk-Hydro Co. at Notodden and later at Rjukan. The Schönherr process was largely developed by the Badische Co. and introduced at the above mentioned Norwegian works. The German capital was afterwards withdrawn from the Norsk-Hydro owing to the development of the Haber process. The Pauling process was used in France, Austria and Italy, whilst another arc process, the invention of Mosicki, was established in Switzerland.

Several methods for the recovery of oxides of nitrogen formed at high temperatures in combustion processes have been suggested; of these, that due to F. Häusser with respect to internal combustion engines has received most publicity.

**Oxides of Nitrogen from Ammonia.**—When ammonia is burnt under ordinary conditions, nitrogen and water vapour are the chief products. That oxides of nitrogen may be formed was observed in the eighteenth century and in 1839 Kuhlmann found the reaction was catalysed by platinum. Shortly before the war, W. Ostwald fixed the conditions by which fair yields can be obtained.

The usual catalyst is platinum gauze (80 to 150 mesh per in., wire diameter 0·001 to 0·003 in.), four layers being frequently employed. A pre-heated mixture of ammonia and air is blown through the catalyst; the time of contact with the platinum is 0·0001 sec. and the temperature 1,000° C; the speed is important. With good conditions the reaction, $4NH_3+5O_2=4NO+6H_2O$, can be realized to the extent of about 95%. If all the ammonia is not oxidized it subsequently reacts with the oxides of nitrogen. It is reported that a granular iron oxide mixed with other oxide promoters has been used successfully in place of platinum. The oxidation of the nitric oxide and recovery as nitrates and nitrites follows, as previously described.

BIBLIOGRAPHY.—*Physical and Chemical Data of Nitrogen Fixation*, and *Report of the Nitrogen Products Committee* (Stationery Office, London, 1918 and 1919 resp.); J. R. Partington and L. H. Parker, *The Nitrogen Industry* (1922), contains many illustrations; *Report on the Fixation and Utilization of Nitrogen* (Washington, 1922) contains flow-sheet diagrams and bibliography to 1922; B. Waeser, *Die Luftstickstoffindustrie* (Leipzig, 1922), trans. by E. Fyleman and J. and A. Churchill, as *The Atmospheric Nitrogen Industry* (1926) with appendices to bring the information up-to-date; J. R. Partington, "Nitrogen Fixation" in Thorpe's *Dictionary of Applied Chemistry;* articles in Ullmann's *Encyklopaedie der technischen Chemie* (1914–22); *Badische Anilin- und Soda-Fabrik* (published by the firm, 1925). (J. T. H.)

### UNITED STATES

While the industrial fixation of atmospheric nitrogen had its birth in the United States when the Atmospheric Products Company was organized at Niagara Falls, N.Y., to exploit the Bradley and Lovejoy patents, little nitrogen was fixed in the United States until after the World War. A Pauling furnace was operated at Nitrolee, S.C., from 1913 to 1916. Another plant was operated by the arc process at Le Grande, Wash., for ten years. The excessive cost of electric energy, however, made it impossible for these plants to compete with the synthetic ammonia plants. The American Cyanamid Company began the operation of the process, for which it is named, in 1907, and has increased its capacity from time to time. The U.S. Nitrate Plant No. 2 at Muscle Shoals, Ala., was also erected to operate the cyanamide process, but has never produced commercially. ("Muscle" is the common spelling of "mussel" in the Colonial period.)

The first attempt in the United States to synthesize ammonia directly was at U.S. Nitrate Plant No. 1, Sheffield, Ala., but this was an experimental plant, the continuous operation of which was never realized. Following the war the Atmospheric Nitrogen Corporation began operations at Syracuse, N.Y., reaching in 1927 an annual capacity of 11,550 tons. A number of small plants followed, using for the most part by-product hydrogen. These were soon followed by a plant at Seattle, Wash., using electrolytic hydrogen, and Lazote, Inc., at Charleston, W. Va., employing water-gas hydrogen, with a production capacity of 6,350 tons in 1927. In 1928, at Hopewell, Va., the first unit of a plant of some 30,000 tons capacity began the manufacture of synthetic sodium nitrate, having the distinction of being the first plant to produce directly a synthetic material identical with Chilean nitrate. Synthetic ammonia processes operating in the United States are for the most part modifications of the Haber, Casale and Claude processes. However, there has been developed a modification so extensive as to entitle it to be known as an "American Process." This has proved such an efficient method for fixing atmospheric nitrogen as to be installed in the newer plants erected both at home and abroad. (H. E. H.)

**NITROGEN HARDENING,** a process of hardening alloy steel at low temperature in ammonia gas. This process was first described in 1926 by Dr. A. Fry, a German metallurgist at Krupp's and has since been widely used for parts requiring high hardness, resistance to wear and toughness, a combination of properties not

easy to obtain in similar degree by any other process. Medium carbon steels containing up to 1% aluminium are required for the process. It has been found that a little chromium is of advantage, while about half of 1% molybdenum is added to prevent brittleness. This steel is first normalized to remove strain and give easy machineability; it is then machined and ground to finished dimensions, next placed loosely in a closed pot, heated up to 48 hours in a slow stream of ammonia gas at 550° C and cooled without removing from the pot. The temperature is so low that no warping will occur; the surface is unscaled but extremely hard. Hardness at the surface is very high, measuring as much as 1,100 by the diamond pyramid penetrator; at 0·01in. below the surface this has dropped to 900 on the same scale, which even so is the maximum that can be achieved by quenched high carbon steel. In certain services such hardnesses insure excellent wear resistance. (*See* CASE HARDENING; CEMENTATION; IRON AND STEEL.) (E. E. T.)

**NITROGLYCERIN,** an explosive first obtained in 1846 by Ascanio Sobrero by acting with a mixture of strong nitric and sulphuric acids on glycerin at the ordinary temperature. It is in fact the ester (*see* ESTERS) of glycerol and other molecules of nitric acid, having the constitutional name of glyceryl trinitrate and the formula $C_3H_5(NO_3)_3$ or $CH_2NO_3{\cdot}CHNO_3{\cdot}CH_2NO_3$.

It is a very pale yellow oil of sp. gr. 1·614 at 4° C and 1·60 at 15° C. One gram requires for solution between 800 and 1,000 c.c. of water, 4 c.c. of absolute alcohol or 18 c.c. of wood spirit. It is scarcely soluble in glycerin, but mixes in all proportions with ether, acetone, ethyl acetate and benzene. (*See* EXPLOSIVES.)

*Therapeutics.*—Nitroglycerin has a sweet burning taste and is decidedly poisonous. Its vapour produces violent headache, and the same effect is often caused by handling compositions containing it. Although a nitrate, its pharmacological actions resemble those of nitrites such as amyl nitrite, taken internally. The explanation is that in an alkaline medium at body heat nitroglycerin yields a nitrite, probably as a preliminary stage of resolution. This gradual conversion in the tissues is a valuable property of nitroglycerin, as its effects take longer to manifest themselves than is the case with amyl and other nitrites. Nitroglycerin is valuable as a preventive in cases of cardiac pain, such as angina pectoris.

**NITROSOBENZENE,** $C_6H_5NO$, first obtained by the action of nitrosyl bromide or chloride on mercury diphenyl, is prepared by the oxidation of $\beta$-phenylhydroxylamine with chromic acid. It results from the oxidation of aniline by monopersulphuric acid (H. Caro). It exists in two crystalline forms. It melts at 68° to an emerald-green liquid which solidifies to colourless crystals melting at 57–59°. It is very volatile and its solutions are green. Nitric acid oxidises it to nitrobenzene. It condenses with aromatic amines to form azo-compounds, with arylhydroxylamines to form azoxy-compounds, and with hydroxylamine it gives isodiazobenzene hydroxide.

**NITTI, FRANCESCO** (1868– ), Italian statesman, was born at Melfi (Potenza). He had already become known as a barrister and as professor of financial science at the University of Naples when he entered parliament in 1904. He made his reputation as an authority on economic and financial questions, and was minister of agriculture, industry and trade in the Giolitti cabinet of 1911–14. When the United States entered World War I in 1917, he was entrusted with an economic mission to that country, and certain of his utterances and acts in this connection were severely criticized. He became minister of the treasury in the Orlando cabinet from Oct. 1917 to Jan. 1919. On the fall of the Orlando ministry, which he helped to bring about in June 1919, he succeeded as premier. Nitti's adoption of the system of proportional representation resulted in an important increase in the Socialist and Popolari deputies at the elections of Nov. 1919, but he failed to conciliate either group. An epidemic of strikes and disorders seriously weakened his position, and he felt forced to resign on March 12, 1920. But no other statesman being willing to assume the succession, he reconstructed his cabinet; defeated in the Chamber after the San Remo meeting of the Supreme Council presided over by him, to prepare the peace with Turkey, he resigned a second time but again reconstructed his cabinet. The arrest ordered by him of the Dalmatians and Fiumani in Rome provoked further irritation. He resigned for the last time on June 9, 1920, leaving the door open for Giolitti's return. On retiring from office he returned to journalism. In parliament he opposed Giolitti, splitting the democratic forces, which helped fascism. Nitti was re-elected in 1921, but did not stand in the 1924 elections held under Mussolini's auspices. His house was looted by fascists, and he subsequently left Italy and settled in Paris. At the time of the German invasion in 1940 he left for Toulouse; but later on returned to Paris, still occupied by the Germans, because of an illness of his son Vincenzo who died there.

Nitti wrote several books on economic questions, including one entitled *Nord e Sud* (1900), dealing with what he regards as the unfair treatment of South Italy by the wealthier North, and *L'Italia all' alba del secolo XX.* (1901). Among his other works, the following have been translated into English: *L'Europa senza pace* (Eng. trans. 1922); *La Decadenza dell' Europa* (Eng. trans. 1923); *La Tragedia dell' Europa* (Eng. trans. *They Make a Desert,* 1924). In 1925 his son Vincenzo Nitti published a vindication of his father's policy, *L'opera di Nitti.*

**NITZSCH, KARL IMMANUEL** (1787–1868), Lutheran divine, was born near Leipzig on Sept. 21, 1787. He studied at Wittenberg, where he began to teach in 1809. From 1820 to 1822 he was superintendent in Kemberg, and in the latter year he was appointed professor of theology at Bonn where he remained until called to succeed Marheineke at Berlin in 1847. Subsequently he became university preacher, rector of the university, provost of St. Nicolai (in 1854) and member of the supreme council of the church, in which last capacity he was one of the ablest and most active promoters of the Evangelical Union. He died on Aug. 21, 1868. He represented the *Vermittelungstheologie* of the school of Schleiermacher, holding "that religion is not doctrine but life, direct consciousness, feeling."

His principal works are: *System der christlichen Lehre* (1829; 6th ed., 1851; Eng. trans., 1849), *Praktische Theologie* (1847–60; 2nd ed., 1863–68), *Akademische Vorträge über christliche Glaubenslehre* (1858) and several series of *Predigten.*

**NIUÉ (SAVAGE ISLAND):** *see* PACIFIC ISLANDS.

**NIVELLE, ROBERT GEORGE** (1856–1924), French soldier, was born on Oct. 15, 1856, at Tulle, Corrèze. He entered the Polytechnic in 1876, and left two years later to join the artillery. He served in China in 1900, and then for many years in Algeria. When the World War broke out he was in command of the 5th Artillery at Besançon.

Appointed a general of brigade on Oct. 24, 1914, he fought successfully on the Aisne, and in Jan. 1915 took a prominent part in the attack on Quesnevières. On Dec. 23, 1915, he was placed at the head of the III. Corps, and in March 1916 was sent to Verdun, where after some remarkable fighting he succeeded in checking the Crown Prince's first attack. On May 2 he succeeded General Pétain in the command of the II. Army, and definitely held the enemy before that glorious citadel. It was he who, in orders which have become famous, made the unforgettable declaration: "Ils ne passeront pas." On Dec. 12, 1916, he succeeded General Joffre as commander-in-chief of the armies of the north and north-east. In conjunction with the British armies he prepared the great offensive of April 16, 1917, between Soissons and Auberive. After this semi-defeat he was replaced by General Pétain in the command of the French armies. On May 15, 1917, he was appointed commander of the armies "chargé de mission," and on Dec. 23, 1917, took over the French troops in North Africa.

On Oct. 14, 1918, General Nivelle was confirmed in his command despite the rules of superannuation, and on Jan. 30, 1920, was nominated a member of the Supreme War Council. On March 5, 1920, he gave up the command of the XIX. Corps, and in Nov. 1920 he was ordered to represent France in the United States at the tercentenary of the arrival of the "Mayflower." He was placed on the retired list on Oct. 11, 1921; he died on March 23, 1924. (M. GU.)

**NIVELLES** (Flem. *Nÿvel*), town, province of Brabant, Belgium, on the Thines 19 mi. south of Brussels. Pop. (1939) 12,899.

It manufactures parchment, cardboard and paper. The town is supposed to owe its origin to the foundation of a convent by Itta or Iduberge, wife of Pippin of Landen, and it is the cradle of the Carlovingians. The Romanesque church of St. Gertrude, named after Itta's daughter, dates from the 11th century. On the top of the tower is the effigy of a man in iron who strikes the hours with a hammer. He is called by the townspeople Jean de Nivelles, a celebrated baron of the 15th century whose title eventually became merged in that of the count de Hornes (Horn). Close to Nivelles is Seneffe, where Condé defeated William of Orange in 1674. At Nivelles the French under Marceau defeated the Austrians in 1794.

**NIVERNAIS,** formerly a province and duchy of France, bounded on the north by Gâtinais-Orléanais and Auxerrois, on the south by Bourbonnais, on the east by Burgundy, on the west by Berri. It is embodied almost entirely in the present department of Nièvre. The capital of Nivernais was Nevers. At the Roman conquest Nivernais was a part of the territory of the Aedui. Nivernais was included in the jurisdiction of the *parlement* of Paris, and was a *gouvernement militaire*. From the time of the Merovingians it comprised the diocese of Nevers.

*See* Guy Coquille, *Histoire du Nivernais* (1612); F. Gillois, *Chronique du Nivernais* (1867).

**NIXIE** or **NIXY,** a female water-sprite. The word is adapted from Ger. *Nixe,* the male water-sprite being *Nix.* The general term covering both the male and female is "nicker," a kelpie. This also appears in Dutch *nikker.* The Old Teutonic *nikus* may be connected with the root which appears in Gr. *νίζειν* or *νίπτειν* "to wash."

**NIXON, JOHN** (1815–1899), English mining engineer and colliery proprietor, was born at Barlow, Durham, on May 10, 1815, the son of a farmer. He was a mine-surveyor on the South Wales coalfield, and he then became engineer to a French coal and iron company. Returning to England, he noticed while travelling on a Thames steamer that the Welsh coal in use gave off no smoke, and was preferred to north country coal both on this ground and because of its greater power-producing efficiency. His experience in France suggested that a profitable market for this coal might be established among the French iron-founders and manufacturers generally who had hitherto imported English north country coal. Eventually he freighted a small craft, and sent it across to Nantes, where he persuaded the local manufacturers to try it on the understanding that he bore the expense of the experiments. These tests, under his direction, proved successful, and his visit to Nantes laid the foundations of the Welsh steam-coal trade, English manufacturers and shipowners imitating the example of their French rivals. Nixon eventually acquired a colliery, known as Nixon's Navigation collieries in the Aberdare valley, and later acquired or developed other South Wales steam collieries. He invented many mechanical improvements in colliery working. He died in London on June 3, 1899.

*See* J. E. Vincent, *John Nixon, Pioneer of the Steam Coal Trade in South Wales* (1900).

**NIZĀMĪ** (1140–1—1202–3). Nizām-uddīn Abū Mohammed Ilyās bin Yūsuf, Persian poet, was born A.H. 535 (A.D. 1140–1). His native place, or at any rate the abode of his father, was in the hills of Kum, but as he spent almost all his days in Ganja in Arrān (the present Elizavetpol) he is generally known as Nizāmī of Ganja or Ganjawī. Nizāmī abandoned himself at an early age to a stern ascetic life, as full of intolerance to others as dry and unprofitable to himself. The first poetical work in which Nizāmī embodied his thoughts on God and man, and all the experiences he had gained, was *Makhzanul Asrār* (*c.* 1165–6) or "Storehouse of Mysteries," and bears the unmistakable stamp of Sūfic speculations. His claim to the title of the earliest Persian romanticist he fully established only a year or two after the *Makhzan* by the publication of his first epic masterpiece *Khosrau and Shīrīn* (*c.* 1175–6), reciting the ancient tale of the loves of Chosroes and Shirin. It was composed, according to the oldest copies, in A.H. 576 (A.D. 1180), and inscribed to the reigning atābeg of Azerbaijān, Abū Ja'far Mohammed Pahlavān, and his brother Kizil Arslān, who, soon after his accession to the throne in A.H. 582, showed his gratitude to the poet by summoning him to his court, loading him with honours, and bestowing upon him the revenue of two villages, Hamd and Nijān. In 1188 Nizāmī completed his *Dīwān,* or collection of kasīdas and ghazals (mostly of an ethical and parenetic character), which are said to have numbered 20,000 distichs, although the few copies which have come to us contain only a very small number of verses. About the same time he commenced, at the desire of the ruler of the neighbouring Shīrvān, his second romantic poem, the famous Bedouin love-story of *Laila and Majnūn* (*c.* 1188–9). His *Iskandarnāma* (1191) or "Book of Alexander," also called *Sharafnāma* or *Iqbālnāma-i-Iskandarī* ("The Fortunes of Alexander"), is split into two divisions, the first based on the historical career of Alexander, which is embroidered by many magical tales, among others the voyage of Alexander to the fountain of life in the land of darkness; the second describing him as prophet and philosopher. Nizāmī's last romance *Haft Paikar* (1198–9), or the "Seven Beauties," comprises seven tales in verses related by the seven favourite wives of the Sassānian king Bahrāmgūr. Among these is the tale of the Russian princess used by Gozzi and Schiller, "Turandot." The five mathnawīs, from the *Makhzan* to the *Haft Paikar,* form Nizāmī's so-called "Quintuple" (*Khamsa*) or "Five Treasures" (*Panj Ganj*), and have been taken as pattern by all the later epic poets in the Persian, Turkish, Chaghatāi and Hindustānī languages. Nizāmī died at Ganja in his sixty-fourth year, A.H. 599 (A.D. 1202–3).

BIBLIOGRAPHY.—The fullest account of Nizāmī is given in Dr. W. Bacher's *Nizāmī's Leben und Werke* (Leipzig, 1871; English translation by S. Robinson, London, 1873; reprinted in the same author's *Persian Poetry for English Readers,* 1883, pp. 103–244). All the errors of detail in Bacher's work have been corrected by Dr. Rieu in his *Catalogue of the Persian MSS. in the British Museum* (1881), ii. 563 *sqq.*

*Principal Editions.*—The whole *Khamsa* (lithographed, Bombay, 1834 and 1838, Teheran, 1845); *Makhzan-ul Asrār* (edit. by N. Bland, London, 1844, lithographed, Cawnpore, 1869, English translation in ms. by Hatton Hindley, in the British Museum Add. 6961); *Khosrau and Shīrīn* (lithographed, Lahore, 1871, German translation by Hammer in *Shīrīn, ein persisches romantisches Gedicht,* Leipzig, 1809); *Laila and Majnūn* (lithographed, Lucknow, 1879; English translation by J. Atkinson, London, 1836); *Haft Paikar* (lithographed, Bombay, 1849, Lucknow, 1873; the fourth tale in German by F. von Erdmann, *Behramgur und die russische Fürstentochter,* Kasan, 1844); *Iskandarnāma,* first part, with commentary (Calcutta, 1812 and 1825, text alone, Calcutta, 1853, lithographed with marginal notes, Lucknow, 1865, Bombay, 1861 and 1875, English translation by H. Wilberforce Clarke, London, 1881; compare also Erdmann, *De expeditione Russorum Berdaam versus,* Kasan, 1826, and Charmoy, *Expédition d'Alexandre contre les Russes,* St. Petersburg, 1829); *Iskandarnāma-i-Bahrī,* second part, edited by Dr. Sprenger (Calcutta, 1852 and 1869).

**NIZHEGOROD** (now GORKY; the name Nizhegorod is an abbreviation from Nijni-Novgorod), a region of the Russian S.F.S.R., bounded on the east by Kirov region and the Marii, Chuvash and Mordovia Autonomous Soviet Socialist republics, on the south by Ryazan region, on the west by the Ivanovo and Yaroslavl regions, and on the north by Vologda region. Area 34,440 sq.mi. Pop. (1939) 3,876,274; urban 1,218,900, rural 2,657,374. The northern portion consists of a pine forest area lying along each side of the Vetluga river from the point where it curves sharply to the south, though the lower course of the Vetluga, and its junction with the Volga, lie in the Marii republic. The forest approaches the left bank closely, but along the right bank there are a series of settlements in the forest-free strip.

South of the Volga is a fertile black earth area, between the Oka on the west, which forms the boundary of the region in the southwest and then flows through the former province of Vladimir, finally turning sharply to the east and flowing through the Gorky region to its junction with the Volga, and the Sura on the east, which flows through the Chuvash republic in the south, but forms the boundary between that republic and the Gorky region in the north of its course. This southern part has little forest and consists of high plains, with river valleys entrenching them, and the valley black earth is the most fertile soil in the entire area of the region.

The southern part is not favourable to grass and meadow cultivation, so that dairying has not developed. Grain cultivation occupies 85% of the ploughed land, the chief crops being rye and oats, with a little wheat, millet and buckwheat. Potatoes, flax

and a little hemp are grown. Fruit and vegetables are cultivated along the Oka and Volga and find a ready market in Gorky (Nijni-Novgorod). Sheep, cattle, horses, pigs and goats are raised. The region is sparsely peopled, especially in the north; the population is mainly Great Russian, though there are Mordvinian and Tatar colonies in the southeast. Bog iron ores, sand, salt and phosphorite are found. The region is rich in peat, and the electric station opened in 1925–26 at Balakhna, on the Volga, north of Gorky, works on peat fuel and has a power of 20,000 kw.

Factory industries include the making of machinery for railway and river transport, and for local peasant industries, flour milling, distilling, sawmilling and the manufacture of cardboard and paper, brewing and the making of leather goods. The poor guarantee for agriculture has led to a great development of koustar (peasant) industry, especially the making of wooden articles (41%) and textiles, including woollen goods and felt (30%). Special peasant industries are wooden spoons in Semenov, cutlery and locks in Gorbatov, spindles in Balakhna, fancy boxes in Makaryev, and furs and leather goods.

**NIZHNI TAGIL** (NIZHNE-TAGILSK, TAGIL), a city of the Russian S.F.S.R., in the Sverdlovsk region, in 57° 27′ N., 59° 54′ E. Pop. (1939) 159,864. It lies in a valley on the eastern slope of the Ural mountains, within a few miles of the place where the Tagil escapes to the lowlands to join the Tura, a tributary of the Tobol. The southern part of this valley is occupied by the upper Tagil, and its northern portion by the upper Tura, from which the Tagil is separated by a low watershed. The town is connected by railway (the first in Siberia) with Perm and Sverdlovsk, and with mines to the east and west. It was founded in 1725 by the Russian mine-owner Demidov. Nizhni Tagil is a central foundry for iron mines and other works. Gold, platinum and copper are mined at Nizhni Tagil, and there is a brick-making industry. Wagon works with an output of 5,000 wagons per annum have been under construction.

**NIZHNIY NOVGOROD:** *see* NIJNI-NOVGOROD.

**NOAH** appears in Genesis v. 29 as son of Lamech and tenth in descent from Adam. The hazardous attempt of the verse to find an etymology for the name in the Hebrew verb "comfort" is an extract from another tradition, and views Noah as repairing in some measure by his discovery of vine-culture, Gen. ix. 20, the disaster of the curse pronounced upon the ground by Yahweh in consequence of the Fall. The story of the Deluge has Noah for its hero. He is represented as the patriarch who, because of his blameless piety, was chosen by God to perpetuate the human race after his wicked contemporaries had perished in the Flood. He receives a divine warning of the impending disaster, and is instructed to build an ark, in which he and his family are preserved alive. In accordance with God's instructions Noah took into the ark specimens of all animals, from which the stocks might be replenished. The story has close affinities with Babylonian traditions, in which Ut-napishtim plays the part corresponding to that of Noah (*see* DELUGE). The narrative of Gen. ix. 18–27 belongs to a different cycle, which seems to know nothing of the Flood story. In the latter Noah's sons are married, and their wives accompany them in the ark; but in this narrative they would seem to be unmarried, living in the tent with their father; nor does the shameless drunkenness of Noah accord well with the character of the pious hero of the Flood story. Three different motives may be traced in Gen. ix. 18–27: first the passage explains to whom agriculture, and in particular the culture of the vine, was due; secondly it attempts to provide in the persons of Noah's three sons, Shem, Ham and Japheth, ancestors for three of the races of mankind, and to account in some degree for their historic relations; in the third place, by its censure of Ham—for whom it is almost certain that Canaan stood in the original text—it reprobates the licentious Canaanite civilization.

(W. L. W.)

**NOAILLES,** the name of a great French family, derived from the castle of Noailles in the territory of Ayen, between Brive and Turenne in the Limousin, and claiming to date back to the 11th century. In the 16th century, its head, ANTOINE de Noailles (1504–1562), became admiral of France, and was ambassador in England during three important years, 1553–1556, maintaining a gallant but unsuccessful rivalry with the Spanish ambassador, Simon Renard. HENRI (1554–1623), son of Antoine, was a commander in the religious wars, and was made comte d'Ayen by Henry IV. in 1593. ANNE (d. 1678), the grandson of the first count, played an important part in the Fronde and the early years of the reign of Louis XIV., became captain-general of the newly won province of Roussillon, and in 1663 was made duc d'Ayen, and peer of France.

ADRIEN MAURICE (1678–1766), the third duke, served in the wars of Louis XV. in Italy and Germany, and became a marshal in 1734. In the war of the Austrian succession he was beaten by the English at the battle of Dettingen in 1743. He married Françoise d'Aubigné, a niece of Madame de Maintenon, and two of his sons became marshals of France. The elder, LOUIS (1713–1793), who bore the title of duc d'Ayen till his father's death in 1766, when he became duc de Noailles, served in most of the wars of the 18th century, and was made a marshal in 1775. He refused to emigrate during the Revolution and died in Aug. 1793, before the Terror reached its height. On the 4th Thermidor (July 22) the aged duchesse de Noailles was executed with her daughter-in-law, the duchesse d'Ayen, and her granddaughter, the vicomtesse de Noailles. JEAN PAUL FRANÇOIS (1739–1824), the fifth duke, was in the army, but his tastes were scientific, and for his eminence as a chemist he was elected a member of the Academy of Sciences in 1777. He became duc d'Ayen in 1766 on his grandfather's death, and duc de Noailles on his father's in 1793. He lived in Switzerland from 1792 until the Restoration in 1814, when he took his seat as a peer of France.

One other branch of the family deserves notice. PHILIPPE (1715–1794), comte de Noailles, afterwards duc de Mouchy, a younger brother of the fourth duke, served at Minden and in other campaigns, and was made a marshal on the same day as his brother. He was long in great favour at court, and his wife was first lady of honour to Marie Antoinette, and was nicknamed by her Madame Étiquette. This court favour brought down punishment in the days of the Revolution, and the old marshal and his wife were guillotined on June 27, 1794.

PHILIPPE LOUIS MARC ANTOINE, duke of Noailles and prince of Poix (1752–1819), was born on Nov. 21, 1752. In 1789 he was elected deputy of the States-General by the nobility of the *bailliages* of Amiens and Ham, but was compelled to resign in consequence of a duel with the commander of the Garde Nationale at Versailles. He left the country but returned and took part in the revolution of Aug. 10, 1792, after which he again escaped until 1800. At the Restoration he was brought again into favour and became a peer of France. He died at Paris on Feb. 17, 1819.

LOUIS MARIE (1756–1804), vicomte de Noailles, was the second son of the marshal. He served brilliantly under La Fayette in America, and concluded the capitulation of Yorktown. He was elected to the states-general in 1789. He began the famous "orgie," as Mirabeau called it, on Aug. 4, when all privileges were abolished, and with d'Aiguillon proposed the abolition of titles and liveries in June 1790. When the Revolution became more pronounced he emigrated to America. He accepted a command against the English in San Domingo, under Rochambeau. He made a brilliant defence of the mole St. Nicholas, and escaped with the garrison to Cuba; but in making for Havana his ship was attacked by an English frigate, and after a long engagement he was severely wounded, and died on Jan. 9, 1804.

**NOAKHALI,** a district and town of British India, in the Chittagong division of eastern Bengal province. The town (pop. [1941] 18,575), also known as Sudharam, is on a small river channel 10 mi. from the sea. The DISTRICT OF NOAKHALI has an area of 1,658 sq.mi.; pop. (1941) 2,217,402. It consists of an alluvial tract of mainland and several islands at the mouth of the Meghna. In general, every homestead is surrounded by a thick grove of betel and coconut palms. Rice is the staple of cultivation. The district is fertile and is under continuous cultivation. The delta was swept by a storm wave on Oct. 31, 1876, and about 100,000 lives were lost. The district is served by the Assam-Bengal railway.

**NOBEL, ALFRED BERNHARD** (1833–1896), Swedish chemist and engineer, was born at Stockholm on Oct. 21, 1833. On his return to Sweden after a stay in St. Petersburg he devoted himself to the study of explosives, and especially to nitroglycerin. He found that when that body was incorporated with an absorbent, inert substance like *kieselguhr* it became safer and more convenient to manipulate, and this mixture he patented in 1862 as dynamite. He next combined nitro-glycerin with another high explosive, gun-cotton, and obtained a transparent, jelly-like substance, which was a still more powerful explosive than dynamite. Blasting gelatin, as it was called, was patented in 1876. Some 13 years later Nobel produced ballistite, one of the earliest of the nitroglycerin smokeless powders, and a precursor of cordite. Nobel's claim that his patent covered the latter was the occasion of vigorously contested lawsuits between him and the British Government in 1894 and 1895; the question was complicated, but eventually the courts decided against Nobel. From the manufacture of dynamite and other explosives, and from the exploitation of the Baku oil-fields, he amassed an immense fortune; at his death on Dec. 10, 1896 at San Remo, he left the bulk of it in trust for the establishment of five prizes (*see* below).

**NOBEL PRIZES.** These are awarded from the Nobel Foundation, a fund established under the will of A. B. Nobel (*q.v.*), which directed that the interest of the bulk of his huge fortune should be apportioned in equal shares to the person who shall have made the most important (a) discovery or invention in the domain of physics, (b) chemical discovery or improvement, (c) discovery in the domain of physiology or medicine; one share to the person who shall have produced the most distinguished literary work of an idealist tendency; and, finally, one to the person who shall have "most or best promoted the fraternity of nations and the abolition or diminution of standing armies and the formation and increase of peace congresses." The prizes for physics and chemistry are awarded by the Swedish academy of science in Stockholm; the one for physiology or medicine by the Caroline medical institute in Stockholm; that for literature by the academy in Stockholm and that for peace by a committee of five elected by the Norwegian Storting. No consideration whatever was to be paid to the nationality of the candidates, but in January 1937 Herr Hitler, claiming that Germany had been insulted by the award in 1936 of the 1935 peace prize to the pacifist writer, Karl von Ossietsky (*d.* 1938), forbade Germans to accept any Nobel Prize in future, and instituted three national prizes of similar monetary value in their place.

As the will was drawn up by Nobel without legal aid, it was interpreted by a code of statutes, approved by the Swedish Government and consented to by the heirs. The distribution of prizes was begun on Dec. 10, 1901, the anniversary of Nobel's death. The amount of each prize (which may be shared between two submitted works adjudged of equal merit) varies with the income from the fund and since 1936 has stood at approximately £8,000.

The statutes provide for the establishment of Nobel institutes, one for each of the five sections, and one-fourth of the amount which falls to each section from the main fund is deducted for its expenses before prize distribution is made. Provision is made that any prize may be reserved for one year; if not then distributed, the amounts revert to the main fund, or special reserves for each section. The peace prize has been reserved most frequently and special Nobel institutes have been created from the surplus funds.

Only Mme. Marie Curie, honoured in both physics and chemistry, has received prizes in more than one section. British and American recipients have been: *Physics,* British—Lord Rayleigh (1904), J. J. Thomson (1906), W. H. Bragg and W. L. Bragg (1915), Charles G. Barkla (1917), C. T. R. Wilson (1927), O. W. Richardson (1928), Sir Chandrasekhara Venkata Raman, (India, 1930), P. H. M. Dirac and E. Schrödinger (1933), James Chadwick (1935), G. P. Thomson (1937); American—A. A. Michelson (1907), R. A. Millikan (1923), Arthur Compton (1927), C. D. Anderson (1936), C. J. Davisson (1937), E. O. Lawrence (1939). *Chemistry,* British—Sir William Ramsay (1904), Sir Ernest Rutherford (1908), F. Soddy (1921), F. W. Aston (1922), Arthur Harden (1929), W. N. Haworth (1937); American—T. W. Richards (1914), Irving Langmuir (1932), Harold C. Urey (1934). *Medicine,* British—Sir Ronald Ross (1902), A. V. Hill (1922), F. G. Banting and J. J. R. Macleod (Canada, 1923), Sir Frederick G. Hopkins (1929), Sir Charles S. Sherrington and E. D. Adrian (1932), Sir Henry H. Dale (1936); American—Alexis Carrel (1912), Karl Landsteiner (1930), Thomas H. Morgan (1933), G. R. Minot, W. P. Murphy and G. H. Whipple (1934). *Literature,* British—Rudyard Kipling (1907), Rabindranath Tagore (India, 1913), W. B. Yeats (Ireland, 1923), George B. Shaw (1925), John Galsworthy (1932); American—Sinclair Lewis (1930), Eugene O'Neill (1936), Pearl Buck (1938). *Peace,* British—Sir W. R. Cremer (1903), Sir A. Chamberlain (1925), Sir N. Angell (1933), Arthur Henderson (1934), Viscount Cecil (1937); American—Theodore Roosevelt (1906), Elihu Root (1912), Woodrow Wilson (1919), Charles G. Dawes (1925), Frank B. Kellogg (1929), Nicholas M. Butler and Jane Addams (1931).

**NOBILE, UMBERTO** (1885– ), Italian explorer, was born at Avellino. He was educated at the Naples Polytechnic, and became an engineer. Later he obtained a post in the railway department of the ministry of public works in Rome. As a result of plans for airship construction made by him, he was given a post in the war ministry, and was entrusted with the construction of the airship "Roma," with the assistance of Uselli. His airship, the "Norge," was used for the flight with Amundsen to the Pole, in May 1926, when a landing was made at Teller, Alaska. Nobile was promoted to the rank of general, was made a marquis and appointed a professor at the Naples Technical College. A controversy subsequently arose both with Lincoln Ellsworth and Amundsen with reference to the credit for leadership of the expedition. In May 1928 Nobile set out on a second expedition to the North Pole, in the airship "Italia," but shortly after passing over the Pole on May 24, 1928, the airship crashed on the ice (May 25). The gondola and main cabin were smashed, and the 10 men in them thrown out on the ice. Seven of the party were carried away with the balloon, and were never traced. On May 30, three of the party, Malmgren, Mariano and Zappi, set out on foot, hoping to reach Cape North. After their departure on June 9, the remainder of the expedition managed to establish wireless communications with rescue parties, and on June 23 Nobile was rescued by an aeroplane belonging to the Swedish expedition. The six men remaining with the party were rescued. Mariano and Zappi were located on July 12, by the Russian airman Tchuknovsky. Malmgren (*q.v.*) died near Brock Island.

Nobile was found responsible for the loss of the "Italia" by an Italian Commission of Enquiry in 1929 and resigned his rank in consequence.

**NOBLE, SIR ANDREW,** 1ST BART., cr. 1902 (1832–1915), British physicist and artillerist, was born at Greenock on Sept. 15, 1832, and was educated at Edinburgh Academy and at the Royal Military Academy, Woolwich. In 1849 he entered the Royal Artillery, attaining the rank of captain in 1855, and in 1857 became secretary to the Royal Artillery Institution. About this time the question of the supersession of the old smooth-bores by rifled guns was coming to the fore, and on the appointment of the select committee on rifled cannon in 1858 to report on the matter, he was chosen its secretary. He devised an ingenious method for comparing the probable accuracy of the shooting attainable with each type of gun. In 1859 he was appointed assistant-inspector of artillery, and in the following year he became a member of the ordnance select committee and of the committee on explosives, serving on the latter until its dissolution 20 years later. About the same time he was prevailed upon by Sir William, afterwards Lord, Armstrong to leave the public service and take up a post at Elswick. Here he became chairman of the company. About 1862 he invented his chronoscope for the measurement of exceedingly small intervals of time, and began to apply it in ballistic experiments for ascertaining the velocity with which the shot moves along the barrel of a gun with different powders and different charges. Then he joined Sir Frederick Abel in a classical research on "fired gunpowder," the experimental work being largely carried on at Elswick. The conclusions they reached

had a great effect on the progress of gunnery, for they showed increased pressures in the gun. Noble advocated nitro or "smokeless" powders, and the Elswick works provided facilities, which were not offered by the Government, for the necessary experimental work of the committee on cordite. Noble was the recipient of many honours. His scientific papers were collected as *Artillery and Explosives* (1906). He died in Argyllshire on Oct. 22, 1915.

**NOCERA INFERIORE,** formerly NOCERA DEI PAGANI (anc. city *Nuceria Alfaterna*), town and episcopal see, Campania, Italy, province of Salerno, at the foot of Monte Albino, 23 mi. E.S.E. of Naples by rail, 135 ft. above sea-level. Pop. (1936) 23,289 (town); 29,347 (commune). In the old castle Helena, widow of Manfred, died after the battle of Benevento. Two miles east near the village of Nocera Superiore is the circular domed church of Sta Maria Maggiore, dating from the 4th century.

The city early became an episcopal see, and in the 12th century it sided with Innocent II. against Roger of Sicily, suffering severely for its choice. A colony of Saracens introduced by Frederick II. probably gave rise to the epithet ("of the pagans"), as well as to the town of Pagani, about 1 m. west.

**NOCTILUCA,** the organism which is the main and most usual cause of the "phosphorescence" of the sea. *Noctiluca* is a protozoan reaching a length of a millimetre, *i.e.,* it may be visible to the naked eye. (*See* BIOLUMINESCENCE; PROTOZOA.)

**NOCTURN** or **NOCTURNE,** in music a term meaning "night piece," a composition, usually for the pianoforte, of a dreamy, tender, romantic and predominantly sad or wistful character. The name is now inseparably connected with Chopin's incomparable compositions so described, though it was actually first employed by the once famous Irish composer and pianist, John Field (*q.v.*), for some charming pieces of his own in precisely the same style. "Notturno" (Italian) was used originally as a term for a type of serenade. Mozart wrote a delightful work under this name for strings and two horns, and an exquisite number in Mendelssohn's "Midsummer Night's Dream" music is also so described.

In the form "nocturn" the word is used as a form of *Nocturnae* or Watches of the night. On Sundays there are three nocturns; the first contains 12 psalms and the two others contain three psalms each. A lesson is read at the end of each nocturn and each lesson is divided into three portions.

**NODDY,** the name applied to a sea-bird, *Anous stolidus,* one of the Terns (*q.v.*), from its showing so little fear of man as to be accounted stupid. It is heavier in flight than most terns, with shorter wings and less forked tail. The plumage is of a uniform sooty hue, except the light grey crown of the head. The noddy is very generally distributed throughout tropical and sub-tropical oceans. It breeds in astounding numbers, on low cays and coral-islets, making a nest composed of sea-weed or small twigs. Other birds of the same genus are: the darker Pacific noddy (*A. s. sidgwayi*), the still darker Galapagos noddy (*A. s. galapagoensis*) and the white-headed noddy (*A. leucocapillus*). There is also the white noddy (*Gygis alba*).

*See* J. B. Watson in *Papers from the Tortugas Laboratory,* No. 8.

**NODE** [Lat. *nodus,* a loop], in astronomy, one of two opposite points at which a heavenly body passes through the principal co-ordinate plane to which its motion is referred. In the case of the heavenly bodies this plane is commonly that of the ecliptic, but, in special cases, the plane through the origin parallel to the earth's equator or the plane of a planet's orbit is used. The ascending node is that at which the body moves from the south or negative towards the north or positive side of the plane. The moon's nodes are the points in which its path intercepts the plane of the ecliptic. In the geometry of curves, a node is the name given to the loop formed by a continuous curve crossing itself, the point of crossing is termed a "double point," and at it there are two non-coincident tangents to the curve; the remaining species of double points, termed "acnode," "spinode" or "cusp," admits of two coincident tangents (*see* CURVE).

**NODIER, CHARLES** (1780–1844), French author, was born at Besançon. His father, on the outbreak of the Revolution, was appointed mayor of Besançon and Charles is said to have been a member of the Jacobin club when he could not have been more than 12 years old. He was sent to Strasbourg, where he lived in the house of Eulogius Schneider, the notorious Jacobin governor of Alsace, but a good Greek scholar. He became librarian in his native town, but his exertions in the cause of suspected persons brought him under suspicion. For a skit on Napoleon, in 1803, he was imprisoned for some months. He then lived a very unsettled life at Besançon, Dôle, where he married, and in other places in the Jura. During these wanderings he wrote *Le Peintre de Salzbourg, journal des émotions d'un coeur souffrant, suivi des Méditations du cloître* (1803). He continued to lead an unsettled life until in 1824 he was appointed to the librarianship of the Bibliothèque de l'Arsenal. He was elected a member of the Academy in 1833, and died on Jan. 27, 1844. During his 20 years at the arsenal he was able to supply a centre and rallying place to a knot of young literary men of greater individual talent than himself—the so-called Romanticists of 1830—and to colour their tastes and work very decidedly with his own predilections. Victor Hugo, Alfred de Musset and Sainte-Beuve all acknowledged their obligations to him. He was a passionate admirer of Goethe and of Shakespeare. The best examples of his work are to be found in the volume entitled *Mélanges tirés d'une petite bibliothèque.*

His *Description raisonnée d'une jolie collection de livres* (1844), which is a catalogue of the books in his library, contains a life by Francis Wey and a complete bibliography of his numerous works. *See* also Sainte-Beuve, *Portraits littéraires,* vol. ii.; G. Brandes, *Main Currents in 19th Century Literature* (1871); Prosper Mérimée, *Portraits historiques et littéraires* (1874); A. Estignard, *Correspondence inédite de Charles Nodier, 1796–1844* (1876); J. Larat, *Bibliographie critique des oeuvres de Charles Nodier, 1780–1844* (1923); and *La Tradition et l'exotisme dans l'oeuvre de Charles Nodier* (1925); J. Vodoz, *La Fée aux Miettes, Essai sur le rôle du subconscient dans l'oeuvre de Charles Nodier* (1925).

**NŌ DRAMA.** In Japan in the beginning of the 15th century, the *Saru-gaku* (lit. "monkey music," consisting of juggling feats and comic remarks with actions to suit) of Yamato province was revolutionized by Kan-nami Kiyotsugu and his son Se-ami Motokiyo, and what is now known as *nō-gaku,* or *nō* music or drama resulted. Not only did these two geniuses, under the encouraging patronage of the Shogun Yoshimasa, build on what was best in their own *Saru-gaku,* but they drew freely from *Den-gaku* (lit. "rice-field music") which had much in common with the *Saru-gaku.* What was graceful in them was ennobled to profundity in the *nō,* while their comical elements developed into *kyogen* (comic performance) usually given in conjunction with the *nō.*

The *nō-gaku* constituted the principal form of entertainment among aristocrats and the warrior class in the feudal Japan. It was sometimes given in the presence of the emperors, and there prevailed a custom for a time to invite the common people to the performances given in commemoration of some happy events by the Tokugawa Shoguns, who used the *nō* on all ceremonial occasions.

**Staging.**—The *nō* is performed on a wooden stage built above the ground, the regular size of which now is 18 ft. square, open on three sides, with a narrow extension on one side for the singers, and another on the back of the stage for the musicians and attendants. To that rear extension is attached aslant a passage called *hashigakari* (a bridge). The players appear from under the curtain at the one end of which the passage slightly slopes down. The stage, too, is very slightly tilted to the front. For acoustic purposes, big ceramic jars are placed, generally seven under the stage and two or more under the passage according to its length. Three pine saplings are planted at intervals along the front of the bridge. The wooden wall called *kagami-ita* (mirror board) on the back of the rear extension, forming a background to the stage, is always decorated with a painting of a pine tree, and the narrow panel adjoining it on the side with that of bamboo. These paintings, together with the saplings, may be taken to indicate that originally the *nō* was performed in the woods.

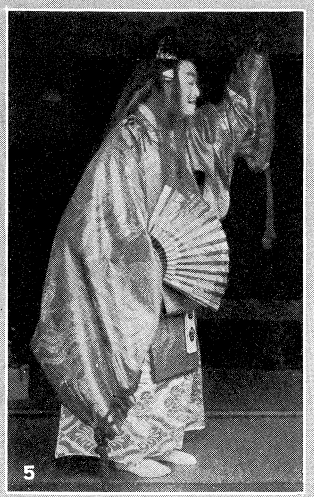
**Character of the Nō Pieces.**—The *nō* pieces, which number more than 250, are classified into five groups for convenience: (1) *waki-nō* (pieces in which *waki,* the secondary character,

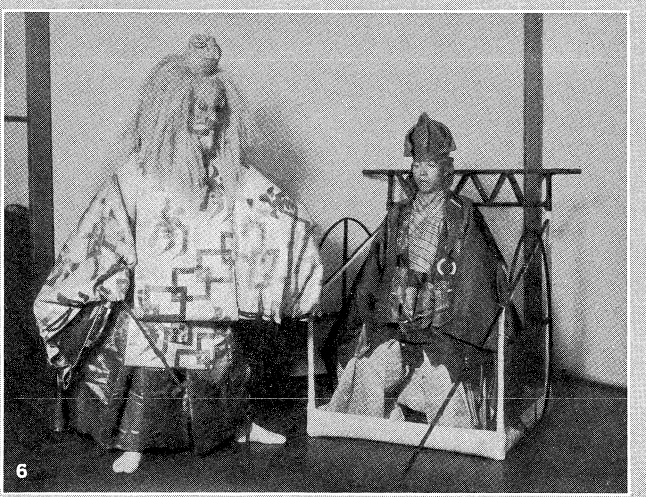
1

2

3

4


5


6

7

8

9

10

11

BY COURTESY OF JIRO HARADA

## CHARACTERS IN THE NŌ DRAMA

1. Celestial being in dancing costume; in *Hagoromo*. Hōshō school
2. Hanako looking at her lover's keepsake; throwing the dress off one shoulder in this instance signifies insanity; in *Hanjo*. Hōshō
3. The ghost of a daughter of the well, dancing in the form of Narihira, her lover; in *Izutsu*. Hōshō
4. The ghost of Rokujo-no-Miyasudokoro, as conceived by Aoinouye; in *Aoinouye*. Hōshō
5. A god being pleased with the filial son of a wood chopper, who is rewarded by the Emperor; in *Yōrō*. Kita school
6. Geni of Atago Mountain and saintly priest of Sagano engaged in discourse; in *Kurumazō*. Hōshō
7. Mother praying for the spirit of her dead son, in *Sumita-gawa*. Kita school
8. Tomonori's ghost attacking his living enemy; in *Funabenkei*. Hōshō
9. Soga brothers about to set out to avenge their father; in *Youchi Soga*. Hōshō
10. Atsumori's ghost narrating the fate of his clan; in *Atsumori*. Hōshō
11. The god Inari assisting at the forging of a sword; in *Kokaji*. Hōshō

BY COURTESY OF JIRO HARADA

## SCENES FROM THE NŌ DRAMA

1. Soga brothers taking leave of their mother before setting out to avenge their father; in *Kosode Soga*. On the Hōshō stage
2. Out in a boat to scare away birds from rice fields; in *Tori Oi*. Hōshō school
3. Benkei and Ushiwaka on the Gojō bridge in Kyoto; in *Hashi Benkei*. Hōshō school
4. Two brothers discussing Buddhistic principles with their enemy; in *Hōkazō*. Kongō school

BY COURTESY OF JIRO HARADA

## MASKS WORN IN THE NŌ PERFORMANCES

1. "Okina" used by the principal character in *Okina*. Hōshō
2. "Magojiro" used by a young woman character. Kongo family in Kyoto
3. "Sanko" used for elderly man of common class. Kongo
4. "Daiakujō" used for an elderly man of fierce character. Marquis Maeda's collection
5. "Zō" used for young woman. Marquis Maeda's collection
6. "Hannya" for woman demon. Marquis Maeda's collection
7. "Yamamba" used by the heroine in *Yamamba*. Marquis Maeda's collection

assumes preponderance in the play) generally dealing with Shinto or Buddhist deities; (2) *Shura-mono,* which commonly deals with ghosts of warriors; (3) *Kazura-mono,* with noble ladies acting the main parts; (4) *Genzai-mono,* or present-day piece, dealing with love, insanity and other manifestations of human nature; (5) pieces dealing with demons or goblins as subjects, or those of congratulatory nature with gay and joyous elements. For each programme of *nō* performance, which generally lasts a whole day, one from each of the above-mentioned five classes is given in the order mentioned, with a *kyogen* between each and generally a dance in an ordinary dress in addition. The whole programme is preceded by a piece called "Okina," which is held in special reverence, the person acting its chief character, Okina, symbolizing the radiant sun-goddess.

**Construction of Nō Pieces.**—The construction of the *nō* piece, though by no means uniform, is generally as follows. A *waki* (the secondary *rôle*), generally a monk or a minister of State, first appears and tells who he is. Then he walks a while, singing, suggesting that he is travelling. Coming to a standstill, he announces his arrival at a certain famous spot and takes his place by the post at the front right-hand corner facing the stage. Then the *maye jite* (the principal character in the first appearance) comes in the form of a farmer, fisherman or priest, etc., describing the scenery of the place, or speaking to *waki* resting at the post. The *waki* questions him, and the *maye jite* gives an historical account of the place and of heroes connected with it, or relates the origin of the temple or shrine as the case may require, thus furnishing the audience with a necessary background to the play. The *maye jite* then retires in a hurry. He was in reality no other than a Shinto or Buddhist deity, or a ghost of a warrior, in disguise. While *waki* is startled by the sudden disappearance, there come to the stage common farmers or wood-choppers and give in plain language, spoken more or less in the ordinary way, all detailed information concerning the place, generally reiterating what was already given in intonation, and retire. This allows a necessary time for the principal character to change for reappearance. While waiting, the *waki* sings, indicating a lapse of time. When it comes to an end, the *nochi jite* (the principal character in the latter appearance) in proper form and attire as a Shinto or Buddhist deity, or a spirit of a hero, comes to the stage and dances as if in a night stroll, revealing some spiritual attributes. In words and in action he recounts his bravery, his death struggle, or his suffering in the underworld, asking for the prayer of the *waki* for the peaceful repose of his soul. The *shite* tells his story as he performs, or he merely dances without any intonation. Generally there is a chorus who intonate either alone or with the performers.

**Music and Accessories.**—Generally several persons sitting on the side extension sing either in chorus, by themselves, or together with the performer. The musicians on the rear extension consist ordinarily of a player each on the transverse flute, the *tsuzumi* (small drum struck with tips of fingers over the shoulder), the *ōkawa* (a slightly larger drum struck on the knee also with tips of fingers) and the drum beaten with two sticks.

The accessories used on the stage in connection with the play are very simple. A fan is much in evidence in the dance (*see* FANS), the studied use of which is very effective with the manipulation of big sleeves. Costumes used in the *nō* are marvels of textile fabrics, refined taste being revealed in bold yet harmonious designs and colours. Above all, the mask to be worn by the principal character (*shite*) and the assistant (*shite-zure*) is a very important part of the *nō* performance (*see* MASKS). There have been great masters among carvers of *nō* masks in the feudal Japan whose works still remain in a large number.

**Main Schools.**—Ever since the great reformation at the beginning of the 15th century, the *nō* has had four main acknowledged schools or houses: Kwanze, Komparu, Hōshō and Kongō, all of which are still thriving. Later, another school, Kita won official recognition, while still another, Umewaka, also has many followers, the variation upheld by each school being but slight. On the whole, the *nō* performance may well be compared to a masterful oriental picture in black monochrome, both being guided by highly idealistic aims and with artistic aspirations with many points in common, possessing alike great impelling qualities that thrill the devotee and weary the uninitiated. It has greatly influenced the Japanese stage and ordinary forms of dance known as *mai,* or *odori,* and it is bound to continue to do so. (*See* THEATRE; JAPANESE LITERATURE; PANTOMIME.)

BIBLIOGRAPHY.—F. Brinkley, *Japan—Its History, Arts and Literature* (Boston and Tokyo, 1901); Marie C. Stopes and Joji Sakurai, *The "Nō" Plays of Old Japan* (1913); N. Peri, *Cinq, Nō, Drama Lyrique Japonais* (1921); A. Waley, *The Nō Plays of Japan* (1921); F. A. Lombard, *An Outline History of the Japanese Drama* (Boston, 1929).

(J. HAR.)

**NOEGGERATH, JOHANN JACOB** (1788–1877), German mineralogist and geologist, was born at Bonn on Oct. 10, 1788. In 1814–15 he became commissioner of mines for some of the Rhine Provinces, and in 1818 professor of mineralogy and afterwards professor of geology, director of the museum of natural history and chief of the mining department in the university at Bonn. He obtained a very fine collection of minerals for the museum and achieved a wide reputation among mining engineers. The Carboniferous plant *Noeggerathia,* allied to the *Zamias* and cycads, was named after him. He died at Bonn on Sept. 13, 1877.

The following are his more important publications: *Über aufrecht im Gebirgsgestein eingeschlossene fossile Baumstämme und andere Vegetabilien* (1819–21); *Das Gebirge in Rheinland-Westphalen, nach mineralogischem und chemischem Bezuge* (4 vols., 1822–26); *Die Entstehung der Erde* (1843); and *Der Laacher See und seine vulkanischen Umgebungen* (1870).

**NOEL, RODEN BERKELEY WRIOTHESLEY** (1834–1894), English poet, son of Noel, Lord Barham, afterwards earl of Gainsborough, was born on Aug. 27, 1834. He was educated at Trinity college, Cambridge, and spent two years in the East. His works include *A Little Child's Monument* (1881). *Behind the Veil, and other Poems* (1863), *Beatrice, and other Poems* (1868), *The Red Flag* (1872), *Livingstone in Africa* (1874), *Songs of the Heights and Deeps* (1885), *A Modern Faust, and other Poems* (1888), *Poor People's Christmas* (1890) and *My Sea, and other Poems* (1896). Roden Noel's versification was unequal and sometimes harsh, but he has a genuine feeling for nature, and the work is permeated by philosophic thought. He died at Mainz, on May 26, 1894.

His *Collected Poems* were edited (1902) by his sister, Victoria Buxton, with a notice by J. Addington Symonds.

**NOGALES,** a city on the southern boundary of Arizona, U.S.A., adjoining Nogales, Mexico (*q.v.*); a port of entry, headquarters of the Arizona customs district, and the county seat of Santa Cruz county. It is the southern terminus of federal highway 89, and is served by the Southern Pacific railroad. The population was 5,199 in 1920 (49% foreign-born white) and in 1940 5,135. The international boundary is a barbed-wire fence down the middle of the main street of the two cities. Nogales has an altitude of 3,869 ft., and is surrounded by the Patagonia mountains.

The commerce of the customs district with Mexico in 1927 amounted to $25,057,175 (58% imports). Stock raising and mining (lead, silver and copper) are the leading occupations of the region. The old Spanish mission of Tumacacori is 18 mi. N. In 1880 Nogales was a trading post. In 1893 it was incorporated as a town and in 1919 as a city.

**NOGARET, GUILLAUME DE** (d. 1313), councillor and keeper of the seal to Philip IV. of France, was born between 1260 and 1270, the son of a citizen of Toulouse. The family took its name from a small property near Saint Félix de Caramon. In 1291 Guillaume was professor of jurisprudence at the University of Montpellier, and in 1296 became a member of the Curia Regis at Paris. His name is connected with Philip IV.'s quarrel with Pope Boniface VIII. (*q.v.*), to whom Nogaret was sent with an embassy in 1300. In Feb. 1303 Nogaret persuaded Philip to agree to a plan to seize Boniface and bring him to a council in France which should depose him. Nogaret went to Italy, and captured Boniface, with the help of Sciarra Colonna, but was eventually defeated by a rising of the townsmen of Anagni. The pope's death at Rome, on Oct. 11, saved Nogaret. The election of the timid Benedict XI. was the beginning of that triumph of France which

lasted through the Avignon captivity. Early in 1304 Nogaret was sent by Philip to demand from Benedict XI. absolution for the enemies of Boniface VIII. Benedict refused to receive Nogaret, and he was excepted from the general absolution of May 13, 1304, and issued against him and his associates the bull *Flagitiosum scelus*. A Frenchman, Bertrand de Got (Clement V) was elected pope on Benedict's death in 1304. The threat of proceedings against the memory of Boniface had forced Clement to absolve Nogaret. When Philip proposed an enquiry into the condition of the Templars as a preliminary to their arrest and the seizure of their property, Nogaret persuaded the renegade members to give evidence against their fellows. Clement's ineffective resistance still further delayed an agreement with Philip. Nogaret became keeper of the seal in 1307, and his talents as *advocatus diaboli* had further scope in the trial (1308–13) of Guichard, bishop of Troyes, charged with crimes which included witchcraft and incontinence. Clement feared similar proceedings against Boniface, and gave Nogaret absolution on April 27, 1311.

*See* E. Renan in *Histoire littéraire de la France,* xxvii. 233; R. Holzmann, *Wilhelm von Nogaret* (Freiburg, 1898). For the sources consult Dom Bouquet, *Recueil de historiens des Gaules et de la France,* vols. xx.–xxiii.; *Annales regis Edwardi primi* in Rishanger ("Rolls" series), pp. 483–491, which gives the fullest account of the affair at Anagni

**NOGENT-SUR-MARNE,** a suburb 6.7 mi. east of Notre Dame de Paris, in the department of Seine, on a hill on the right bank of the Marne. Pop. (1936) 21,056. The Eastern railway here crosses the Marne valley by a viaduct 875 yd. in length. Nogent has a Gothic church, with a tower of the Romanesque period, in front of which there is a monument to Watteau, who died here in 1721. Chemical products are manufactured. The fine situation of the town gained it the name of Beauté, and Charles V built a château here (demolished in the 18th century) which was presented by Charles VII to Agnes Sorel with the title of Dame de Beauté. An island in the Marne to the south of the town is still known as the Île de Beauté. The increase of population here in recent years is very notable.

**NOGUCHI, HIDEYO** (1876–1928), Japanese bacteriologist, was born in Inawashiro, Yama, Fukushima, Japan, Nov. 24, 1876. He received the degree of M.D. in 1897 from the Tokyo Medical college and subsequently did post-graduate work in the United States and Europe, becoming connected with the Rockefeller Institute for Medical Research in New York in 1904. He was the first to obtain pure cultures of the spirochaete of syphilis and to establish the syphilitic nature of general paralysis and *tabes dorsalis* by demonstrating the organism in the cells of the central nervous system of persons dying of these diseases. He did considerable work on the analysis of the Wassermann reaction for the diagnosis of syphilis and devised a skin test for syphilis and a method for the detection of syphilitic and other pathological conditions in the spinal fluid. One of the first to recognize the germicidal properties of certain compounds of unsaturated fatty acids for acid-fast micro-organisms, *e.g.,* the tubercle bacillus, he discovered the parasite of yellow fever in 1918 and prepared a prophylactic vaccine and a curative serum for combating this disease. He also isolated the parasite of Oroya fever and *Verruga peruviana.* During his investigations he contracted yellow fever and died in British West Africa on May 21, 1928.

His published works include *Snake Venoms* (1909), *Serum Diagnosis of Syphilis and Luetin Reaction* (1910) and *Laboratory Diagnosis of Syphilis* (1923).

**NOISE AND ITS CONTROL.** No rigid definition of noise is possible. By analogy with "dirt," it has been called "sound out of place," and it is usually a medley of individual sounds. For measuring noise the instrument most widely used, especially in America, is the audiometer devised by the Bell Telephone Laboratories, in which the noise is matched in the observer's ear against a standard noise produced by the instrument. In England measurements have been made with an electric audiometer invented by Mr. A. M. Low. "Noise units" have been used to express such measurements but most of these are of comparative value only. For scientific purposes the units should be purely physical; for example, to dynes per square centimeter.

A comprehensive survey of the intensity and sources of city noise was made in 1925 and 1926 in New York city. Partial surveys have been made in London, Chicago, Boston, Washington and other cities. The noisiest normal street corner so far discovered anywhere in the world is the corner of Sixth avenue and Thirty-Fourth street in New York city; an intersection of three main highways, three surface car lines and a double-track line of the elevated railway. At this corner the noise intensity is sufficient to make the normal individual about two-thirds deaf. Noise intensity in exceptional places, like railway subways or noisy factories, may be twice or three times greater than this. On the average busy street of an American city the day-time noise is sufficient to render the normal individual one-fourth to one-third deaf. The ebb and flow of noise from hour to hour during the 24-hour day parallels precisely the increase and decrease of vehicular traffic on the streets. In physical units the New York city street noise was found to vary between 0·001 dynes per square centimeter and 20 dynes, averaging about 5 dynes.

Approximately 40% of the noise could be traced to the automobile trucks used for commercial deliveries; 25% to the elevated railway, and 20% to the surface cars. The remaining 15% was supplied by private automobiles, taxicabs, automobile horns, horse-drawn vehicles, riveting and excavating machines, alarm signals of the fire and police departments and other occasional noise-producers. At no place on city streets do human speech and human feet make measurable contributions to the noise. At windows street noise decreases with height, but much less so than would be expected from the physical law of attenuation of sounds in the open air, the discrepancy being due to reflection of the noise between the buildings on the two sides of the street.

The usual assumption that noise is harmful to man is by no means proved. Noise is known to affect the human heart beat as well as the rate at which heat energy is set free in the human body, but the details of these effects have not been studied. Most individuals accustom themselves to living or working in noisy surroundings and only nervous individuals who fail to make this adjustment suffer harmful effects. It has been urged that the greater use of bodily energy in noisy surroundings may cause bodily ills. Searching investigations of these problems are now (1929) under way in several American laboratories of psychology. Contrary to the usual opinion, there is no dependable evidence that life or work in noisy places decreases the acuteness of hearing, except during the first few minutes after the noise ceases.

Much noise could be prevented by denying use of the streets to vehicles improperly cared for, and which rattle or squeak, especially automobile trucks; also by preventing loose, rattling parts on surface cars and by removing loose or wide crossings in the rails of street railways and by restricting the blowing of horns. It is possible that the average street noise of a city could be reduced at least one half by adequate enforcement of such regulations. The construction of noise-proof rooms or noise-proof houses is possible on well-known principles of architectural acoustics but is too expensive for general use. (E. E. F.)

**Law.**—In law noise may be defined as an excessive, offensive, persistent or startling sound. By the common law of England freedom from noise is essential to the full enjoyment of a dwelling house, and acts which affect that enjoyment may be actionable as nuisances. But it has been laid down that a nuisance by noise, supposing malice to be out of the question, is emphatically a question of degree (*Gaunt* v. *Finney,* 1872, 8 Ch. Ap. 8). The noise must be exceptional and unreasonable. The ringing of bells, building operations, vibration of machinery, fireworks, bands, a circus, merry-go-rounds, collecting disorderly crowds, dancing, singing, etc., have been held under certain circumstances to constitute nuisances so as to interfere with quiet and comfort, and have been restrained by injunction. Noise occasioned by the frequent repetition of street cries is frequently the subject of local by-laws, which impose penalties for infringement.

**NOLA,** an ancient city and see of Campania, Italy, province of Naples, pleasantly situated in the plain between Mount Vesuvius and Apennines, 16¾ m. E.N.E. of Naples by rail, 121 ft. above sea-level. Pop. (1936) 10,733 (town); 18,436 (commune). There is an ancient Gothic cathedral with its lofty tower. July

26 is devoted to a great festival in honour of St. Paulinus (*q.v.*). The church erected by him in honour of St. Felix in the 4th century is extant in part. Giordano Bruno (*q.v.*) was born at Nola in 1548. The Etruscans were in Nola about 500 B.C. They helped Neapolis against the Roman invasion (328 B.C.). The Romans made themselves masters of it in 313 B.C. In the Social War it was betrayed into the hands of the Samnites. Sulla in 80 B.C. subjected it with the rest of Samnium. Seven years later it was stormed by Spartacus. Nola became a Roman colony under Augustus, who died there. It was sacked by Genseric in 455, by the Saracens in 806 and 904, captured by Manfred in the 13th century, and damaged by earthquakes in the 15th and 16th.

Nola lay on the Via Popillia from Capua to Nuceria and the south, and a branch road ran from it to Abella and Abellinum. While independent it issued an important series of coins, and in luxury it vied with Capua. Its territory was very fertile. A large number of vases of Greek style were manufactured here of pale yellow clay with shining black glaze, decorated with skilfully drawn red figures. Of the ancient city, numerous ruins, an amphitheatre, still recognizable, a theatre, a temple of Augustus, etc., existed in the 16th century. The neighbourhood was divided into pagi or villages, the names of some of which are preserved to us (Pagus Agrifanus, Capriculanus, Lanitanus). (T. A.)

**NÖLDEKE, THEODOR** (1836–1930), German Semitic scholar, was born at Harburg on March 2, 1836, and studied at Göttingen, Vienna, Leyden and Berlin. In 1859 his history of the Koran won for him the prize of the French Académie des Inscriptions, and he rewrote it in German with additions (*Geschichte des Korans*, Göttingen, 1860). He taught at Göttingen (1861), Kiel (1868) and Strassburg (1872). In the main his work deals with Semitic languages, and the history and civilization of Islam.

Among his best-known works are: *Das Leben Mohammeds* (1863); *Beiträge zur Kenntnis der Poesie der alten Araber* (1864); *Die alttestamentliche Literatur* (1868); *Untersuchungen zur Kritik des Alten Testaments* (1869); *Zur Grammatik des klassischen Arabisch* (1896); *Fünf Mo'allaqat, übersetzt und erklärt* (1899–1901); *Beiträge zur semitischen Sprachwissenschaft* (1904); *Neue Beiträge zur semitischen Sprachwissenschaft* (1910). In the *Encyclopædia Britannica,* he wrote on Persia, the Koran and other subjects.

**NOLLEKENS, JOSEPH** (1737–1823) British sculptor, was born on Aug. 11, 1737, in Dean Street, Soho, London, where his father, a native of Antwerp, the "old Nollekens" of Horace Walpole, was a painter of some repute. In his thirteenth year he entered the studio of the sculptor Peter Scheemakers for drawing and modelling. In 1760 he went to Rome, and his marble bas-relief, "Timoclea before Alexander," brought him a prize of fifty guineas from the Society of Arts in 1762. Garrick and Sterne were among the first English visitors who sat to him for busts; another important piece belonging to this early period is the "Mercury and Venus chiding Cupid." On his return to England he became an associate of the Royal Academy (1771), and in 1772 a member. By this time he had become known to George III., whose bust he shortly afterwards executed, and henceforward, until about 1816, he was the most fashionable portrait sculptor of his day. He himself thought highly of his early portrait of Sterne. Others were those of Pitt, Fox, the prince of Wales (afterwards George IV.), Canning, Perceval, Benjamin West and Lords Castlereagh, Aberdeen, Erskine, Egremont and Liverpool. Among his numerous marble groups and statues are the "Bacchus," "Venus taking off her Sandal," "Hope leaning on an Urn," and (his own favourite performance) "Venus anointing Herself." His work is remarkable for delicacy of workmanship, but deficient in vigour and originality. A later characteristic of Nollekens was his miserliness. He died in London on April 23, 1823, leaving a large fortune.

**NOLLE PROSEQUI,** a term of English law now only used of a stay of proceedings by indictment or by information entered by the attorney general. The *nolle prosequi* is a matter purely for his discretion, and will not be granted unless very good ground be shown for his interference. The object of it generally is to obtain a stay of proceedings against an accomplice in order to procure his evidence. This object is, however, more usually effected by the prosecution offering no evidence and the judge directing an acquittal.

In the United States the attorney general has not always the same discretion with which English law invests him. Although in some States the prosecuting officer may enter a *nolle prosequi* at his discretion, in others the leave of the court must be obtained.

**NOMADS,** "wanderers," primitive pastoral people who have no settled territory.

Nomads seem to exist in every large territory. Some, like the gypsies (*q.v.*), becoming international. There are Asiatic nomads of all types, the chief being the Mongols whose nomadism became highly specialized. The Basques (*see* EUROPE: *Races and Peoples*) are generally supposed to have been nomads from a remote corner of Asia and the report that shifting colonies of *Euskera* stock are to this day found in South America supports this view. Northern Asia is the home of numerous wandering tribes, whose very names have only recently been recorded. These tribes have a definite relation with the settled peoples over whose territory they roam, as is the case with the African nomads (*see* below). Indo-China has its nomad peoples, and South-west China is an area over which several nomad stocks wander. The change from nomadism to a settled state of occupation in well-defined areas is rare but not unknown. (*See* ASIA: *Ethnology; Indo-China.*)

Nomads proper are those who roam over different territories in actual quest of sustenance; as the name implies, they are pastoral people depending on grazing for their animals and edible roots and fruits for themselves. (*See* BUSHMEN.) These nomads have extraordinary powers of adaptability and can support long periods of hunger. The Australian aborigines are sufficiently skilled in woodcraft to trap animals by simply stealing upon them quietly and using the most primitive weapons. The pampas Indians are horseback nomads and wander to and fro over large tracts of territory.

The Bedawin (Bedouins) or Arabs of the desert are among the most familiar of all pastoral nomads, and their nomadism has no known beginning. In times of drought and food shortage such nomads as these and the Hottentots (*q.v.*), are compelled to raid their agricultural settled neighbours. The Kirghiz, an Altai people, are the prominent nomads of Central Asia and their ballads tell of their love of wandering and their passion for their horses, their only tangible possessions.

In recent years much attention has been directed to the nomads of East Africa, as it is believed that from these sprang the original individual peoples of Africa. Some of these nomads are pygmies.

It is probable that at one time they all spoke a distinct language and that many still preserve their own language, while using the language of the tribes among whom they reside. The pygmies of the upper Welle speak the Mbuba language in a manner markedly different from the Mbuba pronunciation, substituting for certain consonants a curious gasp or hiatus almost approximating to a click. The Sanya of north-east Kenya and certain of the Watta are also said to use clicks. The Sandawe (*q.v.*) of Tanganyika Territory, whose skulls possess distinctly Hottentot characters, retain the typical Bushman clicks and gutturals. Rarely has the tribal name been ascertained, the different nomadic groups being called by the names bestowed on them by neighbouring tribes, but the persistence of some of these appellations is remarkable. Some form of the name Twa is widespread among the Bantu: thus the Bushmen of South Africa are known to their neighbours as Abatoa and Batwa is common throughout the Congo and Uganda. The word is said to mean "Bushdwellers," and is probably unconnected with the Watta of southern Abyssinia which is derived from an old Cushitic root meaning "Wanderers." Aka is a name, given to geographically distinct groups of nomads.

In the mountainous forest country of south-west Uganda we find semi-pygmy hunters known as Batwa, and the name reappears on the upper slopes of mount Elgon at an altitude of from 9,000–11,000ft., where they build earth-roofed huts and live principally on rats, other small mammals and honey.

The Sanya and Choni, hunting tribes living on the banks of the Sabaki and the Tana in Kenya, are also known as Watta to the Galla. They are similar to the Boni of Jubaland, and together with the Midgan and the Sandawe, who also practise circumcision,

are the only nomad communities who practice clitoridectomy.

The Doko pygmies were first described in 1842 by Sir W. C. Harris and later by Borelli and Donaldson Smith, and Rigby also in 1842 reported from hearsay evidence the existence of some pygmies called Berikimo about six weeks inland from Mombasa. The latter are probably the pygmies near Lake Baringo, and the former may be the dwarf Dume who are found in the vicinity of Lake Stephanie. Another group of pygmy nomads exists on the slopes of Mt. Kilimanjaro known as Wapare.

Among the Turkana to the west of Lake Rudolf we find the Teuth, who live on roots and grubs and hunt the smaller mammals, and farther south the Ogiek, known to the Masai as Doroba from the Masai word for tsetse fly to which their arrows are likened, wander over a wide area of forest and bush country between Lake Victoria and the eastern lowlands, maintaining a livelihood by hunting and trapping. Among the Nandi the Ogiek are the hunters, but the Kunono fulfil this menial role for the Masai. The Embu speak of pre-Embu inhabitants of Kenya as "Agumba" or "Asi," pygmies, forest-dwellers and hunters. The northern Watta of Lake Tana are fishers and skilled watermen, who use papyrus rafts, and on Lake Kwanya the Kenyi, a Bantuized type of nomad, live on the papyrus marshes and are completely aquatic without any interests on the land, being reminiscent culturally of the Batwa on Lake Bangweulu.

Wherever the nomads are found in East Africa they are treated as pariahs and are engaged in trades or occupations which are considered ignoble, such as hunting, fishing, metallurgy, leather-tanning and pottery. Among the Kaffa and the Galla they provide the executioners. They are dispossessed rather than conquered, and though among the Kaffa they perform menial services like the collection of fuel it is just among the Kaffa that their tribal organization is most developed under an independent chief.

They adopt the language of the tribes among whom they live, and in many cases their social organization, costume and even religion. Thus the Sanya have a clan organization based on Galla clans with Galla clan names, and have imitated the Galla initiations and system of age-grades. The Somaliland nomads use Mohammedan invocations and celebrate the Mohammedan feasts in addition to their own pagan ritual. But, generally speaking, their religion is a vague ancestor-worship. Except when, like the southern Watta, they build temporary villages they are monogamous, and the family wanders from place to place erecting no more than a rude shelter for the night. When anything more permanent is built the little huts are situated close to river banks and are roughly thatched with palm fronds. The northern Watta have portable cane huts which they carry with them in their wanderings. Caves are also used as dwellings and others build hiding-places in trees. They possess no domesticated animals except dogs, and few practise agriculture, and that only of the most elementary kind. Their weapons are the bow and arrow with sometimes a spear in addition, and poison is applied to all weapons. The northern Watta, like the Ogiek, use a hunting spear with a detachable head, which carries the owner's distinctive mark enabling him to claim the kill. Game pits are used also.

Usually they are naked, but they may adopt some of the costume of their neighbours. Thus among the Kaffa the nomads have adopted the Kaffa headdress, a conical hat of monkey fur, and wear the large skin aprons worn by their Kaffa overlords. The Fuga, adjacent to the Watta, now clothe themselves with the typical Galla kilt. The Midgan women plait their hair after the Somali fashion, but long, plaited hair is an indigenous characteristic among several groups, particularly in the Bantu zone, as among the Amba negrillos on the Western flanks of Ruwenzori. The Ogiek plait their hair like the Nandi and wear a skull-cap made from the stomach of a goat like their Kamasia neighbours.

Everywhere the nomads, despite their low status, are respected and feared, both for their knowledge of poisons and of sorcery in which they are thought to be most proficient. This attitude points to the probability that they were the original owners of the country, their conquerors recognizing their greater spiritual affinity with the soil together with its magical implications; and tends to discredit a Watta legend (of doubtful authenticity) that the Watta were banished from Egypt and on arrival at their present habitats were subjected by the Hamites who were already in possession of the country.

BIBLIOGRAPHY.—Antoine d'Abbadie, *Géographie d'Éthiopie* (1890); Gustavo Bianchi, *Alla terra dei Galla* (1884); Enrico Cerulli, "The Folk Literature of the Galla" (*Harvard African Studies,* vol. iii., 1919); Sir H. H. Johnston, *The Uganda Protectorate* (1902); Capt. C. H. Stigand, *The Land of Zinj* (1913).

**NOME,** an Alaskan town on the shore of Seward peninsula, 115 mi. from St. Michael; in 1900 the largest settlement in the territory. Pop. (1900) 12,488; (1939) 1,559. Gulch gold was found near Nome on Anvil creek in Sept. 1898, and diggings on the ocean beach were first worked in July 1899. The rush to Nome in 1900 was one of the most remarkable stampedes in American mining history; the town soon had hotels, banks, stores, several newspapers and weekly mails from the United States; for part of the year there were, it was estimated, 20,000 inhabitants. By 1903 the population had greatly decreased, and in subsequent years the winter population averaged about 3,500, the summer population from 7,000 to 8,000. In 1905 the gold output of the Nome region amounted to about $2,500,000, nearly all from placers, though some quartz mining was done. The output in 1939 in Nome and vicinity (Seward peninsula) was only 36 fine ounces. The nearest harbour is at Point Clarence, 80 mi. west. At Nome, the ice floes are sometimes 30 ft. high on the beach. It was first called Anvil City; the name "Nome" is derived from Cape Nome, first so called on a chart dated 1849, and said to have been a draftsman's mistake for the query "?Name" on the original chart.

**NOMENOË** or NOMINOE (d. 851), duke of Brittany. To pacify Brittany, Louis the Debonair named him count of Vannes in 819 and governor or duke of Brittany in 826. Throughout the reign of Louis, Nomenoë maintained peace in Brittany. But in 841 he resolved to make himself independent of Charles the Bald. In 843 Charles made a vain attempt to subdue Brittany. In 844 Nomenoë invaded Maine, and in 845 the emperor was completely defeated at Ballon near Bain-de-Bretagne. In 846 Charles recognized the independence of Brittany. Having resolved to detach the duchy from the ecclesiastical province of Tours, Nomenoë accused the Frankish bishops of Vannes, Quimper, Dol and Léon of simony at the council of Coëtlouh in 848, replaced them by Bretons, and erected Dol into a metropolitan see. In 849 Nomenoë attacked the Frankish county of Anjou. Charles established a garrison at Rennes. Nomenoë seized Rennes, Nantes and Upper Brittany, and ravaged Maine. In 851 he seized Anjou and invaded Beauce. He died suddenly, leaving as his successor his son Erispoë.

*See* A. de la Borderie, *Histoire de Bretagne,* vol. ii. (1898); R. Merlet, "Guerres d'indépendance de la Bretagne," in the *Revue de Bretagne, de Vendée et d'Anjou* (1891).

**NOMINALISM,** the name of one of the two main tendencies of mediaeval philosophy, the other being Realism (from Lat. *nomen,* name). The controversy between nominalists and realists arose from a passage in Boëthius' translation of Porphyry's *Introduction to the Categories of Aristotle,* which propounded the problem of genera and species, (1) as to whether they subsist in themselves or only in the mind; (2) whether, if subsistent, they are corporeal or incorporeal; and (3) whether separated from sensible things or placed in them. The Realists held that universals alone have substantial reality, existing *ante res;* the Nominalists that universals are mere names invented to express the qualities of particular things and existing *post res;* while the Conceptualists, mediating between the two extremes, held that universals are concepts which exist in our minds and express real similarities in things themselves. Though a strong realist tendency is evident in the system of Erigena (9th century), the controversy was not definitely started till the 11th century: it lasted till the middle of the 12th, when the first period of scholastic philosophy ends. Under an appearance of much vain subtlety the controversy about universals involved issues of the greatest speculative and practical importance: realism represented a spiritual, nominalism an anti-spiritual, view of the world; while realism was evidently favourable, and nominalism unfavourable, to the teaching of the Church on the dogmas of the Trinity and the Eucharist. Nominalism was a doctrine of sceptics and suspected heretics, such as

Berengar of Tours and Roscellinus. Even Abelard's mediating doctrine of conceptualism (*q.v.*) was sufficiently near to obnoxious ideas to involve him in lifelong persecution. The principles of the great orthodox philosophers of the later scholastic period which begins in the 13th century, Albertus Magnus and Thomas Aquinas, were those of moderate realism. When nominalism was revived in the 14th century by the English Franciscan, William of Occam, it gave evidence of a new tendency in thought, a distrust of abstractions and an impulse towards direct observation and inductive research, a tendency which had its fulfilment in the scientific movement of the Renaissance. Occam's dictum "Entia non multiplicanda sunt praeter necessitatem" was inspired by a spirit similar to that of Bacon. Though nominalism is properly a mediaeval theory, the tendency has passed over into modern philosophy: the term "nominalist" is often applied to thinkers of the empirical, sensationalist school, of whom J. S. Mill may be taken as the chief representative. (H. St.)

**NOMOGRAPHY,** a comparatively recent development in applied geometry, analogous to descriptive geometry or to graphical statics. Its object is the general study of the representation, by means of diagrams call *nomograms,* of mathematical laws (Gr. *nomos,* a law) which are expressed analytically by means of equations with any number of variables. The principle involved in representations of this kind was first applied, in the case of a law involving only two variables, by Descartes when, by means of co-ordinates, he showed that every equation in two variables corresponds to a plane curve.

In constructing such a graph we may neglect all measurements, simply drawing on squared paper, divided, say, into millimetres and having two graduated axes, $OX$ and $OY$. A simple reading is then sufficient to give the different values of the variables as thus connected. This method of representation is now perfectly familiar even to those who are not mathematicians.

Thus, to represent the law, $f(z_1\ z_2)=0$, trace a curve whose cartesian equation is, $f(x, y)=0$, on squared paper where $x=z_1$ and $y=z_2$. In the case of a law involving three variables, $f(z_1, z_2, z_3)=0$, the solution that first suggests itself is to give to $z_3$ any arbitrary value and then to proceed as in the example above. If, however, we give to $z_3$ a series of sufficiently contiguous values, and for each of these construct the lines to represent the laws of $z_1$ and $z_2$, then it suffices to write beside each line the value of $z_3$ which served in its construction; for then the lines $x=z_1$ and $x=z_2$, parallel to the axes of the diagram, and the line $z_3$, pass through the same point if the values of $z_1$, $z_2$, and $z_3$, satisfy the given equation. Margetts applied such an idea in his *Longitude* and *Horary Tables* (published in London in 1791). It was also put into systematic use by Pouchet and published in his *Arithmétique linéaire* (an appendix to his *Métrologie terrestre* [Rouen, 1797]). Since that time the idea has gained wide usage.

It should be observed that it is arbitrary to take $z_1$ and $z_2$ and that we can as well replace the axes by two simply infinite systems of lines, the one determined by the values of $z_1$, and the other by the values of $z_2$. At the outset, one will be tempted to see in this only a useless complication, since representation by means of rectangular axes in a plane does not lend itself to equations in three variables. However, there are many instances where, in replacing the rectangular axes by other systems of lines made to correspond to $z_1$, and $z_2$, we obtain straight lines also for $z_3$, which formerly had to be traced out point by point on the ordinary squared paper. Hence arises a greater rapidity, simplicity and precision of the new construction.

The underlying idea of such a transformation was formulated in 1842 by Lalanne, under the name, *the principle of anamorphosis.* This transformation was generalized to a high degree in 1884 by Massau. M. d'Ocagne also helped to generalize this transformation when, recognizing the ease of drawing circles, he developed a theory of representation of equations by three systems of circles (S.52 in the first edition of his *Traité de Nomographie,* 1899).

By means of concurrent lines it is impossible to represent equations of more than three variables, since it is not possible to represent on a plane any system of lines of more than two parameters. Nevertheless, it was possible to use this method for certain equations in more than three variables if, by introducing auxiliary variables, one could replace the given equation by a series of equations in three variables. A particular example of this device was proposed by Lallemand, in 1885, in the form of *binary scales* which he introduced in his *abaques hexagonaux* (an ingeniously combined variation, in view of certain practical ends, of Lalanne's *abaques* with their three pencils of parallel lines). In view of the nature of a nomographic diagram, Lalanne applied to it the name *abacus* (ἄβαξ), and the term has remained.

But to obtain an *intrinsic* representation of an equation of more than three variables, without introducing auxiliary variables, it is necessary to make use of some other principle of representation. The first principle of this kind to appear was that of *collinear points,* which was introduced by M. d'Ocagne in 1884, and has proved to be so usable that, for equations with four variables, such as are found in practical work, it is employed almost universally. The method was derived from a particular application of Chasles's principle of duality, together with a special system of tangential co-ordinates (called *parallels*); it substituted for the concurrent lines of the older anamorphosic diagrams the collinear points; and where in the older method it was only possible to represent a simply infinite system of lines, one could diagrammatize a doubly infinite system of points. This explains why, with concurrent lines, intrinsic representation was limited to three variables, and why it is now possible to include as many as six variables.

As a typical example of an equation which it was not possible to represent by means of concurrent lines, which can easily be treated by means of collinear points, there may be mentioned quadrinomial equations, or more particularly, a complete cubic equation, which we meet with in certain problems of hydraulics and resistance of materials; also the fundamental formulas of spherical trigonometry (which leads to the nomographic solution of all problems in astronomy of position and in navigation); d'Ocagne has also shown that all such problems can be resolved by means of a special unique nomogram. (*Comptes Rendus de l'Académie des Sciences,* vol. 138, p. 70, 1904; and *Bulletin de la Société Mathématique de France,* vol. 32, p. 196, 1904.)

In 1891, under the name *Nomography,* then used for the first time, M. d'Ocagne worked out a synthesis of all the methods of graphic representation proposed up to that date, taking the various points of difference and welding them into a unity of conception. Since then he has continued to search for means of extending these methods into various fields of practice.

In considering a number of planes superimposed upon each other, each with its given geometrical elements numbered or not (called *constants*), among which is established a certain graphic liaison, he has been able to extend these methods and make them as general as possible with a given number of variables. To develop this idea, let us call $E_1$ a geometrical element (point or line) defined by the parameter $z_1$. Now, the aggregate of elements $E_1$ constitutes the system $(E_1)$, and each element is determined by the corresponding value of $z_1$.

If such systems as $(E_1)$, $(E_2)$, . . . , $(E_n)$, fixed or subject to displacement, one with respect to another, co-exist in a plane, and if they are placed in such a way as to realize between the elements a given graphic liaison, this liaison will be expressed by an analytical relation of the corresponding values of the variables, $z_1$, $z_2$, . . . , $z_n$ such as $f(z, z_2 \ldots, Z_n)=O$. This aggregate of numbered systems, completed at the moment when graphic liaison is realized between them, constitutes a nomogram of the equation. Such a nomogram permits, by a simple reading (which guides the graphic liaison in question), the determination of the values of any one of the variables entering into the equation considered, when the values of the other $n-1$ are given.

After these explanations it is easy to perceive what the object is in the more general problems of nomography; one might formulate it thus: one equation being given, to construct a nomogram by means of systems $(E_1)$, $(E_2)$ . . . $(E_n)$ as quickly and easily as possible (*i.e.,* by means consisting exclusively, if possible, of points, straight lines, or circles); a graphic liaison would be established at once between them.

To do this, it is necessary at the outset by a kind of inverse process, to study the types of nomograms conceived *a priori* as the most simple for obtaining the canonical forms of the corresponding equations; for recognizing the conditions necessary for an equation to be reduced to one of these forms; and when this reduction is possible, for deciding the simplest and most direct means of constructing the corresponding systems. It was the need for presenting the nature of mathematical problems that gave rise to nomography, problems into the details of which we need not enter here.

However, without entering into detail, one can take account, more or less, of the manner by which one forms rationally the fundamental types of nomograms. To do this it is first necessary to understand what, being immediately discernible, constitutes a graphic liaison. The only relation of position between two geometrical elements that one can judge at a glance with sufficient exactness is a contact and, more specifically, a contact between line and point; in this connection the parallelism of two straight lines (which one can also judge with some precision) may also be considered, for it is in effect the contact of one of the straight lines with the point at infinity of the other.

The notion of the *graphic contact* being thus understood, we come easily to the conviction that *every graphic liaison intervening in a nomogram consists simply in the simultaneity of many contacts between numbered elements or constants.* Such is the postulate that is to be found at the base of nomography. While we must occasionally consider intervening contacts, confined in practice almost always to contacts between points and lines (parallelism included), the contacts between lines are so infrequent that we may neglect them in this sketch.

It is proper to recall here, as we have noted above, that we can only consider, on a plane, those systems of lines which depend upon a single parameter; on the other hand, it is possible to consider a doubly infinite system of points which has been formed by the mutual intersections of lines taken in two simply infinite systems. The aggregate of these two systems forms what is known as a *reseau* (net). From this it follows that the maximum number of variables directly intervening in the same contact is, at most, three; two being affected by the point, the third by the line entering into the contact. But there must be three contacts, from one plane to the other, to fix the position of a moving plane in reference to a fixed plane. The position being thus fixed, it is then possible to establish a contact between elements belonging to each of the planes; we may then secure an intrinsic representation for equations having as many as 12 variables. This principle was communicated to the Académie des Sciences de Paris by M. d'Ocagne in 1893 (*Comptes Rendus,* vol. 117, p. 216 and 277). If one of four intervening contacts is reduced to a parallelism of the axes $OX$ and $O'X'$ of the two planes, the orientation of the moving plane remains constant in relation to the fixed plane, and can be treated by a type of nomogram which permits intrinsic representation of as many as nine variables. This problem was made the subject of a profound study by Margoulis under the title *L'abaque à transparent orienté.*

If we consider a case where $n$ moving planes are fixed simultaneously on a fixed plane, the fixation of each of them is made by three contacts, and it can be seen that we thus arrive at the most general type of nomogram permitting the intrinsic representation of equations up to $3(3n+1)$ variables.

Nomography reached its full development in the comprehensive *Traité* of M. d'Ocagne, published in 1899, and crowned with the Prix Poncelet (in 1902) by the Académie des Sciences. Since the appearance of this work, later theoretical developments have been made by Soreau, Farid Boulad, Clark, Gercevanoff, Margoulis and others, and the applications have multiplied to an extraordinary degree. Among these applications, the most numerous are those derived from the principle of the collinear points, relating moreover to all kinds of technical fields. The library of the Ecole des Ponts et Chausées in Paris has a considerable collection of material, brought together for most part by M. d'Ocagne. Next to the above method, the orientation of transparents, due to Margoulis, seems to be the most fruitful. Indeed, he has opened up a large number of interesting applications relating to hydrodynamics, aerodynamics, aviation, etc.

BIBLIOGRAPHY.—Works of M. d'Ocagne: *Nomographie, Les calculs usuels affectués au moyen des abaques* (Paris, 1891), *Traité de nomographie* (Paris, 1899; 2nd ed., 1921), *Exposé synthétique des principes fondamentaux de la nomographie* (Paris, 1903), *Calcul graphique et nomographie* (Paris, 1908; 2nd ed. 1914; 3rd ed. 1924), *Esquisse d'ensemble de la nomographie* (Paris, 1925).

Works of other authors: Rev. P. de Beaurepaire, *Graphs and Abacuses* (Madras, 1907); F. Boulad-Bey, *al Nomografia* (Arabian; Cairo, 1908); S. Brodetsky, *A first course in Nomography* (Leeds, 1920); A. Esnouf, *Nomography in a Nutshell* (Port Louis, Mauritius; 1926); N. Gercevanoff, *Les principes du calcul nomographique* (St. Petersburg, 1906); R. K. Heylet, *Nomography or the graphic representation of formulae* (Woolwich, 1913); Hewes and Seward, *The Design of Diagrams for Engineering Formulas and the Theory of Nomography* (New York, 1923); J. Jonesco, *Nomografia* (Rumanian; Bucharest, 1900); B. M. Kanorski, *Die Grundlagen der Nomographie* (Berlin, 1923); F. Krauss, *Die Nomographie oder Fluchtlinienkunst* (Berlin, 1923); O. Laemann, *Die Herstellung gegeichneter Rechentafeln* (Berlin, 1923); W. Laska, *Wyklady nomografii* (Polish, Lemberg, 1905); J. Lipka, *Graphical and mechanical computation* (New York, 1921); P. Luckey, *Einführung in die Nomographia* (Berlin, 1918); K. Ogura, *Calcul graphique et Nomographie* (Japanese, Tokyo, 1923); J. Peddle, *The construction of graphical charts* (London, 1910, 2nd ed. 1919); G. Pesci, *Cenni di Nomografia* (Livarno, 1901); G. Ricci, *La Nomografia* (Rome, 1901); C. Runge, *Graphical Methods* (New York, 1912); F. Schilling, *Ueber die Nomographie von M. d'Ocugne* (Leipzig, 1900); H. Schwerdt, *Lehrbuch der Nomographie* (Berlin, 1924); R. Seco de la Garza, *Nomografia* (Madrid, 1910), *Nomogramas del Ingeniero* (Madrid, 1907; French trans. 1912); R. Sareau, *Contribution à la théorie et aux applications de la nomographie* (Paris, 1901), *Nomographie, Théorie des abanes* (Paris, 1920); R. C. Strachan, "Nomographic solutions for formulas of various types," *Proceedings* of Amer. Soc. of Civ. Eng., vol. 40 (1914) p. 2975–96 and *Transactions,* vol. 78, pp. 1., 399–408; T. Tanimura, *Elements de Nomographie* (Japanese, Tokyo, 1928); F. Ulkowski, *O Nomografii* (Polish, Lemberg, 1905); F. J. Vaës, *Nomographie* (Dutch, Rotterdam, 1901); P. Werkmeister, *Das Entwerten von graphische Rechentaphs* (Berlin, 1923). (M. d'O.)

**NONCONFORMIST,** a term denoting historically (*a*) those persons who at the beginning of the 17th century refused to conform to certain practices, *e.g.,* the wearing of the surplice, kneeling at the reception of the Sacrament, etc., of the Church of England; (*b*) those who, after the passing of the Act of Uniformity 1662, refused to conform to that act and ceased to be members of the church. In current usage the term "nonconformist" is applied in Great Britain to any member of a church not conforming to the ceremonies, worship and doctrines ("forms") of the Church of England, but is generally used of a member of the so-called Free Churches, or Protestant Dissenters, and is not usually applied to Roman Catholics.

**NONCONFORMITY, LAW RELATING TO.** *See* ENGLISH HISTORY; BAPTISTS; CONGREGATIONALISM; METHODISM; FRIENDS, SOCIETY OF, etc.; also OATH. It is proposed here to note the matters in which the law as to nonconformists still differs from that applicable to members of the Church of England.

(1) *Judicial Notice.* Where the tenets and authorities of a nonconformist body come in question they must be proved by evidence. By Lord Lyndhurst's act, the Nonconformist Chapels Act, 1844, where no particular religious doctrine or mode of worship has been prescribed by the deed or instrument of trust the usage of the congregation for 25 years is to be taken as conclusive evidence of the doctrine and worship which may be properly observed in such meeting-houses. (2) *Tribunal.* Matters arising in nonconformist bodies can only be tried by the ordinary secular courts, and generally depend upon the question whether a minister has done any act which is not in accordance with the rules governing the particular body of which he is a minister. A nonconformist body is in law nothing more than a voluntary association, whose members may enforce discipline by any tribunal assented to by them, but must be subject in the last degree to the courts of the realm. (3) *Status of Ministers.* A nonconformist minister is not in holy orders, and his chapel is not a consecrated building. His status is, however, recognized to a limited extent. By the Toleration Act, 1 Will. and Mar., c. 18, a minister, preacher or teacher of a nonconformist congregation is exempt from certain parochial offices, as that of churchwarden. He is also exempt from serving in the reserve forces or on a jury. These privileges only attach

where the place of worship of which he is a minister has been duly registered (the Places of Worship Registration Act, 1855), unless in the case of bodies subject to special legislation as Quakers. By the Municipal Corporations Act, 1882, s. 12, a nonconformist minister (as is a clerk in holy orders) is disqualified from being elected an alderman or councillor of a town council, but under the Local Government Act, 1888, a clerk in holy orders, or other minister of religion, may be a councillor or alderman of a county council, and, under the London Government Act, 1899, of a metropolitan borough. (4) *Marriage.* The first act of parliament relieving dissenters (other than Jews and Quakers) from restrictions was the Marriage Act of 1836. By that act the ceremony of marriage might be performed in a nonconformist place of worship, but it must be after due notice to the superintendent registrar and in his presence or in that of a registrar, and the building must be one that is duly certified for marriages. The Marriage Act, 1898, dispensed with the necessity of the attendance of a registrar at marriages celebrated at a nonconformist place of worship, substituting in place thereof a person duly authorized by the trustees of the place of worship, if the persons intending to be married so desire; but the parties may, if they wish, still require the presence of the registrar. Marriage by banns, licence or special licence cannot take place except in a church. (*See* MARRIAGE.) (5) *Burial.* By the Burial Laws Amendment Act, 1880, burial may take place in a churchyard without the rites of the Church of England. But in such a case notice must be given in a specified form, which is unnecessary where the burial service is conducted by a clergyman of the Church of England. (*See* BURIAL.) (6) *Parish Offices.* By 1 Will. and Mar., c. 18, s. 5, a dissenter chosen churchwarden and scrupling to take the oaths may execute his office by deputy. His acceptance of office is made optional by the act; there is nothing to prevent his discharging it if he see fit to do so. This seems to be still the law, although a declaration was substituted for the oath by the Statutory Declarations Act, 1835, s. 9. (*See* DISSENTER; JEWS; ROMAN CATHOLICS.)

**NONFEASANCE,** MISFEASANCE, MALFEASANCE. The expressions "nonfeasance" and "misfeasance," and occasionally "malfeasance," are used in English law with reference to the discharge of public obligations existing by common law, custom or statute. The rule of law laid down is that no action lies for nonfeasance, *i.e.,* for failure or refusal to perform such obligation, but that an action does lie for damage resulting from misfeasance or malfeasance, *i.e.,* for negligently and improperly performing the obligation. (*See* NEGLIGENCE.) At present the terms misfeasance and nonfeasance are most often used with reference to the conduct of municipal authorities with reference to the discharge of their statutory obligations. In the case of nonfeasance there is a remedy by indictment or *mandamus* or by the particular procedure prescribed by the statutes. This rule is fully established in the case of failure to repair public highways; but in other cases the courts are astute to find evidence of carelessness in the discharge of public duties, and on that basis to award damages to individuals who have suffered thereby. Misfeasance is also a term used with reference to the conduct of directors and officers of joint-stock companies.

**NONIUS MARCELLUS,** Latin grammarian and lexicographer, flourished at the end of the 3rd or the beginning of the 4th century A.D. He is the author of a sort of lexicon called *De compendiosa doctrina,* in 20 sections or chapters, the first twelve of which deal with language and grammar, the remaining eight with special subjects (navigation, costume, food, arms). It is valuable as preserving fragments from old dramatists, annalists, satirists and antiquarian writers. In the quotations from the authors cited Nonius always follows the same order, beginning with Plautus and ending with Varro and Cato. In the 5th century Julius Tryphonianus Sabinus brought out a revised and annotated edition.

Editions by L. Müller (1888); J. H. Onions, bks. i.–iii. (1895); W. M. Lindsay (1903).

**NONJURORS,** the name given to those beneficed clergy of the Church of England who refused to take the oaths of allegiance to William and Mary in 1689. They were about 400 in number, and included William Sancroft, archbishop of Canterbury, and four others of the "seven bishops": Thomas Ken of Bath and Wells, John Lake of Chichester, Thomas White of Peterborough and Francis Turner of Ely, together with the bishops of Gloucester, Worcester and Norwich. Other distinguished nonjurors were: William Sherlock, master of the Temple, Jeremy Collier, the ecclesiastical historian, George Hickes, dean of Worcester, Nathanael Spinckes, John Fitzwilliam, canon of Windsor, Henry Dodwell, Camden professor of history at Oxford, Henry Hyde, second earl of Clarendon, and Roger North, the lawyer. Afterwards their number was augmented by refusals to swear the oaths of allegiance to George I. Ken, the most eminent of the nonjurors, disapproved of their subsequent proceedings, and Sherlock and Dodwell afterwards took the required oaths, the former becoming dean of St. Paul's.

Believing in the doctrine of non-resistance to established authority, the nonjurors argued that James II. was still the rightful king, and likened the position of William to that of Cromwell. With the approval of William III., Gilbert Burnet, bishop of Salisbury, attempted to reconcile them to the new order; and it was only when the generous terms offered by Burnet had been refused, that, in Feb. 1690, they were deprived of their sees and other benefices. Although they had only a small following among the mass of the people, who were not required to take the oaths of allegiance, Sancroft and his colleagues claimed to represent the true Church of England, and requested James II. in his exile to nominate two new bishops to carry on the episcopal succession. James chose Hickes and Thomas Wagstaffe (1645–1712), who were consecrated in 1694 as bishops of Thetford and Ipswich respectively. A further consecration took place in 1713 when Collier, Spinckes and Samuel Hawes (d. 1722), were consecrated "bishops at large." In 1718 the introduction of a new communion office with some "usages" taken partly from primitive liturgies, and partly from the first prayer-book of Edward VI. caused a schism among the nonjurors, dividing them into "Usagers" and "Non-Usagers." The four "usages" were: The mixed chalice, prayers for the faithful departed, prayer for the descent of the Holy Ghost on the consecrated elements, and the Oblatory Prayer, offering the elements to the Father as symbols of His Son's Body and Blood. Accepting the "usages" the two bodies united in 1731, but other dissensions followed, although the episcopal succession was maintained until the death of a bishop named Charles Booth in 1805. The last nonjuror was probably James Yeowell, who died in 1875. Public worship was conducted in chapels or "oratories," and in private houses.

In Scotland the nonjurors included the greater part of the clergy of the Episcopal Church, which ceased to be the state church in 1689. The Scottish clergy maintained their opposition to the government until the death of Prince Charles Edward Stuart in 1788, when the bishops met at Aberdeen, and unanimously agreed to submit to the government of King George III. A large number of the Presbyterians in Scotland, principally found among the Cameronians, also refused to take the oaths of allegiance to William and Mary; but as their reasons for this refusal were quite different from those of the episcopalian nonjurors, they are not usually referred to by this name (*see* CAMERONIANS).

For the history of the nonjurors, *see* Macaulay, *History of England* vol. ii. (1895); T. Lathbury, *History of the Nonjurors* (1845); J. H. Overton, *The Nonjurors* (1902), a defence of the sect.

**NONNUS** (Egyptian for "saint"), Greek epic poet, a native of Panopolis (Akhmim) in the Egyptian Thebaid, probably lived at the end of the 4th or beginning of the 5th century A.D. His principal work is the *Dionysiaca,* an epic in 48 books, the main subject of which is the expedition of Dionysus to India and his return, a subject convenient at the time owing to the popular comparison of Alexander with Dionysus. In its luxuriance and preoccupation with action, it resembles the Indian epics. His chief merit consists in the systematic perfection to which he brought the Homeric hexameter, but this very quality tends to monotony. His influence on later poetic vocabulary was considerable.

We also possess under his name a paraphrase (μεταβολή) of the

Gospel of St. John, which is chiefly interesting as apparently indicating that Nonnus in his later years was a convert to Christianity. His style, in this content, produces an impression of extreme bombast and want of taste. According to an epigram in the Palatine Anthology (ix. 198), Nonnus was also the author of a *Battle of the Giants,* and four lines of the *Bassarica* (also on Dionysus) have been preserved in Stephanus of Byzantium.

Editio princeps (1569); H. Köchly ("Teubner" series, with critical introduction and full index of names, 1858); the most generally useful edition is that by the comte de Marcellus (1856), with notes and prolegomena, and a French prose translation. On the metre, *see* J. G. Hermann, *Orphica* (1805), p. 690; A. Ludwich, *Beiträge zur Kritik des Nonnus* (1873), critical, grammatical and metrical; C. Lehrs, *Quaestiones epicae* (1837), pp. 255–302, chiefly on metrical questions; on the sources, R. Köhler, *Über die Dionysiaka des Nonnus* (1853), a short and connected analysis of the poem, with a comparison of the earlier and later myths; *see* also I. Negrisoli, *Studio critico . . . Nonnus Panopolita,* with short bibliography (1903). The paraphrase on St. John (editio princeps, *c.* 1505) is edited by F. Passow (1834) and A. Scheindler (1881), with complete index.

**NONPAREIL** (*see* PRINTING; PRINTING TYPE), a size of type smaller than minion and larger than ruby. It is also known as 6-point. It is mainly used for footnotes. The following matter is printed in nonpareil:

> In Europe, as late as the second half of the 14th century, every book and every public and private document was written by hand; all figures and pictures, even playing cards and images of saints, were drawn with the pen or painted with the brush.

**NONPAREIL** or **PAINTED BUNTING,** a small, brilliantly coloured finch (*Passerina ciris*) with blue head, green-yellow back, scarlet body and black wings and tail. After wintering in Central America, the painted bunting arrives in the southern states of the U.S.A. in April, and breeds north to Virginia, Ohio and Kansas. The "pin-tailed nonpareil" of Africa (*Erythrura prasina*) is blue in colour; the male has a long tail. It belongs to the *Ploceidae.* (*See* WEAVER-BIRD.)

**NONPARTISAN LEAGUE,** an American political and economic organization of farmers founded by Arthur C. Townley at Bismarck, N.D., in Feb. 1915. For years the farmers of the State had complained of exploitation by grain speculators, bankers and politicians. The 1915 session of the legislature, at which members of the Equity Society—a farm organization—received scant attention, fanned agrarian discontent into immediate flame. The Nonpartisan League, applying modern sales methods, rapidly organized the farmers into a cohesive political body, which captured control of the State Republican Party and elected its candidates for State offices and Congress. In 1916 the league began work outside North Dakota, and eventually established active organizations in 12 other Western and Middle Western States, where influence was exerted in behalf of sympathetic candidates with varying degrees of success. Though confining its own membership to farmers, the league regularly co-operated with urban labour in political action. During the World War the league was bitterly attacked on the ground of the socialist connection of some of its leaders and its advocacy of conscription of wealth to pay for the hostilities. In 1919 the league put its economic programme into effect in North Dakota. A State-owned bank, mill and terminal elevator, home-building association, and hail, fire and tornado insurance constituted the principal enterprises. All of these, except the home-building association, were still in operation in 1928. The league, as such, gradually disintegrated, though not before it had given birth to the Farmer-Labor Party in Minnesota and had stimulated many farmers to "non-partisan" voting.

BIBLIOGRAPHY.—Because of the bitter controversy over the league, little unbiased discussion exists. *See* H. E. Gaston, *The Nonpartisan League* (1920), and C. E. Russell, *Story of the Nonpartisan League* (1920) both sympathetic, while A. A. Bruce, *The Nonpartisan League* (1921) is hostile. The files of the *Nonpartisan Leader* (later the *National Leader*), which was published up to July 1923, give a running account of the league's work. (N. A. C.)

**NON-SHATTERABLE GLASS:** *see* GLASS, SAFETY.

**NONSUIT,** in law, the name given to a judgment whereby an issue is determined against the plaintiff. It was a term peculiar to the English common-law courts before the Judicature Acts, and was simply the expression of the opinion of the court that, apart from the merits, the plaintiff's case was incomplete. It did not in any way act as a bar to his bringing another action for the same cause. Although judgment of nonsuit still exists, it has, since the Judicature Acts, the same effect as a judgment on the merits, unless the court otherwise directs.

In the United States, litigants often take a "nonsuit" when a case has been settled out of court or they realize the futility of further proceedings.

**NORD,** the most northern department of France. Area 2,229 sq.mi. Pop. (1936) 2,022,167. Bounded for 21 mi. by the North sea, it has Belgian territory on the N.E. and E. It lies below, and parallel to, the chalk scarp of Artois, famous for its defense in World War I. The coast is formed largely of sand dunes drained by canals. The department is crossed by the Scheldt (Escaut) with its tributaries and by the Sambre, the chief tributary of the Meuse. The climate of Nord is colder than that of France in general, the mean temperature being 49° or 50° F. Average annual rainfall is about 28 in.

In agricultural and industrial importance Nord is the first of French departments. In the southeast stock raising flourishes; in the central zone beetroot is characteristic, while mixed farming prevails in the northwest. Cereals (especially wheat and oats) and potatoes are grown in abundance, while flax, tobacco, chicory, colza and hops are minor crops. Market gardening and horticulture are practised in some localities. There are mineral springs, notably at St. Amand, where the mud baths are used in the treatment of rheumatism. The mineral wealth lies chiefly in coal mines forming part of the Valenciennes basin, the most important in France, which extends into Belgium and Pas-de-Calais. The textile industry centres in Lille, Roubaix and Tourcoing, which spin and weave cotton, linen and wool, as also around Fourmies. Other centres are Armentières (cloth-weaving), Dunkirk (flax, jute and hemp-spinning), Cambrai (batiste and other delicate fabrics; also chicory), Douai, Avesnes, le Cateau and Caudry. Other great industries are glass, brick, pottery and sugar manufacture, alcohol distilling, dyeing, iron-founding and steel production. Branches of the metallurgical industry are at Denain, Hautmont, Maubeuge, Valenciennes, Douai, Raismes, etc. Dunkirk and Gravelines equip fleets for the cod and herring fisheries. Dunkirk is the chief port. Its system of inland navigation is highly developed, comprising a line of waterways from the Scheldt to the North sea at Dunkirk, with which the coal basin of Valenciennes is linked by the canalized Scheldt and the textile region of Lille by means of the Deûle canal and the canalized Lys.

The department is divided into six arrondissements (Avesnes, Cambrai, Douai, Dunkirk, Valenciennes) with 63 cantons and 668 communes. It forms the archiepiscopal diocese of Cambrai and part of the region of the I army corps (headquarters at Lille) and of the educational division of Lille. Its court of appeal is at Douai.

**NORDAU** (originally **SÜDFELD**), **MAX SIMON** (1848–1923), Jewish-Hungarian author, was born at Budapest on July 29, 1849, and practised medicine in his native town. He made his name by his pseudo-philosophical *Entartung* (Eng. trs. *Degeneration,* 1895), which was translated into many languages, and had a great vogue. Other works were *The Conventional Lies of Society* (Eng. version 1895), and *Biologie der Ethik* (1921). Nordau was an ardent Zionist, and took Herzl's side in wishing to accept the British Government's offer of land for a Jewish settlement in East Africa. In 1903 an attempt was made on his life by a Jew opposed to the scheme. He died on Jan. 22, 1923.

His works include novels and stories: *Gefühlskomödie* (1892); *Die Drohnenschlacht* (1897), *Morganatisch* (1904), etc.; dramas: *Das Recht zu lieben* (2nd ed. 1894), *Doktor Kohn* (1898), and others; some books of travel; and the critical works *Zeitgenössische Franzosen* (1901), and *Von Kunst und Künstlern* (Leipzig, 1905).

**NORD DE FRANCE, COMPAGNIE DU CHEMIN DE FER DU.** This company was one of the earliest formed for general transport in France. It was founded on Sept. 18, 1845, and in the following year its rolling stock totalled 175 locomotives, 46 daily trains, 1,600 trucks. The mileage in that year was 222 km., necessarily confined to a very limited area. Year by year the company made new departures and put out new branches exploiting new territories, and by Jan. 1, 1938, the mile-

age had increased to 2,378. By a decree of August 31, 1937, all the independent railway systems of France were merged in 1938 with the existing state railway system in the Societe Nationale des Chemins de Fer Francais. The railway system is now divided into five regions, of which the Nord forms one.

The Nord serves the industrial area north of Paris to the English Channel, and is the main artery system of communication from the big manufacturing plants to Paris. It is, from its closeness to England, much concerned with the Cross-Channel steamers, which make connections with express train and boat services for visitors to Paris. Express passenger and freight services are constantly maintained, and the company arranges special programs of trains for the holiday season, to connect at Paris with the trains of other lines for Switzerland, Italy, etc. The French government holds 51 per cent of the shares of the new concern, but the Nord still remains in control of its so called *domaine privé*. (GIR.)

**NORDDEUTSCHER LLOYD STEAMSHIP COMPANY.** The Norddeutscher Lloyd was founded on February 20, 1857, by Consul Hermann Heinrich Meier; their first line of steamships plied between Bremen and English ports, and on June 19, 1858, the Company's first ocean-going liner, the Bremen, sailed for New York and inaugurated their transatlantic service. The following years were principally devoted to expanding this traffic; by 1868 the company's vessels were serving all the large ports of the eastern States; the '70's saw the inauguration of the services to the West Indies and Baltimore; and by 1890 the company, under the management of Lohmann, had achieved the position of fourth largest shipping concern in the world. In 1881 the Lloyd, following the example of the British companies, had inaugurated a fast service to New York, and in 1886 the Imperial mail lines to the Far East had been opened. Heinrich Wiegand, who assumed control after Lohmann's death, brought the Lloyd into the position of a leading passenger line of the pre-War period; under him the twin-screw system was introduced and the existing network of lines further developed, while at the turn of the century the fast steamers of the "Kaiser" class represented what then was the last word in ship construction. Shortly before the outbreak of World War I Lloyd's fleet had reached a figure little short of 1,000,000 tonnage displacement (British).

The Peace Treaty destroyed at a blow sixty years of constructive endeavour. In 1914 the Lloyd had owned a fleet of 135 ocean steamers and 358 tugs, river launches and other auxiliary craft, with a total tonnage of 982,951.

Since that date, the Lloyd has re-acquired, bought and built a large number of ships, and by these means has increased its fleet to 218 vessels with a tonnage of 604,990 tons, which was the figure on January 1, 1939 (excluding several services heretofore amalgamated with the Lloyd). The fleet includes the two quadruple-screw turbine steamers "Bremen" and "Europa," employed in the transatlantic service, the three Far East express liners "Potsdam," "Scharnhorst" and "Gneisenau" with a combined tonnage of 53,872 tons, the training ship "Kommodore Johnsen" (3,572 tons), and the cruise liner "Steuben" (14,660 tons), as well as a number of up-to-date freighters. On her maiden voyage to New York on July 22, 1929, the "Bremen" captured the transatlantic record, later relinquished to the "Europa," until again the "Bremen" on her century voyage on Nov. 8, 1934, reached the mark of 4 days, 14 hours, 27 minutes for the westward trip,—a record shortly afterwards lowered by the "Empress of Britain." The Norddeutscher Lloyd offices in the United States and Canada are operated jointly with the Hamburg-American Line.

The capital of the company was 45,000,000 marks as of Dec. 31, 1938, and 1,660,000 marks in preference shares. (EH.; X.)

A fuller account of the early history of this great commercial undertaking may be found in P. Newbaur's *Der Norddeutsche Lloyd* (3 volumes, 1907), while additional material covering 60 years is available in the volume *Norddeutscher Lloyd Bremen* 1857–1917 (1917).

**NORDENSKIÖLD, NILS ADOLF ERIK,** BARON (1832–1901), geographer and Arctic explorer, was born at Helsingfors, on Nov. 18, 1832. He was the son of Nils Gustav Nordenskiöld, a mineralogist and a traveller. Compelled to leave Russia for political reasons, he settled at Stockholm. He received an offer from Otto Torell, the geologist, to accompany him on an expedition to Spitsbergen. To the observations of Torell on glacial phenomena Nordenskiöld added the discovery at Bell Sound of remains of Tertiary plants, and on his return became professor and curator of the mineralogical department of the Swedish State Museum. In 1861 he took part in Torell's second Spitsbergen expedition. Of the further expedition to the same quarter promoted by the Swedish academy of science in 1864, Nordenskiöld was the leader. Four years later he headed an expedition in the iron steamer "Sofia," and reached the highest northern latitude (81° 42′) then attained in the eastern hemisphere. In 1870, with three young naturalists, he visited the vast inland ice-sheet of Greenland. On his next expedition in 1872 the tenders were caught in the ice, and the crews of the three vessels were forced to winter in Spitsbergen. In 1875–1876, however, a successful voyage eastwards, including the ascent of the Yenisei, led him to attempt the discovery of the long-sought North-East Passage. Starting from Karlskrona on June 22, 1878, in the "Vega," he doubled Cape Chelyuskin in the following August, and after being frozen in at the end of September near Bering Strait, completed the voyage successfully in the following summer.

On his return to Sweden he received an enthusiastic welcome, and in April 1880 was made a baron and a commander of the Order of the Nordstjerna. In 1883 he again visited the east coast of Greenland, and succeeded in forcing through the great ice barrier, a feat attempted in vain during more than three centuries. He died at Stockholm on Aug. 12, 1901.

Baron Nordenskiöld also published *Facsimile Atlas* (1889) and *Periplus* (1897). The former contains reproductions of geographical documents printed during the 15th and 16th centuries, and the latter, a work of far greater research, deals with the history of early cartography and the sailing charts in use among mariners during the middle ages.

**NORDENSKJÖLD, OTTO** (1869–1928), Swedish explorer, was born in 1869; his father was a brother of Baron A. E. Nordenskiöld (*q.v.*). He specialized in geology in the University of Uppsala and after travels in Tierra del Fuego and Alaska, he led an expedition (Oct. 1901) to the South Polar regions. He landed at Snow Hill island, off the east coast of Graham Land. Weather conditions made it impossible for the "Antarctic," which had continued her course to Tierra del Fuego, to relieve them in 1902–03, and she sank in the attempt. After several attempts at rescue had been made, they were eventually brought back by a vessel sent by the Argentine Government in Nov. 1903. (*"Antarctic" Två år bland sydpolens isar,* 2 vols. Stockholm, 1904; Eng. trs. *Antarctica,* 1905). In 1920–21 Professor Nordenskjöld explored the Peruvian and Chilean Andes. He died on June 3, 1928.

**NORDERNEY** (*i.e.,* "northern island"), the largest of the East Friesland group, Germany. Pop. (1933) 5,068. It is 8 mi. long and about 1½ mi. broad and is reached by steamer from Norddeich, Bremerhaven or Hamburg, and at low tide by road. The village is a popular resort. Norderney is associated with Heinrich Heine's *Nordseebilder.*

**NORDHAUSEN,** a town in the *Land* of Saxony, Germany. It is situated on the Zorge to the south of the Harz mountains, at the west end of the Goldene Aue (Golden Plain), a fruitful valley watered by the Helme. Pop. (1939) 42,267. Nordhausen possessed a royal palace in 874 and a convent was founded here in 962. It was destroyed by Henry the Lion in 1180, but was soon rebuilt and was made a free imperial town in 1253. In this and the following century several diets and other assemblies were held here. The protector (*Vogt*) of the town was the elector of Saxony and from 1702 to 1715 the elector of Brandenburg. Nordhausen accepted the reformed doctrines in 1522. It was annexed by Prussia in 1803 and again in 1815, having in the meantime belonged to the kingdom of Westphalia. The upper and lower parts of the town are connected by flights of steps. Among its churches the most noteworthy are the Roman Catholic cathedral, late Gothic with a Romanesque crypt, and the Protestant church of St. Blasius. Near the mediaeval town hall stands a Roland's

column, the ancient symbol of free commercial intercourse and civic liberty. The chief importance of the place arises from its distilling of "Korn Schnapps," a spirit somewhat akin to whisky.

**NORDICA, LILLIAN** (1859–1914), American operatic soprano, was born at Farmington (Me.), May 12, 1859, trained at Boston, and later at Milan, under Sangiovanni. She made her début at Brescia in 1879, sang at Covent Garden, London (1887–93), and at the Metropolitan Opera House, New York, after 1895. She died at Batavia, Java, May 10, 1914.

**NÖRDLINGEN,** German town in the Swabian province of Bavaria, on the Eger. Pop. (1939) 8,827. From 898, when first mentioned, to 1215 Nördlingen was subject to the bishops of Regensburg, but about 1215 it became a free city of the Empire. It was annexed to Bavaria in 1803. It is still surrounded with walls and towers. The church of St. George is a Gothic structure erected in the 15th century and restored in 1880. The Late Gothic town hall has a collection of pictures and antiquities.

**Military Operations.**—Nördlingen was the scene of two great battles in the Thirty Years' War (*q.v.*). In the first, which was fought on Sept. 5 and 6, 1634, the hitherto invincible Swedish army, commanded by Duke Bernhard of Saxe Weimar and Marshal Horn, was defeated with great loss by a somewhat superior army of Imperialists and Spaniards under Gen. Gallas, Horn being taken prisoner. In the second battle, fought 11 years later (Aug. 3, 1645), Condé (then duke of Enghien) and Turenne were the leaders on the one side, and Mercy and Johann von Weert, the dashing cavalry commander whose onset had decided the battle of 1634, on the other. The Germans were posted some 5m. to the east of Nördlingen, about Allerheim. In rear of the village the plain was occupied by Mercy's army in the customary two lines, foot in the centre, horse in the wings. The French army, similarly arrayed, was more heterogeneous than the German. After a cannonade in which it suffered more severely than its entrenched enemy, the French centre furiously attacked the village of Allerheim; the fighting here was very heavy, and on the whole in favour of the Germans, although Mercy was killed. The right wing of the French cavalry was swept off the field by Johann von Weert's charge, but the German troopers, intoxicated with success, dispersed to plunder. On the French left, meanwhile, Turenne saved the day. Fighting cautiously at first with his leading line to gain time for his second to come up, he then charged and broke up the hostile right wing of cavalry, while some battalions of infantry scaled the hill and captured the Bavarian guns. Unlike Weert the marshal kept his troops in hand, and swung round upon the Bavarian infantry behind Allerheim, who were at the same time cannonaded by their lost guns. A prolonged fight now ensued, in which the Bavarians had the worst of it, and Weert, returning at last to the field, dared not attempt to engage afresh. The armies faced one another all night with their sentries 50 paces apart, but in the morning the Bavarians were found to have retreated. Nothing was gained by the victors but the trophies and the field of battle, and the losses of both sides had been enormous. Nördlingen, therefore, is a classical instance of the unprofitable and costly *bataille rangée* of the 17th century.

*See* Beyschlag, *Geschichte der Stadt Nördlingen* (Nördlingen, 1851), and Mayer, *Die Stadt Nördlingen, ihr Leben und ihre Kunst im Lichte der Vorzeit* (Nördlingen, 1856).

**NORE, THE,** sandbank at the mouth of the river Thames, England, marked by buoys and a lightship, with revolving light. This ship lies 3 m. from the Kent coast, about the same from the Essex coast, and 47¾ m. below London Bridge. The first light was placed as an experiment by Mr. Hamblin, its patentee, in 1732.

**NORFOLK, EARLS AND DUKES OF.** The 1st earl of Norfolk was RALPH DE GUADER, a follower of William the Conqueror, who forfeited the earldom when he revolted against William in 1075; the 2nd was HUGH BIGOD (d. 1177), one of Stephen's supporters, to whom the earldom was granted by this king before 1141. Hugh's grandson, HUGH (d. 1225), the 3rd earl of this line, married Matilda, daughter of William Marshal, earl of Pembroke, and from the Marshals their son ROGER (d. 1270), the 4th earl, inherited the office of marshal of England. This powerful family of Bigod retained the earldom until ROGER, the 5th earl, died childless in Dec. 1306.

The next earl of Norfolk was THOMAS OF BROTHERTON (1300–1338), a younger son of Edward I., to whom the earldom was granted in 1312 by his half-brother, Edward II. In addition to the estates which had formerly belonged to the Bigods Thomas received the office of marshal. He joined Queen Isabella when she landed in England in 1326, and was one of the group of nobles who brought about the deposition of Edward II. He died in August 1338, leaving no son. The survivor of his two daughters, Margaret (*c.* 1320–1400), who was countess of Norfolk in her own right, married John de Segrave, 3rd Lord Segrave (d. 1353), and their only child Elizabeth (d. *c.* 1375) became the wife of John de Mowbray, 4th Lord Mowbray (d. 1368), and the mother of two sons John and Thomas. In 1397 the countess Margaret was created duchess of Norfolk, and at the same time her grandson Thomas Mowbray was made duke of Norfolk.

On the death of John Mowbray, 4th duke of this creation, in 1476 the dukedom became extinct, but the earldom passed to his daughter Anne, wife of the young Richard, duke of York, who was murdered in the Tower with whom the earldom became extinct.

The dukedom was given in 1483 to John Howard whose mother, Margaret Mowbray, was a daughter of Thomas Mowbray the 1st duke. The dukedom has remained in the Howard line until the present day. (*See* HOWARD.)

**NORFOLK, HENRY FITZALAN HOWARD,** 15TH DUKE OF (1847–1917), was born in London on Dec. 27, 1847, and succeeded his father, the 14th duke, in 1860. He was educated at the Oratory School, Edgbaston, and then spent some time with his uncle, Lord Lyons, in Constantinople. The duke was postmaster-general from 1895 to 1900, first Lord Mayor of Sheffield in 1895, and served in the yeomanry in the South African War. His position as head of the English Roman Catholics and as premier duke and Earl Marshal made him for many years conspicuous in public life. He was throughout his life in close connection with the Vatican, and was sent by Queen Victoria in 1887 on a special mission to Leo XIII. He did not always agree with the policy of the Irish Catholic hierarchy, but he did much for Catholic education in Ireland. He was keenly interested in education generally; was one of the founders of Sheffield University, and its first vice-chancellor. The duke was concerned in the building of many Catholic churches in England, notably the church of St. John the Baptist at Norwich. He died in London on Feb. 11, 1917.

**NORFOLK, JOHN HOWARD,** 1ST DUKE OF (of the Howard line) (*c.* 1430–1485), was the son of Sir Robert Howard by his wife Margaret, daughter of Thomas Mowbray, the first duke of that family. In 1455 John Howard was sent to parliament as member for Norfolk, although he "hadde no lyvelode in the shire"; in 1461 he was knighted; and in 1470, although he appears to have been a consistent Yorkist, he was created a baron by Henry VI. He was treasurer of the royal household from 1467 to 1474, and went to France with Edward IV. in 1475. After Edward's death, however, he supported Richard III., who created him duke of Norfolk and made him earl marshal of England in June 1483. He was killed at Bosworth whilst fighting for this king on Aug. 22, 1485, and the title thus suffered attainder.

**NORFOLK, THOMAS HOWARD,** 2ND DUKE OF (1443–1524), son of the preceding, shared his father's fortunes; he fought at Barnet for Edward IV. and was made steward of the royal household and created earl of Surrey in 1483. Taken prisoner at Bosworth he was attainted and remained in captivity until January 1489, when he was released and restored to his earldom but not to the dukedom of Norfolk. He was then entrusted with the maintenance of order in Yorkshire and with the defence of the Scottish borders; he was made lord treasurer and a privy councillor in 1501, and he helped to arrange the marriage between Margaret, the daughter of Henry VII., and James IV. of Scotland. Henry VIII., too, employed him on public business, but the earl grew jealous of Wolsey, and for a short time he absented himself from court. He commanded the army which defeated the Scots at Flodden in September 1513, and was created duke of Norfolk in February of the following year, with precedency as

of the creation of 1483. In his later years Norfolk worked more harmoniously with Wolsey. He was guardian of England during Henry's absence in France in 1520, and he acted as lord high steward at the trial of his friend Edward Stafford, duke of Buckingham, in 1521. Among his sons were William, 1st Lord Howard of Effingham (1510?–1573), and Sir Edward Howard (*c.* 1477–1513), lord high admiral, who defeated the French fleet off Brest in August 1512, and died during an engagement in April 1513.

**NORFOLK, THOMAS HOWARD,** 3RD DUKE OF (1473–1554), eldest son of the 2nd duke, married in 1495 Anne (1475–1512), daughter of Edward IV., thus becoming a brother-in-law of Henry VII., who had married Anne's sister Elizabeth. He became lord high admiral in 1513, and led the van of the English army at Flodden in September, being created earl of Surrey in February 1514. In 1513 he took for his second wife Elizabeth (d. 1558), daughter of Edward Stafford, duke of Buckingham. In 1520 Surrey went to Ireland as lord-deputy, but soon vacated this post to command the troops which sacked Morlaix and ravaged the neighbourhood of Boulogne in 1522; afterwards he raided and devastated the south of Scotland. He succeeded his father in May 1524, and as the most powerful nobleman in England he headed the party hostile to Cardinal Wolsey. He favoured the divorce of Henry VIII. from Catherine of Aragon, and the king's marriage with his niece Anne Boleyn. In 1529 he became president of the council, but in a few years his position was shaken by the fate of Anne Boleyn, at whose trial and execution he presided as lord high steward. But his military abilities rendered him almost indispensable to the king, and in 1536, just after the rising known as the Pilgrimage of Grace had broken out, he was despatched into the north of England; he temporized with the rebels until the danger was past, and then, as the first president of the council of the north, punished them with great severity. Sharing in the general hatred against Thomas Cromwell, Norfolk arrested the minister in June 1540. He led the English army into Scotland in 1542 and into France in 1544; but the execution of Catherine Howard, another of his nieces who had become the wife of the king, had weakened his position.

His son Henry Howard, earl of Surrey (*q.v.*), was arrested on a charge of treason; Norfolk himself suffered the same fate as accessory to the crime. In January 1547 Surrey was executed; his father was condemned to death by a bill of attainder, but owing to the death of the king the sentence was not carried out. Norfolk remained in prison throughout the reign of Edward VI., but in August 1553 he was released and restored to his dukedom. Again taking command of the English army he was sent to suppress the rebellion which had broken out under Sir Thomas Wyat, but his men fled before the enemy. He acted as lord high steward at the trial of John Dudley, duke of Northumberland; and he died on Aug. 25, 1554. Norfolk was a brutal and licentious man, but was a supporter of the Roman church, being, as he himself admits, "quick against the sacramentaries."

**NORFOLK, THOMAS HOWARD,** 4TH DUKE OF (1536–1572), son of Henry Howard, earl of Surrey, was born on March 10, 1536. His tutor was John Foxe, the martyrologist. Norfolk, who had already been married three times, was regarded as a suitable husband for Mary queen of Scots, who had just taken refuge in England. He presided over the commission appointed by Elizabeth to inquire into the relations between the Scottish queen and her subjects; and although he appears to have believed in Mary's guilt he was anxious to marry her. Among the Scots Maitland of Lethington favoured the proposed union; Mary herself consented to it; but Norfolk was unwilling to take up arms, and while he delayed, Elizabeth ordered his arrest and he was taken to prison in October 1569. In August 1570, after the suppression of the rising in the north of England, the duke was released; but he entered into communication with Philip II. of Spain regarding the proposed invasion of England by the Spaniards. After some hesitation Norfolk placed himself at the head of the conspirators; and in return for his services he asked the king of Spain "to approve of my own marriage with the Queen of Scots." But the plot failed; Norfolk's treachery was revealed to Lord Burghley, and in September 1571 he was arrested. He was beheaded on June 2, 1572. He always regarded himself as a Protestant. Norfolk's first wife, Mary (1540–1557), daughter and heiress of Henry Fitzalan, 12th earl of Arundel, bore him a son, Philip, who in consequence of his father's attainder was not allowed to succeed to the dukedom of Norfolk, but became 13th earl of Arundel in succession to his maternal grandfather in 1580. Norfolk left two other sons, Thomas Howard, created earl of Suffolk in 1603, and Lord William Howard (*q.v.*).

**NORFOLK, THOMAS MOWBRAY,** 1ST DUKE OF (*c.* 1366–1399), son of John de Mowbray, 4th Lord Mowbray, was created marshal of England for life in 1385. He was then Lord Mowbray and earl of Nottingham. In 1387 Nottingham began to act with Thomas of Woodstock, duke of Gloucester, his own brother-in-law, Richard Fitzalan, earl of Arundel, and the party of nobles who wished to deprive the king of his power. They routed the royal favourite Robert de Vere, earl of Oxford, at Radcot Bridge, and Richard was at their mercy. Owing partly to Nottingham's moderate counsels the suggestion to depose him was not carried out, but in the "merciless parliament" of 1388 his favourites were "appealed" of treason and were sentenced to death. For nearly two years the chief power was in the hands of the lords appellant, as Nottingham and his friends were called, but in 1389 the king regained his authority. He detached Nottingham from his colleagues and made him warden of the Scottish marches; later he became captain of Calais and the royal lieutenant in the north-east of France. Richard took him to Ireland in 1394 and soon afterwards sent him to arrange a peace with France and his marriage with Isabella, daughter of King Charles VI. But the earl's supreme service to the king was in 1397 when Richard took a tardy but severe vengeance upon three of the appellants. In their turn these lords were "appealed" of treason before the parliament, and as on the former occasion Nottingham was one of the accusers. He was present when Gloucester was arrested at Pleshey, and Froissart says that he actually beheaded Arundel himself. Gloucester was entrusted to his keeping at Calais, and in September 1397 he reported that his prisoner was dead. The duke had been murdered, and Nottingham was probably responsible, although the evidence against him is not conclusive. As a reward he received most of Arundel's lands in Surrey and Sussex, and was created duke of Norfolk. He now began to fear for his own safety, and took the duke of Hereford, afterwards King Henry IV., into his confidence. Hereford carried his words to the king, who summoned him to his presence, and at Oswestry Norfolk accused Hereford of speaking falsely. A court of chivalry decided that the dispute should be referred to the arbitrament of single combat at Coventry; but when everything was ready (Sept. 16, 1398) for the fight Richard interposed and ordered both combatants into banishment. Norfolk was deprived of his offices, but not of his titles; he left England for Dordrecht, and after passing some months in wanderings he reached Venice, where he died on Sept. 22 or 27, 1399. The concluding scene of the duke's life in England forms the staple material of act i. of Shakespeare's *Richard II.*

**NORFOLK,** an eastern county of England, bounded north and east by the North sea, south-east and south by Suffolk and west by Cambridgeshire and Lincolnshire. The area is 2,055 sq.mi., the county being the fourth in size in England.

**Physical Features.**—The county as a whole is low-lying, no point reaching up over 350 feet. In the extreme west we have the flat fens composed of recent alluvium, which is crossed by various dykes and ditches which help to drain the district; windmills used for this purpose are a conspicuous feature, though they are being replaced by pumping engines. To the east of the Ouse the land rises somewhat, where we have the north easterly extension of the chalk hills of England. These form the oldest rocks in the county, except for a few small patches of Kimeridge clay lying along their western side. The cretaceous rocks dip eastward under various glacial deposits such as boulder clay and gravel. The indeterminate nature of the drainage is due to glacial action. The heights also die away southward and eastward, and here the land is generally fertile and well wooded, with occasional expanses of heath. The rivers follow rather irregular courses, what

watershed there is lying across the centre of the county from south-east to north-west; the Cromer Morainic ridge forms a secondary parting at right-angles to the first. The largest rivers in the east of the county are the Yare and its tributaries the Bure and the Waveney, which forms a large part of the boundary with Suffolk. In the river valleys are large stretches of alluvial deposits.

Nearly two-thirds of the boundary of the county is formed by tidal water, but there are few bays or inlets. For the most part the coast-line is flat and low, and has been greatly encroached on by the sea, several villages having been engulfed since the Conquest. At certain points, however, blown sand is filling up some arms of the sea. From the mouth of the Yare to Happisburgh the shore is skirted by sandbanks. Thence for 20 m. it is formed of cliffs consisting of clay and masses of embedded rocks. These cliffs are succeeded by a low shingly or sandy coast stretching as far as St. Edmund's point. The shores of the Wash are formed of mudbanks, which are left dry at low water. At various points off the coast there are submarine forests, especially in Brancaster bay and in the neighbourhood of Cromer and Happisburgh.

**Archaeology and History.**—Palaeolithic implements have been found in the county in the valley of the Little Ouse and near Cromer. The county, because of the low rainfall and fairly strong winds, was never very heavily forested, and as such it offered a suitable home for Neolithic man, who has left extensive traces of his occupation on the chalk of the west and along the gravels in the east. A few miles north-east of Brandon there are extensive pits in the chalk dug by early man when quarrying for flint (Grimes' Graves), and in them were found numerous deer antlers used by him as picks. Bronze weapons are fairly numerous, and their distribution tallies generally with those of Neolithic artefacts. Evidence of probable contacts across the North sea is borne out by the fact that 11 beakers have been discovered in the county. Finds of the early Iron age are not numerous, but towards the end of the pre-Christian era and for some time after, Norfolk was part of the lands of the Iceni. This tribe accepted the suzerainty of the Romans at the Conquest, but at the death of their ruler, Prasutagus, and following the injustice of the Romans to his wife, Boudicca (Boadicea), and his daughters, they rebelled. Successful at first, they were finally completely defeated, and their territories ravaged by the victors. Of Roman remains in the county we have the settlement of Caister-by-Norwich, perhaps a small village at Caister-by-Yarmouth and a fort at Brancaster which guarded the Wash and the north coast, and which was the headquarters of the Count of the Saxon shore. A Roman road, known as the Peddar way, probably following a more ancient track, crosses the Little Ouse a few miles east of Thetford, and runs north-north-west across the country to near Hunstanton; another road from Colchester to Caister-by-Norwich enters the county by Scole. The eastward continuation of the pre-Roman Icknield way also crossed the county.

The district was invaded in the second half of the 5th century by Angle tribes from north Germany, who, having secured the coast districts, worked their way inland along the river valleys. East Anglia owned successively the supremacy of Kent, of Mercia and Northumbria, until in 827 the whole land was united under the rule of Egbert. In 867 the Danes under Inguar and Ubba defeated and killed King Edmund at Thetford, and Norfolk formed an integral part of the Danelaw. In the renewed Danish attacks of the 11th century Norwich and Thetford were destroyed. At the time of the Norman invasion Norfolk formed part of Harold's earldom.

Norfolk formed part of the diocese of East Anglia from its foundation in 630, and in 1075 the bishop's see was placed at Thetford, whence it was transferred to Norwich in 1093.

**Architecture.**—With a few exceptions, the majority of the churches are Decorated or Perpendicular, or a mixture of both styles. The churches of the marshes in the north-west are noteworthy, especially those of Tilney All Saints and Walpole St. Peter's, the finest Perpendicular edifice in Britain; the rich Norman church of Castle Rising should also be mentioned. At Northwold remains one of the rare Easter sepulchres. Apart from the churches in the towns, those of Worstead, Hingham, Cawston and Terrington St. Clement may be quoted as typical examples of the numerous fine later Gothic churches. Norfolk possessed an unusually large number of monastic foundations, but of these the remains are few and comparatively unimportant. The cathedral church of Norwich was originally connected with a very richly endowed Benedictine monastery. A foundation of almost equal importance was that of Augustinian canons at Walsingham, where there are remains of an Early English and Decorated church, a Decorated refectory and a Perpendicular gateway. The shrine of Our Lady of Walsingham was the resort of great numbers of pilgrims. Other monastic remains are Bromholm priory near North Walsham; slight Early English fragments of Beeston Augustinian priory, west of Cromer; good Norman and later remains at Binham (Benedictine) north-east of Walsingham; the Benedictine nunnery of Carrow near Norwich; the fine church (Norman and later) of the Benedictine priory at Wymondham; and the remains at Castle Acre and Thetford.

The shire-system was not definitely established in East Anglia before the Conquest, but the Domesday boundaries of Norfolk were practically those of the present day. The 36 Domesday hundreds were subdivided into leets, of which no trace remains, and the boroughs of Norwich and Thetford ranked as separate hundreds, while Yarmouth was the chief town of three hundreds. Norfolk and Suffolk were united under one sheriff until the reign of Elizabeth, the shire court for the former being held at Norwich.

In the war between John and his barons Roger Bigod garrisoned Norwich castle against the king. In the rising of 1381 Norwich was plundered by the insurgents, and in the rising of 1549 against enclosures Norwich was again captured by the rebels under Ket. In the Civil War of the 17th century Norfolk as a whole adhered to the parliamentary cause, forming one of the six counties of the Eastern Association. Lynn, however, was held for the king, and Norwich was one of the first cities to welcome back Charles II.

There are several old mansions of interest, such as the Jacobean brick building of Blickling hall, Barningham hall (1612), Hunstanton, the moated Oxburgh hall, and Cressingham manor, both of the 15th century. The larger mansions, however, such as Sandringham, are of modern date. Paston and Oxnead were successively the seats of the Paston family whose Letters are famous.

**Politics and Agriculture.**—Norfolk returned members to parliament in 1290, and in 1298 the county and the boroughs of Lynn, Norwich and Yarmouth returned each two members. Thetford acquired representation in 1529, and Castle Rising in 1558. Under the Reform Act of 1832 the county returned four members in two divisions, and Castle Rising was disfranchised. Under the act of 1868 the county returned six members in three divisions, and Thetford and Yarmouth were disfranchised.

At the time of the Domesday survey sheep-farming flourished almost throughout Norfolk, a flock of 1,300 being mentioned at Walton, and horses were extensively bred; numerous beehives, nearly 600 water-mills and valuable river fisheries are mentioned; and salt was made in the hundreds of Freebridge and East Flegg. There was also, after the Conquest, a well developed trade with Flanders in wool. The worsted trade was introduced by Flemish immigrants as early as the 12th century, and the woollen trade became especially prosperous in the hundreds adjoining the Wash. This immigration and those of religious refugees from the Continent in later times doubtless contributed to the county's having produced many notable men. Linen was manufactured at Aylsham in the 14th century. Fuller, writing in the 17th century, describes Norfolk as abounding in all good things, and especially rabbits, herrings and worsteds. The leather industry flourished in Norman times.

The great variety of the soils has helped to make Norfolk rich agriculturally, and where the land is not suitable for plowing it is usually good for pasture. It was at Holkham, in this county, that Thomas Coke, earl of Leicester, carried out experiments in the cultivation of wheat and began to improve the standard of livestock in Britain. In 1939 the total acreage under crops and grass was 974,246, of which 119,387 ac. were under wheat, 184,719 ac. under barley, while oats occupied less than half the acreage of wheat. Rye covered 1,978, beans and peas 11,338 acres.

The area of sugar beets was 89,391 ac., of potatoes 24,098 ac., and of turnips and swedes 21,698 ac. Clover and rotation grasses for hay occupied 82,633 ac., and orchards 9,664 ac. A feature in the cultivation of Norfolk has been the extensive planting of trees. The National Trust owned 6,538 ac. in 1942.

**Industries, Communications, etc.**—The weaving of silk and wool is still carried on at Norwich and also shawl weaving, although the staple trade of the town is now boots and shoes. Silk is also manufactured at Yarmouth, Wymondham and North Walsham. Flour-mills are numerous all over the county, and there are agricultural implement works at Norwich, Lynn, Thetford, East Harling, North Walsham, Walsingham and East Dereham. Lime-burning, brick-making, tanning, malting and brewing are carried on in various districts. There are extensive mustard and starch works at Norwich. The sea-coast is of a dangerous nature and there is a lack of harbours. A large trade, however, is carried on at Yarmouth, which is also famous for its herring fishery. The other principal port is Lynn, and there is a small trade at Wells.

The L.N.E. and the M. and Gt.N.Jt. railways serve the principal towns. The eastern rivers afford water communication with Great Yarmouth, while the Great and Little Ouse and some of the drainage cuts communicate with Lynn.

The area of the administrative county is 2,036 sq.mi., with a population (1938) of 501,660, though between Sept. 1939 and Feb. 1941 the population decreased 2% as a result of wartime evacuation. The municipal boroughs are—King's Lynn; Norwich, a city and county borough and the county town; Thetford; and Yarmouth, properly Great Yarmouth, a county borough. The county is in the south-eastern circuit, and assizes are held at Norwich. There are two courts of quarter sessions. Each of the four municipal boroughs has a separate court of quarter sessions. Norfolk is in the diocese of Norwich except for three rural deaneries in west Norfolk, which are in that of Ely. There are five parliamentary divisions—King's Lynn, South-Western, Northern, Eastern and Southern—as well as the parliamentary borough of Norwich (two members), and part of the parliamentary borough of Great Yarmouth (one member). Of the three boys' public schools in the county, two are in Norwich, viz., King Edward VI's school and the City of Norwich school. The third, Gresham's school, was founded at Holt, near Sheringham, in 1555, by Sir Thomas Gresham (*q.v.*).

**Broads and Rivers.**—The rivers and broads (lakes) of Norfolk, together with the few in Suffolk, form over 200 m. of navigable waterway. They are now, however, chiefly used by pleasure craft, though a diminishing number of trading wherries still carry coal and other goods between the large towns, such as Yarmouth, and the villages. The southern rivers are wider and deeper than the northern, and the Yare can be navigated by sea-going trading vessels as far as Norwich.

The formation of a broad may be due either to the widening of a river or to a sea-estuary becoming completely enclosed by sand-banks. The broads tend to become overgrown with reeds which, if they are not cut (they can be utilized to make a very durable thatch), rot and fall to the ground, and, aided by the general silting up, they may cause the broad to be replaced by dry land. Several of the broads have to be dredged to preserve a navigable channel, some of them (*e.g.*, Hickling broad) being extremely shallow.

Some of the broads are extremely beautiful; notably Wroxham, Salhouse and South Walsham (up the Bure), which are surrounded by wooded country; Barton broad (up the Ant); and Horsea mere (up the Thurne, not far from the sand dunes and near to Hickling broad), which is of quite a different character, being surrounded by reedy marshland, the haunt of hundreds of different species of wild birds. The bittern (*q.v.*) was saved from extinction at an island on Hickling broad, and now flourishes in considerable numbers. The bearded tit (*see* TITMOUSE) has also been saved from the same fate. The fishing is good, and wild duck are shot from a "Breydon duck-punt" which carries a heavy gun aimed by manoeuvring the boat itself.

See *Victoria County History; Norfolk;* F. Blomefield, *Essay towards a Topographical History of . . . Norfolk* (1739–75 and 1805–10); W. Rye, *History of Norfolk* (1885); P. H. Emerson, *Pictures of East Anglian Life* (1888); Rev. A. Jessopp, *Arcady* (1887), and other works by both; *Quarterly Review* (1897), where other literature is cited; G. C. Davies, *Norfolk Broads and Rivers* (Edinburgh, 1884); Christopher Marlowe, *People and Places in Marshland* (1927); "Land of Britain," *Land Utilisation Survey,* Part 70 (London, 1938).

**NORFOLK,** a city of Madison county, Nebraska, U.S.A., in the northeastern part of the state, on the Elkhorn river, at an altitude of 1,525 feet. It is on federal highway 81 and is served by the Chicago and North Western, the Chicago, St. Paul, Minneapolis and Omaha and the Union Pacific railways. The population was 8,634 in 1920 (88% native white); it was 10,717 in 1930 and 10,490 in 1940. The city was founded in 1866, incorporated in 1881 and chartered in 1886.

**NORFOLK,** a seaport of Virginia, U.S.A., on the Hampton Roads. It is on federal highways 58, 60 and 460 and is served by the Atlantic Coast Line, the Chesapeake and Ohio, the Norfolk Southern, the Norfolk and Western, the Pennsylvania, the Seaboard Air Line, the Southern and the Virginian railways (all interconnected by an industrial belt line), and by interurban trolleys, motorbus and air lines, several ferries and about 60 steamship lines. Pop. 115,777 in 1920 (37% Negroes); it was 129,710 in 1930 and 144,332 in 1940 by federal census.

The city has a land area of 28.2 sq.mi. and 50 mi. of water front on Hampton Roads, Chesapeake bay, the Elizabeth "river" (which is a tidal estuary, not a river), and the Lafayette river (another estuary). Immediately opposite is the city of Portsmouth. The town of Berkley was annexed to Norfolk in 1906, and lying beyond it is the still independent town of South Norfolk.

The waters about Norfolk, Portsmouth and Newport News (officially known as the Port of Hampton Roads, and under the jurisdiction of the state port authority created in 1926) form one of the finest natural harbours of the world, where a thousand ships at a time have found berthing space or anchorage without taxing its capacity. The part known as Norfolk harbour (which includes the Portsmouth waters) is 15·5 mi. long, varies from $\frac{1}{6}$ to 2 mi. in width and is connected with the bay by a 40-ft. channel. On the Norfolk water front there are 154 piers, largely owned by railroads, steamship lines and shipbuilding companies. The army supply base, north of the Lafayette river, established in 1917 and representing an investment of $30,000,000, was leased by the city from the United States in 1919, and beyond it a modern municipal terminal has been constructed (at an expenditure of $6,000,000) including a grain elevator with a capacity of 800,000 bushels, a dock specially equipped for shipping garden and farm produce and a general merchandise pier 1,210 ft. long, with transit sheds and warehouses. The business section of the city is compactly built up with hotels, stores and office buildings that seem tall in proportion to the width of the streets.

Some beautiful antebellum homes and interesting old buildings remain, including St. Paul's church (1739), which has a British cannon ball embedded in its walls; the old Norfolk academy (built in 1840), now used temporarily by the juvenile and domestic relations court; and the colonnaded city hall (1850). There are public parks covering 500 ac., 22 playgrounds, 38 public-school buildings, 209 churches, two daily newspapers, a public library with seven branches, a municipal market built in 1923 at a cost of $500,000 and a picturesque municipal armoury.

Virginia beach, a popular resort on the Atlantic, 5 mi. below Cape Henry, is 20 mi. east of Norfolk, and there are many other recreation spots in the vicinity.

The water supply, sufficient for a much larger city, comes partly from works built in 1872–73, which for some time had been seriously inadequate, and partly from Lake Prince (20 mi. W.) through a new system constructed since 1920 at a cost of $6,000,000. Since 1919 the city has operated under a commission-manager form of government. The assessed valuation for 1940 was $139,522,150.

Norfolk is the centre of many activities of the federal government. The Norfolk navy yard is on the Portsmouth side of the Elizabeth river (*see* PORTSMOUTH), and the naval hospital is also in Portsmouth. In Norfolk (directly opposite the navy yard) is the St. Helena naval reservation, now used as a naval air-landing

field. Within the city are also a U.S. Public Health Service hospital, a branch of the U.S. Hydrographic Office, district headquarters of the Coast Guard, headquarters of the customs district of Virginia and various other offices. At Sewall point, on the northern edge of Norfolk, is the Hampton Roads naval operating base, comprising a training station where nearly 50,000 men were trained for the navy during the war of 1914–18; a supply station with warehouse floor space of 55 ac. and the navy's principal fuel reserve depot; a naval air station and a submarine base.

Hampton Roads has become one of the important ports of the United States in respect to foreign trade, handling in 1939 2,552,197 tons of imports and exports, about 2% of the total of the United States. About 70% of the tobacco exported from the United States moves through Hampton Roads, and in 1940 the railroads dumped altogether 19,941,874 tons of coal at this port, for coastwise and foreign trade and for bunkering purposes. It is also an important oil-bunkering port, with a storage capacity of 2,500,000 bbl. About two-thirds of the total tonnage of Hampton Roads moves through the Norfolk harbour.

Norfolk is surrounded by one of the finest truck-farming districts of the United States, and is the shipping point for immense quantities of potatoes, spinach, kale, beans, cauliflower, tomatoes and strawberries. Norfolk's industries had a total output in 1940 valued at $110,000,000. Shipbuilding is perhaps the most important. Among products are fertilizers (1,000,000 tons a year), peanut and cotton-seed oil, sea foods, textiles, automobiles, cement and lumber.

Norfolk was laid out in 1682 (on 50 ac. of land bought from Nicholas Wise, a carpenter, for 10,000 lb. of tobacco) to be a centre of trade, and was incorporated as a borough in 1736. On Jan. 1, 1776, it was furiously bombarded by the British under Lord Dunmore. Sailors set fire to the warehouses along the water front, and the town burned for three days, until all the buildings except St. Paul's church were destroyed. After the Revolution it was rebuilt, and grew rapidly until the Embargo Act of 1807 ruined its commerce at a single stroke. In the War of 1812 Norfolk was attacked and successfully defended. It was chartered as a city in 1845. In 1855 there was a disastrous epidemic of yellow fever, brought in by a man-of-war. At the outbreak of the Civil War Norfolk had a population of 14,620. The navy yard was burned and abandoned by the Federals in April 1861, and the city was held by the Confederates until May 10, 1862. Recovery after the war was gradual until 1880, when the population was 21,966. After that growth was more rapid, to 34,871 in 1890, 46,624 in 1900, and 67,452 in 1910. The Ter-Centennial Exposition, celebrating the founding of Jamestown, was held here in 1907, on ground now within the city limits and occupied by the naval base. During the World War Norfolk had a period of intoxicating prosperity, due at first to heavy shipments of orders to the Allies, and after 1917 to the activities at the army supply base and the naval operating base and navy yard. Correspondingly severe was the post-war deflation, when the army base was closed down, the fleet transferred to the Pacific coast and the naval training station reduced to a skeleton organization; but in the following years substantial foundations were laid for a healthy commercial, civic and industrial development.

**NORFOLK AND WESTERN RAILWAY COMPANY, THE,** one of the world's greatest coal carriers, with total assets of $564,039,308.91 and a total capitalization of $163,482,800 on Dec. 31, 1939, employed 20,000 persons and operated 4,628.01 m. of track in six States in the United States, namely: Virginia, West Virginia, North Carolina, Maryland, Ohio and Kentucky. Its main line runs from Norfolk and Lambert Point, Va., the eastern terminus, on the Port of Hampton Roads, through agricultural, livestock and mineral sections of Virginia, through vast coal fields in West Virginia and thence into Ohio to Cincinnati and Columbus, the western terminals. A line from Roanoke, Va., to Hagerstown, Md., makes connections for the east and north; two lines into North Carolina, one from Roanoke, Va., to Winston-Salem and the other from Lynchburg, Va., to Durham, make connections with the south. One of the first railroads in the country to employ electric traction, the N. and W. greatly increased its operating efficiency by electrifying 210 m. of track on mountain grades in West Virginia. The coal traffic of the road has grown from 70,000 tons in 1883 to about 40,000,000 tons annually.

The road had its beginning in Virginia in 1838 as the City Point Railroad running between Petersburg and City Point, a distance of nine miles. The South Side (which purchased the City Point), Norfolk and Petersburg, and Virginia and Tennessee railroads, all in Virginia, and built between 1849 and 1858, running from Norfolk to the Tennessee line at Bristol, consolidated in 1870 as the Atlantic, Mississippi and Ohio R.R. Co., with a total trackage of 479 miles. This road was sold in 1881 and became the Norfolk and Western Railroad Company. Between 1881–91 it built three lines into the coal fields of Virginia and West Virginia extending beyond to Ohio and acquired by purchase two other roads, one running from near Ironton, Ohio to Columbus, and the other, from Roanoke to Hagerstown. In Sept. 1896, the railroad was reorganized as the Norfolk and Western Railway Co. Later in the year it purchased the two lines running from Virginia into North Carolina. In 1901 it bought a second line in Ohio, from Sciotoville to Cincinnati. Since that time the road has had a steady development, with double tracking, branch construction and the complete modernization of all its facilities. (W. J. J.)

**NORFOLK ISLAND:** *see* PACIFIC ISLANDS.

**NORICUM,** a district south of the Danube, corresponding to part of Styria and Carinthia, Austria, Bavaria and Salzburg. The population was Illyrian afterwards subordinate to various Celtic tribes. The country is mountainous and the soil poor, but it was rich in iron, and the famous Noric steel was used for Roman weapons. The inhabitants were warlike and paid more attention to cattle-breeding than to agriculture. Gold and salt were found in considerable quantities; the wild nard grew in abundance, and was used as a perfume. Noricum was the southern outpost of the Celtic peoples and the starting-point of their attacks upon Italy. The cemeteries of Hallstatt (*q.v.*), less than 40m. from Noreia, contained weapons and ornaments from the bronze age up to the fully developed iron age. Prof. Ridgeway (*Early Age of Greece,* i. ch. v.), holds that here was the cradle of the Homeric Achaeans. For a long time the Noricans enjoyed independence under princes of their own, and carried on commerce with the Romans. In 16, having joined with the Pannonians in invading Histria, they were defeated by Publius Silius, proconsul of Illyricum. From this time Noricum was called a province, although not organized as such, but remaining a kingdom with the title *regnum Noricum,* under the control of an imperial procurator. In the reign of Marcus Antoninus the Legio II. Pia was stationed at Noricum, and the commander of the legion became governor.

BIBLIOGRAPHY.—J. Marquardt, *Römische Staatsverwaltung,* i. p. 290 (2nd ed. 1881); T. Mommsen, *Corpus inscriptionum Latinarum,* iii. 587; *Provinces of the Roman Empire* (1886); Mary B. Peaks, *The General Civil and Military Administration of Noricum and Raetia* (Chicago, 1907); full references to ancient authorities in A. Holder, *Alt-celtischer Sprachschatz,* ii. (1904).

**NORMAL SCHOOLS:** *see* TEACHERS, TRAINING OF.

**NORMAN, SIR HENRY WYLIE** (1826–1904), field-marshal and colonial governor, was born on Dec. 2, 1826, and entered the Indian army at the age of seventeen. Norman served in numerous frontier campaigns between 1850 and 1854, and in the suppression of the Sonthal rebellion of 1855–56. In the Mutiny campaign he was constantly engaged, being present at the siege of Delhi, the relief of Lucknow and a number of other affairs. As adjutant-general of the Delhi Field Force, he was one of the leading spirits of the siege, and afterwards became its chief chronicler. Altogether he was mentioned twenty-five times in despatches. He held various important positions at Simla and at Whitehall until 1883. He was then governor of Jamaica (1883–88), governor of Queensland (1888–95), agent-general for Queensland, and in 1901 governor of the Royal Hospital, Chelsea. In 1902 he was made a field-marshal. He died on Oct. 26, 1904.

*See* Sir William Lee Warner, *Memoirs of Field-marshal Sir Henry Wylie Norman* (1908).

**NORMAN, MONTAGU COLLET** (1871– ), British financier, was educated at Eton and King's college, Cambridge, and served in the South African War, 1900–01. He afterwards be-

came connected with finance and his active association with the Bank of England began during World War I. In 1918 he was appointed deputy governor and in 1920 governor of the Bank of England. By 1926, when he was re-elected for the 7th time, he had held the post longer than any previous governor. He finally retired in April 1944 because of failing health and was succeeded as governor by Lord Catto. During his governorship the gold standard was restored (1925) and again abandoned (1931). In 1923 he was made a privy councillor and in 1933 he married Priscilla Worsthorae, granddaughter of the 7th Earl of Abingdon. He was created a baron in July 1944 and took the title "Baron Norman St. Clere in the county of Kent."

**NORMAN,** a city of central Oklahoma, U.S.A., 18 mi. S. of Oklahoma City, on a plateau 1,170 ft. above sea level, overlooking the valley of the South Canadian river; county seat of Cleveland county. It is on federal highway 77, and is served by the Oklahoma and the Santa Fe railways. Pop. (1940) 11,429. It is the seat of the University of Oklahoma (opened in 1892) and of the state hospital for mental diseases. The university's total enrolment for the academic year 1940–41 was 8,026, of whom 6,178 were full-time students. The faculty numbered 301, and the endowment was $3,752,583. Norman was founded in 1889 and chartered as a city in 1902. Since 1919 it has had a commission-manager form of government.

**NORMAN,** in architecture, the Romanesque style developed in Normandy and England during the 11th and 12th centuries, up to the time of the general adoption of Gothic architecture in both countries. As it was only shortly before the Norman conquest of England that Normandy became settled and civilized enough to produce an architecture, the origin in both countries is the same, and early types extremely similar. This common early Norman differed from Romanesque in its love of geometric ornament such as zig-zags, general crudeness in carving figures and leaves, and a daring originality in construction ideas, probably owing much to the fact that Lanfranc of Pavia (d. 1089) had introduced Lombard ideas into many Norman abbeys.

Although the English and French phases of the style were thus identical at the start, they soon became different. The French was characterized by careful, structural articulation (Abbaye-aux-Dames and Abbaye-aux-Hommes, Caen, both founded in 1062, but altered later), and elaboration of tower and spire (S. Michel de Vaucelles, Caen, 12th century). In England the chief characteristics are enormous length of church plan, the frequent use of great round columns for the nave arcade (Gloucester cathedral, 1089–1100; Tewkesbury abbey, 1123; and Durham cathedral, alternate piers, 1099–1128) and great decorative richness (Prior's door, Ely cathedral, late 12th century; S. Mary's chapel, Glastonbury abbey, 1186; the front of Iffley church, 12th century; and the Galilee porch at Durham, *c.* 1175). The general Norman structural genius is most markedly shown in the ribbed vault of Durham cathedral, whose date is much debated, being placed as early as 1133 and as late as the 13th century. (*See* BYZANTINE AND ROMANESQUE ARCHITECTURE.)

**NORMANBY, CONSTANTINE HENRY PHIPPS,** 1ST MARQUESS OF (1797–1863), British statesman and author, son of Henry, 1st earl of Mulgrave (1755–1831), was born on May 15, 1797. The 1st earl (who was created baron in 1794 and earl in 1812) was a distinguished soldier, and Pitt's chief military adviser; and he held the offices of chancellor of the duchy of Lancaster (1804), secretary for foreign affairs (1805), first lord of the admiralty (1807–10), and master of the ordnance (1810–18). In 1792 he inherited the earlier Irish barony of Mulgrave—created in 1767 for his father, Constantine (1722–75) grandson of Sir Constantine Phipps (1656–1723), the lord chancellor of Ireland—from his elder brother Constantine (1744–92), a naval captain.

His son, the 1st marquess, was governor of Jamaica (1830–35) and lord-lieutenant of Ireland (1835–39). He was created marquess of Normanby in 1838, and held successively the offices of colonial secretary and home secretary in the last years of Lord Melbourne's ministry. From 1846 to 1852 he was ambassador at Paris, and from 1854 to 1858 minister at Florence. The publication in 1857 of a journal kept in Paris during the stormy times of 1848 (*A Year of Revolution*), brought him into violent controversy with Louis Blanc, and he came into conflict with Palmerston and Gladstone, on French and Italian policy. He died on July 28, 1863. He was succeeded as 2nd marquess by his son George (1819–90), a liberal statesman, who became governor of Queensland (1871–74), New Zealand (1874–79), and Victoria (1879–84).

**NORMANDY,** a province of old France, bounded on the N.E. by the river Bresle, which falls into the Channel at Tréport and separates Normandy from Picardy, and then roughly by the Epte, which divides the Vexin into two parts.

Under the feudal régime, the energy of the Norman dukes prevented the formation of many powerful lordships, and there are few worthy of note, save the countships of Eu, Harcourt, Le Perche and Mortain. The duchy of Normandy, which was confiscated in 1204 by King Philip Augustus of France, formed in the 16th century the *gouvernement* of Normandy; the extent of this *gouvernement* did not, as a matter of fact, correspond exactly to that of the duchy, for Le Perche, which had been part of the duchy, was annexed to the *gouvernement* of Maine, while the Thimerais, which had belonged to the countship of Blois, was joined to the *gouvernement* of Normandy. In the 17th century this *gouvernement* was divided into three *généralités* or *intendances:* those of Rouen, Caen and Alençon. For judicial purposes Normandy was under the jurisdiction of the parlement of Rouen, created in 1499. Since 1791 the territory of the old duchy has composed, roughly speaking, the departments of Seine-Inférieure, Eure, Calvados, Manche and Orne.

**History.**—The province of *Lugdunensis Secunda,* which included Normandy, was conquered by Clovis before 506, and during the Merovingian times followed the fortunes of Neustria. In the 9th century this country was ravaged by the Northmen, and at length was formally ceded to them. The definitive establishment of the Normans, to whom the country owes its name, took place in 911, when by the treaty of Saint-Clair-sur-Epte, concluded between King Charles the Simple of France and Rollo, chief of the Normans, the territory comprising the town of Rouen and a few *pagi* situated on the sea-coast was ceded to the latter. Later, Rollo received from the king of France Bessin and Maine. Although baptized, he seems to have retained many pagan customs. The legend that he married Gisela, daughter of Charles the Simple seems to be unfounded.

History is here obscure. The first two dukes, Rollo and his son William "Longsword," displayed a certain fidelity to the Carolingian dynasty, and in 936 William did homage to Louis IV. d'Outremer. He died on Dec. 17, 942, assassinated by the count of Flanders. During the minority of his successor, Duke Richard, King Louis IV., who was making an expedition into Normandy, was captured by the inhabitants of Rouen and handed over to Hugh the Great. From this time onwards the dukes of Normandy began to enter into relations with the dukes of France; and in 958 Duke Richard married Hugh the Great's daughter. He died in 996. At the beginning of the reign of his son, Richard II. (996–1026), there was a rising of the peasants, who formed assemblies with a view to establishing fresh laws for the management of the forests. This attempt at insurrection, described by William of Jumièges, and treated by many historians, on the authority of the poet Wace, as a sort of democratic movement, was put down with an iron hand. Richard III. reigned from 1026–27 and Robert the Magnificent or the Devil (1027–35). In 1031 Robert supported King Henry I. of France against his brother Robert, who was laying claim to the throne, and in return for his services received the French Vexin. The duke died on a pilgrimage to Jerusalem, leaving as his heir an illegitimate son, William, born of his union with the daughter of a tanner of Falaise and left under the protection of the king. In 1047 Henry I. had to defend the young duke against an army of rebellious nobles, whom he succeeded in beating at Val-ès-dunes. In the following year the king of France was in his turn supported by the duke of Normandy in his struggle against Geoffrey Martel, count of Anjou; the two allies besieged Mouliherne (1048); and the war was continued between the duke of Normandy and the count of Anjou by the

siege of Alençon, which was taken by Geoffrey Martel, then retaken by William, and that of Domfront, which in 1049 had to surrender to Duke William.

In 1054 the duke married Matilda, daughter of Baldwin V., count of Flanders. The king of France before long became alarmed at William's ambitions, and encouraged William Busac, count of Eu and Montreuil, in his claim to the ducal crown. In 1054 he invaded Normandy with his brother Odo and this count, but Odo was beaten at Mortemer. In 1058 the king of France, joined by Geoffrey Martel, count of Anjou, tried to revenge himself, but was beaten at the ford of Varaville.

Towards the same time occurred the temporary annexation of Maine to Normandy. Herbert II., the young count of Maine, who was a vassal of the count of Anjou, did homage to William between 1055 and 1060, perhaps after the defeat of Geoffrey Martel; he promised to marry one of William's daughters, and betrothed his sister Margaret to the duke's son, Robert Curthose, on the understanding that, if he died leaving no children, the countship was to fall to William. After his death, the people of Maine revolted (1063), choosing as their lord Walter of Mantes, count of Vexin; but William, after one campaign, succeeded in imposing Norman authority. Three years later, he took possession of England, of which he was crowned king in 1066. Normandy now became the scene of William's quarrels with his son, Robert Curthose, who laid claim to Normandy and Maine, and with the aid of King Philip I. of France succeeded in defeating his father at Gerberoi in 1079.

After the death of William (Sept. 7, 1087), his eldest son, Robert Curthose, kept Normandy and Maine, and his second son, William Rufus, became king of England. In 1096 Robert departed on a crusade and pledged the duchy to his brother for 10,000 livres. When Robert returned, William Rufus had just died, and his youngest brother, Henry, had already taken possession of the crown. Henry was ambitious of uniting Normandy to England; in 1105, with the aid of Helias, count of Maine, and the son of Geoffrey Martel, count of Anjou, he took and burnt Bayeux, but failed to take Falaise. On Sept. 28, 1106, he defeated his brother at Tinchebrai, took him prisoner, and seized Normandy. Thus the centre of gravity was changed; England had at first been dependent on Normandy, Normandy was now subordinate to England.

**Union with England.**—From 1106 to 1204 Normandy remained united to England. Henry I. carried on hostilities against the king of France and William Clito, son of Robert Curthose, whose claim to the duchy of Normandy was upheld by Louis VI., and won an important victory over his opponents at Brémule (1119). After the disaster of the White Ship (1121), in which Atheling William lost his life, Henry's only surviving child was a daughter, Matilda, widow of the emperor Henry V. In 1127 Matilda married Geoffrey the Fair, eldest son of Fulk V., count of Anjou. After the death of Henry I. in 1135, a struggle arose between Matilda, who claimed the kingdom of England and the duchy of Normandy in the name of her son Henry, and Theobald, count of Champagne, grandson of William the Conqueror on the side of his mother Adela, the candidate of the Normans of Normandy, while the Norman party in England supported Stephen, brother of Theobald. In 1144 Theobald, whose position had been much weakened since the taking of the castle of Rouen, gave up his rights in Normandy to Matilda's husband Geoffrey, count of Anjou, in favour of Henry Plantagenet. Between 1139 and 1145 Geoffrey, with French and Flemish help, gradually subdued Normandy, and on his death, in 1151, his son Henry Plantagenet was master of Normandy as well as count of Anjou. In 1152, by his marriage, Aquitaine also was secured to himself and his descendants, and in 1153 he was recognized as heir to the throne of England. The duchy of Normandy, though nominally in feudal dependence on the king of France, thus became part of the great Angevin empire, of which the power and resources were more than equal to that of the French kings (*see* FRANCE: *History*, and ENGLISH HISTORY).

From the first the French kings were fully conscious of the menace of the Angevin power. The reign of Louis VII. was occupied by the struggle against Henry II. Philip Augustus (1180–1223) pursued the same policy with greater tenacity and success. He began by taking part against Henry II. with his son and successor, Richard, who obtained the throne on the death of Henry II. in 1189. From the point of view of Normandy, the most important events of Richard's reign were: the truce of Issoudun, by which Philip Augustus kept the Norman Vexin which he had just conquered (1195), the building by Richard of Château-Gaillard (1196), and finally the defeat of Philip Augustus by Richard at Courcelles, near Gisors (1198). On the death of Richard at Chalus in 1199 the position of Philip Augustus was critical. The situation was modified under the reign of John Lackland, Richard's brother, who had himself crowned duke of Normandy at Rouen (April 25, 1199). Philip Augustus set up in opposition to him Arthur of Brittany, son of Geoffrey and grandson of Henry II., and the first phase of the struggle between the kings of France and England continued until the treaty of Goulet (1200). But in 1202 Philip made a fresh attempt to seize the Continental possessions of the kings of England. An excuse for reopening hostilities offered itself in the abduction, by John, of Isabel of Angoulême, the betrothed of Hugh le Brun, son of the count of La Marche. The barons appealed to Philip Augustus, who summoned John to appear before the royal judges; he failed to appear, and was consequently condemned by default, as a disloyal vassal, to have all the fiefs which he held in France confiscated (April 1202). The confiscation, a purely formal operation, was followed by the actual conquest.

In June 1202 Philip Augustus invaded Normandy and besieged the castle of Arques, near Dieppe; at the same time Arthur of Brittany was taken prisoner by John at Mirebeau in Poitou, and imprisoned in the castle of Falaise, from which he was removed to Rouen and died, probably assassinated by John's orders. The conquest of Normandy began with the occupation of Château-Gaillard after an eight months' siege (Sept. 1203–April 1204); the rest of Normandy was taken during the following months, Rouen surrendering in 1204 but obtaining a guarantee of her privileges. The conquest of Normandy by the French was not, however, recognized officially till the treaty of Paris (1259). In 1329 the duchy of Normandy was revived in favour of John, son of King Philip VI.

**The Hundred Years' War.**—Owing to her geographical position, Normandy suffered heavily during the Hundred Years' War. In 1346 Edward III., at the instance of Godefroi d'Harcourt lord of Saint-Sauveur, invaded Normandy, landing at Saint-Vast-la-Hougue (July 12); and arriving at Caen on July 25, he laid waste the country as far as Poissy. After the accession of John II. (1350), Normandy was given as an appanage to the dauphin Charles. The treaty of London (1359) stipulated for its cession to England, but the provisions of the treaty were modified by those of the treaty of Brétigny (1360), and it remained in the possession of France.

The most striking event of the war in Normandy during the reign of Charles V. (1364–80), was the siege of Saint-Sauveur-le-Vicomte, which was occupied by the English, and only surrendered after a siege of several years. The opening years of the reign of Charles VI. (1380–1422) were disturbed by a revolt which broke out in Rouen against the *aides* which the royal Government had tried to impose (1381). In 1415 the war with England was resumed: an English army of 60,000 men landed on Aug. 14 at the mouth of the Seine, took Harfleur on Sept. 16, and finally defeated the army of the king of France at Agincourt. During the following years the whole of Normandy was occupied, Rouen holding out for nearly six months (July 29, 1418–Jan. 13, 1419), and Henry V. of England entrusted the administration of Normandy to a special council. After the expeditions of Joan of Arc and the treaty of Arras the position of the English in Normandy became insecure; at the end of 1435 the whole district of Caux, and in 1436 that of the Val de Vire revolted; Mont-Saint-Michel, which had never been taken by the English, continued to resist, and in order to keep guard over it the English built Granville. But Normandy was not recovered by the French till after the sack of Fougères (1449). Cotentin was reconquered by the earl of Richmond (*see* ARTHUR III) and the duke of Brittany;

Rouen surrendered on Oct. 29, 1449. An English army was sent into Normandy under the leadership of Thomas Kyriel; it landed at Cherbourg and marched across Cotentin to Bayeux, but was met at Formigny (April 15, 1450) by the count of Clermont and utterly routed. Caen, and finally Cherbourg, capitulated.

After the French conquest, the history of Normandy is less eventful. The kings of France maintained the provincial Estates and the University of Caen, founded by the kings of England, and transformed the Exchequer of Normandy into a permanent court of justice (1499) which was called the parlement of Normandy. Among the measures which contributed to the increase of the prosperity of Normandy should be noted the construction in 1752 of the Hâvre de Grace.

During the 16th century the Protestant Reformation met with some success in Normandy. The Reforming movement began with Pierre Bar in 1528, and the first apostle of the Reformation at Rouen was François Legay, called Boisnormand. Caen received the Reformed religion in 1531, and Alençon in 1582. In the massacre of St. Bartholomew's day (1572) more than 500 victims were slaughtered by the Catholics. After 1588 the Catholic party of the League established itself in Normandy, and King Henry IV. had to conquer it by force of arms. The most famous engagements during this expedition were the king's victories at Arques and Ivry, but he failed to take Rouen, which was defended by Alexander Farnese, duke of Parma, and only surrendered after the abjuration of the king.

BIBLIOGRAPHY.—Arthur du Monstier, *Neustria pia* (1663); L. du Bois, *Itinéraire descriptif, historique et monumental des cinq départements composant la Normandie* (1828); G. Depping, *Histoire de la Normandie* (2 vols., 1835); Fr. Palgrave, *The History of Normandy and of England* (2 vols., 1851–57); L. Delisle, *La Normandie illustrée* (2 vols., 1852–55) and *Étude sur la condition des classes agricoles en Normandie* (reprinted 1906); E. Frère, *Manuel de bibliographie normande* (1858–60); E. A. Freeman, *The History of the Norman Conquest of England* (3rd ed., 5 vols., 1877); Joh. Steenstrup, *Les Normands* (1880); E. J. Tardif, *Les Coutumiers de Normandie* (1881–96); N. Oursel, *Nouvelle Biographie normande* (3 vols., 1886–88).

(R. LA.; F. M. S.)

**NORMANS,** the softened form of the word "Northman," applied first to the people of Scandinavia in general, and afterwards specially to the people of Norway. In the form of "Norman" it is the name of those colonists from Scandinavia who settled in Gaul, founded Normandy, adopted the French tongue and French manners, and from their new home set forth on new errands of conquest, chiefly in the British islands and in southern Italy and Sicily. Normans and Northmen must be carefully distinguished. For these Normans began to adopt a new religion, a new language, a new system of law and society, new thoughts and feelings on all matters. To all outward appearance the Norman conquest of England was an event of an altogether different character from the Danish conquest. The one was a conquest by a people whose tongue and institutions were still palpably akin to those of the English. The other was a conquest by a people whose tongue and institutions were palpably different from those of the English. The Norman settlers in England felt no community with the earlier Danish settlers in England. In fact the Normans met with the steadiest resistance in a part of England which was largely Danish. But the effect of real, though unacknowledged, kindred had none the less an important practical effect. There can be no doubt that this hidden working of kindred between conquerors and conquered in England, as compared with the utter lack of all fellowship between conquerors and conquered in Sicily, was one cause which made so wide a difference between the Norman conquests of England and of Sicily.

**Character of the Normans.**—The English and the Sicilian settlements form the main Norman history of the 11th century. The new creed, the new speech, the new social system, had taken such deep root that the descendants of the Scandinavian settlers were better fitted to be the armed missionaries of all these things than the neighbours from whom they had borrowed their new possessions. With the zeal of new converts they set forth very much in the spirit of their heathen forefathers. The same spirit of enterprise which brought the Northmen into Gaul seems to carry the Normans out of Gaul into every corner of the world. Their character is well painted by a contemporary historian of their exploits, Geoffrey Malaterra. He sets the Normans before us as a race specially marked by cunning, despising their own inheritance in the hope of winning a greater, eager after both gain and dominion, given to imitation of all kinds, holding a certain mean between lavishness and greediness—*i.e.*, perhaps uniting, as they certainly did, these two seemingly opposite qualities. Their chief men, he adds, were specially lavish through their desire of good report. They were, moreover, a race skilful in flattery, given to the study of eloquence, so that the very boys were orators, a race altogether unbridled unless held firmly down by the yoke of justice. They were enduring of toil, hunger, and cold whenever fortune laid it on them, given to hunting and hawking, delighting in the pleasure of horses, and of all the weapons and garb of war. Love of imitation is marked. Little of original invention can be traced to any strictly Norman source; but no people were ever more eager to adopt from other nations, to take into their service and friendship from any quarter men of learning and skill and eminence of every kind. To this admirable quality is perhaps to be attributed the fact that a people who accomplished so much, who settled and conquered in so large a part of Europe, has practically vanished from the face of the earth.

**Their Faculty of Adaptation.**—But Geoffrey hardly did justice to the Normans if he meant to imply that they were simple imitators of others. Their position was very like that of the Saracens. In no department of science or art did any Saracen, strictly speaking, invent anything; but they learned much both from Constantinople and from Persia, and what they learned they largely developed and improved. The Normans did just the same. They adopted the French tongue, and were presently among the first to practise and spread abroad its literature. They adopted the growing feudal doctrines of France, and worked them, both in Normandy and in England, into a harmonious system. From northern Italy, as it would seem, they adopted a style of architecture which grew in their hands, both in Normandy and in England, into a marked and living form of art. Settled in Gaul, the Scandinavian from a seafaring man became a landsman. Even in land-warfare he cast aside the weapons of his forefathers; but he soon learned to handle the weapons of his new land with greater prowess than they had ever been handled before. He welcomed the lore of every stranger. Lanfranc brought law and discipline; Anselm brought theology and philosophy. The gifts of each were adopted and bore fruit on both sides of the Channel. And no people ever better knew how to be all things to all men. The Norman power in England was founded on full and speedy union with the one nation among whom they found themselves. The Norman power in Sicily was founded on a strong distinction between the ruling people and the many nations which they kept in peace and prosperity by not throwing in their lot with any one among them.

The quality which Geoffrey Malaterra expresses by the word "effrenatissima" is also clearly marked in Norman history. It is, in fact, the groundwork of the historic Norman character. It takes in one case the form of ceaseless enterprise, in another the form of that lawlessness which ever broke out, both in Normandy and in every other country settled by Normans, when the hand of a strong ruler was wanting. But it was balanced by another quality which Geoffrey does not speak of, one which is not really inconsistent with the other, one which is very prominent in the Norman character, and which is, no less than the other, a direct heritage from their Scandinavian forefathers. This is the excessive litigiousness, the fondness for law, legal forms, legal processes, which has ever been characteristic of the people. If the Norman was a born soldier, he was also a born lawyer. But nothing so well illustrates this formal side of the Norman character as the whole position of William the Conqueror himself. His claim to the crown of England is something without earlier precedent, something as far as possible removed from the open violence of aggressors who have no pretexts with which to disguise their aggression. It rested on a mass of legal assumptions and subtleties, fallacious indeed, but ingenious, and, as the result proved,

effective. His whole system of government, his confiscations, his grants, all that he did, was a logical deduction from one or two legal principles, arbitrary certainly in their conception, but strictly carried out to their results. Even Norman lawlessness in some sort took a legal shape. In the worst days of anarchy, in the minority of William or under the no-reign of Robert, the robber-baron could commonly give elaborate reasons for every act of wrong that he did.

The Normans were, therefore, crusaders before crusades were preached. Norman warriors had long before helped the Christians of Spain in their warfare with the Saracens of the Peninsula, and in Sicily it was from the same enemy that they won the great Mediterranean island. Others had done a kindred work in a more distant field as helpers of the Eastern emperors against the Turks of Asia. All these might pass for religious wars, and they might really be so; it needed greater ingenuity to set forth the invasion of England as a missionary enterprise designed for the spiritual good of the benighted islanders. The Norman, a strict observer of forms in all matters, attended to the forms of religion with special care. No people were more bountiful to ecclesiastical bodies on both sides of the Channel; the foundation of a Benedictine monastery in the 11th century, of a Cistercian monastery in the 12th seemed almost a matter of course on the part of a Norman baron. On the other hand, none were less inclined to submit to encroachments on the part of the ecclesiastical power, the Conquerer himself least of all.

Neither England nor Sicily has become a Norman land, and the tongue which the Norman brought with him into both has not for ages been spoken in either. Norman influence has been far stronger in England than in Sicily, and signs of Norman presence are far more easily recognized. But the Norman, as a distinct people, is as little to be seen in the one island as in the other, a result due to different and almost opposite causes. The whole circumstances of the conquest of England constrained the conquerors to become Englishmen in order to establish themselves in the conquered land. In William's theory, the forcible conquest of England by strangers was an untoward accident. The lawful heir of the English crown was driven against his will to win his rights by force from outside. But he none the less held his crown as an English king succeeding according to English law. Moreover, every Norman to whom he granted lands and offices held them by English law in a much truer sense than the king held his; he was deemed to step into the exact position of his English predecessor, whatever that might be. This legal theory worked together with other causes to wipe out all practical distinction between the conquerors and the conquered in a wonderfully short time. By the end of the 12th century the Normans in England might fairly pass as Englishmen, and they had largely adopted the use of the English language. The fashionable use of French for nearly two centuries longer was far more a French fashion than a Norman tradition. When the tradition of speaking French had all but died out, the practice was revived by fashion. Still the tradition had its effect. The fashion could hardly have taken root except in a land where the tradition had gone before it.

The Normans in England therefore became Englishmen, because there was an English nation into which they could be absorbed. The Normans in Sicily could hardly be said to become Sicilians, for there assuredly was no Sicilian nation for them to be absorbed into. While the Normans in England were lost among the people of the land, the Normans in Sicily were lost among their fellow-settlers in the land. The Normans who came into Sicily must have been much less purely Norman than the Normans who came into England. Indeed, we may doubt whether the Norman invaders of Sicily were Norman in much more than being commanded by Norman leaders. They were almost as little entitled to be called pure Scandinavians as the Saracens whom they found in the island were entitled to be called pure Arabs. The conquest of England was made directly from Normandy, by the reigning duke, in a comparatively short time, while the conquest of Sicily grew out of the earlier and far more gradual conquest of Apulia and Calabria by private men. The Norman settlements at Aversa and Capua were the work of adventurers, making their own fortunes and gathering round them followers from all quarters. They fought simply for their own lands, and took what they could by the right of the stronger. They started with no such claim as Duke William put forth to justify his invasion of England; their only show of legal right was the papal grant of conquests that were already made. The conquest of Apulia, won bit by bit in many years of what we can only call freebooting, was not a national Norman enterprise like the conquest of England, and the settlement to which it led could not be a national Norman settlement in the same sense. The Sicilian enterprise had in some respects another character. By the time it began the freebooters had grown into princes. Still there was a wide difference between the duke of the Normans and the duke of Apulia, between an hereditary prince of 150 years' standing and an adventurer who had carved out his duchy for himself.

The characteristic point of Norman rule in Sicily is that it is the rule of princes who were foreign to all the inhabitants of the island, but who were not more foreign to the inhabitants of the island than different classes of them were to one another. The Norman conqueror found in Sicily a Christian and Greek-speaking people and a Muslim and Arabic-speaking people. The relations between the two differed widely in different parts of the island, according to the way in which the Saracens had become possessed of different towns and districts. In one place the Christians were in utter bondage, in another they were simply tributary; still, everywhere the Muslim Saracen formed the ruling class, the Christian Greek formed the subject class. We speak of the Saracen very much as we speak of the Norman; for of the Muslim masters of Sicily very many must have been only artificial Arabs, Africans who had adopted the creed, language and manners of Arabia. In each case the Arab or the Norman was the kernel, the centre round which all other elements gathered and which gave its character to the whole. Besides these two main races, Greek and Saracen, others came in through the Norman invasion itself. There were the conquerors themselves; there were the Italians, in Sicily known as Lombards, who followed in their wake; there were also the Jews, whom they may have found in the island, or who may have followed the Norman into Sicily, as they certainly followed him into England. The special character of Norman rule in Sicily was that all these various races flourished, each in its own fashion, each keeping its own creed, tongue and manners, under the protection of a common sovereign, who belonged to none of them, but who did impartial justice to all. Such a state of things might seem degradation to the Muslim, but it was deliverance to the native Christian, while to settlers of every kind from outside it was an opening such as they could hardly find elsewhere. But the growth of a united Sicilian nation was impossible; the usual style to express the inhabitants of the island is "omnes" or "universi Siciliae populi." In the end something like a Sicilian nation did arise; but it arose rather by the dying out of several of the elements in the country, the Norman element among them, than by any such fusion as took place in England.

**Normans in Scotland, Wales and Ireland.**—From England, the Norman spread into Scotland, Wales and Ireland. In Scotland he was not a conqueror, but a mere visitor, and oddly enough he came as a visitor along with those whom he had himself overcome in England. Both Normans and English came to Scotland in crowds in the days of Margaret, Edgar and David, and Scottish national feeling sometimes rose up against them. In Scotland again the Norman settlers were lost in the mixed nationality of the country, but not till they had modified many things in the same way in which they modified things in England. They gave Scotland nobles and even kings; Bruce and Balliol were both of the truest Norman descent; the true Norman descent of Comyn might be doubted, but he was of the stock of the Francigenae of the Conquest. In Wales the Norman came as a conqueror, more strictly a conqueror than in England; he could not claim Welsh crowns or Welsh estates under any fiction of Welsh law. The Norman settler in Wales, therefore, did not to any perceptible extent become a Welshman. In Ireland the Norman was more purely a conqueror than anywhere else; but in Ireland his power of adaptation caused him to sink in a way in

which he sank nowhere else. While some of the Norman settlers in Ireland went to swell the mass of the English of the Pale, others threw in their lot with the native Irish, and became, in the well-known saying, *Hibernis ipsis Hiberniores* (see BOROUGH).

BIBLIOGRAPHY.—Ulysse Chevalier, *Répertoire des sources hist. du moyen-âge. Topobibliogr.* (Montbéliard, 1903), ii. 2140; also, for sources for the Norman invasion of France, Molinier, *Sources de l'hist. de France* (1901), i. 264. Of modern works may be mentioned H. Dondorff, *Die Normannen und ihre Bedeutung für das europäische Kulturleben im Mittelalter* (1875); E. A. Freeman, *Hist. of the Norman Conquest* (1867–79) and *Hist. of Sicily* (1891–94); O. Delarc, *Les Normands en Italie, 859–1073* (1883); A. F. von Schack, *Gesch. der Normannen in Sicilien* (Stuttgart, 1889); L. von Heinemann, *Gesch. der Normannen in Unteritalien und Sicilien* (Leipzig, 1894); W. Vogel, *Die Normannen und das fränkische Reich, 799–911* (1906); F. Chalandon, *La Domination normande en Italie et Sicile, 1009–1194* (1907); F. Lot, "La Grande Invasion normande, 856–862," in t. 69 of the *Bibliothèque de l'Ecole des Chartes* (1908); C. H. Haskins, *The Normans in European History* (Boston and New York, 1915).

(E. A. F.; F. M. S.)

**NORMANTON:** *see* CARPENTARIA, GULF OF.

**NORMANTON,** an urban district in the West Riding of Yorkshire, England, 3 mi. N.E. of Wakefield, on the L.M.S. and L.N.E. railways. Pop. (1938) 17,962. Area, 4.8 sq.mi. It is in the Calder valley, 1½ mi. from the right bank of the river, and is a railway junction for the line from Manchester to Leeds via Wakefield, and for the main line from the south via Chesterfield. A mound in the neighbourhood, called Haw hill, is believed to be a barrow. Traces remain of a moat surrounding the town, which is now a colliery district. Altofts, a neighbouring parish, was the home of Sir Martin Frobisher.

**NORNS,** in Northern mythology, the female divinities of fate, like the Gr. Μοῖραι generally represented as three in number, and said to spin, or weave, the destiny of men. They dwell beside the "Spring of fate," beneath the "world-tree," Yggdrasil's ash, which they water from the spring. Sometimes the Norns are indistinguishable from the Valkyries (*q.v.*). They appear as prophetesses (*völur*) at the birth of children. The most famous story is contained in the *Tháttr af Nornagesti.* (*See* TEUTONIC PEOPLES.)

**NORRIS, FRANK** (1870–1902), American novelist, was born in Chicago (Ill.), March 5, 1870. Believing that America ignored her own national epic, he devoted himself to his uncompleted trilogy of the wheat. *The Octopus* (1901) shows with a striking use of symbolism the raising of the wheat in California and the hold of the railway upon the ranchmen; *The Pit* (1903) is a powerful portrayal of the lure of board of trade gambling; the author's early death prevented completion of the third volume, dealing with consumption in Europe. Reared in Chicago (Ill.), educated at the San Francisco high school, the University of California, and Harvard, he studied art in Paris and served in South Africa as war correspondent for the San Francisco *Chronicle.* In 1896–97 he was associate editor of the San Francisco *Wave;* and in 1898 he was war correspondent in Cuba for *McClure's Magazine.* He died Oct. 25, 1902.

Besides the wheat trilogy, Norris's most important works are: *A Deal in Wheat, and Other Stories of the New and Old West* (1903); *The Third Circle* (1909), another collection of tales; *The Responsibilities of the Novelist, and Other Literary Essays* (1903); *Moran of the Lady Letty* (1898), a tale of adventure off the California coast; *Blix* (1899), a love story; *McTeague* (1899), a story of the San Francisco slums; and *Vandover and the Brute* (1914), a repulsive study of degeneration, issued with an introduction by Charles G. Norris. For a bibliography *see* F. T. Cooper's *Some American Story Tellers* (1911).

**NORRIS, GEORGE WILLIAM** (1861–1944), U.S. legislator, was born on a farm in Sandusky county, Ohio, on July 11, 1861. The death of his father and only brother while he was very young left the family in straitened circumstances, and Norris was required to work out among the farmers in the summer and attend school only in the winter. He afterwards taught school and studied law, and earned enough to finish his law course at Valparaiso university. He was admitted to the bar in 1883. In 1885 he moved to McCook, Neb., and began to practise. He was later elected prosecuting attorney of Furnas county, and in 1895 district judge of the 14th judicial district; re-elected in 1899, he was serving in this position when in 1902 he became a U.S. representative. He was re-elected for five successive terms and in 1910 was the leader of the insurgent group which successfully held out for a reform of house rules, and thus put an end to the autocratic control of the speaker. He also led the fight against secret committee meetings. Norris was elected to the senate in 1912 and served with that body until 1942, thus finishing 40 years in congress. He voted against the entrance of the U.S. into World War I, and denounced the Versailles Treaty. He fought for the direct election of senators, and for presidential primaries, and was the author of the 20th Amendment, which abolished "lame-duck" congresses. Norris favoured strict restrictions on private power interests; and the Norris bill for the retention by the government of the Muscle Shoals power development, the Tennessee Valley authority which he fathered and fought through congress, and the Norris dam are the result of his efforts to provide publicly produced electric power. He was a leader in the demand for farm relief legislation, and the leader of the independent group in congress. Though nominally a Republican, party ties rested lightly upon him, his dictum being that the people "ought to be independent of all parties." He backed the Roosevelt New Deal administration wholeheartedly because he believed it would carry out his own aims for governmental reform. His last fight was an unsuccessful attempt to pass anti-poll tax legislation. Senator Norris died Sept. 3, 1944, in McCook, Neb.

**NORRIS, HENRY NORRIS** or **NORREYS, BARON** (*c.* 1525–1601), belonged to an old Berkshire family, many members of which had held positions at the English court. His father, Henry Norris, was a grandson of Sir William Norris, who commanded the royal troops against Lambert Simnel at the battle of Stoke in 1487. Like his brother John (d. 1564), the elder Henry Norris obtained a post at the court of Henry VIII.; he gained the king's favour and was rewarded with many lucrative offices. He belonged to the party which favoured the elevation of Anne Boleyn; but in May 1536 he was arrested on the charge of intriguing with her, and though he was probably innocent of any serious offence, he was beheaded on May 17, 1536. His son Henry regained some of his father's lands and entered upon court life, being a member of parliament under Edward VI. During Mary's reign he was one of those who were entrusted with the custody of the princess Elizabeth, and when the princess became queen she amply repaid the kindness which Norris had shown to her when he was her guardian at Woodstock. In 1566 he was knighted and sent as ambassador to France, where he remained until 1570, and in 1572 he was created Baron Norris of Rycote. He died in June 1601.

The eldest of his six sons, Sir WILLIAM NORRIS, died in Ireland in Dec. 1579, leaving a son Francis (1579–1623), who succeeded to his grandfather's barony and also to the estates of his uncle Sir Edward Norris. In 1621 Francis was created earl of Berkshire. He left no sons and the earldom became extinct, but the barony descended to his daughter Elizabeth (d. 1645), the wife of Edward Wray (d. 1658). Their daughter Bridget (1627–57) married as his second wife Montagu Bertie, 2nd earl of Lindsey, and their son James Bertie (1654–99) became Baron Norris (or Norreys) in 1657, and was created earl of Abingdon in 1682. His descendants the Berties, earls of Abingdon, still hold this barony.

Sir EDWARD NORRIS (d. 1603), the 1st Lord Norris's third son, served with the English troops in the Netherlands from 1585 to 1588. He is chiefly remembered owing to his fierce quarrel with Philip, count of Hohenlohe (1550–1606), called Hollock by the English, in August 1586 at Gertruydenberg.

**NORRIS, SIR JOHN** (*c.* 1547–1597), English soldier, was the second son of Henry Norris, Baron Norris of Rycote, and gained his earliest military experience in the civil wars in France. In 1573 he went to Ulster with Walter Devereux, earl of Essex, winning fame by his conduct in the guerrilla wars against the Irish, and being responsible for the massacre on the island of Rathlin in July 1575. He was again in Ireland in 1584, but the greater part of these years was spent in service in the Netherlands. In 1588, when the Spanish Armada was expected, he was marshal of the camp at Tilbury; later in the same year he served the queen as ambassador to the Dutch states, and in 1589 he and Sir Francis

Drake led the fleet which ravaged the coasts of Spain and Portugal. In 1591, and again in 1593, he aided Henry IV. of France in his struggle with the League in Brittany; and in May 1595 he landed again in Ireland, where he was lord president of Munster. He was to assist the lord deputy, Sir William Russell, in subjugating Ulster. After fighting and negotiating with the O'Neills in Ulster, and warring in Connaught, he asked for his recall. This was not granted, but he was supplanted in his military command; and he retired to Munster and died at Mallow on July 3, 1597. His monument is in the church of Tattendon, Berkshire.

*See* J. L. Motley, *The United Netherlands,* vol. ii. (1904); and R. Bagwell, *Ireland under the Tudors,* vol. iii. (1890).

**NORRIS, JOHN** (1657–1711), English philosopher and divine, was born at Collingbourne-Kingston in Wiltshire. He was educated at Winchester and Exeter college, Oxford, being subsequently elected to a fellowship at All Souls'. His first original work was *An Idea of Happiness* (1683), in which, with Plato, he places the highest happiness or fruition of the soul in the contemplative love of God. He studied the works of Malebranche and of Descartes and his followers and opponents. Of English thinkers, More and Cudworth, the so-called Cambridge Platonists, had influenced him most; and in 1685 his study of their works led to a correspondence with More, published after his death by Norris as an appendix to his Platonically conceived essay on *The Theory and Regulation of Love* (1688). He also corresponded with Mrs. Astell (*q.v.*) and Lady Masham, the friend of Locke, to whom he addressed his *Reflections upon the Conduct of Human Life* (1689). In 1689 Norris was presented to the living of Newton St. Loe, in Somersetshire. In 1690 he published a volume of *Discourses upon the Beatitudes,* followed by three more volumes of *Practical Discourses* between 1690 and 1698. In an appendix to his *Discourses* he gave "Cursory Reflections" on Locke's *Essay on the Human Understanding* which anticipate many later criticisms of Locke's philosophy, though he was at one with Locke in dismissing the "grey-headed, venerable doctrine" of innate ideas. The last 20 years of Norris's life were spent at Bemerton, to the living of which he had been transferred in 1691. In 1691–1692 he was engaged in controversy with his old enemies the "Separatists," and with the Quakers, his Malebranchian theory of the divine illumination having been confounded by some with the Quaker doctrine of the light within. In 1697 he wrote *An Account of Reason and Faith,* one of the best of the many answers to Toland's *Christianity not Mysterious.* Reason, according to Norris, is nothing but the exact measure of truth, that is to say, divine reason, which differs from human reason only in degree, not in nature. In 1701 appeared his most important work, *An Essay towards the Theory of the Ideal or Intelligible World.* The first volume treats the intelligible world absolutely; the second, which appeared in 1704, considers it in relation to human understanding. It is a complete exposition of the system of Malebranche, in which Norris refutes the assertions of Locke and the sensualists. In 1708 Norris wrote *A Philosophical Discourse concerning the Natural Immortality of the Soul,* defending that doctrine against the assaults of Dodwell. He died at Bemerton, and a monument was erected to his memory in the church. He occupies a place in the succession of ecclesiastical and mystical thinkers of whom Coleridge is the last eminent example.

*See* Wood, *Athenae Oxonienses* (ed. Bliss), iv.; *Biographia Britannica;* Leslie Stephen in *Dictionary of National Biography;* J. Tulloch, *Rational Theology and Christian Philosophy in England in the 17th Century* (1874), who calls Norris "as striking and significant a figure in the history of English philosophy," as Berkeley, another idealist.

**NORRIS, WILLIAM EDWARD** (1847–1925), English novelist, was born on Nov. 18, 1847, the son of Sir W. Norris, chief justice of Ceylon. He was educated at Eton, and called to the bar at the Inner Temple in 1874. His first story, *Heaps of Money,* appeared in 1877, and was followed by *Mademoiselle de Mersac* (1880), *Matrimony* (1881), *No New Thing* (1883), *My Friend Jim* (1886), *The Despotic Lady* (1895), *Matthew Austin* (1895), *The Widower* (1898), *Pauline* (1908), *Not Guilty* (1910); *The Rt. Hon. Gentleman* (1913); *Barbara and Company* (1914); *The Triumphs of Sarah* (1920); *Sabine and Sabina* (1922); *Next of Kin* (1923) and *Trevalion* (1925). He died on Nov. 19, 1925.

**NORRISTOWN,** a borough of Pennsylvania, U.S.A., the county seat of Montgomery county; on the Schuylkill river, 17 mi. N.W. of the centre of Philadelphia. It is served by the Pennsylvania, Reading and Philadelphia & Western railways. Pop. 38,181 in 1940. Across the river is the borough of Bridgeport (pop. 5,904 in 1940). Norristown is a residential community; its industries are textile machinery, hosiery, fibre products, yarn and steel tubing. The Norristown State hospital, an institution for mental cases, is there. Valley Forge (*q.v.*) is 6 mi. S.W. of the borough. The site of Norristown is part of a manorial estate purchased from William Penn in 1704 by Isaac Norris. The borough was incorporated in 1812.

**NORRKÖPING,** the fourth town of Sweden, in the district (*län*) of Östergötland, 113 m. S.W. of Stockholm by the Malmö railway. Pop. (1943) 72,039. A bull of Pope Lucius III. shows that Norrköping existed in 1185. In the 17th century, Duke John of Östergötland introduced German craftsmen into Norrköping. Under Charles XII. the town suffered not only from war but from pestilence, 2,700 of its inhabitants perishing in 1710–1711. After the Russian invasion of 1719 the population was only 2,600. Norrköping occupies both banks of the Motala, the wide and rapid emissary of lake Vetter. Fires in 1719, 1812, 1822 and 1826 have caused rebuilding on modern lines. The falls in the river afford motive power to the cloth and cotton mills (spinning and weaving)—the staple industries—and to factories for sugar, paper, lithography, tobacco and carpets, joinery works and breweries. There are also shipbuilding yards and docks. Fine granite is quarried at Grafversfors, $7\frac{1}{2}$ m. north. The inlet of Bråvik affords excellent harbour facilities for vessels up to $18\frac{1}{2}$ ft. draught near the quay, and safe anchorage up to 30 ft. in the Pampas roads, 6 m. from the town.

**NORSE LANGUAGE.** The *Old Norwegian* language (till the Reformation) was not, like the modern language, confined to Norway and the Färoe islands, but was for some time spoken in parts of Ireland and the north of Scotland, the Isle of Man, the Hebrides, Shetland and Orkney (where it continued to the end of the 18th century), and also in certain parts of western Sweden.

The runic inscriptions in Old Norse are few in number (about 150) and of trifling philological importance, since they belong almost wholly to the period between 1050 and 1350, and are consequently not much earlier than the earliest literature. The whole literature preserved is written in the Latin alphabet. The earliest manuscripts are not much later than the oldest Old Icelandic ones and are of the greatest interest. The masses of charters which occur throughout the whole middle age of Norway from the beginning of the 13th century give information, especially of dialect.

In Old Norwegian the most primitive forms occur in old poems from times as remote as the days of Þorbiorn Hornklofi (end of the 9th century). The language at this epoch differed very little from other Scandinavian dialects. From the 13th century, Norwegian, owing to geographical and political circumstances, is considerably influenced by the eastern Scandinavian languages. The tendency in Norwegian to reduce the use of the so-called *u*-Umlaut has already appeared. There appears another kind of vowel-assimilation, almost unknown to Icelandic, the vowel in terminations being in some degree influenced by the vowel of the preceding syllable. Thus, for instance, we find in some manuscripts that the vowels *e, o, ø,* and long *a, æ,* are followed in terminations by *e, o; i, u, y* and short *a, æ,* on the other hand, by *i, u*—as in *bøner,* prayers, *konor,* women; but *tiðir,* times, *tungur,* tongues. The same fact occurs in certain Old Swedish manuscripts. When Norway had been united later with Sweden under one crown (1319) we meet pure Suecisms in the Norwegian literary language. In addition to this, the 14th century exhibits several differences from the old language: *rl, rn* are sometimes assimilated into *ll, nn*—as *kall* (elder *karl*), man, *konn* (*korn*), corn, *prestanner* (*prestarnir*), the priests; *i* passes into *y* before *r, l*—as *hyrðir* (*hirðir*), shepherd, *lykyl* (*lykill*), key; final *-r* after a consonant is changed into *-ar, -er, -ir, -or, -ur* or *œr,* sometimes only *-a, -e, œ*—as *hester* (*hestr*), horse, *bøker* (*bøkr*), books, the names Þolleifœr (Þorleifr), Guðlæifæe (Guðleifr). About the beginning of the 15th cen-

tury initial *kv* occurs for old *hv* (not, however, in pronouns, which take *kv* only in western Norway), as the local name *Quiteseið* (*hvítr,* white). During the 15th century, Norway being united with Denmark, and at intervals also with Sweden, a great many Danisms and a few Suecisms are imported into the language. Towards the end of the middle ages the Danish influence shows an immense increase, until at last Norwegian as a literary language is supplanted by Danish. Many Norse dialects developed in the 13th, 14th and 15th centuries. The language of western Norway resembles Icelandic, and the language of eastern Norway is still nearer to contemporary Old Swedish. The present dialectical division was in all essentials accomplished about the year 1600.

**NORTH, BARONS.** The English title of Lord North of Kirtling was created for Edward North (*c.* 1496–1564), son of Roger North, a London citizen, in 1554; he was a successful lawyer, clerk of the parliament (1531) and chancellor of the court of augmentations (1545). His second son was Sir Thomas North (*q.v.*), and he was succeeded as 2nd baron by his son Roger, a courtier and soldier of Queen Elizabeth's day, who married the daughter of Lord Chancellor Rich.

DUDLEY NORTH, 3rd Baron North (1581–1666), son of Sir John North and of Dorothy, daughter and heiress of Sir Valentine Dale, was born in 1581 and succeeded his grandfather, the 2nd Baron North, at the age of 19. He was educated at Cambridge, and married in 1599 Frances, daughter of Sir John Brockett of Brockett Hall, Hertfordshire. He travelled in Italy, took part in the campaign of 1602 in the Netherlands, and on his return became a conspicuous figure at court, excelling in athletic exercises as well as in poetry and music, and gaining the friendship of Prince Henry. In 1606, while returning from Eridge to London, he discovered the springs of Tunbridge Wells, which cured North himself of a complaint and quickly became famous. He also recommended the Epsom springs to the public. He supported and subscribed to the expedition to Guiana made by his brother Roger North (*c.* 1582–*c.* 1652) in 1619, and when Roger departed without leave Dudley was imprisoned for two days in the Fleet. In 1626 he attached himself to the party of Lord Saye and Sele in the Lords, who were in sympathy with the aims of the Commons; and when the civil war broke out he was on the side of the parliament. In 1641 he was a member of the Lords' committee on Religion, and served on the committee to consider Laud's attainder in 1644, finally voting for the ordinance in Jan. 1645. He was placed on the admiralty commission in 1645, and acted as lord lieutenant for Cambridgeshire. He was one of the small group of Lords who continued attendance in the House of Peers, and on Dec. 19, 1648, with three others, visited Fairfax, when they "cast down their honours at his Excellency's feet" and protested their desire not to retain any privileges prejudicial to the public interest. (Gardiner's *Civil War,* iv. 285.) He passed the rest of his life in retirement at Kirtling in Cambridgeshire, with his family, finding "employment with many airy entertainments as poetry, writing essays, building, making mottoes and inscriptions as well as in music." He wrote *A Forest of Varieties* (1645), a miscellany of essays and poems, another edition of which was published in 1659 under the title of *A Forest promiscuous of various Seasons' Productions.* He died on Jan. 16, 1666. North is described as "full of spirit and flame," of imperious temper but of well-balanced judgment, Lord Holland declaring that "he knew no man less swayed with passion and sooner carried with reason and justice." He left, besides one daughter, two sons, the elder of whom, Sir Dudley, succeeded him as 4th Baron North.

DUDLEY NORTH, 4th Baron North (1602–77), increased the family fortune by marrying the daughter of Sir Charles Montagu, brother of the 1st earl of Manchester. He was an accomplished man, of studious bent, and had 14 children, of whom the third son, Francis, became lord chancellor as Lord Guilford; the fourth was Sir Dudley North (*q.v.*), the economist; the fifth, John (1645–83), master of Trinity, Cambridge, and professor of Greek in the university; and the sixth, Roger (*q.v.*), the lawyer and historian.

The eldest son, Charles (d. 1691), was created Lord Grey of Rolleston during his father's life, and succeeded his father as 5th Baron North; and on the death of his son, William, 6th Lord North, without issue, in 1734, the barony of North went to a cousin, Francis North, 3rd baron, afterwards 1st earl of Guilford. The title of Lord North is that by which the 2nd earl of Guilford, prime minister from 1770–82, is best known in history. (*See* GUILFORD, BARONS AND EARLS OF.)

George Augustus, 3rd earl of Guilford (d. 1802), left three daughters, and the barony of North fell into abeyance till 1841 when it vested in Susan, Baroness North (1797–1884), wife of John Sidney Doyle, who took the name of North; at her death her son William Henry John North (b. 1836) succeeded as 11th baron, the title now being separate from that of Guilford.

**NORTH, SIR DUDLEY** (1641–1691), English economist, was 4th son of Dudley, 4th Lord North, who published *Passages relating to the Long Parliament,* of which he had himself been a member. He was born on May 16, 1641, and in his youth was carried off by gipsies and recovered with some difficulty by his family. He engaged in foreign trade, especially with Turkey, and spent many years at Constantinople and Smyrna. During the Tory reaction under Charles II. he was one of the sheriffs forced on the city of London with an express view to securing verdicts for the Crown in state trials. He was knighted, and was appointed a commissioner of customs, afterwards of the treasury, and again of the customs. Under James II., "he took," says Roger North, "the place of manager for the Crown in all matters of revenue." After the Revolution he was called to account for his alleged unconstitutional proceedings in his office of sheriff. He died on Dec. 31, 1691.

His tract entitled *Discourses upon Trade, principally directed to the cases of the interest, coinage, clipping and increase of money,* was published anonymously in 1691, and was edited in 1856 by J. R. M'Culloch in the *Select Collection of Early English Tracts on Commerce* printed by the Political Economy Club of London. In this emphatic assertion of the free-trade doctrine against the prevailing system of prohibitions, North shows that wealth may exist independently of gold or silver, its source being human industry, applied either to the cultivation of the soil or to manufactures. The export of money in the course of traffic, instead of diminishing, increases the national wealth, trade being only an exchange of superfluities. Nations are related to the world just in the same way as cities to the State or as families to the city. North emphasizes more than his predecessors the value of the home trade. With respect to the interest of capital, he maintains that it depends, like the price of any commodity, on the proportion of demand and supply, and that a low rate is a result of the relative increase of capital, and cannot be brought about by arbitrary regulations. In arguing the question of free trade, he urges that every advantage given to one interest over another is injurious to the public and that no trade is unprofitable to the public.

North, Locke and Petty are named by Wilhelm Roscher as the "great triumvirate" of English economists of the period.

**NORTH, MARIANNE** (1830–1890), English naturalist and flower-painter, was born at Hastings on Oct. 24, 1830, the eldest daughter of a Norfolk landowner, descended from Roger North (1653–1734). She trained as a vocalist under Madame Sainton Dolby, but her voice failed, and she then devoted herself to painting flowers. After the death of her parents she resolved to paint the flora of distant countries and with this objective she went to Canada, the United States and Jamaica, and spent a year in Brazil, where she did much of her work at a hut in the depths of a forest (1871–72). Later, she visited Teneriffe, California, Japan, Borneo, Java, Ceylon, Australia, New Zealand, South Africa, the Seychelles and Chile; and the scientific accuracy with which she represented plant life gives her work a permanent value. In 1882, her gallery at Kew Gardens was opened. It contains her paintings. She died at Alderly in Gloucestershire on Aug. 30, 1890.

**NORTH, ROGER** (1653–1734), English lawyer and biographer, was the sixth son of the 4th Baron North. He acquired a good practice at the bar, being helped by his elder brother Francis, who became lord chancellor and was created Baron Guil-

ford (*q.v.*), and in 1684 he became solicitor-general. But the Revolution stopped his advancement, and he retired to his estate of Rougham in Norfolk, and increased his fortune by marrying the daughter of Sir Robert Gayer. He collected books, and was constantly occupied in writing. He is best known for his *Lives of the Norths,* published after his death, together with his own autobiography (*see* the edition in Bohn's *Standard Library,* 1890, by Jessopp), a classic authority for the period. He died at Rougham on March 1, 1734.

He is to be distinguished from Roger North (1585–1652), brother of the 3rd baron, one of the captains who sailed with Raleigh in 1617, and who projected the plantation of Guiana.

**NORTH, SIR THOMAS** (1535?–1601?), English translator of *Plutarch,* second son of the 1st Baron North, was born about 1535. He is supposed to have been a student of Peterhouse, Cambridge, and was entered at Lincoln's Inn in 1557. In 1574 he accompanied his brother, Lord North, on a visit to the French court. He served as captain in the year of the Armada, and was knighted about three years later. He was a justice of the peace for Cambridge in 1592 and again in 1597, and he received a pension (£40 a year) from the queen in 1601. He translated, in 1557, Guevara's *Reloj de Principes* (commonly known as *Libro Aureo*) (*see* GUEVARA) under the title of *Diall of Princes.* The English of this work is one of the earliest specimens of the ornate, copious and pointed style for which educated young Englishmen had acquired a taste in their continental travels and studies. With its mannerisms and constant use of antithesis, it set the fashion which was to culminate in Lyly's *Euphues.* His next work was *The Morall Philosophie of Doni* (1570), a translation of an Italian collection of eastern fables. The first edition of his translation of *Plutarch,* from the French of Jacques Amyot, appeared in 1579. The first edition was dedicated to Queen Elizabeth, and was followed by other editions in 1595 and 1603, containing in each case fresh *Lives.* The influence of North's vigorous English on contemporary writers was very great, and some critics have called him the first master of English prose. The book formed the source from which Shakespeare drew the materials for his *Julius Caesar, Coriolanus* and *Antony and Cleopatra.* It is in the last-named play that he follows the *Lives* most closely, whole speeches being taken direct from North.

*See Plutarch's Lives of the Noble Grecians and Romans: English ed. by Sir T. North* (in Tudor Translations, 1895); *Shakespeare's Plutarch* (a selection ed. C. F. T. Brooke, 1909); *The Diall of Princes* (reprinted 1921); F. Bushby, *Three Men of Tudor Times* (1911).

**NORTH, THE,** originally those of the English Colonies in America north of the Mason and Dixon line (*q.v.*), as distinguished from those south. They were New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey and Pennsylvania. With the extension of settlements across the Alleghenies, the Ohio river was considered as a continuation of the Mason and Dixon line to the Mississippi river. Missouri, west of the Mississippi, was before the Civil War, considered part of the South because it was a slave-holding State, but after the Civil War it became a part of the North in its political and economic life. West of Missouri the boundary between the two sections followed the southern boundary of Kansas (37° N. lat.) to the Great Plains. Beyond were the Western States which, because they supported the North, were usually considered part of it during the great struggle over slavery. The characteristic Northern life and settlement was broken, however, by the Great Plains which may, therefore, be considered to form the western boundary of the section.

The division between the North and the South was in no slight degree a natural one. In the North land and climate made small farms with diversified crops the only profitable type of agriculture. In the older sections the limited supply of farm land and the abundant amount of water-power stimulated manufacturing and the growth of town life. In the South, large plantations growing only cotton, or only tobacco, and dependent upon slave labour came into existence. As these economic systems with their attendant social differences grew in power and clashed in conflict over the virgin lands of the West, an intense struggle developed for supremacy, a struggle fought first, but vainly, in the halls of Congress, and later on the battlefields of the Civil War. The North through its victory gained undisputed political, economic and cultural supremacy. Politically, the North has always been the stronghold of the Republican Party which has fostered its industrial interests.

**NORTH ADAMS,** a city of Massachusetts, on the Hoosac river and at the west end of the Hoosac tunnel, served by the Boston and Albany and the Boston and Maine railways. Pop. (1920) 22,282 (23% foreign-born white); and by the census of 1940, 22,213. The city has a beautiful situation, 700 ft. above sea-level, in the foothills of the Berkshires, at the west end of the Mohawk trail. Within its limits is a natural bridge 50 to 60 ft. high, across Hudson brook. It is the seat of the Massachusetts State Teachers college (1897) and has extensive manufactures (chiefly cotton print, woollen goods, cotton cloth, boots and shoes, machinery and electric condensers). In the western part of the city are the ruins of Ft. Massachusetts, built in 1745 by the Massachusetts Bay Colony as a frontier defence, and captured in 1746 by French and Indians under the Chevalier de Vaudreuil. North Adams was set off from Adams and incorporated as a town in 1878, and in 1895 it was chartered as a city.

**NORTHALLERTON,** an urban district, market town and administrative capital of the North Riding of Yorkshire, England, 30 mi. N.N.W. of York by the L.N.E. railway, on which it is an important junction. Pop. (est. 1938) 4,970. Area 5.7 sq.mi. It is on a slight eminence at the foot of the Cleveland and Hambleton Hills, 3 mi. from the bank of the Swale. It thus avoids the flood land of the Vale of York. Here the western scarp of the Wolds causes the Vale to narrow to a width of 10 mi. forming the Northallerton Gate.

Northallerton (Alvetune, Allerton) is believed to have been a Roman station, and the importance of the Gate is marked by two Roman roads, one running north from Catterick, the other from York. It was probably later a Saxon "burgh," and a Danish settlement, but nothing is known with certainty about it before the account given in the Domesday Survey, which shows that the Normans had destroyed the manor so utterly that it was still waste in 1086. In mediaeval times, the Gate was an obvious way south into England for the Scottish army. The Battle of the Standard was fought near the town in 1138 and the castle was destroyed in 1174. In 1317, the town was burned by the Scots under Robert Bruce. Soon after his accession, William Rufus gave Northallerton to the Bishop of Durham, whose successors continued to hold it until it was taken over by the ecclesiastical commissioners in 1865. There are now no traces of the fortified palace of the bishops. A priory was founded here in 1341, and a White Friars monastery in 1354, and all trace of these also has been lost. The Mount Grace priory, a Carthusian foundation of 1397, remains.

According to an inquisition taken in 1333, the town, markets and fairs were held by the burgesses who were governed by two reeves and the bishop's bailiff. This form of government continued until 1851, when a local board was formed, and this was superseded by an urban district council in 1894. As a borough by prescription, Northallerton returned two members to the parliament of 1298, but it was not represented again until 1640 when its earlier privileges were restored. From 1832 to 1885 it returned one member but is now in the Richmond division. The North Riding county library was opened in 1924 with headquarters at Northallerton. By 1943 it had 490 branches. The town has a considerable trade in dairy farming and has held a weekly market since 1205. There are flour mills, linoleum works, tanning and the manufacture of cart covers and tent cloths. A fair held on St. Bartholomew's day was famous for cattle in the 16th century, but it is no longer held. Northallerton is the railway focus of the Gate.

*See* C. J. D. Ingledew, *History and Antiquities of Northallerton in the County of York* (1858); J. L. Saywell, *History and Annals of Northallerton* (1885); *Victoria County History, Yorkshire.*

**NORTH AMERICA.** The continent of North America has a mean altitude of about 2,000 ft., and an area of about 8,000,000 sq.mi., 16% of the earth's land area and 4% of the earth's entire surface. Certain correspondences of its geological structure and history with those of the greater part of Europe and Asia, sym-

metrically disposed, right and left, with respect to the Atlantic, support the view that Eurasia is a single continent: furthermore they controvert the idea that the new world of discovery is an old world geologically; and that the old world of history is geologically new. Both worlds are in part old, in part new; both share structures and changes of similar dates from the most ancient to the most modern periods.

## PHYSICAL FEATURES

**The Laurentian Region.**—The general structural features of North America are (*see* map): the extensive area of ancient crystalline rocks, stretching from Labrador past Hudson bay and thence northwestward to the Arctic ocean, is of disordered structure; the surface now seen must have been originally buried at a considerable depth beneath a higher and mountainous surface; but that higher surface was reduced to low relief at a remote period. The Laurentian part of this great region has been described as the first emerged land area of North America, around which many later additions on the south and west built up the present continent; but a more modern interpretation shows that the worn-down Laurentian region is only part of a much larger land mass which in pre-Palaeozoic time extended more or less continuously as far as Texas and parts of the Rocky mountain region, and on which marine deposits were unconformably deposited as the land mass was progressively submerged beneath the Palaeozoic ocean. Hence the Laurentian region differs from other parts of North America more in having escaped later deformation than in being of earlier origin. In Pleistocene time, the Laurentian region became the centre from which ice sheets spread out on all sides. As a result the weathered soils were swept away, together with an unknown measure of unweathered rock, leaving scattered boulders and gravelly drift upon a rugged upland without mountains (except in Labrador) but diversified by innumerable knobs and hollows, and here and there covered by clay belts that are arable in spite of severe winter climate. The drainage of the region, which in pre-glacial times was probably accomplished by well-ordered rivers, was thus thrown into great disorder; large and small lakes abound, and some of the lakes have two outlets; the streams are repeatedly interrupted by rapids and not infrequently split into two channels, enclosing islands many miles in length. The region remains a forest wilderness, except at mining centres (several of which have produced large quantities of nickel, silver and gold), near pulp mills and on the sparsely settled clay belts.

**The Appalachian Area.**—This is a hilly and mountainous belt, stretching from Newfoundland to Alabama, with a western branch in Arkansas. It seems to have belonged in the earliest times to the great pre-Palaeozoic land mass, but it must be set aside from the undisturbed Laurentian region because of repeated movements of depression, deformation and elevation that it has suffered, generally along a northeast-southwest trend, causing alternations of heavy deposition and almost equally heavy degradation. These movements took place with generally decreasing intensity, through nearly the whole stretch of geological time covered by the fossiliferous record. The Appalachian mountains of today were formerly regarded as unconsumed residuals of greater mountains formed at the close of the Palaeozoic period; but it is now generally agreed that Mesozoic erosion reduced most of that ancient range to a lowland of moderate or small relief, leaving only isolated groups of subdued mountains in the areas of the most resistant rocks; and that the altitude and form of the mountains today, as well as of a belt of horizontal strata on the west, now known as the Allegheny plateau, are largely the result of Tertiary elevation and dissection of the previously worn-down mass; the additional height thus given to the subdued mountain groups made them the loftiest parts of the range today, as in the White mountains of New Hampshire (Mt. Washington, 6,293 ft.) and the Black mountains of North Carolina (Mt. Mitchell, 6,684 ft.). The Ozark plateau of Missouri and the Ouachita mountains of Arkansas and farther west are related to each other in much the same way as the Allegheny plateau and the middle and southern Appalachians. Numerous coal seams occupy discontinuous basins in the Appalachians from Nova Scotia to Pennsylvania, in the Allegheny plateau from Pennsylvania to Alabama, and in the extension of the same strata across the Ohio basin. The eastern coast of the continent has a rocky and irregular shore line from Greenland and Labrador to Massachusetts, with numerous submerged valleys forming bays and as many uplands and ridges outstanding in promontories and islands; this being the result of an increasing measure of depression to the north, where an archipelago now replaces what was probably once a corner of the continent.

**A Coastal plain** of gently inclined and imperfectly consolidated strata, which still borders the Gulf and part of the Atlantic coast of the United States, formerly extended northeast, probably at least as far as Nova Scotia; the same depression that has brought the ocean upon the older rocks from Massachusetts northward has diminished the breadth of the Coastal plain and embayed its shore line from North Carolina to the mouth of the Hudson, and has submerged it from the Hudson mouth, northeastward.

**The Western Highlands.**—The great complex of mountains in the Western highlands, sometimes styled the Cordilleras of North America (of which the Rocky mountains are eastern members in the United States and Canada), differs from the Eastern highlands in having suffered strong deformation in late geological periods. On the other hand, the transition from Palaeozoic to Mesozoic times, when mountain-making disturbances were so general in western Europe and eastern North America that earlier geologists thought them to be of world-wide extent, was here generally accomplished in relative quiet, so that in certain districts a conformable succession of stratified formations was accumulated in great thickness from Cambrian to late Mesozoic or early Tertiary time. Further, the Carboniferous period was marked by the deposition of marine limestones in the Cordilleran region. In contrast to the long quiescent Atlantic coast, the Pacific coast of North America is bordered for a good part of its length by mountains of late origin.

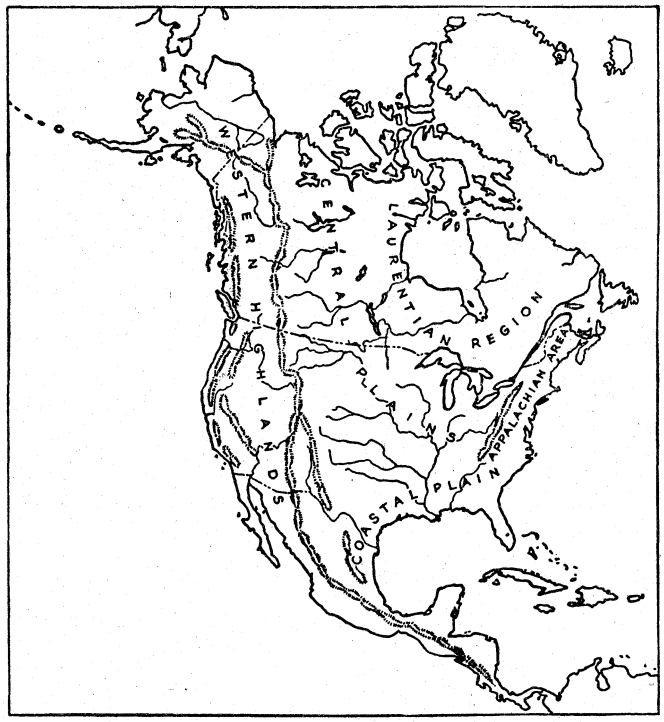
Volcanoes of commanding height here and there dominate the Western plateaus and mountains. Orizaba (18,314 ft.), Popocatepetl and their neighbours crown the southern portion of the Cordilleran system in Mexico; Mt. San Francisco rises over the desert plateau of Arizona and bears snow and Arctic plants; Shasta has small glaciers in northern California; Rainier, bearing large glaciers, surmounts the Cascade range in Washington; Wrangell is a lofty volcanic mass in Alaska. Vast lava floods have been poured out at various periods; those of the Snake and Columbia river basins in Washington, Oregon and Idaho are the most extensive. Similar lava-flows in British Columbia have been broadly uplifted and are now deeply dissected by Frazer river and its branches, leaving only disconnected highland patches.

As in all regions of great altitude, the erosion of valleys has progressed on a magnificent scale in the Cordilleran region. The plateaus of northern Arizona are traversed by the canyons of the Colorado river and its branches, at places over a mile in depth; yet upon the plateaus themselves, long and ragged cliffs of recession attest a vastly greater erosion before the uplift of the plateaus than is demanded by the canyons after uplift. Along the Pacific coast, as well as in the higher ranges of the northwest interior, intense glacial erosion during the Glacial period excavated huge cirques at the valley heads and deep troughs along the valley courses; on the coast these troughs are now occupied by sea water as fjords. Fitting complements to the deep erosion of the mountain masses are found in the great accumulations of mountain waste in various intermontane and piedmont basins, of which the so-called valley of California is the finest example. Similar basin deposits of Tertiary date abound in the Cordilleran region.

**Central Plains.**—Between the lower Eastern highlands and the higher Western highlands lies a great extension of medial plains, stretching in moderate altitude from the Arctic ocean to the Gulf of Mexico and having at their mid-length a breadth of 1,500 mi. They are composed throughout of nearly horizontal strata and mark a region long exempt from deformation. The eastern plains, best represented in the Ohio valley, are underlain by Palaeozoic strata, already mentioned as having been laid down

on the subsiding Archaean continent; the western plains are composed of Mesozoic and Tertiary strata. Both east and west large areas of the plains do not owe their present evenness to the preservation of their originally smooth surface, but to the degradation of that surface from the considerable altitude of its first uplift to low relief. The degraded surface has, however, been smoothed by veneers of till plains in the Ohio and upper Mississippi valleys, and by the addition of extensive piedmont detrital deposits in the central-western plains.

The Cordilleras of North and South America are not only far out of line with each other, but are separated by about 1,200 mi. in Central America, where, in association with the West Indies, an Antillean system of late geological deformation with east and west trends is believed to prevail, with abundant volcanic additions on the Pacific border and along the curved range of the Lesser Antilles, while in an intermediate space the calcareous lowlands of Yucatan resemble those of Florida in being the emerged parts of a larger area, much of which is still below the waters of the Gulf of Mexico. The warm waters that bathe the West Indies permit the growth of coral reefs in the Caribbean; the Bahamas are the slightly overtopping parts of broad platforms of calcareous deposits, of which the greater area constitutes extensive shallow banks which descend steeply to great depths.




PHYSIOGRAPHIC REGIONS OF NORTH AMERICA

**Rivers.**—The successive crustal movements by which North America has been developed have determined the growth of several great river systems. The broad upheavals which developed the medial plains had the effect of engrafting many rivers from the Eastern and Western highlands upon trunks of unusual dimensions. Thus the Mississippi system, some of whose eastern tributaries probably date from early Mesozoic times, received great reinforcement by the addition of many long western branches in late Tertiary time, roughly contemporaneous with the uplift of the southern Coastal plain, by which the lower trunk of the river was extended from its mid-length into the gulf. The present headwaters of that river-trunk to which the name Mississippi has been rather arbitrarily applied are of very modern date, as they are consequent upon the abundant glacial deposits of northern Minnesota; and relatively modern courses appear to have been taken by the earlier-born Ohio and Missouri around the margin of invading Canadian ice sheets, which displaced them from earlier courses. The evolution of the Mackenzie resembles that of the Mississippi in a general way, but it has presumably been much affected by glacial erosion and deposition, in consequence of which it, like the St. Lawrence, has many large lakes in its course. The regime of this great north-flowing river is strikingly unlike that of its south-flowing analogue on account of its course being from a warmer to a colder climate; hence while Mississippi floods have a free southward discharge, the floods of the Mackenzie have an obstructed northward discharge due to ice dams. Indeed, but for the complications that appear to be related to the outspread of Laurentian ice sheets, the areas drained by the Nelson and the St. Lawrence, now flowing to Hudson bay and St. Lawrence gulf, would be discharged by the Mackenzie and Mississippi. For a time, during the presence of the ice sheets, that simpler system was realized for the Mississippi, when it carried to the Gulf of Mexico much drainage now received by the St. Lawrence and Nelson; the flood plain of its lower trunk was probably given its great breadth at that time. Lake Superior is peculiar in apparently owing its great depth to a somewhat pronounced displacement of its basin floor, in addition to whatever deepening it gained by glacial erosion.

The chief rivers that discharge to the Pacific rank below those that discharge to the Atlantic; but the Yukon, flowing from farther Canada and inner Alaska, is one of the great rivers of the world. The Columbia, of hardly inferior rank, drains a large area of the Cordilleran system in Canada and the United States; it is peculiar in having one of its head branches rise at the eastern base of the Rocky mountains in Montana, so that its waters flow westward through all the Cordilleran ranges of its latitude. The Colorado discharges a muddy current into the Gulf of California.

**Climate.**—The climate of North America exhibits modifications of general conditions resulting from the globular form and eastward rotation of the earth. In January a mean temperature of zero or less invades the region northwest of Hudson bay, and extends as far south as the extreme central-northern United States, which thus resembles northeastern Asia in departing greatly from the more temperate mean prevailing in similar latitudes on the northern oceans. In July the great middle area of the continent becomes warmer than the oceans on the east and west, having a mean temperature ranging from 65° in the vicinity of the 50th parallel to above 80° south of the 35th parallel. Consequently the annual range between the means of January and July exceeds 40° for a large part of the continent, and exceeds 70° for much of the northern lands; the range of extreme temperatures is much greater. On corresponding northern oceanic areas, the temperature range is little more than 20°; and in the southern hemisphere it is probably less than 10°.

The several members of the planetary wind system, including therein the trades of a broadened torrid zone, the prevailing and westerlies of middle latitudes, and the irregular winds of the polar region, are well exemplified over North America; but they are better seen in the drift of clouds than in the movements of the surface winds. In consequence of the dominance of westerly winds, a great stretch of the Pacific coast, even as far north as Alaska, has a small annual temperature range (generally less than 20°); while a range more appropriate to continental interiors is experienced over most of the eastern coast of the continent in temperate latitudes; hence the extraordinary unlikeness between the climates of western Europe and eastern North America, where habitable Great Britain faces almost uninhabitable Labrador. The distribution of rainfall is likewise largely controlled by the general wind system. The West Indies, especially the mountainous islands, receive abundant precipitation from the passing trade winds. In Mexico and Guatemala the eastern slopes are for the most part better watered by the same winds (maximum, over 100 in.) than the western slopes. Farther north the reverse holds true; the Pacific coast north of latitude 40° has an abundant rainfall (maximum over 100 in.), and its mountains are clothed with dense forests; but there are large areas of deficient rainfall (less than 20 in.) in the interior where the intermontane and piedmont plains of the Cordilleras in middle latitudes are dry and treeless. Regions of heavy snowfall are chiefly in the far northwestern Cordilleras: in the northern interior and Greenland it is less heavy.

**Fauna and Flora.**—The fauna of North America (Nearctic)

BY COURTESY OF THE SMITHSONIAN INSTITUTION

## NORTH AMERICAN INDIAN TYPES: STOCKS AND TRIBES

1. Stock: Salish. Tribe: Salish or Flathead
2 & 3. Stock: Athabascan. Tribe: Apache
4. Stock: Eskimo. Tribe: Kiñugumiut
5. Stock: Algonkin. Tribe: Sauk and Fox
6. Stock: Sioux, Yankton Group. Tribe: Yankton
7. Stock: Shahaptian. Tribe: Nez Percé
8. Stock: Kiowa and Tribe: Kiowa

BY COURTESY OF (2-8) THE SMITHSONIAN INSTITUTION; PHOTOGRAPH, (1) THOMAS LEE

## NORTH AMERICAN INDIAN TYPES: STOCKS AND TRIBES

1. Guatemala. A Maya-Quiché Indian Woman
2. Stock: Shoshone. Tribe: Ute
3. Stock: Zuni and Tribe: Zuni
4. Stock: Caddo. Tribe: Pawnee
5. Stock: Yuma and Tribe: Yuma
6. Stock: Shoshone. Tribe: Comanche
7. Stock: Sioux. Dhegiha group. Tribe: Osage
8. Stock: Sioux. Chiwere group. Tribe: Oto

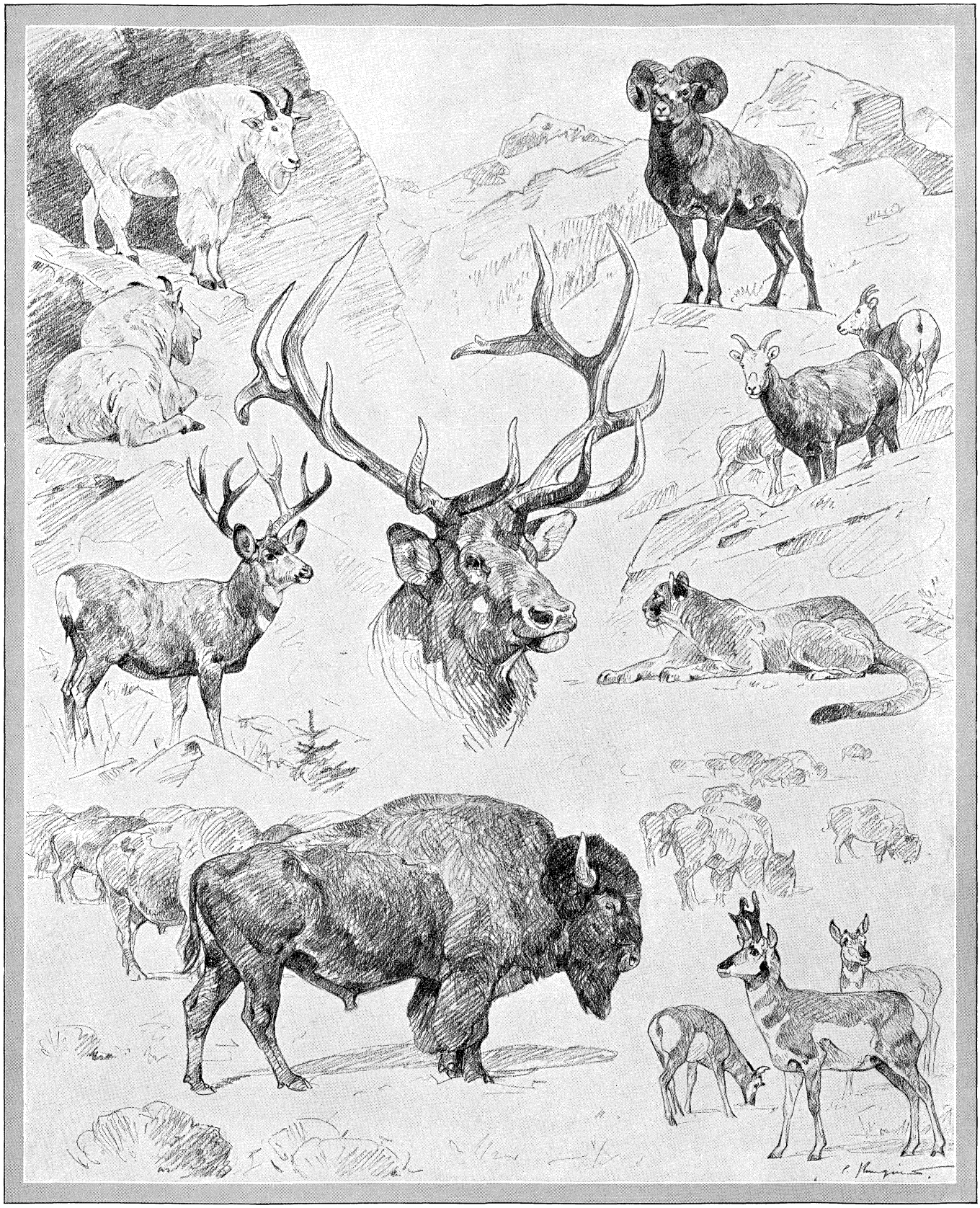
BY COURTESY OF CARL RUNGIUS

## AMERICAN MOOSE AND ELK, BY CARL RUNGIUS

"After the Storm." Two bull moose (*Alces americana*) are passing through deep snow in a spruce forest in Alberta, Canada, in September, after a heavy storm. The brown leaves of the undergrowth form a contrast with the green of the spruces

"The Stampede." A stampede of American elk (Wapiti, *Cervus canadensis*) high in the Wind River mountains near Fremont Lake in western Wyoming, in September. The bull elk is leaping over a fallen spruce, with one cow, while other cows have gone ahead

# NORTH AMERICA



DRAWN FOR THE ENCYCLOPÆDIA BRITANNICA

## NORTH AMERICAN MAMMALS, BY CARL RUNGIUS

The animals of North America, in general, more closely resemble those of Europe and Northern Asia than those of any other grand division of the world. Many North American mammals have almost exact counterparts in the Old World, as, for example, the bison. A few, however, as the Rocky Mountain goat and the Pronghorn, shown in the illustration, are found only in North America

Rocky Mountain Goat (*Oreamnos montanus*), upper left

Bighorn or Mountain Sheep (*Ovis canadensis*), ram with ewes and lamb, upper right

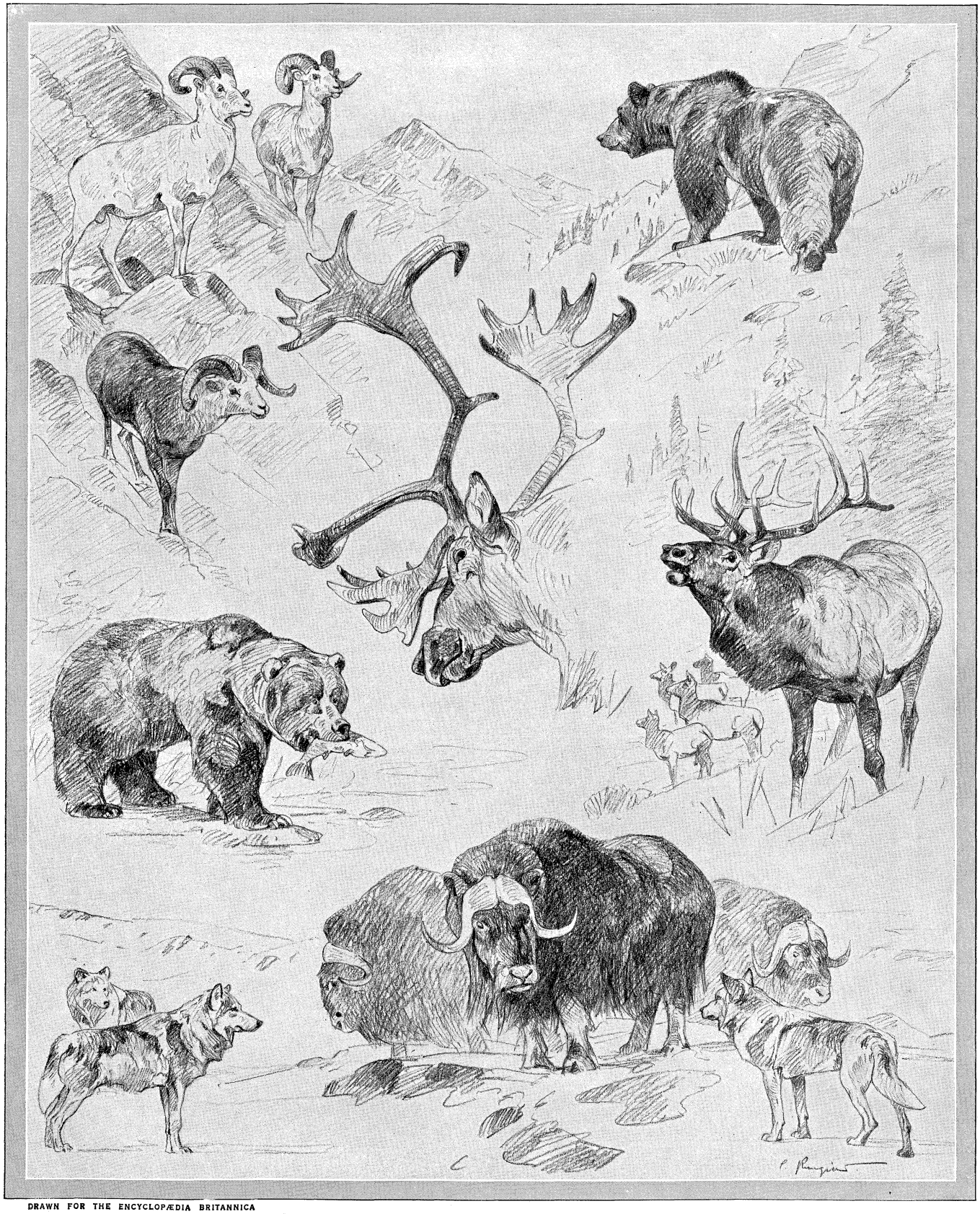
Mule Deer (*Odocoileus hemionus*), left centre

American Elk or Wapiti (*Cervus canadensis*), head with antlers, centre

Puma, Cougar or Mountain Lion (*Felis concolor*), right centre

American Bison or Buffalo (*Bison americanus*), lower centre

Pronghorn or American Antelope (*Antilocapra americana*), a male and two females, lower right



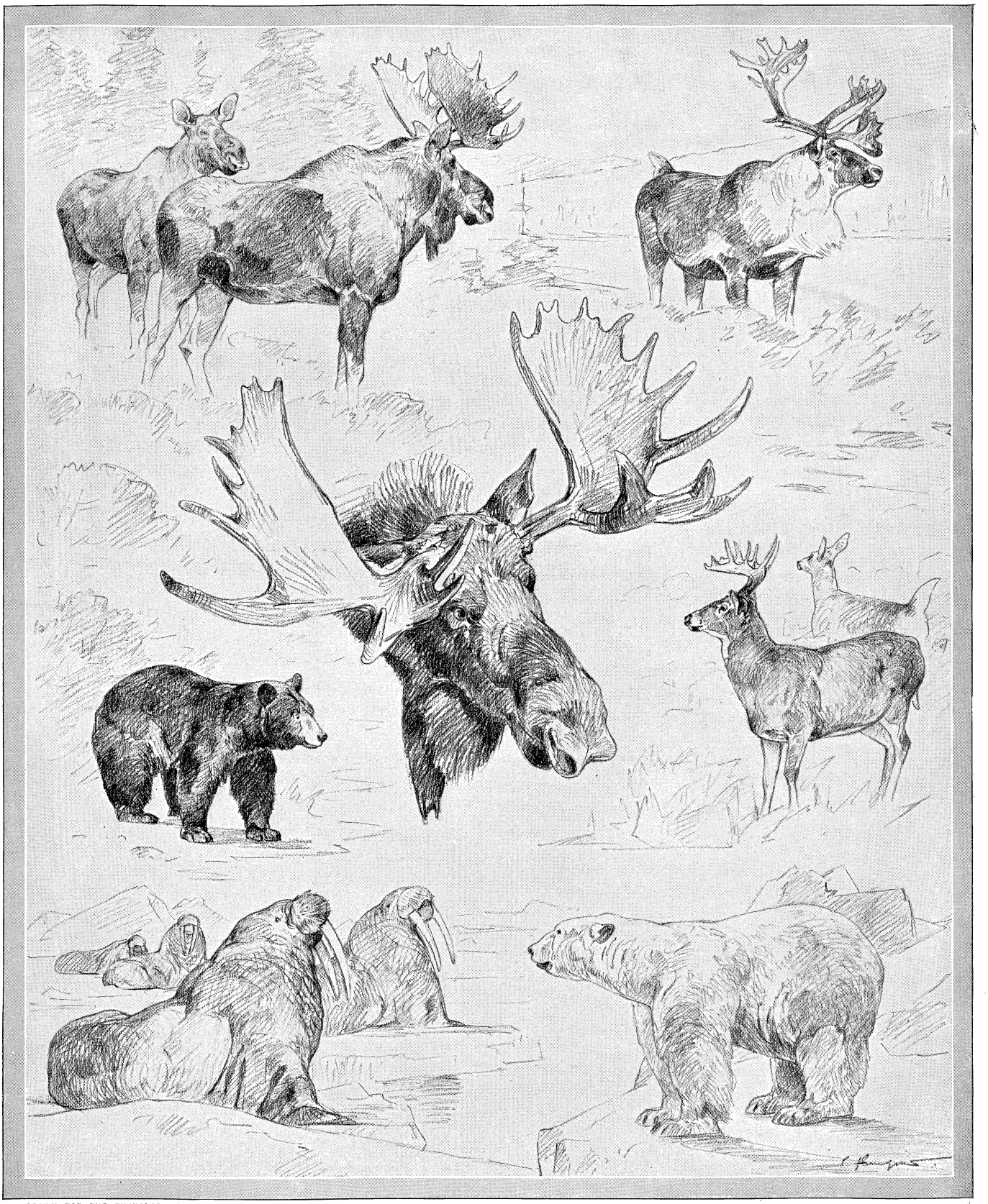
DRAWN FOR THE ENCYCLOPÆDIA BRITANNICA

## NORTH AMERICAN MAMMALS, BY CARL RUNGIUS

Except the muskox, which occurs only in arctic America, the groups of mammals here illustrated, like those in Plate IV, have very similar representatives in the Old World; the caribou, for example, is represented by the reindeer and the American elk or wapiti by the red deer or stag. In North America various bears attain immense size, the Kodiak brown bear (*V. middendorffi*) being the largest and heaviest land carnivore known, sometimes weighing 1,200 pounds

Northern Bighorn or White Sheep (*Ovis dalli*), two males, upper left
Grizzly Bear (*Ursus horribilis*), upper right
Stone Bighorn or Black Sheep (*Ovis dalli stonei*), upper left centre
Osborn Caribou (*Rangifer osborni*), head with antlers, centre
Alaskan Brown Bear (*Ursus dalli*), left centre
American Elk or Wapiti (*Cervus canadensis*), with cows, challenging, right centre
Muskox (*Ovibos moschatus*), three males, lower centre
Timber Wolf (*Canis nubilus*), lower left and lower right

# NORTH AMERICA



DRAWN FOR THE ENCYCLOPÆDIA BRITANNICA

## NORTH AMERICAN MAMMALS, BY CARL RUNGIUS

The American Moose (*Alces americanus*), which sometimes stands 6½ feet high at the shoulder, is closely allied to the Old World Elk (*A. alces*). The taller and blacker Alaskan Moose (*A. gigas*), sometimes attaining a height of 7½ feet, an antler spread of 6 feet and a weight of 1,800 pounds, is the largest known member of the deer family. For further details, *see* the articles on the animals illustrated

American Moose (*Alces americanus*), bull and cow, upper left
Woodland Caribou (*Rangifer caribou*), upper right
American Moose, head with antlers, centre
Black Bear (*Ursus americanus*), lower centre
Virginia Deer (*Odocoileus virginianus*), buck and doe, lower centre
Pacific Walrus (*Odobaenus obesus*), lower left
Polar Bear (*Thalarctos maritimus*), lower right

is more closely related to that of Europe-Asia (Palaearctic) than to that of any other zoogeographical province; the two areas are united by many writers in one province (Holarctic). The reindeer (caribou), beaver and polar bear are found in both; the moose, wapiti, bison and grizzly bear of North America are closely related to the elk, red deer or stag, bison, and brown bear of Eurasia; and the following groups are well represented in both provinces: cats, lynxes, weasels, bears, wolves, foxes, seals, hares, squirrels, marmots, lemmings, sheep and deer. The following forms are characteristic of North America: (rodents) pouched rats or pocket gophers, musk-rat, prairie dog, Canada porcupine; (carnivores) raccoon and skunk; (ungulates) musk-ox, big-horn, Rocky mountain goat, prong-horn; (marsupial) opossum. Among birds, there is a close resemblance to those of Eurasia, with some admixture of South American forms, such as humming-birds. Characteristic forms are the Baltimore oriole, bobolink, cowbird, flycatchers, wood-warblers, California quail, tree grouse, sage grouse, wild turkey and turkey buzzard. Turtles are especially numerous; salamanders are varied and large; rattlesnakes are among the reptiles.

The floral area of North America, defined by form and climate, may be divided into five belts: the eastern forested area, the western forested area, the interior unforested area, the northern barren lands and the torrid coasts. The eastern forested area extends from the Laurentian highland in Canada southward to the Gulf and Atlantic coast east of the Mississippi; in the north and southward along the mountains the trees are largely conifers with a mixture of birches, poplars and maples; southward, especially in the interior and at low levels, the conifers almost disappear and oaks, hickories, plane-trees, tuliptrees, walnuts and other valuable deciduous trees are in abundance; the long-leaf pine characterizes the low coastal margin. The western forested area begins in the Rocky mountains and extends to the Pacific, but does not descend below the lower timber line into the dry intermontane basins of middle latitudes; northward in Canada, the forest is continuous from the upper timber line down into the valleys; it attains a luxurious and dense development along the rainy coast, where the redwood (*Sequoia*) of northern California and Oregon reaches a height of from 300 to 400 ft. The unforested area of the interior includes two dissimilar regions. On the east are the fertile prairies, spreading between the middle Ohio and the upper Great Lakes and extending beyond the Mississippi; here the native grasses and herbaceous vegetation are now largely replaced by agricultural crops. On the west under a drier climate vegetation is more scanty; but far north a wooded belt connects the eastern and western forests across the medial plains. Aridity and barrenness increase southwestward into California and southward into Mexico; on this broad desert few trees are found, although piñons grow on cliffs and ledges and cottonwoods are found along watercourses; and the mountains that rise above the desert carry forests. The desert vegetation consists of cactus, agaves, sage-brush (*Artemisia*) and other dry-climate plants in large variety. In the far north are the "barren lands," with their permanently frozen subsoil; the growing season here is short and trees cannot develop, although birches, poplars, willows and some other kinds that attain good size southward are here present as dwarfed shrubs. The torrid coasts support a tropical vegetation; it is somewhat developed in Florida and becomes dominant in Mexico and Central America. (W. M. D.; P. H. O.)

## POPULATION

In the table on page 504 are given the best available data with respect to the number of people in the major political divisions of North America and the islands in the Caribbean sea generally regarded as belonging to this continent. For continental United States and the American possessions there are available the returns of the 1940 census; and for Mexico and Canada, the largest of the other areas, there are results of the censuses of 1940 and 1941, respectively. Comparatively reliable estimates are provided by the governments of the British and French possessions, and several of the Central American republics have had recent censuses. From the figures in the fourth column of the table, which gives the population per square mile, it may be seen that some of the smaller islands of the West Indies are very densely populated indeed. Among the larger areas, Puerto Rico, with 549.8 persons per square mile, is the most densely populated, this fact being even more significant when it is realized that much of the interior of this island is steep and mountainous and ill-adapted to agriculture, which is Puerto Rico's dominant industry. In the last column of the table is presented the population of the several areas around 1881, or nearly 60 years earlier than the dates represented by the current figures. It will be seen that the population of the continent has considerably more than doubled during this period, having increased from 72,991,815 to 185,402,402.

**Urban and Rural.**—In the U.S., 56.5% of the 1940 population lived in urban areas, which are defined as comprising all cities and other incorporated places having 2,500 inhabitants or more, and 43.5% lived in rural territory. In Canada, according to the 1941 census, 54.3% of the population was classified as urban; 45.7% as rural. In Canada, the urban classification includes all incorporated cities, towns and villages. In the 1930 census of Mexico, 33.5% of the population was classified as urban; 66.5% as rural, the urban population including all persons living in places (*localidades*) having 2,500 inhabitants or more. (The 1940 census made no classification by urban and rural areas.) In Puerto Rico 30.3% of the population was urban in 1940. In the data available for the other West Indies and for Central America, there are in general no urban-rural classifications, but a large part of the people in most of the areas live in rural territory, since their occupations are mainly agricultural and there is no extensive development of commerce or manufacturing to support large city populations. Mexico City and Havana are the only really large cities in the southern part of the North American area.

**Racial Composition.**—The base of the population of Mexico and Central America is Indian. In Mexico, for example, the census of 1930 reported, in round numbers, 2,444,000 whites; 4,621,000 Indians; and 9,181,000 of mixed blood, almost all white and Indian. (The 1940 census of Mexico made no classification by race.) Thus less than 15% of the population is locally considered white, and the percentage of pure white stock is probably much smaller. What is true of Mexico is true also of the Central American republics. Furthermore, in these the Indians and mixed stocks are being still further mixed by a considerable immigration of West Indian Negroes. In the West Indies there are great differences between one area and another, but the predominant stock in many of these islands is Negro, very generally mixed with white and in some cases with Indian stock. Even in Puerto Rico, the percentage of the population returned as white in the census (76.6% in 1940) is without doubt an overstatement, though the proportion of the inhabitants of Puerto Rico who do not manifest any of the characteristics usually associated with either Negro or Indian blood is considerable. In the United States, certain racial lines are closely drawn. Of the total population in 1940, 89.8% were white and 10.2% non-white, all except about one-twentieth of the nonwhites being Negroes. In Canada, in 1941, Indians and Eskimos formed only 1.1% of the population and Asiatics only 0.6%. Negroes were not classified according to race, but in 1931 they formed only 0.2% of the population. The important distinction in Canada, however, is that between the French-speaking and the non-French, the French constituting 29.2% of the total in 1941, and in the province of Quebec, about 82%. Thus Canada, unlike most other countries in North America, has no real colour problem, but only a language problem. (L. E. T.)

## ETHNOLOGY

The Indians of North, as of South, America are believed to have had their origin in the eastern hemisphere. In the new world there are no unquestioned fossils of human ancestors or extinct human races of markedly distinct type, such as Europe, Africa, Asia and Oceania contain. Also, most American archaeological sites contain artifacts of Neolithic as well as Palaeolithic type, in contrast with the thousands of pure Palaeolithic sites in the old world. Nevertheless, since about 1930, there have been reported discoveries of chipped stone implements (Folsom type) in positive

*Population of the Countries of North America, 1936–43 and 1880–82, With Area and Population Per Square Mile*

| Area | Population | Source and date | Land area (square miles) | Population per square mile | Population, 1880–82 |
|---|---|---|---|---|---|
| United States and territories and possessions: | | | | | |
| Continental United States | 131,669,275 | Census, 1940 | 2,977,128 | 44.2 | 50,155,783 |
| Alaska | 72,524 | Census, 1939 | 586,400 | 0.1 | 33,426 |
| Panama Canal Zone | 51,827 | Census, 1940 | 362 | 143.2 | .. |
| Puerto Rico | 1,869,255 | Census, 1940 | 3,423 | 549.8 | 731,648 |
| Virgin Islands | 24,889 | Census, 1940 | 132 | 187.1 | |
| British possessions: | | | | | |
| Canada | 11,506,655 | Census, 1941 | 3,466,556 | 3.3 | 4,324,810 |
| Newfoundland | 295,300 | Estimate, 1940 | 42,734 | 6.9 | 179,509 |
| Labrador | 5,000 | Estimate, 1939 | 112,000 | 0.04 | |
| British Honduras | 58,759 | Estimate, 1939 | 8,598 | 6.7 | 27,452 |
| Bermudas | 32,857 | Estimate, 1942 | 19 | 1,729.3 | 14,888 |
| Barbados | 197,956 | Estimate, 1941 | 166 | 1,192.5 | 171,860 |
| Windward Islands— | | | | | |
| Dominica | 53,202 | Estimate, 1941 | 304 | 170.5 | .. |
| Grenada | 90,586 | Estimate, 1940 | 133 | 681.1 | 42,403 |
| St. Vincent | 61,447 | Estimate, 1940 | 150 | 409.6 | 40,548 |
| St. Lucia | 71,232 | Estimate, 1940 | 233 | 305.7 | 38,511 |
| Leeward Islands | 99,329 | Estimate, 1942 | 422 | 232.1 | 119,546* |
| Bahamas | 68,846 | Census, 1943 | 4,375 | 15.7 | 43,521 |
| Jamaica | 1,237,063 | Census, 1943 | 4,470 | 276.7 | 580,804 |
| Cayman Islands | 6,670 | Census, 1943 | 93 | 71.7 | 4,700 |
| Turks and Caicos Islands | 6,138 | Census, 1943 | 202 | 30.4 | 4,732 |
| French possessions: | | | | | |
| Guadeloupe | 304,239 | Census, 1936 | 583 | 521.4 | 200,329 |
| Martinique | 246,712 | Census, 1936 | 385 | 640.8 | 167,679 |
| St. Pierre and Miquelon | 4,175 | Census, 1936 | 93 | 44.9 | 5,534 |
| Danish possessions: | | | | | |
| Greenland | 18,000 | Estimate, 1938 | 736,518 | 0.02 | 10,000 |
| Mexico and Central America: | | | | | |
| Costa Rica | 656,129 | Estimate, 1940 | 23,000 | 28.5 | 203,780 |
| Guatemala | 3,284,269 | Census, 1940 | 42,353 | 77.5 | 1,224,606 |
| Honduras | 1,107,859 | Census, 1940 | 59,145 | 18.7 | 350,000 |
| Mexico | 19,473,741 | Census, 1940 | 758,061 | 25.7 | 10,447,974 |
| Nicaragua | 983,160 | Census, 1940 | 53,668 | 18.3 | 275,815 |
| Panamá | 622,576 | Census, 1940 | 28,575 | 21.8 | 285,000 |
| Salvador | 1,787,930 | Estimate, 1940 | 13,176 | 132.4 | 613,273 |
| West Indian republics: | | | | | |
| Cuba | 4,778,583 | Census, 1943 | 44,217 | 108.1 | 1,521,684 |
| Haiti | 3,000,000 | Estimate, 1941 | 10,695 | 294.0 | 872,000 |
| Dominican Republic | 1,656,219 | Estimate, 1940 | 19,325 | 85.6 | 300,000 |
| Total | 185,402,402 | | 8,997,694 | 20.6 | 72,991,815 |

*Including Dominica.

association with Pleistocene mammals now extinct (elephants, bisons, horses, camels, sloths, etc.), with the result that man in America is now believed less recent than was the prevalent opinion a decade ago: some authorities allow him an age of 20,000 years, and most at least 10,000.

There is no reason to believe that the entry of man into America occurred as a single migration which was discontinued and never resumed. If one body of immigrants was able to find the way, it is almost certain that others would find it. The great speech diversification of America may have begun while the original speakers were still in the old world.

## THE PEOPLING

It is practically certain that the peopling took place from Siberia via Bering strait, other land bridges to America being geologically too ancient to have served man. Bering strait is shallow, frozen over part of each year, less than 50 miles wide, with the Diomede islands near the middle. While probably never an insuperable obstacle even to primitive peoples, it never has been and is not now an easy means of communication; and the lands on both sides of it are inhospitable and capable of sustaining only a thin population. The strait thus served much like a kinked tube. Man managed to filter through, and culture elements succeeded in being transmitted, but the flow of both was impeded.

There is no evidence that until the Russian occupation any advanced people ever occupied extreme northeastern Asia. Consequently, whatever accessions of inventions or other cultural materials reached the American Indians, were of a type normally occurring among peoples of a relatively low level. Both in America and Asia the higher attainments of civilization occurred in latitudes not far from or below the Tropic of Cancer.

That the intercontinental connections occurred as just outlined, is strongly suggested by recent ethnic conditions about Bering strait. The Eskimos on both sides of the strait are almost identical in physique, speech and customs; and farther back live Palaeo-Asiatic tribes (Chukchee, Koryak, Yukaghir) and American tribes (Dene, Tlingit, Haida) which resemble each other so definitely that some authorities have included the Palaeo-Asiatic ones with the Indians.

**Race.**—It follows that the racial origin of the American Indian has to be sought in Asia. The findings of anthropometry bear out the inference. The Indian belongs obviously to the Mongoloid division of the human species. He is brown skinned, with straight, stiff, black head hair, a minimum of beard and body hair, a definitely broad face (in popular parlance, high cheek bones), and moderate prognathism. These traits are constant among Indians, as among East Asiatics. Minor peculiarities, such as shovel-shaped incisor teeth, and bluish pigment spots in the sacral region during infancy, occur equally among the two populations.

The relations of the American Indian are, however, to the Mongoloid stock as a whole rather than to any one specific Mongolian people. They are probably closest to the East Siberians.

Although often called "red," the American Indians are so only when they paint themselves. Their general colour is a brown, little

if any darker than that of the Japanese. The tallest people are found in the centre of the continent in the Mississippi valley, and for some distance north and east. Along the Pacific coast and in Mexico, body heights are less. The Aztecs and Mayas were short peoples. Head form is about as variable as in the old world. In general, the cranial index is 79 or above (cephalic index 81+), except in six areas where it is less (longer heads): 1, the Eskimos of the Arctic coast; 2, 3, 4, in the east, from Cape Hatteras to St. Lawrence river; from the St. Lawrence north of the Great Lakes almost to the Rockies; an irregular tract in the Ohio and middle Mississippi valleys; 5, 6, on or near the Pacific coast, two intermittent tracts or chains of separated groups, between northern California and the tip of Baja California; from southern Arizona to central Mexico. In South America the long heads are almost all found in the eastern half of the continent, in or adjacent to Brazil. In both continents, ancient populations tend toward narrower heads than do modern populations.

The Eskimos (*q.v.*) are a well-marked sub-race. They are short, thick set, unusually long headed and broad faced, powerful jawed, narrow nosed, and with some tendency to the Mongolian eye. The remainder of the American race is difficult to sub-classify satisfactorily. Ales Hrdlicka distinguishes three types, of which he considers all existing populations in North and South America to be either representatives or mixtures. These are: 1, tall and broad headed; 2, long headed, mostly tall; 3, broad headed, stature moderate to short. The more advanced peoples from Mexico to Peru are assigned to this third type.

**Language.**—The outstanding characteristic of native American speech is its diversity. According to the older reckoning there were more stocks of languages in either North or South America than in the entire eastern hemisphere—about 75 on each continent. Recent researches have moved in the direction of uncovering similarities between some of these stocks, thereby reducing their number. There is little indication of borrowing between languages, except in South America.

The older view that American languages are overwhelmingly agglutinating, incorporating or polysynthetic, can no longer be maintained. There are languages as genuinely inflectional (Penutian) and isolating (Otomi, Zapotec) as in the old world. It is, however, true that the Indian languages tend to describe concretely and visually. Elements expressing the instrument or manner of action, the shape or position, and space relations, although by no means universal, are frequently well developed in the grammatical structure. It is also true that many of the idioms do not shrink from piling up structural elements into long words.

The most important linguistic stocks north of Costa Rica, in point of number of speakers or territory, are Eskimo, Athabascan, Algonkin, Iroquoian, Siouan, Muskogi, Caddoan, Uto-Aztecan, Salish, Sahaptin, Penutian, Hokan, Tarascan, Otomi, Totonac, Zapotecan, Mixe-Zoque, Maya, all of which are separately described. Of secondary rank, and also treated separately, are Tlingit and Haida (with Athabascan = Na-Dene?), Tsimshian, Wakashan (Kwakiutl and Nutka), Chinook, Kootenay, three Pueblo stocks (Tanoan, Keres, Zuñi), Kiowa (with Tanoan?), Tonkawa, Natchez (probably with Muskogi), Yuchi, Beothuk.

**Culture.**—The culture of the American Indians, like that of any large group, is so complex that a descriptive review is inadequate in proportion as it is compact. This culture is therefore perhaps best considered from the point of view of how its constituents classify as to origin—elements common to America and the old world, peculiar to America, important in the old world but lacking in the new, etc.

1. A series of simple culture traits are literally (or practically) universal among American tribes and of equally common occurrence in the old world, and may be assumed to have formed part of the culture stock with which the first immigrants came into the hemisphere. These traits include the use of fire and the ability to make fire with the drill; the dog as a domesticated or semi-domesticated animal; stone implements for piercing, cutting, scraping, chopping; the spear, the spear-thrower, and perhaps the harpoon and simple bow; cordage, netting and basketry; crisis rites and shamanistic beliefs and practices. These elements survive in the more remote and backward portions of the eastern hemisphere, and for the most part have their relative antiquity attested directly by archaeology, carrying back to the end of the Palaeolithic or beginning of the Neolithic period.

2. Equally well defined is a class of culture traits which are widespread in the eastern hemisphere, in fact practically universal in all parts possessing a sufficient development, but are totally lacking in both North and South America. These elements evidently originated in the old world subsequent to the movement which mainly populated America; they were not for some reason, perhaps chiefly because of the inhospitable conditions and backwardness of culture in the region of Bering sea, diffused into America. This class of traits includes all the important domesticated animals and plants of the old world excepting the dog, viz., cattle, sheep, the goat, pig, horse, ass, camel and even reindeer; wheat, barley, rice, etc.; the plough and the wheel; iron; stringed instruments; proverbs. Environment may be held responsible for the absence of some of these from the western hemisphere; it cannot account for the non-existence of the last four or five.

3. The higher civilizations of America were reared on an economic and technological foundation of their own, evidently evolved in and largely remaining confined to the region of "Middle America," namely the area from Mexico to Peru. The basis of this civilization was a form of agriculture limited to a series of indigenous plants. Fundamental among these plants was maize, whose wild ancestor, or hybridizing ancestors, and place of origin, remain a puzzle to botanists. Closely associated with maize were true beans (*Phaseolus*) and squashes. These plants were cultivated by nearly all Indians of both Americas as far as agriculture was practised by them at all, from the St. Lawrence to the La Plata. In the tropical region there were cultivated in addition other important plants—the potato, sweet potato, manioc, tomato, pineapple, chili pepper, tobacco, chocolate, etc. All this agriculture was practised without implements more complicated than a hoe or simple planting stick; it was strictly a hand culture. Domesticated animals were lacking, except for the llama and alpaca in Peru and the turkey in Mexico. Copper, gold, silver, tin and lead were smelted, cast, plated and alloyed in Middle America; in other words, metallurgy comparable to that of the old world prior to the iron age was known. Cotton, of another species than the cotton of the old world, had been domesticated in Middle America and was the basis of an elaborate textile art, operating, however, with simple apparatus; and clothing was of types based upon true fabrics instead of skins or bast fibres. Pottery shows a wide distribution almost identical with that of agriculture; archaeologically, it is generally associated with agricultural remains; and it may therefore be assumed to have originated in Middle America at about the same time as agriculture. Masonry had spread somewhat beyond the cultural nucleus of Middle America, as far as northwestern Argentina and southwestern United States.

Middle America was a region of towns, therefore of higher political organization, and in Mexico and Peru of considerable empires. In the same regions ritualistic religion, including altars, permanent edifices, sacrifices and symbolism, reached its most complex development. This development was evidently dependent upon the existence of a priesthood persisting through successive generations under stable social and political conditions. Finally, the intellectual achievements, probably also in large part due to priests, culminated in the mathematical and calendrical systems of the Maya, and in an incipient system of writing employed by them and the neighbouring Mexican nations. Attempts have been made to derive these products of learning from the old world; but analysis shows their principles, especially those of the calendar, to be unique. The Maya, for instance, had devised position numerals and a sign for zero; but their system of numeration was vigesimal, and they were probably using this system before any people in the old world had invented a sign for zero.

4. Other culture traits in America, not specially characteristic of higher civilization, do not occur regularly distributed in or around the Mexican-Peruvian area. Some of these traits may be presumed as due to local inventions independent of the Middle

American stimulus. Others may have originated earlier than the Middle American agriculture-metal-town-priesthood growth and have diffused irregularly, or perpetuated themselves only in certain tracts. Most elements peculiar to one or two culture areas fall into the present class; for instance, the carpentering, woodcarving and frame houses of the North Pacific coast; the special war customs of the eastern United States; the acorn food technique of California. Clan systems or exogamic institutions, usually with totemic manifestations, occur in North America in several areas: the southeast and northeast, the North Pacific coast, in a limited area in the plains, and in the southwestern United States.

5. A certain number of traits restricted to the northwestern half of North America show modern or recent analogues in the old world, usually in northern Asia and Europe, but do not appear to possess extreme antiquity. They may therefore be assumed as importations into America, mainly by diffusion rather than by migration, in the last few thousand years. For the most part these traits are distinguishable without difficulty from the universal and supposedly very ancient ones of class 1. Into the present group there may fall the sinew-backed bow (the American equivalent of the composite bow of Asia), the tepee or skin tent on poles, the snow-shoe and toboggan (equivalent of old world snow-shoe of ski type), birch bark canoes and vessels, the half-underground house roofed with earth, tailored or fitted clothing of sewn skins, and several myth episodes such as "Earth Diving" and the "Magic Flight." The distribution of most of these traits in America stops before it reaches the southwest and southeast United States. None of them had reached the advanced portions of Mexico.

**Culture Types.**—An attempt has been made by Americanists to organize the complex and irregular manifestations of native culture by classifying them into certain types characteristic of regions known as culture areas. These are to a certain degree environmental; the natural environment is thought to have acted as a stabilizing and perpetuating factor, once a certain type of culture had been achieved in an area. Essentially, however, this classification is one of culture types, and the concordant geographical areas largely represent empirical determinations of distribution. In this respect the culture area classification, as first formulated by Wissler and accepted with only minor modifications by practically all American students, differs from older attempts which proceeded from environment as the supposed determinative factor. The more important types of culture in these areas are outlined in separate articles. The areas are: 1, Mexican, north about as far as the Tropic of Cancer (*see* AZTEC, TOLTEC, MAYA, ZAPOTEC); 2, Southwest (*i.e.*, of the United States, but including northern Mexico; *see* PUEBLO); 3, 4, Southeast and Northeast, perhaps to be joined and called Eastern woodland (*see* MUSKOGIAN, MOUND-BUILDERS, IROQUOIS); 5, Plains (*q.v.*), in the untimbered centre of the continent; 6, Plateau, in the western intermountain region, an area relatively undifferentiated in culture, with actively entering influences from the adjacent areas (the Great Basin is sometimes separated from the upper Columbia and Frazer region and united with California); 7, California; 8, North Pacific Coast (*q.v.*), from northern California to southern Alaska inclusive; 9, Mackenzie-Yukon (*see* ATHABASCAN); 10, Arctic (*see* ESKIMO). The West Indies seem to belong culturally with South rather than with North America. The southern frontier of the Mexican area may be placed at southern Nicaragua—Costa Rica and Panama forming part of the Chiboha or Colombian area of South America.

Qualitatively, these areal types are not equivalent but of quite different intensity and historic depth. The Southeast has been influenced by Mexico, and has in turn influenced the Northeast and Plains. The Southwest represents a second and largely distinct centre of derivation from Mexico. The North Pacific Coast has perhaps adopted more cultural material of Asiatic than of Mexican origin, and has reworked it all with considerable originality. On the technological side alone, the same may be said of the Eskimo. California, Plateau, Mackenzie-Yukon are intermediate areas of rather indifferent characterization.

**Temperament.**—This is notoriously difficult to dissociate from culture habits, but there appears to be a fairly general agreement as to a characteristic American type of mind and personality, though it might be arguable how far this is innate. Almost universally the American Indian is reserved, stoic, enduring and unresponsive, the antithesis of the Negro, and more similar to the Mongolian in behaviour than to the Caucasian. He is not without humour, but holds expressions of it in rigorous check, so that it becomes manifest chiefly in intimacy. He is patient but not quick; tough in adversity but unenterprising; stable but unimaginative; cruel when his inhibitions have been removed, but not given to brutality ordinarily. He prizes control as the highest virtue, and restraint and decorum as the essentials of manners, and therefore almost always impresses as imbued with unusual sense of respect of personality.

**Population.**—The original numbers of the American Indians are imperfectly known. The most complete and careful count, that by Mooney (*Smithsonian Misc. Coll.*, lxxx, 1928) arrives at a total of 1,150,000 souls north of Mexico at the time of first contact with Europeans. Inasmuch as several specialists have set a somewhat lower figure for the regions with which they were most familiar, Mooney's total is probably too large rather than too small, and one million in the United States and Canada was, perhaps, not far from the true number. In Mexico and in Central America population was much denser relatively and absolutely; it cannot well be put at less than three to four million, and has generally been estimated as several times greater than that. Similar conditions prevailed in South America: there may have been nearly as many natives under Inca rule as in the remainder of the continent.

In general, the race has declined after contact with Europeans. Some North American tribes have become completely extinct. Some have shrunk, lost their identity and merged. Some have more or less held their own, and a few, like the Navaho, have increased markedly. In the United States, most tribes began to increase again by 1910, and this growth has been maintained.

In many tribes there has been an infusion of white and sometimes of Negro blood. Except in the Southwest, it may be said that even those tribes that remain as numerous as originally, are so through the inclusion of alien blood. Socially the mixed bloods generally are Indians. Of this population of pure and mixed blood, there remains not quite half a million in the United States and Canada. Mexico is estimated to be about one-third pure Indian, and more than another third, part Indian. Guatemala is mostly Indian.

**History.**—There is no native documented history of the American Indian, except for the Mexicans and Maya. The great bulk of the tribes had neither time systems nor writing, and left only legendary traditions. These usually possess limited authenticity. In the main the history of the tribes is a history of their contacts with Caucasians. Often more can be gathered as to the movements or former fortunes of a stock, from its recent distribution and from the relations of its component languages, than from any directly historical source.

(*See* for instance ATHABASCAN, UTO-AZTECAN, ALGONKIN, SIOUAN, MUSKOGIAN, IROQUOIS.)

Native history resting on a documentary basis has been preserved only in the Mexican region. The Maya left both monuments with dated inscriptions and post-Spanish chronicles. The calendar (*q.v.*) in which the inscriptions are expressed is extremely accurate and is well understood, but its conversion into our chronology is still controversial. According to the correlation formerly accepted by most specialists, the Maya cities of the Great period, which have left the principal dated inscriptions, flourished from the 1st to the end of the 6th century after Christ. The present tendency is to construe the time as 260 years later: from the 4th to the 9th century. This calendar system involves long observation, some astronomical knowledge, considerable facility in computing, and is accompanied by hieroglyphic writing, fine sculpture, and advanced architecture. Beyond this was a formative period on which information is accumulating.

An Archaic period is well known from remains in and around

the valley of Mexico. This, however, was a culture already emerged from primitiveness, since the first of its several stages possessed agriculture and pottery. For this reason some now name it the Middle culture. Its beginnings seem coeval with the Maya formative period. The Archaic was succeeded by the more advanced culture of the Toltecs (Teotihuacan), and on this legendary data were preserved by the historic Aztecs, Mixtecs, etc. Some of these accounts are chronological and carry Toltec history back to about A.D. 600. The Toltec-Aztec calendar, however, while accurate within its cycles of 52 years, did not with certainty distinguish successive cycles, so that most Mexican dates must be accepted as only approximations.

In the southwestern U.S., Pueblo and pre-Pueblo culture has been unravelled by intensive archaeological work, until a series of seven stages is known, the first being without pottery and dated by dendrochronology (tree rings) to the 3rd century A.D. The Hohokam culture of S. Arizona is as old and may be older.

BIBLIOGRAPHY.—The most important general work of reference is the *Handbook of American Indians,* published by the Bureau of American Ethnology as Bulletin 30 in two parts (1907 and 1910). The basic work on linguistic classification is by Powell, *7th Report of the Bureau of American Ethnology* (1891). As regards culture, the points of view here adhered to were first outlined by Boas in a brief article, "The History of the American Race" (*N.Y. Acad. Sci.,* xxi, 1912); supplemented in the *Intern. Congr. Americanists,* xxi (Göteborg, 1925); and are most fully developed, with special emphasis on the culture areas and with attention also to racial and linguistic factors, in Wissler, *The American Indian* (1917; 3rd ed., 1938). Brief comprehensive works on special areas are Goddard, *Indians of the South-west, Indians of the North-west;* Wissler, *Indians of the Plains;* Spinden, *Ancient Civilizations of Mexico* (these four are *Handbooks* of the American Museum of Natural History) Kroeber, *Handbook of the Indians of California,* Bur. Amer. Ethn. Bull. 78; Kidder, *South-western Archaeology* (1924). Numerous monographs and special articles are cited in the bibliographies included in these general works. (A. L. K.; X.)

## ARCHAEOLOGY

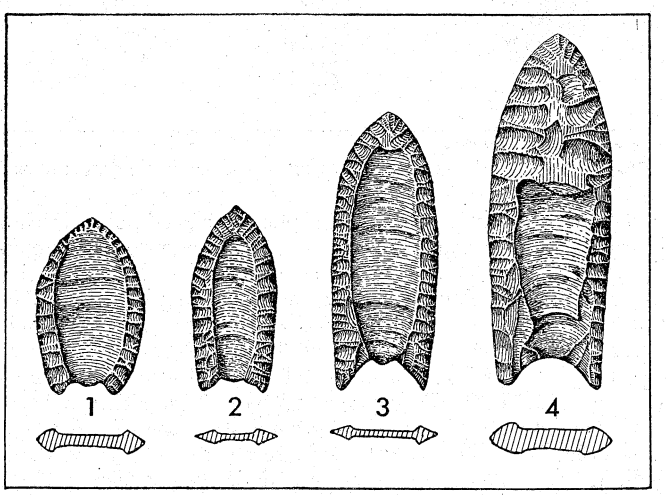
The discoveries of Palaeolithic man in Europe stimulated activities to discover similar evidence in the new world. Laymen and scientists expected to find comparable associations and closely related types of primitive man. During the close of the 19th century and the beginning of the 20th century a lack of sound criteria as well as over-enthusiasm on the part of many investigators created numerous erroneous conclusions. Many reputed discoveries of Palaeolithic man in America, when critically examined on a strictly scientific basis of direct association, did not satisfy the open-minded scientist.

Improved archaeological techniques, more careful observations and the accurate recording of information have provided the evidence of direct association between man-made objects, such as chipped arrow and spear points, gravers, knives and other tools, and the now extinct forms of mammoth, mastodon, bison, camel, horse and other animals.

The objects recovered by these more carefully controlled archaeological methods and the close co-operation between specialists of related sciences, such as Pleistocene geologists and palaeontologists, have produced the basic evidence required. This evidence consists of man-made stone tools and fire hearths in identifiable geologic strata, comparable tools in direct association with now extinct animals, camp site refuse on old land terraces and the shores of old beach lines.

The most generally accepted archaeological complex which has provided the evidence of ancient man in North America is known as the Folsom complex. The name "Folsom" has been given to this horizon because the first occurrence of extinct animals associated with finely chipped projectile points was discovered in a bone deposit on the upper sources of the Cimarron river near the town of Folsom, in eastern New Mexico. This bone deposit, consisting of articulated skeletons of extinct bison and a large deer-like animal, was discovered in 1925. During the next three years palaeontologists and archaeologists worked together in the excavation of the site and recovered numerous flint projectile points, characteristically chipped, in direct contact with the skeletons of the extinct forms of bison. In 1932 a similar characteristic Folsom point was found in conjunction with a few bones of a musk-ox-like animal eight feet beneath the surface of a cave deposit in the Guadalupe mountains in southeastern New Mexico. This association was several feet beneath a stratum of cultural material identified as a Basket Maker cultural-pattern, the oldest cultural level then known in the Pueblo area of the American Southwest. The three major sites producing specific Palaeo-Indian evidence are: (1) the original Folsom site; (2) along Black Water draw between Clovis and Portales in central-eastern New Mexico; (3) the Lindenmeier Ranch north of Fort Collins in the northeast corner of Colorado. There are other sporadic sites throughout the central plains east of the Rocky mountains, extending from Texas north into Canada, which have produced the association between these characteristic fluted points and mammoth or extinct bison bones.

There are two types of flint implements which are distinct and quite characteristic of this archaeological horizon: (1) a relatively small projectile point; (2) a larger knife-like specimen. Both of these forms have a longitudinal groove or channel on both faces extending from the base for two-thirds the length of the implement. In cross-section they have a biconcave appearance. The form is somewhat leaf-shaped with a concave base, and on the smaller points the tip is stubby. Along the edges of the blades and between them and the parallel ridges, formed by the removal of the central flake, is a fine marginal edge formed by the removal of small flakes. These points were extremely well made before the central flakes were removed, as indicated by the finding of the original lateral flakes which showed the primary flaking grooves. The exact purpose of the lateral grooves which characterize these specimens is not known. Such a form may have simplified the hafting of the point to the shaft of spear or arrow; it may have reduced the weight; enabled the shaft to be removed while the point remained in the animal to promote bleeding. The few perfect points that have been recovered represent some of the finest examples of aboriginal chipping techniques in North America.



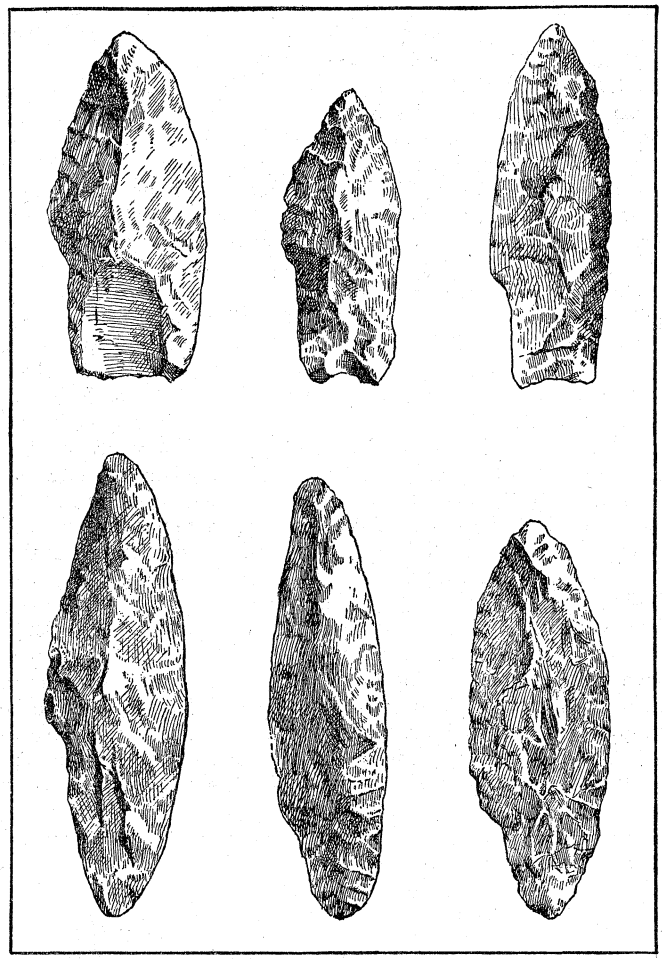

BY COURTESY OF SMITHSONIAN INSTITUTION

TYPES OF FOLSOM POINTS AND CROSS-SECTIONS ILLUSTRATING THE CHARACTERISTIC LONGITUDINAL GROOVE

In the stratified deposit of a cave high up in Las Huertas canyon in the north end of the Sandia mountains, east of Albuquerque, New Mexico, a group of artifacts was recovered beneath a Folsom deposit. This is the first and only site providing unquestionable proof of a period antedating the Folsom horizon. The archaeological results obtained at Sandia cave are of major importance. Three distinct cultural levels were recovered.

Pottery fragments comparable to those from pueblos inhabited prior to the Spanish explorations were found near the mouth of the cave. Under this more or less recent deposit extended a sheet of travertine representing roughly the end of the Pleistocene geological period in this section of North America. Beneath this hard crust classic Folsom points, large blades, gravers, scrapers, an ivory shaft and worked splinters of bone, together with fragmentary bones of the mammoth, bison, camel, horse and ground

sloth were recovered. Below this Folsom layer was found a sterile laminated stratum of yellow ochre. Under the yellow ochre the collection of Sandia material was found. This, the oldest level of



BY COURTESY OF SMITHSONIAN INSTITUTION

CHARACTERISTIC PROJECTILE POINTS FROM THE LOWEST LEVEL IN THE SANDIA CAVE

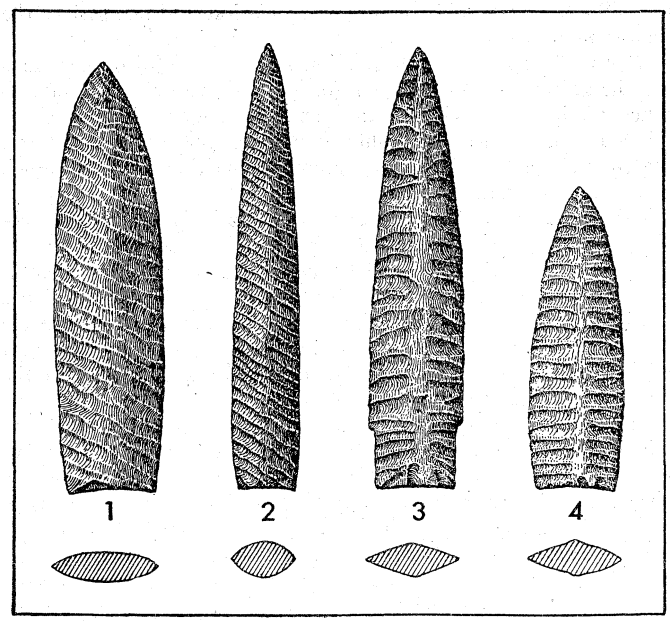
occupation, contained a distinctive type of chipped point which is larger than the Folsom type and not as well chipped. The points are characterized by a side shoulder or notch which is somewhat comparable to a Solutrian type. Some of the points are lanceolate in shape, others are straight shafted with paralleling sides. Snub-nosed and side scrapers, numerous flakes and bone points were also found in this layer. The animal bones identified are similar to those found in the Folsom stratum with the addition of bones from a mastodon. Evidence of ground sloth was found in the Folsom layer as well as in the most recent deposit, which would indicate the ground sloth to be one of the last survivors of the many large mammals belonging to the Pleistocene fauna.

In Yuma county, Colorado, relatively long, well-chipped spear points or knives were found associated with some Folsom points. These long slender blades, oval or diamond-shaped in cross-section, have been considered by some authorities as being contemporaneous with the Folsom remains. Others believe that they represent a later group of people although they have been found in association with some of the most recent Pleistocene mammals. They no doubt represent the work of nomadic hunters living on the North American continent at the very end of the glacial period and continuing after the Folsom horizon. The major concentration of this type of projectile seems to extend across the western plains from Alaska to Texas.

Except for the Sandia horizon there are many Folsom and Yuma sites throughout the central and western portions of the United States, ranging from sporadic discoveries on the surface to those providing direct association between the characteristically chipped points and now extinct animals. In none of the more important sites has there been any direct association between these projectiles and human skeletal material. Therefore, all conclusions have been based on the geological strata and the recurring fauna. On the basis of the geology and archaeology it is safe to assume that these sites represent the first and oldest evidence of man in the western hemisphere. Even though no direct association of human skeletal material has yet been recovered, most authorities agree that it represents an essentially modern type of American Indian arriving in the new world about 15,000 years ago with a stone culture somewhat comparable to the Early Neolithic in Europe. On the basis of this evidence a considerable hiatus exists between this Palaeo-Indian horizon and the oldest remains of the subsequent Indian tribes, whose earliest remains rarely precede the beginning of the Christian era. A broad interpretation of the factors governing such a long separation, of at least 10,000 years, is that the first migrants, after crossing Bering sea into Alaska, came down the eastern corridor shortly after the receding of the northern glaciers. Minor oscillation of subsequent ice sheets may have discouraged or prevented human migrations until a much later date. Other barriers may have prevented a continuous migration from the northern Asiatic mainland. A better understanding of the geology together with additional explorations may provide the necessary information relating to this most interesting problem of the Palaeo-Indian in America.

As indicated in the foregoing section, one of the most interesting problems for future research is a sound explanation of the hiatus of 10,000 years which now seems to exist between the remains of the Palaeo-Indian horizon and the basic cultures of the ancestors of the historically known American Indians. When written records were not left by the vanished peoples, as is the case in most of North America and in many other regions of the world, there must always be a considerable element of speculation regarding major archaeological monuments, though the basic facts may be ascertained with more or less clarity.

After 1930 modern archaeological techniques, the analysis of tree rings, as well as the concentration on historical problems, reduced the time elements formerly considered essential in the evolution and development of the prehistoric Indian cultures. Generally speaking, the ecology of various areas in the United States and the adjustments made by the aborigines to these local regions have played an important role in the various archaeological manifestations thus far recovered. For the sake of brevity and




BY COURTESY OF SMITHSONIAN INSTITUTION

YUMA POINTS ILLUSTRATING OBLIQUE CHIPPING

clarity the various archaeological horizons will be considered in the following arbitrary areas: Alaska, Northwest Coast, Intermontane, the Southwest, the Mississippi Valley, the Great Plains and the North Atlantic.

## ALASKA

In the Alaskan area, in contrast to some of the others to be considered, we are not confronted with the problem of major shifts in the population nor profound changes in culture caused by environmental factors. The local, somewhat limited, fauna is practically identical to that existing in prehistoric times. No other part of the continent presents such a clear picture of a modern culture derived from a prehistoric pattern as some of the sites in Alaska and Greenland. Many important sites have been abandoned for centuries while others are still occupied by the descendants of the prehistoric Eskimos. On Little Diomede Island, half way between Asia and America in the Bering strait, the modern Eskimo houses are built on top of the old midden and the present population continues to add evidence of their handiwork and discarded material to the mass of refuse that has been accumulating for the past 2,000 years.

The permanently frozen soil has preserved a remarkably full and detailed picture of life and the objects used by the aborigines. Implements, weapons, ornaments and utensils exist in large quantities, which provides the archaeologist with the necessary data for reconstructing the life of these people.

Thus far the real origins of the Eskimo culture have not as yet been fully established. No trace of a pre-Eskimo population has been found. Nevertheless, Palaeo-Indian migrations must have used the Bering strait corridor in order to reach the new world. These original migrations developed no doubt as a result of following the herds of land mammals upon which ancient man depended for his livelihood.

Archaeological excavations in Alaska have disproven the theory that the more ancient the artifacts the more simple their design elements. The excavations within the Bering strait region have indicated a long series of cultural changes in the direction of simplification rather than progressively complex. From the point of view of decorative motifs the Old Bering Sea culture is much more advanced than that of the present-day Alaskan Eskimo. In southern Alaska, on the other hand, the oldest level at Kachemak bay is a more simple generalized Eskimo character in contrast to the more recent stages, largely due to the influence of the Northwest Coast Indians.

Several archaeological horizons have been established in Alaska. Starting with the oldest remains, which have been dated around the beginning of the Christian era, there is the Old Bering Sea culture from excavated sites on St. Lawrence Island, the Diomede and Prince of Wales Island, and postulated for the region around Point Barrow. In southern Alaska a contemporaneous group has been called Kachemak Bay. In the central area and extending east as far as Greenland are cultures derived from ancient manifestations known as the Dorset culture.

The lack of concentrated archaeological excavations in northeastern Asia has been largely responsible for the lack of comparative material from such Asiatic coast sites. In 1939 and 1940 a site was discovered at Point Hope in northwest Alaska which has produced strange and highly conventionalized examples of carvings on ivory which do not resemble comparable material from other sites in the Eskimo region. This site consisted of hundreds of house ruins, none of which was superimposed, which would seem to indicate simultaneous occupancy by several thousand people. If this surmise is correct it would represent one of the most concentrated settlements in prehistoric times. Ipiutak, the name given to the site, produced a preponderance of chipped flint arrowpoints, knives and scrapers, and lacked many implements typical of the other prehistoric Eskimo cultures. They may have been an inland people dependent on land mammals, who concentrated at such a coast site for a limited period in the spring for the hunting of such sea mammals as the walrus and seal. The 4,000 artifacts from this site are made from ivory, bone, antler and flint. One of the most striking differences between the collections from Ipiutak and other Eskimo sites is the lack of harpoon heads and the presence of many hundreds of arrowheads. There was also a group of 150 fantastic ivory objects whose use thus far has been impossible to classify.

It would seem from the above description, and based on the tentative conclusion, that Ipiutak is the oldest of the Eskimo cultures; that the farther the past is penetrated the more complex are the ivory carvings. Future excavations in the Amur regions and other sections of northeastern Asia may produce comparable traits. Eskimo culture as it is known today may be an adaptation to the rigorous Arctic coast by people from southern latitudes in eastern Asia.

In southern Alaska, the Aleutian Islands, Kodiak Island and Cook inlet there is a more or less generalized Eskimo culture. In only a few cases are there any specific resemblances to the northern or Bering strait types. These few examples, however, would seem to indicate an ancient Eskimo stratum which became isolated and permitted the growth of a specialized form of culture in south Alaska. At a later period these people were subjected to strong Indian influences from the Northwest Coast.

The great number of kitchen middens or shell heaps, some attaining 20 ft. in height, throughout the Aleutian chain of islands is sufficient proof that these islands and the adjacent Alaskan coast line were as densely populated in prehistoric times as they were when explored by the Russians in the 18th century. The material culture from the sites in this general region consists of stone lamps, elaborate barbed bone points, compound fishhooks, awls, needle cases, needles, wedges, labrets, pendants, spoons, harpoon heads, foreshafts, drill points, chipped stone, rubbed slate knives and whetstones. Excavations on Kodiak Island produced skeletal evidence showing that the skulls from the lower levels are longer and higher (Eskimoid) as in contrast to the more modern Aleuts, which are extremely low and broad.

In the later stages of the culture, possibly in the 13th and 14th centuries, the Indian cultures farther south, along the Northwest Coast, greatly influenced this Eskimoid pattern by the introduction of such customs as disarticulated burials, the gathering of trophy heads, the use of human bones, and by the introduction of such specimens as the pestle, copper ornaments, elaborate stone lamps, nose pins, slate mirrors, stone clubs and the splitting adze. Environmental factors no doubt led to the adoption of many traits from the more highly developed social groups to the south.

## NORTHWEST COAST

This comprises a coastal area ranging northward from Oregon to the Alaskan peninsula. The exceptional fauna and flora of this territory together with the peculiar geographical conditions influenced a specialized type of Food-gathering culture. So far very little archaeological research has been made, and for this reason it is not possible to determine any contrast between the culture of the highly organized Indian tribes of the 18th century and their antecedents. Except for a few minor objects there seems to be very little influence from the Eskimo to the north. Certain traits, such as slat or rod armour, woven hats, grave monuments, bark beaters, and edged clubs are comparable to similar forms in southeastern Asia and parts of Oceania. Whether these objects reached the coast by direct contact or the accidental shipwreck due to ocean currents has not been definitely determined. The similarities between the Northwest Coast and the Asiatic mainland west of the Aleutian Islands, as found among the Kamchadal-Koryak groups may be due to relatively recent contacts from east to west across the Aleutian Islands.

FROM A. L. KROEBER AND T. T. WATERMAN, "SOURCE BOOK IN ANTHROPOLOGY" (UNIVERSITY OF CALIFORNIA PRESS)

MODEL OF A TOTEM POLE FROM THE HAIDA INDIANS LIVING IN THE NORTHWEST COAST AREA

The material culture of the historic Indian tribes inhabiting this unusual coastal strip and the adjacent island represents one of the outstanding aboriginal cultures on the American continent. This is especially noteworthy of a semi-nomadic group of people where agriculture was unknown. The ecological factors of the territory together with the aggressive and vigorous nature of the inhabitants are largely responsible for such a development. Because of the splendid forests the people developed great skill in the carving of wooden monuments, such as the totem poles, decorating their houses and implements, and in the manufacture of their world renowned dugout canoes from the giant cedar trees. Their aesthetic ability is also shown by their works of art in shell, ivory, stone, bone, horn and copper. The stone objects consisted of mauls, hammers, clubs, pipes, pestles and mortars, knives and chisels. The chipped stone objects are rare in the northern sections but more common to the south. Wooden, bone and horn vessels took the place of pottery. Even though copper occurs in easily mined surface deposits it is unknown as to whether this medium was used in prehistoric times. In historic times conventionalized copper plates served as important exchange items together with their beautifully woven goat hair blankets during their highly ceremonialized potlatch.

Many tribal variations are found based on the foregoing material culture. In the north were the Tlingit, Haida and Tsimshian; in the central area were the Kwakiutl and Bellacoola; in the south the Salish, Nootka, Chinook and some Athapascan tribes. The staple food

was that derived from fish and sea mammals and some hunting on the mainland, and there was dependence on the varieties of berries and plants. They cooked their food in the beautifully carved wooden boxes by heating the liquid with hot stones; lived in rectangular gabled houses of upright cedar planks, and travelled chiefly by water in their large artistically painted sea-going canoes. Their social organization consisted of matrilineal descent and was organized into a definite class system of chiefs, nobles, commoners and slaves. Their mythology was characterized by Raven legends.

### THE INTERMONTANE

This area, sometimes referred to as the Great Basin, covers the southeastern part of Oregon, southern Idaho, Nevada, Utah and the eastern part of California. The natural environment at the close of the Pleistocene geological period became one vast desert with a rugged topography, all of which limited any horticultural activities except in a few restricted parts of the Colorado river valley and in the piedmont area of the Wasatch mountains. The deep valleys and high mountain ranges discouraged communication and infiltration from neighbouring culture areas. The scant vegetation restricted the survival of any herds of large animals. Mountain sheep and deer lived in the mountains, while a few antelope occurred in the valleys. Special techniques were required for the trapping of smaller mammals. Such limited natural resources formed a distinct barrier to a concentration of people. It is roughly estimated that from 30–35 sq.mi. of land was required to support one person.

Even though the Intermontane extends as far east as the Rocky mountains, the cultural remnants thus far recovered are associated with those from the west and south. The archaeological cultures reported from this area seem to cover a considerable period of antiquity, ranging from the close of the Pleistocene period at such sites as Gypsum cave in Nevada, remnants of early cultures along ancient stream and lake shores in southeastern California, through the Anasazi influences from northern New Mexico, Arizona and southern Colorado, to the historic Shoshonean Indian tribes.

During the close of the Pleistocene period or during the glacial age the Great Basin area was probably much more fertile than at the present time. Prehistoric man with his simple equipment would have found sufficient game to exist in considerable numbers. Except for those sporadic finds, such as at Gypsum cave and Lake Mohave to the south, no specific evidence has been found of glacial age man. After the continental glaciers receded the present semi-desert environment vastly changed the flora and fauna. The available natural food supply after the beginning of the Christian era consisted of seeds, rodents and fish in restricted localities. To exist under these limited conditions would require a culture possessing a basketry complex, the metate for the grinding of seeds and nuts, traps, nets, snares, the bow and arrow or spear for the limited hunting and fishing, and methods for transporting and storing water. During the development of the classical Basket Maker period in the archaeological area known as the Southwest, the fundamental traits required to maintain a livelihood in this semi-desert environment were developed and permitted population expansion and direct migration. Those traits of a Basket Maker origin which were carried into the Great Basin area were sandals, skin blankets of twisted animal fur, curved wooden clubs known as rabbit sticks, and the metate for pulverizing nuts. Other phases of the Basin culture may have spread from the west or north, such as the nets, snares, traps, bow and arrow. Many of these traits spread slowly within the Great Basin by the ancestors of the historic Shoshoneans. Before these ancestors spread this predominantly Basket culture to the eastern sections of the Basin a new and more highly developed Pueblo culture invaded the eastern sections. Evidence of this pottery-making culture spread throughout northern Utah and eastern Nevada. These pottery-making peoples did not remain for many years, and after their return to the Southwest the ancestral Shoshoneans expanded throughout the territory. After this settlement congealed the Shoshoneans borrowed salmon-fishing techniques from their northern neighbours, twined basketry from the west, pottery from the south and east, skin garments and moccasins and later the horse from the Plains Indians east of the Rocky mountains.

### THE SOUTHWEST

This important archaeological area—where diverse prehistoric peoples overcame a rigorous semi-desert environment to become sedentary, establishing large apartment-like dwellings, with a communal society directed by native priests within an elaborate framework of ritualism—is located within the states of New Mexico, Arizona, southwestern Colorado, southern Utah, eastern Nevada and northern Chihuahua and Sonora. This area has been roughly divided into two distinct categories. The northern cultures have been grouped under a single term, "Anasazi," a Navaho word meaning "the ancient ones," while those cultures to the south, along the Gila and Salt rivers, have been designated by a word from the Pima tradition for those who departed long ago, "Hohokam." Archaeological investigations throughout the Southwest have been based on a true historical perspective by the use of the stratigraphic method. This method is comparable to that used by the geologists and palaeontologists in reconstructing the history of the earth and the animals that lived upon it. The seriation of European cultures from the Palaeolithic period to the beginning of historical records has been established through the same sound approach. In any undisturbed deposit of geological or human character formed over a considerable portion of time, the oldest material is found at the bottom of the deposit and the most recent material on the top, while those strata or layers in between the top and bottom are of an intermediate age.

The evidence obtained from pure stratigraphical studies gives a relative position for the early and late material. Due to conditions of an arid climate in the Southwest, many perishable objects such as wooden roof beams were preserved for many centuries. Such a climate with its radical wet and dry years influenced the growth of trees in a manner affecting the growth rings of the trees. To the archaeologist relative dating based on actual stratigraphy was vitally important, but to find a method whereby actual dates could be assigned to the Pueblo ruins and thereby determine the century or years within a century was even more acceptable. Such studies have now given dates to specific archaeological horizons extending back to A.D. 475, while unassociated timbers extend the dating back to A.D. 150. The following Pueblo ruins have been dated: Mesa Verde in southwestern Colorado, A.D. 1073–1272; in northwest New Mexico, Pueblo Bonito A.D. 919–1130; Aztec Ruin, A.D. 1110–1121, and many others with equal positiveness.

**The Anasazi.**—The Anasazi or Pueblo culture is located in what has been broadly characterized as a vast plateau ranging from 900–2,100 ft. above sea level. This terrain varies from vast open prairie to ragged mountains. Rivers and streams have eroded gorges and perpendicular canyons. The people lived for the most part on the intermediate levels where, even in this arid climate, they perfected agricultural methods to irrigate their soils for the growing of maize. This northern section contains the antecedents of all cultural horizons belonging to the division known as Anasazi. It is encompassed within an area drained by the San Juan, the Rio Grande, the Upper Gila and Salt, and the Little Colorado rivers, most of southern Utah and eastern Nevada. This Anasazi horizon has been divided, on the basis of the material culture and physical types, into two broad categories: the Basket Maker and the Pueblo groups. The earliest evidence of a semi-nomadic cave dwelling group is the Basket Maker. This has been divided into two divisions: Basket Maker and Modified Basket Maker. Here again as in other areas a hiatus of 10,000 years or more exists between the Folsom complex and earliest evidence of the Basket Maker, which may be dated approximately at the beginning of the Christian era.

The earliest evidence of the Basket Maker stage of development places them in a transitional state between a food-gathering mode of life and the very beginning of a food-producing style of existence in which agriculture played an important part. The growing of maize became the foundation for all ensuing cultures. The origin or method of diffusion of this very important cultural trait is unknown. The growing of maize imposed a more sedentary mode of life and necessitated a more permanent habitat. This factor as well as providing a stable supply of food encouraged the development of new arts and a subsequent broadening of the cultural pattern.

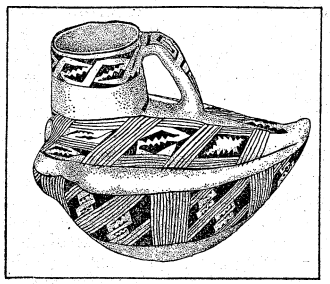
The artifacts left by these early Basket Makers are found in the lowest levels of human occupancy of dry caves and shelters. These shelters, however, served mostly as storage places for their food and seeds, which were stored in circular or oval stone-lined pits. Some of these pits were found to contain small, hard, yellow kernels of popcorn-like maize. Some of these pit granaries were also used for beds as well as places for the interment of their dead. From the skeletal material we know that they were a relatively long-headed people of short and slender stature. They were experts in the making of artistically twined woven bags and coiled baskets, sandals, fur-cloth robes, snares and nets for catching small mammals. In the planting of maize they used long, wooden, digging sticks and wooden scoops. Bone tools and curved sticks were used in dressing skins and making garments. They wore feathered headgear and comb-like ornaments as well as necklaces made from coloured stones, bones, shells and seeds. In these early levels no sign of the bow and arrow is found, but in its place is a long spear thrown with the aid of an atlatl, or spear thrower. The Basket Makers had no true fired pottery. However, near the end of this horizon a few unfired clay vessels have been found. Whether this important cultural element originated among these people as a result of lining their baskets with clay or the idea was diffused from other peoples to the south is still debatable. The clay used in the sun-dried forms was mixed with grass and cedar bark to allow for expansion and contraction. Some of the vessels which were molded in baskets extended above the sides by the addition of bands or coils of clay. Others were made without the support of baskets by the coiling process.

The most concentrated centre of this early period is found in what has been termed the Four Corners region, namely, northwestern New Mexico, southwestern Colorado, southeastern Utah and northeastern Arizona. On the basis of tree rings or dendrochronology, the Basket Makers used the caves in this region from about the 1st through the 6th centuries A.D. Elements somewhat comparable to those of the Basket Makers are found as far east as western Texas and south to Coahuila although no definite proof has been found that these cave cultures constitute a direct relationship. Other cultural lags have been identified in the Great Basin area to the north.

The Basket Maker horizon contributed one of the most important

cultural elements to the subsequent Indian tribes, namely, the beginning of a food-producing economy. Their agricultural traits consisted of at least one variety of maize, pumpkin and beans. At the present time all evidence seems to point to Mexico and Central America for the original domestication of this indigenous wild plant. The necessary steps involved as well as the method of its diffusion have not been determined. Roughly estimated, this period ranges from the beginning of the Christian era to A.D. 500.

The next important period is known as the Modified Basket Maker, indicating a basic Basket Maker culture although somewhat changed in form. The most important changes which occurred during this period are: A few undeformed round-headed individuals in contrast to the earlier long-heads; sandals made with a scalloped instead of the square toe; degeneration in twined woven bags; the making of thin fired pottery vessels; the clustering of houses to form small villages and a better developed residential architecture; the appearance of the bow and arrow; grooved axes and mauls; the domestication of the wild turkey and the growing of additional varieties of maize or corn. This period extended from approximately A.D. 500–750.



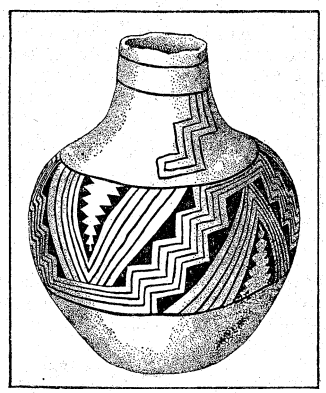
BY COURTESY OF SMITHSONIAN INSTITUTION. FROM "BULLETIN 126" OF THE BUREAU OF AMERICAN ETHNOLOGY

BIRD-SHAPED VESSEL WITH BLACK-ON-WHITE DESIGNS. DEVELOPMENTAL PUEBLO PERIOD

After the establishment of a food-producing economy and the manufacture of fired pottery vessels evidence of a new physical type is found coming into the area. The appearance of this new individual marks a new epoch in the gradual transition of this culture. Even though the changes which take place are in no sense radical, the next period has been termed Developmental Pueblo, which is dated from A.D. 750–900. Besides the influx of a people with round skulls, it has been found that some of the skulls have a definite artificial flattening at the back of the head. This deformation, which becomes more pronounced at the end of this horizon and continues in subsequent periods, is explained by the use of a rigid cradle to which the child was securely fastened. A constant pressure against the plastic skull would tend to flatten the back part of the head. By the close of the Modified Pueblo period this flattening of the skull became a standard of personal appearance. By the end of the 8th century all long-headed individuals became submerged.

Other changes in the culture consisted of: elaborate designs on the coiled rod and bundle baskets; growing of cotton and the manufacture of cotton cloth; the exclusive use of the bow and arrow; houses were built above ground in units of 6 to 14 rooms, single story in height made from stone or adobe, in some areas they retained the pole and mud and rectangular pit dwellings; many types of painted and corrugated fire-baked pottery vessels.

This now brings us to the classical or Great Pueblo period which ranges in point of time from about A.D. 900–1250. This, the best known epoch of these prehistoric people, is characterized by extreme development and local specialization in architecture and ceramics. One of the most important characteristics is the building of large multistoried apartment-like dwellings containing about 1,000 rooms, especially in Chaco canyon, the Kayenta district and at Mesa Verde. Here we find examples of the highest architectural achievements. Normally the great house is built around a court. These immense structures were usually rectangular or D-shaped and could serve as a fortress if necessary. The most distinctive type of walls consisted of very thin tabular blocks laid in horizontal bands, which provided an outside surface impervious to erosion. Those structures built in caves, such as the cliff-houses, were relatively thin and flimsy. Many theories exist as to the adoption of these large residences. At the end of the Developmental period the small unit houses were widely scattered near good farming lands. Some believe this connotes peace and freedom from attack. The arrival of foreign predatory raiders forced the Puebloans to gather in larger groups and to construct well defended communal houses; others believe that the development of the large apartment-like dwellings was a natural evolution and the product of an architectural vogue rather than fear of outside marauding groups. Within the central courts numerous types of ceremonial rooms were built. These semi-subterranean structures served as the centre for religious ceremonies. Both the small or common kiva as well as the large or great kiva are an outgrowth of similar ceremonial chambers developed in the Basket Maker period.



BY COURTESY OF SMITHSONIAN INSTITUTION. FROM "BULLETIN 126" OF THE BUREAU OF AMERICAN ETHNOLOGY

CHARACTERISTICALLY DECORATED JAR OF THE DEVELOPMENTAL PUEBLO PERIOD

Except for the architectural and ceramic developments, very few new traits occur during this horizon. The growing of cotton and loom weaving were the only basic items which had been added to the previous lists. Nevertheless considerable improvements were made in the material culture.

BY COURTESY OF SMITHSONIAN INSTITUTION. FROM "BULLETIN 100" OF THE BUREAU OF AMERICAN ETHNOLOGY

A PAINTED PITCHER FROM ONE OF THE CLASSICAL OR GREAT PUEBLO PERIOD SITES IN EASTERN ARIZONA

By the end of the Great Pueblo period various forces caused a general breakdown within the culture centres. This period is known as the Regressive Pueblo, extending from A.D. 1250–1400. There occurred a complete abandonment of the large pueblo structures and the population shifted to the south and southeast, those localities where the first Spanish explorers encountered them and in the general regions where the descendants now make their homes. The entire culture was in a state of flux. Whether this was due to recurring droughts or influenced by pressure of nomadic groups has not yet been determined. The most important settlements, during the transitional period, were made along the Rio Grande river in eastern New Mexico and the Little Colorado river in Arizona.

After the people became established in their new environments many of the older cultural traits with a strong social and religious organization became re-established. The people were tending toward a renaissance. This revival took place from about A.D. 1400–1700. The coming of the Spanish explorers and the subsequent conquest by the Europeans ended the further development of the aboriginal cultural pattern.

From A.D. 1700 to the present is known as the Historic Pueblo. Here we find both the deformed and undeformed crania; the use of moccasins in place of the sandal; baskets of wickerwork and plaited yucca leaves; cotton, wool and commercial textiles of European manufacture; bow and arrow, throwing clubs and European guns; villages of terraced houses and single units such as those of the modern Hopi towns, Acoma, Zuni and Taos.

**The Hohokam.**—Another important series of prehistoric cultural developments is termed the Hohokam. The evidence for the reconstruction of these people has been found in the general area bordered by the Colorado river on the west, the New Mexico state line on the east, and from Flagstaff, Arizona, on the north to the upper part of the state of Sonora in Mexico. The main centre is concentrated along the middle Gila basin.

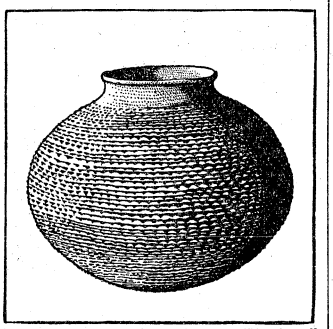
The earliest evidence of these people would seem to indicate a sedentary type of subsistence, based on shaped metates for the grinding of maize. This early horizon is known as the Pioneer. The people lived in houses made from poles, brush and mud plaster, the roof supported by four posts, vestibule on one side, square in plan and about 40 ft. across. They made thin plain and red fired pottery vessels. Their crops were watered by means of flood water irrigation. The bodies of the deceased were cremated and the ashes buried in pits. During this period the houses became smaller and more rectangular in shape and the pottery instead of being plain had decorative designs painted on the surface.

As this pattern of culture developed, other changes were made; new features were incorporated into the construction of their houses; the four posts supporting the roof were reduced to two near the ends of the rectangular houses, and these posts supported a ridge pole. The interiors were not plastered but lined with reeds. Each of the dwellings constituted a unit in the village which was scattered over the semi-arid valleys. Their food-producing fields were irrigated by ditches. The dead continued to be cremated. Ceramic and other industries advanced and became more and more standardized. This horizon is termed Colonial.

The stage known as the Sedentary is marked by new features: The villages were concentrated in smaller areas; two types of houses were constructed, a rectangular one over a shallow pit, with four roof supports, and a similar one built on the surface of the ground, with the framework covered with grass and daubed with mud; some of the villages were surrounded with a compound wall; the irrigation system was enlarged; the ashes of the dead were placed in pottery urns instead of a pit; the forms of pottery vessels were changed. During this Sedentary period and perhaps going back to the end of the Colonial a most unusual type of feature has been recovered, namely, ball courts, or at least structures very similar to those used in Middle America. This implies some connection with the Mexican area to the south. They are the only structures of this nature found north of the Mexican border.

The Classical period, which follows the Sedentary, is interesting because of the evidence showing an invasion of Anasazi people from the plateau country to the north. Even though the people lived side by side, each maintained its distinctive cultural patterns and the association was of such a short duration that no extensive borrowing or hybridization took place. Pueblo structures of stone and adobe were built within the Hohokam communities. The Hohokam cremated their dead while the Anasazi interred their deceased intact. Both Hohokam

and Anasazi types of pottery were used. The great irrigation systems along the Gila and Salt rivers were completed. After a span of about 100 years the Anasazi withdrew to the north while the Hohokam continued to live along their irrigated fields. Because of the seemingly peaceful invasion and on the basis of the Anasazi material culture, a tentative date for this phase in the Hohokam development has been given from about A.D. 1325–1425.



FROM BUREAU OF AMERICAN ETHNOLOGY "REPORT"

VASE FROM PUEBLO VIEJO, GILA VALLEY, ARIZONA

Little is known of the following period, termed Recent, except that the houses were possibly of pole, brush and clay, the dead continued to be cremated, and the pottery vessels were quite plain, resembling the ware of the modern Pima and Papago Indian tribes.

The Modern and last stage of the culture is represented by the Pima and Papago Indian tribes. Some believe that these modern Indians are the descendants of the older Hohokam. Others consider them a mixture of the Hohokam and more recent migrants from outside the area.

**The Mogollon.**—A third prehistoric pattern of semi-sedentary peoples is called the Mogollon. These inhabited an area centring in the San Francisco and Mimbres river valleys in southwestern New Mexico. Even though preponderantly dependent on agriculture, they supplemented their diet by the hunting of game.

As a whole the developmental stages represented by these people seem to compare with both the Anasazi to the north and the Hohokam to the west. The various phases have been designated as the Georgetown, San Francisco, Three Circle, Mimbres, and the most recent, Animas. The Georgetown period existed prior to the 9th century A.D. The first type of dwellings were deep pit-houses changing from round to rectangular pits with a pole, brush and plaster superstructure, the roof supported by a single post. Associated with the dwellings were ceremonial chambers analogous in type to the kiva structures among the Anasazi. Later houses had shallow pits and finally came the many-roomed, single-storied pueblo type of house. After this the territory was abandoned, the people migrating south to northern Chihuahua, Mexico. The subsequent inhabitants, in the Animas period, consisted of a pueblo-building group with a mixed cultural pattern. Disposal of the dead was usually by inhumation between the houses at first, and later burials were made beneath the floors of houses. Some bodies were cremated, as among the Hohokam. The skulls of the earlier people were low-vaulted, undeformed, round heads, while those buried under the pueblo type houses had high vaults, deformed, round heads. Pottery was made by the coiling process and then smoothed and rubbed. The greatest variations occur in the painted vessels. During the Mimbres period the pottery shows influences from the Hohokam and Anasazi cultures. Some of the earlier forms show some resemblance to pottery forms and decorative techniques comparable to vessels from the Mississippi valley. Certain developmental changes took place in their pipes, metates, mauls, bowls and other artifacts of stone, whereas numerous forms again show the influence from the Anasazi and Hohokam centres.

Besides the three more or less sedentary permanent house and village groups, the peripheral areas were occupied by semi-nomadic peoples. These are represented at least in modern times by the Navaho in central districts surrounding the Anasazi group, the Apache in the south, and the Shoshone along the western peripheries.

## THE MISSISSIPPI VALLEY

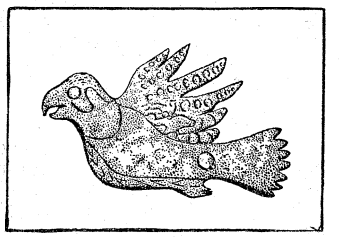
The prevalence of burying their dead in earth mounds, some of which, because of their size, were obvious to the early explorers and European settlers, caused the prehistoric cultures within the Mississippi valley to be given the general name of Mound-builders. Throughout the broad expanse of the Mississippi river drainage there are to be found prehistoric people adapting themselves to the ecological factors of the region. Here the rivers served as highways and the most prolific concentrations of prehistoric villages were located within the broad valleys of the numerous streams and rivers.

After the discovery of the distinctive type of Folsom projectile in association with extinct forms of animals, most of the museums throughout the Mississippi valley were amazed to find comparable types in their miscellaneous collections. A sufficient number have been found in Ohio, Virginia and other states to indicate the wide dispersal of this early horizon throughout the area. None of these points was found associated with any of the later archaeological complexes, but constituted arrowpoints collected from the surface.

As indicated in the other cultural centres, a considerable hiatus exists between this Folsom complex and the more sedentary type of prehistoric cultures. The following described cultures do not antedate A.D. 500. The centuries given for the various manifestations are purely relative. Thus far the dendrochronological studies have not advanced sufficiently to give actual years to the excavated sites. The environment, types of trees used, and method of interment do not preserve the wood to the same extent as in the semi-arid Southwest.

Many names have been assigned to the variety of archaeological remains recovered within the Mississippi valley. Those sites producing objects of European origin are considered protohistoric.

**Hopewellian Phase.**—Various phases have been determined for classification purposes and these have been subdivided in order to compare the archaeological specimens and determine their relationship. One of the most widespread archaeological manifestations throughout the northern and southern Mississippi valley is termed the Hopewellian phase. It represents one of the earliest of the sedentary groups. The most important diagnostic traits distinguishing it from other cultures found within the valley are: Realistically carved stone platform pipes, cut and hammered copper plates, modelling and painting miniature human figures in clay, intricate variety of woven textiles, conventionalized and realistic design patterns incised on pottery vessels. Much of the material used to portray their artistic talents as well as other artifacts in their culture came from widespread areas. Obsidian, a black volcanic glass, was brought into the Ohio valley from northwestern Wyoming, native copper from the Lake Superior region, barracuda jaws and conch shells from the Gulf of Mexico, mica, in large sheets, from North Carolina. These Ohio people also made good use of the pearls from the nearby freshwater molluscs, colourful flint from outcrops in southern Ohio, as well as the native pipestone for the carving of their animal and bird pipes. Thus far the excavations in southern Ohio, one of the most important centres of this culture, have been confined to the large burial mounds; therefore most of the analysis of the evidence is based on the objects buried with the dead. Burial consisted of a complex mortuary ritual. About 65% of the bodies were cremated and the ashes and unburned fragments of bones were placed in well prepared graves. The remaining 35% were buried extended in the flesh in similarly prepared graves. The bodies or ashes were usually surrounded with a rectangular cribbing of logs and covered with brush or bark, then covered with earth. A considerable number of these adjoining graves were in turn covered with a mound of earth extending 15 ft. or more in height and about 50–75 ft. in diameter. When two or more such mounds were built adjacent to each other they too would be covered with an additional mound, making a large single tumulus 25–30 ft. in height and from 200–300 ft. long and 100 ft. wide. Many smaller mounds were erected within a given area and these were surrounded by earth embankments. These embankments were designed as geometric patterns. On the basis of the evidence thus far produced, the construction of these large mounds, hundreds of small mounds and the surrounding earthworks must have required a relatively dense population and a well co-ordinated society which would also prescribe a relatively stable economy based on intensive horticulture. Hunting and fishing provided a varied diet. The society must have supported the sculptors and modellers, as evidenced by the number and excellence of the Hopewellian objects of art. To have obtained and transported the raw materials such as obsidian, copper, mica and gulf coast shells required time and encouraged explorations. The construction of the large mortuary tombs postulates a well developed ritual associated with considerable religious fervour. If these factors were due to a restricted ruling class, it must have dominated the greater portion of the central Mississippi valley. Even though no evidence has been found which can be identified with any of the higher culture centres in Mexico or Yucatan, the political organization may have been comparable to the autocratic forms in these areas. Such objects as copper head ornaments, coloured woven garments decorated with hundreds of fresh-water pearls and intricately cut mica, copper axes, black obsidian spear points, copper ear ornaments, and grizzly bear teeth necklaces would certainly clothe a person in a manner that would set him apart from one wearing only a breech cloth and copper ear spools.



BY COURTESY OF OHIO STATE ARCHAEOLOGICAL AND HISTORICAL SOCIETY

FLYING EAGLE, 12½ IN. LONG, MODELLED IN COPPER, FROM THE MOUND CITY GROUP OF OHIO

One of the most interesting problems associated with this manifestation is its origin and distribution. On the basis of pottery decoration, platform pipes, simple earth embankments, mound burial, and a few other traits, a somewhat related group inhabited east central Louisiana. Other elements of comparison to the southern Ohio centre have been found in northern Indiana, central Illinois, eastern Iowa, western Wisconsin, and as far west as Kansas City, Missouri.

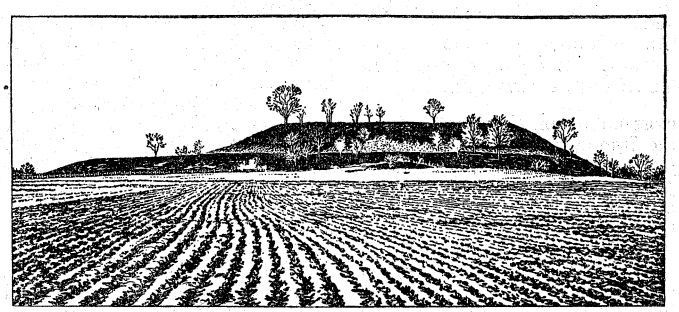
**Adena Phase.**—Another prehistoric manifestation which recent excavations in Kentucky have shown to be somewhat related to the foregoing Hopewellian people has been called the Adena phase. The important burial traits consist of groups of two or more conical shaped burial mounds containing the remains of several individuals placed therein at different periods of time. However, they customarily consist of a central subfloor pit surrounded by wooden timbers. Numerous objects of copper, such as bracelets and finger rings, were worn at the time of burial. Pipes were usually made in the form of a simple tube. In one instance this tube was incorporated within a carved

full length human figure. Except for copper, very few objects were made from material foreign to the Ohio valley. Some of the incised designs on pottery from the Adena sites in Kentucky are comparable to those from Hopewellian sites in Louisiana. The use of tobacco, as evidenced from their pipes, the building of large mounds associated with specialized mortuary custom, together with other traits would imply a rather well organized society of a sedentary nature. To what extent the Adena phase may be related to the Hopewellian phase is undetermined; nevertheless their traits are more comparable to each other than to any of the later prehistoric groups. Here again it is impossible to give a specific period of time for the Adena culture. It is assumed, since no evidence of European trade objects has been recovered in their sites, that they lived along the drainage of the Ohio river before the 18th century and may have been contemporaneous with the Hopewellians.

BY COURTESY OF OHIO STATE ARCHAEOLOGICAL AND HISTORICAL SOCIETY

TUBULAR EFFIGY PIPE FROM AN ADENA MOUND IN OHIO

**Mississippi Phases.**—Herein are grouped a number of somewhat divergent and yet closely related archaeological manifestations. Their relationship to the preceding cultures is somewhat apparent in the southern portions of the Mississippi valley and quite dissimilar in the regions north of the Ohio and Arkansas rivers. At the present time the better known complexes are termed the Middle Mississippi and Upper Mississippi phases. As a whole these cultures are relatively recent, in most cases prehistoric yet later than the Hopewellian and Adena phases. Neither the Middle nor the Upper Mississippi phases existed much before A.D. 1400. The Middle Mississippi group centred between the mouth of the Arkansas northward to the Missouri and Ohio rivers. An eastward extension ranged along northern Mississippi, Alabama, into Georgia and Florida. The Ozark mountains seemed to confine its westward expansion; nevertheless important sites such as the famous Cahokia mounds in East St. Louis, Illinois, and the Angel and Kincaid sites in southern Illinois and Indiana were built by these people. The most important generalized traits consist of the use of earth mounds as foundation platforms on which their temples, chief's house and other ceremonial structures were built. These rectangular truncated pyramids reveal a series of superimposed floors and evidence of structures showing a distinct tendency of rebuilding at the same site.

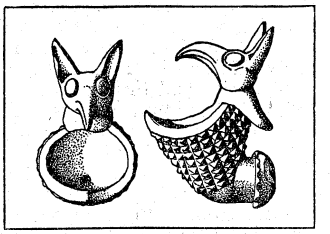


FROM "PAPERS" OF THE PEABODY MUSEUM

CAHOKIA MOUND, IN ILLINOIS, LOOKING WEST; THE LARGEST PREHISTORIC EARTH-WORK IN AMERICA

These mounds, seldom used for mortuary purposes, are grouped around a plaza. The houses built on their summits were also rectangular in shape, consisting of a single room with walls of bent pole framework covered with cane-thatch or clay. The deceased were usually buried in cemeteries or around the village sites. They made large chipped stone implements for agricultural purposes as well as highly polished celts such as the monolithic ax. Circular discoidal stones were beautifully shaped and polished and used in one of their games. They also carved a few stone vessels and some human statues. Many objects used for fishing, preparation of skin and woven garments, and other utilitarian purposes were made of shell, bone and horn. The large conch shells were cut and carved to form ornaments suspended from the neck. Some of the designs carved on these shells are reminiscent of art forms from prehistoric sites in Mexico.

The pottery made by these people excels that of all other horizons both in the wide variety of forms and in painted decorations on their vessels. Pottery was also used for making pipes, figurines, rattles, ear ornaments, beads and disks. Their vessels consisted of plain type used for utility purposes and the polished ware, some engraved, others painted to produce a red ware, red and white, red, white, and black, and a lost colour technique. A heavy textile impressed pottery was used for the evaporation of liquids, sometimes called salt pans. Wherever stratigraphy has been established the Middle Mississippi overlies the other prehistoric cultures and just prior to those of an early European contact period such as the historic Choctaw, Caddo, Tunica and Natchez Indians. This would establish a period ranging from about the 14th to 18th century A.D.



BY COURTESY OF MUSEUM OF THE AMERICAN INDIAN

EARTHENWARE EFFIGY PIPE FROM THE NACOOCHEE MOUND, IN GEORGIA

The Upper Mississippi phase as in contrast to the Middle Mississippi phase extends north of the junctions of the Ohio and Missouri rivers with the Mississippi. The greatest concentrations have been found in the southern half of Ohio, southeastern Indiana, northeastern Ohio and western New York, eastern Iowa, Minnesota and central Wisconsin. Extensive village sites as well as mortuary mounds have produced the cultural traits for these late prehistoric people. In the Madisonville site in southern Ohio a few glass beads and iron axes were recovered, indicating a distant contact with early European explorers.

The thousands of small mounds as well as their village sites were used for the disposal of the dead. In contrast to the highly developed mortuary customs of the Hopewellians, among these Upper Mississippi people the deceased were buried in the flesh in the most convenient type of grave, soon after death, and forgotten. Some bodies were tightly flexed and placed in abandoned storage pits, while others were placed extended in rectangular graves. Subsequently storage pits were dug through these graves.

The material culture was largely of a utilitarian nature; very few examples of outstanding artistic merit have been recovered. Their stone objects consisted of small triangular flint projectile points, triangular knives, stone mortars and bell-shaped pestles, chipped and polished celts, and grooved club stones and hammers. Bone was used for every conceivable purpose—fishhooks, harpoons, needles, pins, awls, chisels, scrapers, tools for flaking arrowheads, animal shoulder blades were used for hoes, while other bones were made into whistles, flutes, beamers for preparing skin garments, etc. Shells from the native mussels were adapted for hoes, scrapers, neck ornaments and beads. The fired pottery vessels are quite distinct from the Middle Mississippi and preceding cultural groups. The clay was mixed with both powdered shells and fine grained sand to prevent cracking. Most of the vessels are jars with four or more strap handles. The decoration is primarily incised curvilinear or rectilinear patterns around the upper half of the vessel. The hundreds of cache pits which dotted their village sites were used for the storing of cultivated maize and beans. Here is found evidence of a domesticated dog, often buried with his master.

FROM BUREAU OF AMERICAN ETHNOLOGY "REPORT"

VASE WITH INCISED DESIGN FROM THE LOWER MISSISSIPPI VALLEY

The above evidence indicates a rather large concentrated population widespread throughout this northern Mississippi watershed. Most of their artifacts were made from local materials. Their villages are located in most of the valleys previously occupied by the Hopewellians, and herein we find some evidence of definite superimposition or burials made in the tops of the large Hopewell mounds.

Because a few objects made from European material were recovered from an important village of this group, various attempts have been made to identify the occupants or their descendants with some of the historic Indians visited or described by the first European explorers coming into the Ohio river region. Some believe the location of Mosopelia, as given on maps representing the area in the latter half of the 17th century, to correspond with the site at Madisonville, Ohio. If this hypothesis is correct it would identify the Upper Mississippi people as ancestors of the widely dispersed Siouan groups of historic times. Others imply from the archaeological evidence that the Upper Mississippi phase may represent the ancestors of the Algonquian linguistic stock.

Many of the archaeological manifestations to the west and north, especially those in the Great Plains, which will be described in the next section, seem to have had their original cultural stimulus emanating from the Mississippi river valley.

No attempt has been made to describe all of the cultural variations within the Mississippi valley. The following manifestations will summarize the various archaeological horizons: (1) Prepottery horizons, represented by the builders of extensive shell mounds along the Tennessee river in northern Alabama, Green river, Kentucky and along the falls of the Ohio river in southern Indiana. Along the middle Tennessee river drainage basin these shell mound cultures underlie all other archaeological manifestations. (2) The cave cultures in southern Ohio, Illinois and Kentucky as well as comparable remains in the Ozark mountains area of Arkansas. (3) Hopewellian, Copena and Adena phases. (4) Mississippi phase. (5) Historic period.

## GREAT PLAINS

This area encompasses the states east of the Rocky mountains from the Canadian border to the mouth of the Arkansas river. The areas most densely inhabited by prehistoric Indians are those within the region drained by the Missouri and Arkansas rivers and their tributaries. Here as in the Mississippi valley the rivers and streams served as highways and their arable stream valleys provided the soil for the Indians' agricultural pursuits. The chief attraction to aboriginal man, however, were the vast herds of buffalo and other animals.

The variable climatic conditions ranging from the Missouri river to the high plains east of the Rocky mountains had a definite influence on the economy and cultural manifestations of the various archaeological groups. In historic times the Great Plains were inhabited by some 30 historic Indian tribes, such as the great buffalo hunting groups known as the Dakota, Arapaho, Cheyenne, Kiowa, Apache and Comanche. They are characterized by their complete dependence upon the buffalo, and by the skin tepee, dog and later the horse, specialized talent in working skins, numerous men's societies, the Sun Dance and scalp dances. As a result of the adoption of the horse they developed a nomadic food-gathering economy. Farther east, along the Missouri river, were the more sedentary Indian tribes belonging to the Caddoan and Siouan linguistic groups. They lived in grass, bark and earth houses, had pottery and raised maize, which gave them a more stable economy. Because of their large villages inhabited over long periods, more evidence is available for historical reconstructions.

Since the tribes inhabiting the Great Plains were in contact with whites for a considerable period of time during America's westward expansion, many opportunities are offered to complete the record between the last portion of the prehistoric era and the beginning of the historic period. It has not been possible, however, to link the antecedents of all the tribes inhabiting the area either as buffalo hunters or the food-producing sedentary groups. In the case of the Pawnee, excavations of historically documented sites have provided the material culture which has served as distinct indicators for the protohistoric sites, as well as the general antecedents of the Pawnee tribes. Similar studies have been advanced for the Omaha, Mandan and Cheyenne groups.

Within this area have been found sites producing the association of man made objects with now extinct forms of mammals. This has been described in the section on Folsom Man. The next dramatic act of prehistoric man shifts to the east of the high plains along the fertile river valleys, where man could develop a more sedentary form of life by growing maize and beans as well as hunting the bison. How many centuries elapsed between the nomadic Folsom hunters and the raising of domestic food plants is unknown. From the evidence recovered in the Southwest, and allowing ample time for the spread and adaptation of maize and bean cultivation, one may assume that this took place some time after A.D. 500.

The principal semi-sedentary prehistoric horizons within the Great Plains are distantly related to those manifestations east of the Mississippi river. The same temporal position of sequence of cultures occurs in the Great Plains as in the Mississippi valley. A so-called Woodland manifestation underlies all other prehistoric horizons. These sites are small, giving the impression of people from the upper Mississippi river and Great Lakes region pushing into what was to them an unknown land. The sites occur along old stream beds sometimes covered to a depth of 25 ft. The post hole patterns from their houses indicate a thatch type of structure comparable to eastern rather than western forms. Traces of squash and gourds have been found, but no direct evidence of maize cultivation. The stone work consists of roughly made knives and picks. Needles and bone awls were common. Their pottery comprised small to medium sized thin-walled jars with scalloped or incised decorations around the rims. Ceramic forms differ considerably in various sections. Lack of burials prevents a comparison of the physical types.

Some of the sites around Kansas City, Missouri, and extending as far west as Peru, Nebraska, have contained assemblages of cultural material comparable to some of the Hopewellian sites in eastern Iowa and western Wisconsin and Illinois. Although these do not contain all the elements described in the previous section on the Hopewellian phase, they nevertheless indicate a western dispersal of some of the characteristic elements.

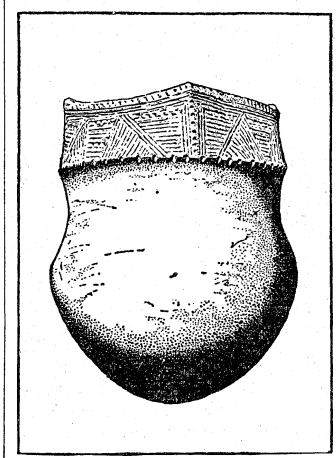
Following the Woodland and Hopewellian horizons, in point of time, are people of a more firmly established occupancy. Because of their wide distribution and prolonged tenure, several distinct variations developed. All of these widely dispersed groups had the following traits in common: A food-producing economy based on maize, beans and squash as the staple crops; a semi-permanent earth lodge subrectangular in shape; several such houses constituted a village, surrounded by their cultivated fields with no apparent attempt at concealment or fortification. This has led to the assumption that considerable freedom was enjoyed by these agriculturists of the Great Plains; the ceramic ware produced at this period differs in form and decoration from the Woodland peoples; the large assortment of implements made from bone, stone, shell and horn provides additional traits of similarity among themselves.

The following cultural divisions have been determined which formed the basic elements out of which the protohistoric and finally the well known historic groups of Indians developed: Upper Republican phase, ancestors of the Pawnee, Arikara and Mandan tribes; Nebraska and Plains-Mississippi phase, largely responsible for the sedentary Siouan groups; Mill Creek phase in the northern Great Plains, out of which developed the Assiniboine, Eastern Dakota, Chippewa and Cheyenne Indians.

The coming of European explorers ended one of the highest cultural attainments of the Great Plains village groups. It also ushered in a period of widespread unrest culminating in the rise and menace of nomadic groups. The adoption of the horse and firearms simplified their dependence on the vast bison herds to such an extent that the region became peopled largely by the roving bands of hunters, forcing the village tribes into small isolated groups along the eastern fringes of the Great Plains.

## THE NORTH ATLANTIC AREA

This culture area, sometimes divided into two at the Delaware valley and sometimes into still lesser areas, may be regarded as extending from Newfoundland and the St. Lawrence valley in the north to Georgia in the south, and as including the maritime provinces of Canada, New England, New York, Pennsylvania, Maryland and large portions of Virginia, West Virginia, the Carolinas, the northern part of the territory extending inland indefinitely to the north and west, and its southern part extending westward to the Appalachian mountains. The tribes were chiefly those of the Algonkin, Iroquoian and Siouan stocks of historic times, and save for certain shiftings of boundaries and the extinction especially of most of the Algonkin and Siouan members, the archaeological and known linguistic areas may be regarded as practically coextensive. The forests and highlands afforded excellent hunting; the many rivers and bays, and the sea itself, offered an abundance of fish and shellfish, and while agriculture was practised, it was subordinate to fishing and the chase. Shellfish (oysters, clams, mussels, scallops, whelks, cockles) formed an important part of the diet, as shown by the almost numberless shell refuse heaps along the coast and the tidewater bays, rivers and inlets. One heap at Pope's creek on the Potomac in Maryland, consisting of oyster shells, covered about 30 acres.



FROM BUREAU OF AMERICAN ETHNOLOGY "REPORT"

AN IROQUOIS VASE, 13 IN. IN HEIGHT, FOUND IN A GRAVE IN NORTHERN PENNSYLVANIA

The dwellings of the ancient Indians of the North Atlantic area probably varied in no respect from those of early historic times. Stone as a building material was almost unknown, construction being of wattlework, bark and mats, and the Iroquois villages were often protected with stockades. Cache pits for storage were used in the central part of the area, centring in New Jersey. Some of the houses, as those of the Iroquois, the Mohican, and of Virginia and North Carolina tribes, were of the community type, those of the Iroquois (the well known "long-houses") being 50 to 100 ft. long and 16 to 18 ft. wide.

Burial customs varied more or less with locality, but interment was the usual practice; sometimes the corpse, fully clothed, was placed in the grave in a sitting posture. The custom of the Algonkin and Iroquois tribes from the St. Lawrence to the Delaware was to wrap the corpse and to bind the legs against the trunk, and sometimes, except among the early Algonkins who rarely practised the custom, the implements, utensils and ornaments of the departed were buried with his remains. Interment of dogs, sometimes with the human dead, was common. In the Iroquois area especially the bones of the dead were periodically gathered from their graves and deposited in ossuaries lined with furs and covered with brush and earth, but this was not an Algonkin custom. Among the Powhatan tribes of Virginia two methods of disposal were practised in prehistoric times as well as at the beginning of the Colonial period—the bodies of important men were wrapped and placed on platforms in the "temples," and probably afterward gathered and buried while those of ordinary people were at once inhumed.

In the lower Penobscot valley, in Maine, it was an ancient custom to place quantities of red hematite paint in the graves and to deposit with the dead certain exceptional stone objects only—long slender celts, gouge-adzes, and slate points of bayonet shape, resembling those of the Eskimo. In the abundant shell-heaps of the region such slate points are unknown, and the other implements are either scarce or entirely lacking, whereas bone and shell objects so common to the shell-heaps are not found in the graves. These conditions have given rise to the designation "Red-paint people" to distinguish the earlier from the later inhabitants, not alone because the graves of the ancients contain the hematite deposits, for a similar custom was practised elsewhere in New England as late as Colonial times. There are certain indications that point to relationship with the extinct Beothuk of Newfoundland, as well as with the Algonkin culture of New York.

The ceramic art of the North Atlantic area was somewhat rudimentary in comparison with that of other cultures, yet the cooking utensils and the trumpet-like smoking pipes of the Iroquois display considerable taste, and the pipes especially were often elaborately decorated with modelled life forms of miniature jars. The typical Virginian pipe with long stem and upturned bowl, taken to England by early colonists along with the first tobacco, gave form to the clay pipe of the colonial times. The chief distinguishing features of the ancient earthenware vessels of the Iroquois of New York and Pennsylvania are a conical base, constricted neck, and flaring squarish collar usually embellished with an incised rectilinear pattern and sometimes with modelled heads and figures in relief. In the marginal regions—New York bay, Long Island, the lower Hudson valley, Connecticut and Rhode Island—the Algonkin pottery, otherwise usually plain in form and simply decorated by incising or with fabric or cord-marked impressions, often shows Iroquois influence.

Stone objects consisted of the pecked and polished celt-hatchet, grooved axe, chisel, pick, gouge-adze, mortar, long cylindrical pestle, knife and spearhead of slate, and hammer-stone; of these the gouge-adze is of exceptional excellence. Chipped stone implements of all the ordinary types (knives, projectile points, drills, etc.) were plentiful; objects of the same material used as ornaments or in ceremony were bannerstones, bird-shaped stones, "plummets," tubes, pierced gorgets, etc. Not all of these objects are found throughout the area, their distribution depending on the varying sub-cultures of the former tribes and their chronological sequence. Human effigies of stone are rare. Soapstone (steatite) abounds, and owing to its suitability and the ease with which it may be fashioned, it was extensively quarried with stone pickaxes and chisels for manufacturing cooking-pots, smoking pipes and ornaments. Objects of bone, especially in the Iroquois area, are rich in form and variety. Mica was mined in Virginia and North Carolina for use especially in making ornaments and mirrors, and it became an important medium of trade over a wide area, great quantities having been recovered from Ohio mounds. Argillite, jasper and rhyolite were quarried in New Jersey, Pennsylvania and New York, and quartz and quartzite boulder deposits in the District of Columbia and elsewhere for chipping into prodigious numbers of implements and weapons, especially arrowpoints and celt-hatchets (tomahawks). Engraved conch-shell gorgets of Virginia and the Carolinas suggest culture intrusion from the west. Water transportation was by dugout and bark canoes. Petroglyphs, or rock-writings, are rather common, the most noted being Dighton Rock in Taunton river, Massachusetts.

BIBLIOGRAPHY.—The following list of references has necessarily been selected from the hundreds of publications covering the archaeological areas in North America. After the more generalized publications, which encompass several cultural areas, the publications have been grouped under the headings as used in the text. Most of the publications cited contain additional bibliographies which would provide more detailed accounts of the specific cultural complexes. The more generalized publications are: *Handbook of the American Indians,* Bull. 30, Bur. Amer. Ethnol. (1907–10); Cyrus Thomas, *Report on the Mound Explorations of the Bureau of Ethnology,* 12th Ann. Rep., Bur. Amer. Ethnol. (1894); various authors, *Essays in Historical Anthropology of North America,* Smithsonian Misc. Coll., vol. 100 (1940); various authors, *The Maya and Their Neighbors* (1940); Clark Wissler, *The American Indian,* 3rd ed. (1938); A. L. Kroeber, *Cultural and Natural Areas of Native North America* (1939).

Publications treating specifically with the culture areas are:

*North American Palaeo-Indian.*—Ernst Antevs, "Climate and Early Man in North America," *Early Man* (1937); Kirk Bryan, "Geologic Antiquity of Man in America," *Science,* vol. 93, no. 2422 (May 30, 1941); *idem,* "Geology of the Folsom Deposits in New Mexico and Colorado," *Early Man* (1937); Kirk Bryan and Louis L. Ray, *Geologic Antiquity of the Lindenmeier Site in Colorado,* Smithsonian Misc. Coll., vol. 99, no. 2 (1940); M. R. Harrington, *Gypsum Cave, Nevada,* Southwest Mus. Papers no. 8 (1933); Frank C. Hibben, *Evidences of Early Occupation in Sandia Cave, New Mexico, and Other Sites in the Sandia-Manzano Region,* Smithsonian Misc. Coll., vol. 99, no. 23 (1941); Edgar B. Howard, "Evidence of Early Man in North America," *Museum Journal,* Univ. of Pennsylvania, vol. 24, nos. 2–3 (1935); A. E. Jenks, *Pleistocene Man in Minnesota* (1936); F. H. H. Roberts, Jr., *Archaeological and Geological Investigations in the San Jon District, Eastern New Mexico,* Smithsonian Misc. Coll., vol. 103, no. 4 (1942); *idem, Recent Evidence Relating to an Early Indian Occupation in North America,* Proc. 8th Amer. Sci. Cong., 1940 (1942); *idem, Developments in the Problem of the North American Palaeo-Indian,* Smithsonian Misc. Coll., vol. 100 (1940); *idem, The Folsom Problem in American Archaeology,* Ann. Rep., Smithsonian Inst. for 1938 (1939); *idem, Additional Information on the Folsom Complex,* Smithsonian Misc. Coll., vol. 95, no. 10 (1936); Alfred S. Romer, "Pleistocene Vertebrates and Their Bearing on the Problem of Human Antiquity in North America," *American Aborigines* (Toronto, 1933); H. C. Shetrone, "The Folsom Phenomena as Seen from Ohio," *Ohio State Arch. and Hist. Quarterly* (July 1936).

*Alaska.*—Kaj Birket-Smith, *The Eskimos* (1935); Franz Boas, "Relationships Between North-West America and North-East Asia," *The American Aborigines,* Univ. of Toronto Press (1933); *idem, The Central Eskimo,* 6th Ann. Rep., Bur. Amer. Ethnol. (1888); H. B. Collins, Jr., *Outline of Eskimo Prehistory,* Smithsonian Misc. Coll., vol. 100 (1940); *idem, Archaeology of St. Lawrence Island, Alaska,* Smithsonian Misc. Coll., vol. 96, no. 1 (1937); Ales Hrdlicka, *Catalog of Human Crania in the United States National Museum Collections: Eskimo in General,* Proc. U. S. Nat. Mus., vol. 91, no. 3131 (1942); *idem, Anthropological Survey in Alaska,* 46th Ann. Rep., Bur. Amer. Ethnol. (1930); Diamond Jenness, *Prehistoric Culture Waves from Asia to America,* Journ. Washington Acad. Sci., vol. 30, no. 1 (Jan. 15, 1940); *idem,* "The Problem of the Eskimo," *The American Aborigines, Their Origin and Antiquity* (1933); Waldemar Jochelson, *Archaeological Investigations in Kamchatka,* Carnegie Instit. (1928); *idem, Archaeological Investigations in the Aleutian Islands,* Carnegie Institution (1925); Frederica de Laguna, *The Archaeology of Cook Inlet, Alaska* (1934); Therkel Mathiassen, *The Eskimo Archaeology of Greenland,* Ann. Rep., Smithsonian Inst. for 1936 (1937); *idem, Archaeological Collections from the Western Eskimos,* Rep. of Fifth Thule Exped., 1921–24, vol. 10, no. 1 (Copenhagen, 1930); *idem, Archaeology of the Central Eskimos,* Rep. of Fifth Thule Exped., 1921–24, vol. 4 (Copenhagen, 1927).

*Northwest Coast.*—Franz Boas, *The Kwakiutl of Vancouver Island,* Memoir, Amer. Mus. Nat. Hist., vol. 8, pt. 2 (1909); *idem, The Decorative Art of the Indians of the North Pacific Coast,* Bull. Amer. Mus. Nat. Hist., vol. 9, art. 10 (1897); Diamond Jenness, *The Indians of Canada,* Nat. Mus. of Canada, Bull. 65 (Ottawa, 1932).

*Intermontane.*—Ernst Antevs, *On the Pleistocene History of the Great Basin,* Pub. 352, Carnegie Inst. of Washington (1925); L. S. Cressman *et al., Archaeological Researches in the Northern Great Basin,* Pub. 538, Carnegie Inst. of Washington (1942); John Gillin, *Archaeological Investigations in Central Utah,* Peabody Mus. Papers, vol. 17, no. 2 (1941); Neil M. Judd, *Archaeological Investigations at Paragonah, Utah,* Smithsonian Misc. Coll., vol. 70, no. 3 (1919); *idem, Notes on Certain Prehistoric Habitations in Western Utah,* Proc. 19th Internat. Cong. of Americanists, Washington, 1915 (1917); Leonard L. Leh, *Prehistoric Pueblo Ruins in Range Creek Canyon, Utah,* Univ. of Colorado Studies, vol. 23, no. 2 (Jan. 1936); Robert H. Lowie, *Notes on Shoshonean Ethnography,* Anthrop. Papers, Amer. Mus. Nat. Hist., vol. 20 (1924); *idem, The Cultural Connection of California and Plateau Shoshonean Tribes,* Univ. of Calif. Pub. in Amer. Arch. & Ethnol., vol. 20 (1923); Noel Morss, *The Ancient Culture of the Fremont River in Utah,* Peabody Mus. Amer. Arch. and Ethnol., vol. 12, no. 3 (1931); A. B. Reagan, *Additional Archaeological Notes on the Uintah Basin in Northeastern Utah,* Transactions, Kansas Acad. Sci., vol. 37 (1934); Elmer R. Smith, *Areas of Prehistoric and Historical Settlements in Utah,* Proc., Utah Acad. Arts, Sci. & Letters, vol. 17 (1940); J. H. Steward, *Native Cultures of the Intermontane (Great Basin) Area,* Smithsonian Misc. Coll., vol. 100 (1940).

*Southwest.*—Ernst Antevs, "Dating Records of Early Man in the Southwest," *The Amer. Naturalist,* vol. 70, no. 729 (July–Aug. 1936); J. O. Brew, "Mexican Influence upon the Indian Cultures of the Southwestern United States in the Sixteenth and Seventeenth Centuries," *The Maya and Their Neighbors* (1940); A. E. Douglass, *Dating Pueblo Bonito and Other Ruins of the Southwest,* Nat. Geogr. Soc., Pueblo Bonito Series, no. 1 (1935); J. W. Fewkes, *Archaeology of the Lower Mimbres Valley, New Mexico,* Smithsonian Misc. Coll., vol. 63, no. 10 (1914); H. S. Gladwin, *Excavations at Snaketown II: Comparisons and Theories,* Medallion Papers, no. 26, Gila Pueblo, Globe, Ariz. (1937); H. S. Gladwin, E. W. Haury and E. B. Sayles, *Excavations at Snaketown: Material Culture,* Medallion Papers, no. 25, Gila Pueblo, Globe, Ariz. (1937); S. J. Guernsey and A. V. Kidder, *Basket-Maker Caves of Northeastern Arizona,* Papers Peabody Mus. Amer. Arch. & Ethnol., vol. 8, no. 2 (1921); E. W. Haury, *The Canyon Creek Ruin and the Cliff Dwellings of the Sierra Ancha,* Medallion Papers, no. 14, Globe, Ariz. (1934); *idem, Roosevelt: 9:6, a Hohokam Site of the Colonial Period,* Medallion Papers, no. 11, Globe, Ariz. (1932); *idem, The Mogollon Culture of Southwestern New Mexico,* Medallion Papers, no. 20, Gila Pueblo, Globe, Ariz. (1930); Frank C. Hibben, "The Gallina Phase," *Amer. Antiquity,* vol. 4, no. 2 (Oct. 1938); E. A. Hooton, *The Indians of Pecos Pueblo,* Papers of Southwest Exped. no. 4, Dept. of Arch., Phillips Acad., Andover, Mass. (1930); Neil M. Judd, *Progress in the Southwest,* Smithsonian Misc. Coll., vol. 100 (1940); *idem, Archaeological Observations North of the Rio Colorado,* Bull. 82, Bur. Amer. Ethnol. (1926); *idem, Archaeological Investigations in Utah, Arizona, and New Mexico,* Smithsonian Misc. Coll., vol. 72, no. 6 (1921); A. V. Kidder, *The Artifacts of Pecos,* Papers of the Phillips Academy Southwestern Exped., no. 6 (1932); *idem, An Introduction to the Study of Southwestern Archaeology, with a Preliminary Account of the Excavations at Pecos,* Papers of the Phillips Academy Southwestern Exped., no. 1 (1924); A. V. Kidder and C. A. Amsden, *The Pottery of Pecos,* vol. 1, Papers of the Phillips Academy Southwestern Exped., no. 5 (1931); A. V. Kidder and Anna O. Shepard, *The Pottery of Pecos,* vol. 2, Papers of the Phillips Academy Southwestern Exped., no. 7 (1936); A. L. Kroeber, *Native Culture of the Southwest,* Univ. of Calif. Pub. Amer. Arch. & Ethnol., vol. 23, no. 9 (1928); Paul S. Martin, *Archaeological Work in the Ackmen-Lowry Area, Southwestern Colorado, 1937,* Anthrop. Ser., Field Mus. Nat. Hist., vol. 23, no. 2 (1938); *idem, Lowry Ruin in Southwestern Colorado,* Anthrop. Ser., Field Mus. Nat. Hist., vol. 23, no. 1 (1936); Earl H. Morris, *Archaeological Studies in the La Plata District, Southwestern Colorado and Northwestern New Mexico,* Pub. 519, Carnegie Instit. of Washington

(1939); *idem, The Beginnings of Pottery Making in the San Juan Area; Unfired Prototypes of the Earliest Ceramic Period,* Anthrop. Papers, Amer. Mus. Nat. Hist., vol. 28, pt. 2 (1927); Earl H. Morris and Robert F. Burgh, *Anasazi Basketry,* Pub. 533, Carnegie Instit. of Washington (1941); Paul H. Nesbitt, *Starkweather Ruin. A Mogollon-Pueblo Site in the Upper Gila Area of New Mexico, and Affiliative Aspects of the Mogollon Culture,* Bull. 6, Logan Mus. Pubs. in Anthrop., Beloit College (1938); Elsie Clews Parsons, "Relations Between Ethnology and Archaeology in the Southwest," *Amer. Antiquity,* vol. 5, no. 3 (Jan. 1940); F. H. H. Roberts, Jr., "Archaeology in the Southwest," *Amer. Antiquity,* vol. 3, no. 1 (July 1937); *idem, A Survey of Southwestern Archaeology,* Ann. Rep. Smithsonian for 1936 (1936); E. B. Sayles, *An Archaeological Survey of Chihuahua, Mexico,* Medallion Papers, no. 22, Gila Pueblo, Globe, Ariz. (1936); F. M. Setzler, "A Prehistoric Cave Culture in Southwestern Texas," *Amer. Anthrop.,* vol. 37, no. 1, pt. 1 (1935).

*Mississippi Valley.*—Glenn A. Black, *Excavation of the Nowlin Mound,* Indiana History Bull., vol. 13, no. 7 (1936); Joseph Caldwell and Catherine McCann, *Irene Mound Site, Chatham County, Georgia* (1941); Fay-Cooper Cole and Thorne Deuel, *Rediscovering Illinois,* Univ. of Chicago Pubs. in Anthrop., Arch. Ser. (1937); S. D. Dickinson and Harry J. Lemley, *Evidences of the Marksville and Coles Creek Complexes at the Kirkham Place, Clark County, Arkansas,* Bull. 11, Texas Arch. & Paleon. Soc. (1939); J. A. Ford and Gordon R. Willey, "An Interpretation of the Prehistory of the Eastern United States," *Amer. Anthrop.,* n.s., vol. 43, no. 3, pt. 1 (July–Sept. 1941); *idem, Crooks Site, a Marksville Period Burial Mound in La Salle Parish, Louisiana,* Louisiana Dept of Conservation, Anthrop. Study 3 (1940); Gerard Fowke, *Archaeological Investigations,* 44th Ann. Rep., Bur. Amer. Ethnol. (1928); *idem, Archaeological Work in Louisiana,* Expl. & Field-Work of Smithsonian Inst. in 1926, Smithsonian Misc. Coll., vol. 78, no. 7 (1927); E. F. Greenman, "Excavation of the Coon Mound and an Analysis of the Adena Culture," *Ohio State Arch & Hist. Quarterly,* vol. 41, no. 3 (1932); James B. Griffin, *The Fort Ancient Aspect. Its Cultural and Chronological Position in Mississippi Valley Archaeology* (1943); M. R. Harrington, *Certain Caddo Sites in Arkansas,* Indian Notes & Monographs, Misc. no. 10, Mus. Amer. Indian, Heye Foundation (1920); W. H. Holmes, *Aboriginal Pottery of the Eastern United States,* 20th Ann. Rep., Bur. Amer. Ethnol. (1903); *idem,* "Aboriginal Copper Mines of Isle Royal, Lake Superior," *Amer. Anthrop.,* n.s., vol. 3 (1901); E. A. Hooton and C. C. Willoughby, *Indian Village Site and Cemetery near Madisonville, Ohio,* Papers Peabody Mus. Amer. Arch. & Ethnol., vol. 8, no. 1 (1920); A. R. Kelly, *A Preliminary Report on Archaeological Explorations at Macon, Georgia,* Bull. 119, Bur. Amer. Ethnol. (1938); G. Langford, "The Fisher Mound Group, Successive Aboriginal Occupations Near the Mouth of the Illinois," *Amer. Anthrop.,* n.s., vol. 29 (1927); T. M. N. Lewis, *Late Horizons in the Southeast,* Proc. Amer. Philos. Soc., vol. 86, no. 2 (1943); Eli Lilly, *Prehistoric Antiquities of Indiana,* Indiana Historical Soc. (1937); W. C. McKern, *A Wisconsin Variant of the Hopewell Culture,* Bull. Pub. Mus. Milwaukee, vol. 10, no. 2 (1931); *idem, Kletzien and Nitschke Mound Groups,* Bull. Pub. Mus. Milwaukee, vol. 3, no. 4 (1930); *idem, Neale and McClaughry Mound Groups,* Bull. Pub. Mus. Milwaukee, vol. 3, no. 3 (1928); W. C. Mills, "Exploration of the Mound City Group," *Ohio State Arch. & Hist. Quarterly,* vol. 31, no. 4 (1922); *idem,* "The Feurt Mounds and Village Site," *Ohio State Arch. & Hist. Quarterly,* vol. 26, no. 3 (1917); *idem,* "Explorations of the Westenhaver Mound," *Ohio State Arch. & Hist. Quarterly,* vol. 26, no. 2 (1917); *idem,* "Exploration of the Tremper Mound," *Ohio State Arch. & Hist. Quarterly,* vol. 25, no. 3 (1916); *idem,* "Excavations of the Adena Mound," *Ohio State Arch. & Hist. Quarterly,* vol. 10, no. 4 (1902); W. K. Moorehead, *The Hopewell Mound Group of Ohio,* Anthrop. Ser., vol. 6, no. 5, Pub. 211, Field Mus. Nat. Hist. (1922); N. C. Nelson, *Chronology of Florida,* Anthrop. Papers, Amer. Mus. Nat. Hist., vol. 22, pt. 2 (1918); P. Phillips, "Middle American Influences on the Archaeology of the Southeastern United States," *The Maya and Their Neighbors* (1940); Frank M. Setzler, *Archaeological Accomplishments During the Past Decade in the United States,* Journ. Washington Acad. Sci., vol. 32, no. 9 (1942); *idem, Pottery of the Hopewell Type from Louisiana,* Proc. U. S. Nat. Mus., vol. 82, art. 22, Pub. 2963 (1933); *idem, The Archaeology of Randolph County and the Fudge Mound,* Indiana History Bull., vol. 9, no. 1 (1931); *idem, The Archaeology of the Whitewater Valley,* Indiana History Bull., vol. 7, no. 12 (1930); Frank M. Setzler and Jesse D. Jennings, *Peachtree Mound and Village Site, Cherokee County, North Carolina,* Bull. 131, Bur. Amer. Ethnol. (1941); H. C. Shetrone, *The Moundbuilders* (1930); *idem,* "Explorations of the Hopewell Group of Prehistoric Earthworks," *Ohio State Arch. & Hist. Quarterly,* vol. 35, no. 1 (1926); *idem,* "Culture Problem in Ohio Archaeology," *Amer. Anthrop.,* n.s., vol. 22, no. 2 (April–June 1920); H. C. Shetrone and E. F. Greenman, "Explorations of the Seip Group of Prehistoric Earthworks," *Ohio State Arch. & Hist. Quarterly,* vol. 40, no. 3 (1931); E. G. Squier and E. H. Davis, *Ancient Monuments of the Mississippi Valley,* Smithsonian Contrib. to Knowledge, vol. 1 (1848); John R. Swanton, *Aboriginal Culture of the Southeast,* 42nd Ann. Rep., Bur. Amer. Ethnol. (1928); *idem, Early History of the Creek Indians and Their Neighbors,* Bull. 73, Bur. Amer. Ethnol. (1922); W. M. Walker, *The Troyville Mounds, Catahoula Parish, La.,* Bull. 113, Bur. Amer. Ethnol. (1936); W. S. Webb, *The Crigler Mounds, Sites Be 20 and Be 27, and The Hartman Mound, Site Be 32, Boone County, Kentucky,* Univ. of Kentucky Reports in Anthrop. and Arch., vol. 5, no. 6 (1943); *idem, The Wright Mounds. Sites 6 and 7, Montgomery County, Kentucky,* Univ. of Kentucky Reports in Anthrop., vol. 5, no. 1 (1940); *idem, An Archaeological Survey of the Norris Basin in Eastern Tennessee,* Bull. 118, Bur. Amer. Ethnol. (1938); W. S. Webb and D. L. DeJarnette, *An Archaeological Survey of Pickwick Basin in the Adjacent Portions of the States of Alabama, Mississippi, and Tennessee,* Bull. 129, Bur. Amer. Ethnol. (1942); W. S. Webb and W. D. Funkhouser, *Archaeological Survey of Kentucky,* Univ. of Kentucky Pubs. in Anthrop. and Arch., vol. 2 (1932).

*The Great Plains.*—John L. Champe, "The Sweetwater Culture Complex," *Chapters in Nebraska Arch.,* vol. 1, no. 3 (1936); Paul Cooper, "Archaeology of Certain Sites in Cedar County, Nebraska," *Chapters in Nebraska Arch.,* vol. 1, no. 1 (1936); George Bird Grinnell, *The Cheyenne Indians* (1923); *idem,* "Early Cheyenne Villages," *Amer. Anthrop.,* n.s., vol. 20, no. 4 (1918); F. Haines, "The Northward Spread of Horses Among the Plains Indians," *Amer. Anthrop.,* n.s., vol. 40, no. 3 (1938); A. T. Hill and Waldo R. Wedel, "Excavations at the Leary Indian Village and Burial Site, Richardson County, Nebraska," *Nebraska History Mag.,* vol. 17, no. 1 (1936); C. R. Keyes, "Some Methods and Results of the Iowa Archaeological Survey," *Wisconsin Arch.,* n.s., vol. 8, no. 4 (1929); *idem,* "Prehistoric Man in Iowa," *Palimpsest,* vol. 8, no. 6 (1927); R. Linton, "Origin of the Plains Earthlodge," *Amer. Anthrop.,* n.s., vol. 26, no. 2 (1924); Robert H. Lowie, *The Assiniboine,* Anthrop. Papers Amer. Mus. Nat. Hist., vol. 4, pt. 1 (1909); W. H. Over, "The Archaeology of Ludlow Cave and Its Significance," *Amer. Antiquity,* vol. 2, no. 2 (Oct. 1936); *idem, Archaeology in South Dakota* (Mimeographed), Univ. of South Dakota (1934); E. B. Renaud, *Archaeological Survey of Western Nebraska* (1934); C. B. Schultz and L. Eiseley, "Palaeontological Evidence for the Antiquity of the Scottsbluff Bison Quarry and Its Associated Artifacts," *Amer. Anthrop.,* n.s., vol. 37, no. 2 (1935); W. D. Strong, *From History to Prehistory in the Northern Great Plains,* Smithsonian Misc. Coll., vol. 100 (1940); *idem, An Introduction to Nebraska Archaeology,* Smithsonian Misc. Coll., vol. 93, no. 10 (1935); *idem,* "Plains Culture Area in the Light of Archaeology, *Amer. Anthrop.,* n.s., vol. 35, no. 2 (1933); J. R. Swanton, "Some Neglected Data Bearing on Cheyenne, Chippewa, and Dakota History, *Amer. Anthrop.,* n.s., vol. 32, no. 1 (1930); Waldo R. Wedel, *Culture Sequence in the Central Great Plains,* Smithsonian Misc. Coll., vol. 100 (1940); *idem, The Direct-Historical Approach in Pawnee Archaeology,* Smithsonian Misc. Coll., vol. 97, no. 7 (1938); *idem, Hopewellian Remains Near Kansas City, Missouri,* Proc. U. S. Nat. Mus., vol. 86, no. 3045 (1938); *idem, An Introduction to Pawnee Archaeology,* Bull. 112, Bur. Amer. Ethnol. (1936); G. F. Will, "A Resumé of North Dakota Archaeology," *North Dakota Hist. Quarterly,* vol. 7, nos. 2–3 (1933); *idem, Archaeology of the Missouri Valley,* Anthrop. Papers Amer. Mus. Nat. Hist., vol. 20, pt. 6 (1924); *idem, The Cheyenne Indians in North Dakota* (1914).

*North Atlantic Area.*—Douglas Byers and Frederick Johnson, *Two Sites on Martha's Vineyard,* Robt. S. Peabody Foundation for Archaeology Papers 1, no. 1, Phillips Acad. (1940); M. R. Harrington, *Cherokee and Earlier Remains on Upper Tennessee River,* Indian Notes & Monographs, Misc. no. 24, Mus. Amer. Indian, Heye Foundation (1922); D. Jenness, *The Indians of Canada,* Nat. Mus. of Canada, Dept. of Mines, Bull. 65 (1932); Frederick Johnson, "Problems Surrounding the Classification of Certain Culture Complexes in New England," *Amer. Antiquity,* vol. 3, no. 2 (Oct. 1937); W. A. Ritchie, *The Pre-Iroquoian Occupations of New York State,* Rochester Mus. Memoir No. 1 (1944); C. C. Willoughby, *Antiquities of the New England Indians,* Peabody Mus. Amer. Arch. & Ethnol. (1935); W. J. Wintemberg, *Distinguishing Characteristics of Algonkian and Iroquoian Cultures,* Ann. Rep., Nat. Mus. of Canada, Bull. 67 (1931). (F. M. Se.)

## NORTHAMPTON, EARLS AND MARQUESSES OF.

The Northampton title has been held in various English families. About 1080 Simon de Senlis (d. 1109), a Norman noble, and the builder of Northampton castle, was created earl of Northampton as well as earl of Huntingdon by William the Conqueror; his son Simon (d. 1153) was also recognized in the title about 1141, though his stepfather, David, king of Scotland (1084–1153), had meanwhile obtained the earldom in right of his wife. The second Simon died childless. In 1337 William de Bohun (*c.* 1310–60), a son of Humphrey de Bohun, 4th earl of Hereford and 3rd earl of Essex, was created earl of Northampton; and his son Humphrey, who succeeded, fell heir in 1361 to the earldoms of Hereford and Essex, which thus became united under that of Hereford. The titles, however, became extinct at his death in 1372.

In 1547 William Parr (1513–71), son of Sir Thomas Parr and brother of Catherine Parr, queen of Henry VIII., was created marquess of Northampton, and though attainted in 1553 was re-created marquess in 1559. He favoured the claim of Lady Jane Grey to the English throne. Although sentenced to death he was pardoned and released from prison at the end of 1553. North-

ampton died at Warwick on Oct. 28, 1571. He left no children and his marquessate became extinct. In 1604 Henry Howard (*see* below) was created earl of Northampton, his title dying with him. It next passed into the Compton family, where it has since remained. The 1st earl of Northampton in this line, William Compton (d. 1630), who received the title in 1618, was a great-grandson of the Sir William Compton (1482–1528) who was with Henry VIII. at the Field of the Cloth of Gold, and his son the 2nd earl is noticed below. The 9th earl, Charles Compton (1760–1828), was created a marquess in 1812, receiving at the same time the titles of Earl Compton and Baron Wilmington.

HENRY HOWARD, earl of Northampton (1540–1614), was the second son of Henry Howard, earl of Surrey, the poet, and of Lady Frances Vere, daughter of the 15th earl of Oxford, and younger brother of Thomas Howard, 4th duke of Norfolk. After discovery of his brother's plot to marry Mary, Queen of Scots, and of his own correspondence with her, he was arrested more than once on suspicion of harbouring treasonable designs. In 1583 he published a work entitled *A Defensative against the Poyson of supposed Prophecies,* an ostensible attack upon astrology, which, being declared to contain heresies and treason, led to his imprisonment for a short time. After the accession of James I. he received many honours, and became Lord Privy Seal (1604) and a commissioner of the treasury (1612). He was one of the judges at the trials of Raleigh and Lord Cobham in 1603, of Guy Fawkes in 1605, and of Garnet in 1606, in each case pressing for a conviction. In 1604 he was one of the commissioners who composed the treaty of peace with Spain, and from that date he received from the Spanish Court a pension of £1,000. Northampton died on June 15, 1614. His title died with him. Northampton built Northumberland house in London and superintended the construction of the fine house of Audley End. He founded and planned several hospitals. Bacon included three of his sayings in his "Apophthegms," and chose him as "the learnedest councillor" in the kingdom to present to the king his *Advancement of Learning.*

Northampton's works are: a *Treatise of Natural and Moral Philosophy* (1569; ms. in the Bodleian library); a pamphlet supporting the union between Elizabeth and the duke of Anjou (1580; Harleian mss. 180); *A Defensative against the Poyson of supposed Prophecies* (1583); a reply to a pamphlet denouncing female government (1589; Harleian ms. 7021); *Duello Foiled,* printed in T. Hearne's *Collection of Curious Discourses* (1775), and ascribed there to Sir Edward Coke; *Translation of Charles V.'s Last Advice to Philip II.,* dedicated with a long epistle to the queen (Harl. 836, 1506 and elsewhere in Stowe 95, King's mss. 106); devotional writings (Arundel mss. 300); speeches at the trials of Guy Fawkes and Garnet in *State Trials,* vol. i. In Somers Tracts (ed. 1809), ii. 136, his opinions on the union between England and Scotland are recorded.

*See* the life in *Surrey's and Wyatt's Poems,* ed. by G. F. Nott (1815), and Sidney Lee's article in the *Dict. Nat. Biog.*

SPENCER COMPTON, 2nd earl of Northampton in the Compton line (1601–43), was the son of William, 1st earl, lord president of the marches. On the outbreak of the Civil War he was entrusted with the execution of the commission of array in Warwickshire. After varying success and failure in the Midlands he fought at Edgehill, and after the king's return to Oxford was given, in November 1642, the military supervision of Banbury and the neighbouring country. He was attacked in Banbury by the parliamentary forces on Dec. 22, but relieved by Prince Rupert the next day. In March 1643 he marched from Banbury to relieve Lichfield, and having failed there proceeded to Stafford, which he occupied. Thence on March 19, accompanied by three of his sons, he marched out with his troops and engaged Sir John Gell and Sir William Brereton at Hopton Heath. In the moment of victory he was surrounded by the enemy, and, refusing quarter, was slain.

*See* the article in the *Dict. of Nat. Biog.* by C. H. Firth; E. B. G. Warburton, *Life of Prince Rupert;* S. R. Gardiner, *Hist. of England and of the Civil War; Thomason* Tracts, E 99 (18) (Hopton Heath and Northampton's death), E 103 (11) (elegy), E 111 (11), E 110 (8) 1642 (Proceedings at Banbury), E 83 (47) (speech).

**NORTHAMPTON,** county town of Northamptonshire, England, 66 mi. N.W. by N. from London by L.M.S.R. Pop. (1938) 96,540. Area 9.7 sq.mi.

British and Roman remains have been discovered near Northampton and it became the chief settlement of the Angle tribes early in the 6th century. It was occupied by the Danes in the reign of Edward the Elder. It is mentioned as a borough in Domesday. Henry II granted the incorporation charter in 1189. Tanning was an industry in the time of Edward I and in 1675 a law was made forbidding strangers to purchase hides in the town except on fair days. Boots and shoes were made here in the reigns of John and Edward I, and by the 17th century Northampton was one of the most noted places in England for their manufacture.

Northampton was the meeting place of several important councils and parliaments. In the wars between John and his barons the castle withstood a siege by the latter, but in 1264 it was occupied by the barons under the earl of Leicester. In the Wars of the Roses it was the scene of the battle in which Henry VI was defeated and taken prisoner in 1460. During the Civil Wars of the 17th century it was held for the parliament by Lord Brooke. In 1675, 600 houses were destroyed by fire.

The town is situated on the river Nene. The main roads converging upon the town meet near the centre in a market place. An important building scheme was the civic centre, which includes a fire station (1935), public baths (1936) and police buildings (1941). All Saints church was rebuilt after the fire of 1675, but retains its Decorated embattled tower. The church of St. Giles, a cruciform structure in the 12th century, has been greatly changed, and besides a Norman doorway contains Early English, Decorated and Perpendicular work. St. Peter's is supposed to be of the same date and its interior is Norman. St. Sepulchre's, one of the four round churches remaining in England, may have been built by the Knights Templars at the close of the 11th century.

Northampton is the seat of a Roman Catholic bishop, the cathedral being in Early Decorated style. Near the town there were a Cluniac priory of St. Andrew, a house (Delapré) for nuns of the same order, and one for Augustinian canons, but only of the last are there any remains. Some portions of the castle were re-erected on a new site after their destruction when the Castle station was built by the L.M.S. company. In Hardingstone, south of the town, is one of the original Eleanor crosses. The town and county school was founded in 1541. The charitable foundations include St. John's hospital (12th century). There is a race course north of the town. The staple trade is the manufacture of boots and shoes. There are also iron foundries, maltings, breweries and flour mills. The cattle market is extensive. The county borough returns one member to parliament.

**NORTHAMPTON,** a city of Massachusetts, U.S.A., the county seat of Hampshire county; on the Connecticut river and federal highways 5 and 10; 16 mi. N. of Springfield. It is served by the Boston and Maine and the New York, New Haven and Hartford railways, also by eight bus lines. Pop. (1930) 24,381; in 1940 it was 24,794. Venerable trees, an irregular plan and the grounds of its many institutions make the city very attractive. It is the home of Smith college (*q.v.*), two preparatory schools for girls, Massachusetts state hospital, U.S. Veterans' facility and the Clarke School for the Deaf (1867). Mt. Holyoke, 954 ft., is 2 mi. S.E. of the city; Mt. Tom, 1,214 ft., is 6 mi. S. of the city. The city's industrial output includes silk stockings, brushes, cutlery, machine tools, ladies' hats and dresses. The city's factory output was valued in 1940 at about $16,000,000. Northampton was settled in 1654, became a separate town in 1656 and was incorporated as a city in 1883.

It was the birthplace of Caleb Strong, Joseph Hawley, Cornet Parsons and Timothy Dwight.

Jonathan Edwards was pastor there from 1727 to 1750. It was the home of Calvin Coolidge.

**NORTHAMPTON,** a borough of Northampton county, Pennsylvania, U.S.A., on the Lehigh river, 6 mi. N.W. of Allentown; served by the Central Railroad of New Jersey and the Bath and Northampton railroad. Pop. 9,349 in 1920 (29% foreign-born white); in 1940, 9,622. It is a cement-manufacturing centre, and there are silk and textile mills in the vicinity. It was settled about 1740 and incorporated in 1901.

**NORTHAMPTON, ASSIZE OF,** a short code of English laws issued in 1176, drawn up in the form of instructions to six committees of three judges each, who were to visit the six circuits into which England was divided for the purpose. Though purporting to be a reissue of the Assize of Clarendon (1166), it contains in fact many new provisions. As compared with the earlier assize it prescribes greater severity of punishment for criminal offences; arson and forgery were henceforth to be crimes about which the jurors were to enquire, and those who failed at the ordeal were to lose a hand as well as a foot. In what is perhaps the most important section we may probably see the origin of the possessory action of *mort d'ancestor,* an innovation scarcely less striking than the institution of the *novel disseisin* in the winter of 1166. The justices were also ordered to try proprietary actions commenced by the king's writ for the recovery of land held by the service of half a knight's fee or less. In their fiscal capacity they were to enquire into escheats, churches, lands, and women in the king's gift. The royal bailiffs were to answer at the exchequer for rents of assize and all the perquisites which they made in their offices, and apparently the duty of enforcing this provision was entrusted to the justices. As a result of the rebellion of 1173–74 it was provided that an oath of fealty should be taken by all, "to wit, barons, knights, freeholders, and even villeins (*rustici*)," and that any one who refused should be arrested as the king's enemy, and the justices were to see that the castles, the demolition of which had been ordered, were razed.

*See* Pollock and Maitland, *History of English Law* (1898); Stubbs, *Constitutional History of England* (1895). The text occurs in *Cronica Rogeri de Howden* (Rolls Series), ii. 89, and *Gesta Henrici Regis Secundi* (Rolls Series), i. 108. It has been reprinted from the latter by Stubbs in *Select Charters* (1913). (G. J. T.)

**NORTHAMPTONSHIRE,** an east midland county of England, bounded north by Lincolnshire, north-west by Rutland and Leicestershire, west by Warwickshire, south-west and south by Oxfordshire, south-east by Buckinghamshire, and east by Bedfordshire, Huntingdonshire and Cambridgeshire. The area of the geographical county is 998 sq.mi.

**Geology and Physical Features.**—The underlying structure of the county is very simple. It forms part of the Jurassic escarpment, here known as the Northampton uplands. All the rocks are of Jurassic age, the dip being in a general way to the south-east, and the strike from south-west to north-east. The oldest, and most westerly belt consists of Lias formations which cover a large surface in the south-west and centre, around Banbury, Daventry and Market Harborough, and they are also exposed along the rivers near Towcester, Northampton, Wellingborough and Kettering. The marlstones of the Middle Lias were formerly much used for building material; the Upper Lias is worked for bricks at Easton Neston (Towcester), Blisworth, Gayton, Heyford, Northampton, Wellingborough, Rushden, Irthlingborough, Kettering and Corby. Through the middle of the county, north-east to Northampton, Rockingham and Peterborough, is an elevated tract of Oolitic rocks, which formerly supplied stone, of which many of the villages are built, as well as lime and marl. The New Duston quarries have several varieties of good stone, the district around Northampton a limestone known as Pendle, and Weldon (Lincolnshire Oolite) a noted freestone; Barnack Rag (near Stamford) is no longer worked. The great Oolite limestone, though unsuitable for building material, owing to the ease with which it weathers, was largely used in the past, Culworth, Blisworth and Cosgrove quarries being famous. At the base of the Inferior Oolite, Northampton sands yield iron ore, which is worked at Duston, Culworth, Towcester and at numerous localities north-east of Northampton. Certain hard shelly beds in the Oolite rocks have been polished and used as marble.

On the south-east border of the county, a belt of Oxford clay occupies the surface, good exposures occurring in the brick fields about Peterborough. Boulder clay is widely distributed over the uplands and in the east of the county, and glacial and river gravels are also plentiful. The south-west portion of the county forms the principal watershed of the Midlands; the Cherwell, the Avon, the Leam, the Welland, the Nene have their sources in this region, and all form sections of county boundaries. The position of Daventry as a wireless station and a meeting place of roads is also related to this fact of centrality and elevation. The longitudinal river Nene flows in a north-easterly direction along the foot of the uplands, draining them to the Wash.

**History and Early Settlement.**—In primitive times the waters of the North sea reached almost to the foot of the Northamptonshire uplands. The immigrants of the end of the Stone age seem to have penetrated up from the coast, and Peterborough has yielded important finds of early pottery. Some Beaker pottery occurs, chiefly on the uplands. There are a few material objects of the La Tène I. culture and the La Tène III. culture. During the Iron age, the uplands offered defensible sites, and many hill camps were made, Hunsbury (1½ m. S.W. of Northampton), being one of the most famous. In Roman times, iron, stone and clay were worked, and Towcester was an important station on the Watling street route to the north-west. At some time in the 7th century the district suffered a simultaneous invasion (West Saxons from the south, Anglian tribes from the north), finds show a mingling of races, but West Saxon influence never spread farther north than a line from Daventry to Warwick, and with the extension of the Mercian kingdom under Penda and the conversion of the midland districts, ceased altogether. The abbey at Medehamstede (now Peterborough) was begun by Saxulf, a monk, and Penda's son, Peada, in 655. Foundations were also established at Peakirk, Weedon Beck, Castor and Oundle. In 870 the district was overrun by the Danes, and Northampton was one of the five Danish boroughs, until in 921 it was recovered by Edward the Elder, who fortified Towcester in that year.

In the 11th century Northamptonshire was included in Tostig's northern earldom; but in 1065, together with Huntingdonshire, it was detached from Northumbria and bestowed on Waltheof. The monastic foundation of Peterborough survived the Conquest. Norman castles existed at Rockingham, Barnwell, Lilbourne and Northampton. The shire is probably of Danish origin, representing in the 10th century the area which owed allegiance to Northampton as a political and administrative centre. In 921 this area extended to the Welland, and at the time of the Domesday survey the boundaries were approximately those of the present day. Northamptonshire is first mentioned by name in the *Historia Eliensis,* in connection with events which occurred at the close of the 10th century.

The Geld roll (William I.) and Domesday (1086) mention 28 hundreds in Northamptonshire, and part of Rutland is assessed under this county. By 1316 the divisions were changed, re-named and reduced to 20, and have remained practically unaltered. The names of the hundreds point to primitive meeting-places gradually superseded by villages and towns, and the court for Fawsley hundred met under a large beech tree in Fawsley park until the beginning of the 18th century, when it was transferred to Everdon. The shire-court originally met at Northampton.

Northamptonshire was originally included in the diocese of Lincoln. The archdeaconry of Northampton is mentioned in the 12th century, and in 1291 included the deaneries of Peterborough, Northampton, Brackley, Oundle, Higham, Daventry, Preston, Weldon, Rothwell and Haddon. The diocese of Peterborough was created in 1541, and in 1875 the archdeaconry of Oakham.

At the time of the Domesday survey the chief lay-tenant in Northamptonshire was Robert, earl of Mortain, whose fief escheated to the Crown in 1106. The estates of William Peverel, founder of the abbey of St. James at Northampton, also escheated to the Crown in the 12th century. Holdenby House was built by Sir Christopher Hatton, privy councillor to Queen Elizabeth, and Yardley Hastings was named from the Hastings, formerly earls of Pembroke. Higham Ferrers was the seat of the Ferrers family; Braybrook Castle was built by Robert de Braybrook, a favourite of King John; and Burghley House gave the title of baron to William Cecil. During the middle ages the Nene was a busy artery of trade, and many moated homesteads were built on its banks.

Northampton was a favourite meeting-place of the councils and parliaments of the Norman and Plantagenet kings. In 1215 John was besieged in Northampton castle by the barons, and in 1264

Henry III captured the castle from the younger Simon de Montfort. During the Wars of the Roses Henry VI was defeated at Northampton in 1460. In the Civil War of the 17th century the county declared almost unanimously for the parliament. A royalist garrison was placed at Towcester by Prince Rupert in 1644, but almost immediately withdrawn

In 1547 Brackley and Peterborough returned each two members, and in 1557 Higham Ferrers returned one member. Under the act of 1832 the county returned four members in two divisions, the above boroughs being merged in the county divisions. There are now four divisions with one member each, in addition to a member for the county borough of Northampton

**Architecture.**—Of monastic foundations, the abbey-church of Peterborough, afterwards the cathedral, is the only remaining one of importance. At Geddington, and also at Hardingstone, near Northampton, there is an Eleanor cross, erected by Edward I. The county is famous for its churches with beautiful broached spires. To the Saxon period belong the tower of Earls Barton church, on what is probably the mound of an old English strong-house; the tower, etc., at Brigstock; the ground plan, etc., at Wittering; the remarkable tower at Barnack; and Brixworth church, by some believed to include part of a Roman basilica. Of Norman work, excluding Peterborough cathedral, the finest examples are St. Peter's and St. Sepulchre's, Northampton, and the tower of Castor church. St. Mary's church, Higham Ferrers, formerly collegiate, Early English and Decorated, is one of the finest churches in the county; the churches at Irthlingborough and Lowick, with their lantern towers, Warmington, fine Early English work, Rushden, Finedon, Raunds and Fotheringhay should be mentioned.

A gateway at Rockingham, and earth-works at Higham Ferrers and Brackley are worthy of mention. Some castellated ruins remain of the castle at Fotheringhay, famous as the scene of the imprisonment, trial and execution of Mary, Queen of Scots. Barnwell castle, founded by William the Conqueror, is still a fine ruin, which includes four of the round towers and an imposing gateway. Holdenby manor house, where Sir Christopher Hatton (1540–1591) was born, and whence Charles I was carried away by Cornet Joyce, is largely restored. Among ancient mansions are Castle Ashby, the seat of the Comptons; Althorp, the seat of the Spencers; Drayton House; Burghley House, Stamford, founded by Lord Burleigh (1553); and Kirby Hall, a beautiful Elizabethan building once the residence of Sir Christopher Hatton.

**Climate and Agriculture.**—The climate of Northamptonshire is mild, and it is drier than many other inland districts owing to its low elevation (rarely more than 700 ft.). The mean annual rainfall at Wellingborough is 27·2 in. The soil is fertile, 84½% of the surface being under cultivation in 1939. The Lias clay belt gives rise to good grazing, and 303,889 ac., or about 46%, were under permanent pasture. Large numbers of cattle (152,024 in 1939) are fattened, droves from Scotland, Ireland, Wales, Hereford being sent for that purpose. The selling of fat cattle for Christmas markets, sets the population free in winter for hunting, giving rise in the 18th century to the making of whips at Daventry, while the long winter evenings encouraged the use of the tobacco-pipe, made almost exclusively from Northampton clays. Easy access to hides and to bark for tanning in the forests originated an industry in leather, which flourished in Norman times, and, in the middle of the 17th century Northampton began to specialize in the manufacture of boots and shoes, for which it has become famous. The difference in bulk between imported raw hides and exported finished boots and shoes creates an economic problem in connection with this trade. Good wheat can be grown on the boulder clay, and 11½% of the county was under grain in 1939, wheat accounting for 44,304 ac. Beans form an important crop; root-crops are also grown; sugar-beet is a fast developing industry (5,408 ac. in 1939, as against 1,077 ac. in 1926).

Sheep are kept in large numbers on the rich pastures, improved Leicesters for wool and Southdown for mutton. Wool was important in Norman times; in the 17th century the centre of weaving changed from Northampton to Kettering. Charcoal-burning was an early industry in the forests (Rockingham, etc.), mast from the oaks also feeding large numbers of pigs; these are still important. Paper-making, dependent on pure water, was introduced in the 18th century; early in the 19th, silk-weaving spread from Coventry.

**Communications.**—Two main lines of the L.M. and S. railway cross the county, linking London with the industrial north-west. The first is the Wolverton (Bucks) Blisworth, Rugby (Warwick) line, with an alternative route to Northampton, and branches northeast to Peterborough and north to Market Harborough (Leics.); with it are connected at Blisworth junction, branch lines through Towcester, west to Stratford-on-Avon (Warwick) and southwest to Banbury (Oxon). The second is the Wellingborough, Kettering, Market Harborough line with a branch to Oakham (Rutland). There are other branch lines. A main line of the L. and N.E. railway passing through the south of the county, connects with the G.W. railway at Banbury through Woodford. The Grand Junction canal, which is connected with the Oxford canal, enters the county at Braunston on the borders of Warwickshire, and passes by Daventry and Blisworth into Buckinghamshire, a branch connecting it with Northampton. The Grand Union canal unites with the Grand Junction near Daventry, and runs north until it joins the Leicester canal at Foxton, branches passing to Welford and Market Harborough.

**Population and Administration.**—The area of the administrative county is 905 sq.mi.; pop. estimated, 1938, 317,940. The soke of Peterborough, itself an administrative county, has an area of 84 sq.mi. and a population estimated in 1938 at 55,860, while the county borough of Northampton occupies 9·7 sq.mi. Wartime evacuation from the eastern counties of England and an increase in agriculture and industry caused a rise of 17% in the population of the geographical county between Sept. 1939 and Feb. 1941. In Domesday the county is mentioned as containing 30 hundreds, but it then included a considerable part of Rutland. These divisions were first reduced to 28, and in the reign of Henry II to 20, their present number. The administrative counties include four municipal boroughs, namely, Brackley, Daventry, Higham Ferrers and Kettering, in addition to Peterborough and Northampton. There are one court of quarter sessions and nine petty sessional divisions. The borough of Northampton and the liberty of the soke of Peterborough have each a separate court of quarter sessions and a separate commission of the peace. The total number of civil parishes in 1943 was 295, of which 25 were in the soke of Peterborough. The geographical county, including the soke of Peterborough, is in the diocese of Peterborough. The National Trust owned 31 ac. in Northamptonshire in 1942. For parliamentary purposes the county is divided into four divisions, Daventry, Kettering, Peterborough and Wellingborough. The parliamentary borough of Northampton returns one member.

See *Victoria County History, Northamptonshire;* John Norden, *Speculi Britanniae, pars altera,* or *A Delineation of Northamptonshire* (1720); John Bridges, *History and Antiquities of Northamptonshire,* compiled by Rev. Peter Whalley (2 vols., Oxford, 1791); Francis Whellan, *History, Topography and Directory of Northamptonshire* (2nd ed., London, 1874).

**NORTH ANDOVER,** a manufacturing town of Essex county, Massachusetts, U.S.A., on the Merrimack river, 2 mi. E. of Lawrence. The population was 6,265 in 1920 (30% foreign-born white); in 1930 it was 6,961, and in 1940, 7,524 by the federal census. The town was settled about 1643, and a house built in 1667 by Simon Bradstreet, one of the founders, is still standing. His wife, Anne Dudley Bradstreet (1612–72), was the first woman in America to make a reputation as a poet. North Andover was set off from Andover and incorporated as a town in 1855.

**NORTH BAY,** a lumber, mining and railway city on the northeast shore of Lake Nipissing, northern Ontario, Canada, 227 mi. N. of Toronto, on the Canadian Pacific, Canadian National, and Temiskaming and Northern railways and a port of call of the main Trans-Canada Air lines. It is the base of supply for the mining districts of Cobalt, Gowganda and Porcupine, and is a summer resort. Pop. (1941), 15,599.

**NORTH BERWICK,** royal and small burgh, East Lothian, Scotland. Pop. (est. 1938) 3,165. It is on the south shore of the entrance to the Firth of Forth, 22½ mi. E.N.E. of Edinburgh by the L.N.E.R., the terminus of a branch line from Drem Junc-

tion. Created a royal burgh by Robert III (d. 1406), it was once a port of some importance, but dwindled to a fishing hamlet. It is probably the most fashionable watering place in Scotland, frequented for bathing and golf. Here are the ruins of an abbey of Cistercian nuns founded by David I, and to the S. rises the fine cone of North Berwick Law.

**NORTH BRADDOCK,** a borough of Allegheny county, Pennsylvania, U.S.A., 10 mi. S.E. of Pittsburgh, on the hills back of Braddock and Rankin. The population was 14,928 in 1920 (27% foreign-born white); in 1930 it was 16,782, and in 1940, 15,679 by the federal census. The three boroughs form one community and industrial centre, with large steelworks and other important manufactures. North Braddock is chiefly a residential section, but one of the largest steel plants is within its limits. The first white man's cabin west of the Alleghenies was built there in 1742 by John Frazier.

On the ground now occupied by Braddock and North Braddock was fought (July 9, 1755) the battle in which Braddock was defeated.

**NORTHBRIDGE,** a town of Worcester county, Massachusetts, U.S.A., on the Blackstone river, 13 mi. S.E. of Worcester; served by the New York, New Haven and Hartford railroad. Pop. (1930) 9,713; by the 1940 census it was 10,242. It is a manufacturing town, making principally textile machinery, silk and cotton goods and embossed paper. Part of Uxbridge was established as the district of Northbridge in 1772, and in 1775 the district was made a town.

**NORTHBROOK, THOMAS GEORGE BARING,** 1ST EARL OF (1826–1904), English statesman, eldest son of the first baron (long known as Sir Francis Baring; *see* BARING), was born on Jan. 22, 1826, and educated at Christ Church, Oxford, where he graduated with honours in 1846. He was successively private secretary to Mr. Labouchere (Lord Taunton), Sir George Grey and Sir Charles Wood (Viscount Halifax). He was member of parliament for Penryn and Falmouth (1857–66). He was a lord of the admiralty in 1857–8; undersecretary for war, 1861; for India, 1861–4; for the home department, 1864–6; and secretary to the admiralty, 1866. In the Gladstone ministry of 1868 Northbrook was undersecretary for war (1868–72). He was then governor general of India, but resigned in 1876, because his policy of coming to an arrangement with Shere Ali, which might have prevented the Afghan War, was overruled by the duke of Argyll, then secretary of state. From 1880 to 1885 Northbrook, who had received an earldom, was first lord of the admiralty in Mr. Gladstone's second government. In Sept. 1884 Northbrook was sent to Egypt as special commissioner to enquire into its finances. He died on Nov. 15, 1904.

*See* B. Mallet, *Thomas George, Earl of Northbrook* (1908).

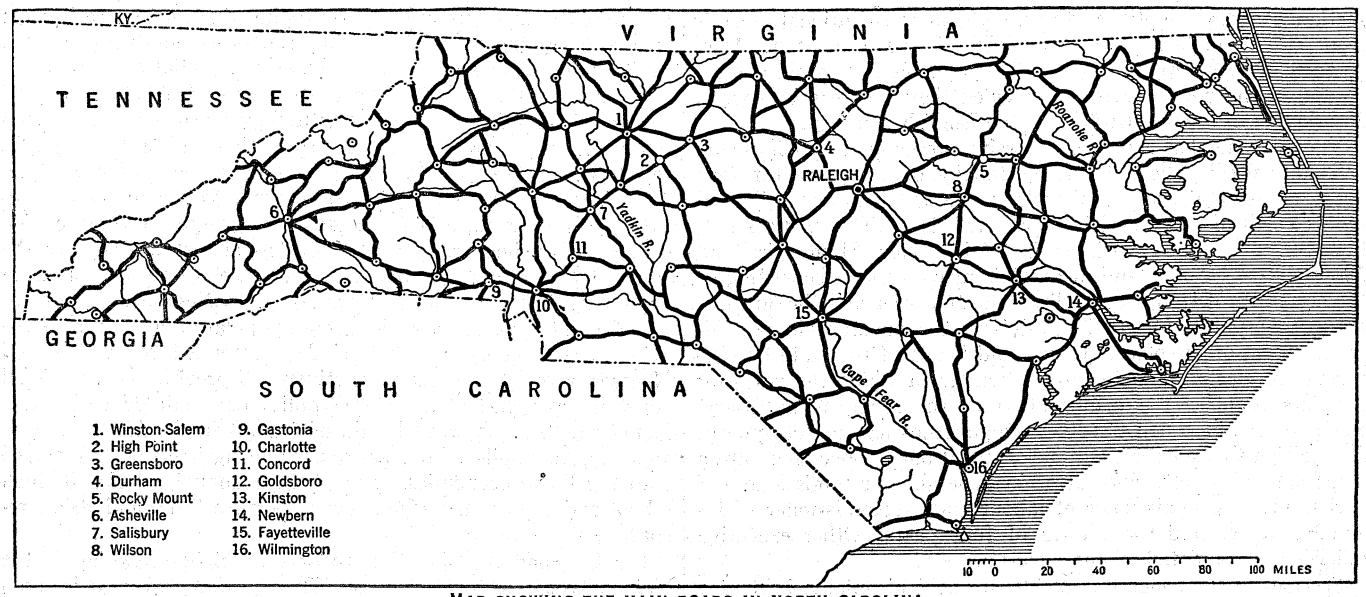
**NORTH CAPE,** a promontory on the island Magerö off the north coast of Norway in 71° 10′ 20″ N., 25° 45′ E., 78 mi. northeast of Hammerfest. Knivskjaerodden, an island a little to the west, is actually a little farther north than the North Cape, and Nordkyn, 45 mi. farther east, is the northern extremity of the mainland (71° 7′ N.). The desolate cape, rising abruptly over 1,000 ft. from the sea, is frequently visited during the summer period of the "midnight sun."

**NORTH CAROLINA,** popularly known as the "Tar Heel state," is one of the Atlantic coast states of the United States of America, situated between 33° 51′ 37″ and 36° 34′ 25·5″ N., and between 75° 27′ and 84° 20′ W. It is bounded north by Virginia, east and southeast by the Atlantic ocean, south and southwest by South Carolina, south also by Georgia, and west and northwest by Tennessee. North Carolina has an extreme length from east to west of 503¼ mi., which is greater than that of any other state east of the Mississippi river. Its total area is 52,712 sq.mi., of which 3,570 sq.mi. are water surface.

**Physical Features.**—The state lies wholly within the three leading topographical regions of the eastern portion of the United States: the Coastal Plain region, which occupies approximately the eastern half, the Piedmont Plateau region, which occupies about 20,000 sq.mi. in the middle, and the Appalachian region, which occupies about 6,000 sq.mi. in the west. At the eastern extremity of the Coastal Plain region an outer coast line is formed by a chain of long narrow barrier beaches from which project capes Hatteras, Lookout and Fear, whose outlying shoals are known for their dangers to navigation. Between Hatteras and Lookout is Raleigh bay and between Lookout and Fear is Onslow bay; and between the chain of islands and the deeply indented mainland Currituck, Albemarle, Pamlico and other sounds form an extensive area, especially to the northward, of shallow, brackish and almost tideless water. Projecting into these sounds and between the estuaries of rivers flowing into them are extensive tracts of swamp land—the best known of these is Dismal Swamp, which lies mostly in Virginia and is about 30 mi. long and 10 mi. wide. Through most of the Coastal Plain region, which extends inland an average of 150 mi., the country continues very level or only slightly undulating, and rises to the westward at the rate of little more than one foot to the mile. The "Fall Line," the boundary between the Coastal Plain and the Piedmont Plateau, has a very irregular course across North Carolina, but lies in a general southwest direction from the Falls of Roanoke between Halifax and Northampton counties to Anson county on the South Carolina border and marks a rapid increase in elevation of about 200 feet. The Piedmont Plateau region extends from this line to the Blue Ridge Escarpment, toward which its mean elevation increases at the rate of about 3½ ft. to the mile. The southeast face of the Blue Ridge Escarpment, which rises precipitously 1,200–1,500 ft. or more above the Piedmont Plateau, forms the southeast border of North Carolina's Appalachian mountain region, which includes the high Unaka mountain range, segments of which are known by such local names as Iron mountains, Bald mountains and Great Smoky mountains. These ranges reach their culmination in this state, and with a series of more or less interrupted cross ranges constitute the greatest masses of mountains in the east half of the United States. Four peaks along the Blue Ridge have an elevation exceeding 5,000 ft., and 43 peaks in the Unakas and in the several cross ranges exceed 6,000 ft., the highest being Mt. Mitchell or Mitchell Dome (6,684 ft.), of the Black mountains, a short cross range extending north from the Blue Ridge through Yancey county. Another noteworthy peak is Hairy Bear (6,681 ft.), the next highest mountain. The valleys are usually narrow and deep, though few descend to less than 2,000 ft. above the sea.

From the Black mountains, the streams flow as from a ridge pole, some to the Atlantic, others to the Mississippi and finally to the Gulf of Mexico. West of Blue Ridge the Hiwassee, the Little Tennessee and the French Broad rivers flow west or northwest into Tennessee. Farther north are the headwaters of the New river, which finds its way to the Ohio. On the southeast slope of the Blue Ridge rise the Broad, the Catawba and the Yadkin, which first flow northeast, then finding a passage across one of the ridges of the Piedmont Plateau, turn to the south-southeast and across the boundary line into South Carolina, in which state their waters reach the Atlantic. In the northwest part of the Piedmont Plateau region rises the Dan, which in its northeast course crosses the boundary into Virginia, where it becomes a tributary of the Roanoke, in which its waters are returned to North Carolina near the "Fall Line." The other principal rivers—the Cape Fear, the Neuse and the Tar—rise in the northeast part of the Piedmont Plateau region, have their southeast courses wholly within the state, and, with the Roanoke, drain the Coastal Plain region. In the Mountain region and in the Piedmont Plateau region the rivers have numerous falls and rapids which afford a total hydroelectric capacity exceeded only by that in the states of California, New York and Washington, the largest being on the Yadkin, Roanoke and Catawba; and in crossing some of the mountains, especially the Unakas, the streams have carved deep narrow gorges that are much admired for their scenery. In contrast with the rivers of these regions those of the Coastal Plain are sluggish, and toward their mouths expand into wide estuaries.

**Climate and Soil.**—North Carolina has a climate which varies from that of the southeast corner, which approaches the subtropical, to that of the Mountain region, which is like the medium

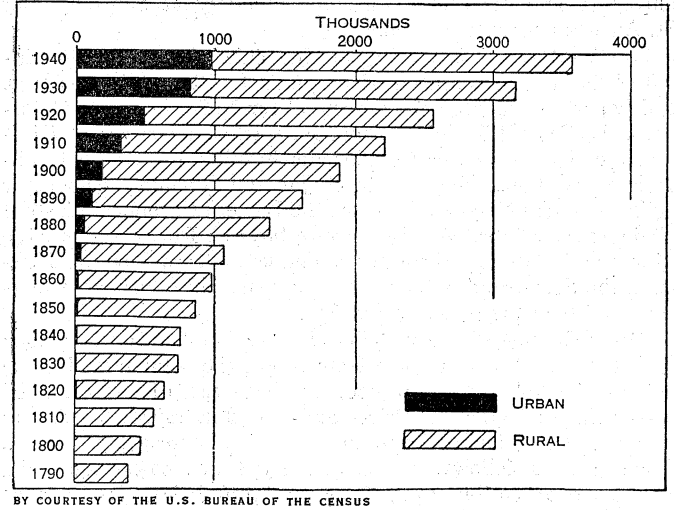



MAP SHOWING THE MAIN ROADS IN NORTH CAROLINA

continental type, except that the summers are cooler and the rainfall is greater. The mean annual temperature for the state (below an elevation of 4,000 ft.) is about 59° F. For the coastal plain region it is 62° F.; for the Piedmont plateau region, 60° F.; for the mountain region, 55° F.; for Southport, in the southeast corner of the state, 64° F.; and for Highlands, at an elevation of 3,817 ft. in the southwest corner, 50° F. Extremes have ranged from −19° F. at Highlands to 107° F. at Chapel Hill, Orange county, in 1900 and again in 1902. The average precipitation for the state is about 50 in. a year, nearly all of it in the form of rain. For the coastal plain region it is 48 in.; for the Piedmont plateau region 47 in.; and for the mountain region 54 in. On the east slope of some of the mountains the rainfall is exceedingly heavy. The winds are variable and seldom violent, except along the coast during the subtropical storms of late summer and early autumn.

On the coastal plain the soil is generally sandy, but in nearly all parts of this region more or less marl abounds; south of the Neuse river the soil is mostly a loose sand, north of it there is more loam on the uplands, and in the lowlands the soil is usually compact with clay, silt or peat; toward the western border of the region the sand becomes coarser and some gravel is mixed with it. The entire Piedmont region is underlain by crystalline rocks, such as granite and schists. The soils are, for the most part, red sandy loams and clay loams, gravelly and sandy in spots.

**Population.**—The population of North Carolina in 1790 was 393,751; in 1820 it was 638,829; in 1850, 869,039; in 1880, 1,399,750; in 1910, 2,206,287; and in 1940, 3,571,623. This last figure represents an increase of 12·7% over the population in 1930. The population per square mile was 72·7, as compared with 44·2 for the United States as a whole. Of the 1940 population, 974,175, or 27·3%, lived in urban places, that is, in cities and towns of 2,500 or more. The rural population, occupying the remainder of the state, thus constituted 72·7% of the total. The number of occupied dwelling units returned in the housing census of 1940 was 789,566, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 4·9 in 1930 to 4·5 in 1940. The white population of North Carolina formed 71·8% of the total in 1940, as compared with 70·5% in 1930, practically all the nonwhite population being Negro. The number of males per 100 females in the entire population of the state was 100·2; there was a larger excess of males in the white population, the sex ratio being 100·8 for the white and only 98·7 for the nonwhite population. The number of persons 65 years old and over in North Carolina increased from 115,671, or 3·6% of the total population in 1930 to about 158,000, or 4·4%, in 1940, while the number of children under 14 decreased somewhat. The population of the state and of its principal cities is summarized in the following table:




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF NORTH CAROLINA: 1790 TO 1940

| Area | Population | | | Per cent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 3,571,623 | 3,170,276 | 2,559,123 | 12·7 | 23·9 |
| Urban | 974,175 | 809,847 | 490,370 | 20·3 | 65·2 |
| Rural | 2,597,448 | 2,360,429 | 2,068,753 | 10·0 | 14·1 |
| Per cent urban | 27·3 | 25·5 | 19·2 | .. | .. |
| Principal cities: | | | | | |
| Charlotte | 100,899 | 82,675 | 46,338 | 22·0 | 78·4 |
| Winston-Salem | 79,815 | 75,274 | 48,395 | 6·0 | 55·5 |
| Durham | 60,195 | 52,037 | 21,719 | 15·7 | 139·6 |
| Greensboro | 59,319 | 53,569 | 19,861 | 10·7 | 169·7 |
| Asheville | 51,310 | 50,193 | 28,504 | 2·2 | 76·1 |
| Raleigh | 46,897 | 37,379 | 24,418 | 25·5 | 53·1 |

**Government.**—North Carolina has been governed under the charters of 1663 and 1665 (1663–1729), under commissions and instructions from the crown (1729–76), and under the state constitutions of Dec. 1776 and of April 1868, with numerous amendments. The present constitution, as amended, prescribes that no convention of the people of the state may be called by the legislature unless by the concurrence of two-thirds of all the members of each house, followed by an affirmative vote of a majority of the electors voting on the question; and that an amendment to the constitution may be adopted also by a three-fifths vote of each house, followed by an affirmative vote of the majority of electors voting on the question. The suffrage provisions containing the famous "grandfather clause" (in Art. vi.

section 4), were adopted in the form of a constitutional amendment, ratified in Aug. 1900, and in effect July 1, 1902. Since Dec. 1, 1908, all new applicants otherwise qualified may place their names on the voting register, provided they can read and write any section of the constitution in the English language.

The governor has acquired extensive power over appointments and state fiscal policy. He is elected by popular vote for four years, and cannot succeed himself in office. His power is limited by a council of state, a relic of colonial days. This body is not, however, a special board, as in Maine, New Hampshire and Massachusetts, but a kind of administrative cabinet consisting of the secretary of state, the auditor, the treasurer and the superintendent of public instruction, advising the governor in the administration of his office. Judges and heads of the state departments are elected, and in most instances in which the governor appoints to office the confirmation of the senate is necessary. Furthermore, in North Carolina the governor has no veto power. In addition to the executive officials mentioned above there are a lieutenant governor, and attorney-general, a commissioner of agriculture, a commissioner of labour and a commissioner of insurance, all elected for a term of four years. Other executive officials are appointed by the governor.

Sessions of the general assembly are held biennially, beginning on the Wednesday after the first Monday in January, in odd-numbered years. The senate is composed of 50 members elected biennially from 33 senatorial districts, and the house of representatives of 120, elected biennially and chosen by counties according to their population, each county having at least one representative, no matter how small its population. The pay for both senators and representatives is $600 for their term of office, but if an extra session is called they also receive $8 per day for a period not exceeding 20 days.

There is a supreme court consisting of a chief justice and six associates, elected by popular vote for eight years, and superior or circuit courts, composed of 21 judges elected by the people in each of 21 districts for a term of eight years. Minor civil and criminal cases are tried before a justice of the peace or municipal judge. The county officials are the sheriff, a coroner, a treasurer, a register of deeds, a surveyor and a board of commissioners, elected by the people; a clerk of the court elected for four years; a county board of education, elected by the legislature for two years; and a superintendent of schools and a superintendent of public welfare, appointed for a term of two years.

**Finances.**—North Carolina was one of the few states in the union in 1940 that had no state tax on property. The total of the state's general fund revenues for the fiscal year ending June 30, 1940, was $55,264,170; the principal sources being sales ($12,206,193), income ($12,007,105), franchise ($8,103,744), licence ($2,995,779), beverages ($2,264,909), intangibles ($1,532,892), and inheritance ($996,684) taxes. The average rate of county taxation in 1939 was around $9.00 per $1,000 of valuation on assessed property values of $2,337,223,566. The chief sources of revenue of the state highway fund were gasoline taxes ($25,954,450), automobile licences ($8,006,185), and a contribution from the federal government ($5,687,468). General fund disbursements for the fiscal year 1940 were $55,128,535. Of this amount the chief disbursements were for public schools and colleges ($36,236,695), general administration and governmental costs ($4,452,250), interest on sinking funds and debt payments ($4,419,960), and maintenance of charitable and correctional institutions ($2,385,825). Of the special fund disbursements the greater were for road construction and public works ($30,310,294), interest and the redemption of state bonds ($9,369,838). The total indebtedness of the state on June 30, 1940 was $147,733,500 in bonds. Of this bonded debt, $76,270,000 were for highway construction, $60,628,500 for educational and charitable institution improvement, $8,335,000 for public school building bonds, $2,500,000 World War (1917–18) Veterans' Loan bonds, and the remainder for funding and miscellaneous improvements.

**Education.**—The public school system of North Carolina has made remarkable and well rounded progress since 1900. The total school expenditures increased from $1,248,157 in 1901 to $39,626,396 in 1929, or from $2.87 per capita of enrolment to $42.53; as a result of the depression, public school expenditures dropped to $28,848,728 in 1935 or $25.29 per capita but rose to $42,324,988 in 1938. In 1901 there were 8,320 teachers and 435,184 enrolled pupils as compared with 25,370 teachers and 910,206 pupils in 1938. In addition, in 1934 there were 6,223 pupils registered in the private and parochial schools of the state. The high school enrolment increased from 63,499 in 1923–24 to 116,937 in 1929–30, and to 196,407 in 1938–39. The state-wide eight-month school system is supported almost entirely by the state. Of the total public school enrolment of the state in 1939, 635,916 were white and 274,290 were Negroes; these comprised about 85% of the white school population and 80% of the Negro. The average number of days attended for whites and Negroes were 154 and 148 respectively. A program of vocational education as a part of the State's policy of public education was inaugurated in 1917 with the aid of federal funds. There were in 1938 27,000 pupils taking instruction in agriculture and 15,756 studying home economics. The average annual salaries of high school and elementary school teachers were $911 and $818, respectively.

Chief among the state institutions of higher learning is the University of North Carolina at Chapel Hill, chartered in 1789 and opened in 1795, one of the oldest state universities in the country and the first to begin operation in the south. In 1939–40 it had an average enrolment of 4,305 students, of whom most were resident students during the main term. Other branches of the consolidated university are North Carolina College of Agriculture and Engineering at Raleigh and North Carolina College for Women at Greensboro. Other state schools are East Carolina Teachers' college at Greenville, Western Carolina Teachers' college at Cullowhee and the Appalachian State Teachers' college at Boone. State-supported Negro institutions include the Negro Agricultural and Technical college at Greensboro, the Winston-Salem Teachers' college at Winston-Salem, North Carolina college for Negroes at Durham, and normal schools at Fayetteville and Elizabeth City. A school for the Cherokee Indians of Robeson county is located at Pembroke. Among the nonstate-supported institutions of higher education Duke university, formerly Trinity college, at Durham, is the greatest. It received from the late James B. Duke the sum of $6,000,000 for building and an endowment fund estimated to amount to anywhere from $80,000,000 to $100,000,000, one of the largest foundations for education and hospitalization in the world. Well known sectarian schools are Wake Forest college at Wake Forest; Davidson college at Davidson; Greensboro college for women at Greensboro; Guilford college (co-ed.) near Greensboro; Lenoir-Rhyne college at Hickory; Catawba college at Salisbury; Meredith college at Raleigh; Belmont Abbey college at Belmont; Elon college at Elon; and Atlantic Christian college at Wilson. Institutions for Negroes include Shaw university at Raleigh, Johnson C. Smith university at Charlotte, Livingston university at Salisbury and St. Augustine's school at Raleigh.

**Charities and Corrections.**—The chief state-supported institutions in 1940 consisted of hospitals for the white insane at Raleigh and Morganton and a hospital for Negro insane at Goldsboro, the Caswell Training school for mental defectives at Kinston, the North Carolina Orthopaedic hospital for crippled children at Gastonia, the Stonewall Jackson Training school for delinquent white boys at Concord, the Eastern Carolina Industrial Training school for delinquent white boys at Rocky Mount, the Morrison Industrial school for delinquent Negro boys at Hoffman, the Samarcand Manor for delinquent white girls at Samarcand and the state prison at Raleigh.

**Agriculture.**—North Carolina, in 1939, ranked fourth among the states in the cash income from crops, the total farm income being estimated at $237,005,000. In that year, the state ranked first in the production of tobacco and second in lespedeza seed and peanuts. The principal crops in 1939, their acreage, yields and values are as follows: tobacco, 774,598 ac., 715,616,397 lb., $123,868,000; cotton, 710,228 ac., 458,146 bales, $21,825,000; Indian corn, 2,458,076 ac., 50,797,461 bu., $31,347,000; tame hay,

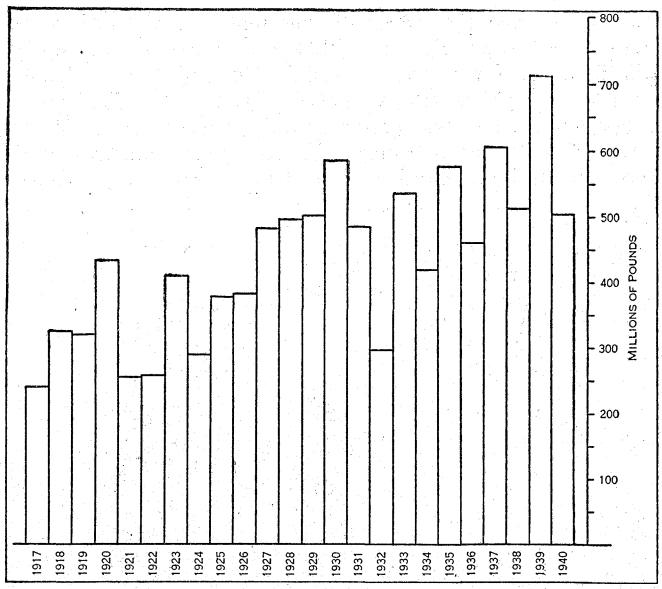



DIAGRAM SHOWING TOBACCO CROP OF NORTH CAROLINA 1917–1940

1,100,000 ac., 984,000 tons, $13,874,000; sweet potatoes, 71,338 ac., 8,149,360 bu., $5,606,000; wheat, 387,382 ac., 4,968,759 bu., $4,641,000; potatoes, 81,182 ac., 8,109,284 bu., $5,576,000; oats, 245,000 ac., 5,512,000 bu., $2,591,000; rye, 61,000 ac., 458,000 bu., $426,000; barley, 12,951 ac., 286,336 bu., $158,000.

In the production of vegetables and fruits the state ranks high. In 1939 the orchards yielded 1,120,000 bu. of apples, 1,305,000 bu. of peaches and 230,000 bu. of pears. The vineyards of the state produced 7,500 tons of grapes. The approximate value of these crops in 1939 were: apples, $719,000; peaches, $1,696,000; pears, $196,000; and grapes, $450,000. This represents some decline in production and value over the previous years.

The livestock on the farms of North Carolina in 1940 consisted of 684,000 cattle, of which 385,000 were kept for dairy purposes; 1,167,000 swine; 305,000 mules; 71,000 horses and 54,000 sheep; their total value was estimated at $90,845,000. Milk produced in 1939 amounted to 143,428,605 gal., butter production was 27,778,389 lb. and eggs 41,847,391 doz.

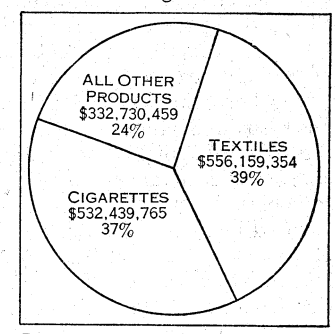
The tendency noted in 1920 and 1930 toward smaller holdings was slightly reversed by 1940; in the last mentioned year, the average size farm was 67·7 ac. In 1940 the farm acreage was 18,845,338 as compared with 19,936,307 in 1935. During the same period the number of farms decreased from 300,967 to 278,276. Of the total number of farmers 218,008 were whites and 60,268 Negroes. The greater part of the Negro farmers (41,994) were tenants. The total number of tenants was 123,476 or 44·4% of the farmers as compared with 47·2% in 1935. The total farm population in 1940 was 1,623,481 as compared with 1,599,918 in 1930.

**Forests and Fisheries.**—North Carolina had in 1939 1,879 active sawmills which produced 1,042,122,000 bd.ft. of sawed lumber as compared with 1,040,735,000 bd.ft. in 1925 and 571,000,000 in 1933. Of the 1939 production, 842,983,000 bd.ft. were classified as softwood, chiefly yellow pine (791,473,000 bd.ft.), white pine (15,782,000 bd.ft.), cypress (30,543,000 bd.ft.) and hemlock (4,909,000 bd.ft.); and 199,139,000 bd.ft. as hardwood, principally oak (80,499,000 bd.ft.), chestnut (28,476,000 bd.ft.), tupelo (33,664,000 bd.ft.) and yellow poplar (26,096,000 bd.ft.). Other species of some importance were maple, cedar, red gum and ash. The early production of rosin, turpentine and tar from the long-leaf pine forests of the coastal plain caused North Carolina to be popularly called the "Tar-Heel State." Forest resources were the basis for the manufacture of furniture and lumber and timber products.

In the sounds along the coast, in the lower courses of the rivers that flow into them, and along the outer shores, fishing is an important industry. In 1938–40 the total value of the food fish, shrimp, menhaden and shellfish taken in the waters of the state was $7,310,864.

**Minerals.**—During the first half of the 19th century North Carolina was a mining state of the first importance, but in 1938 it ranked 31st among the states of the union. The total value of the mineral products of the state, in the latter year, was $14,959,228 or ·34% of the total for the United States. The principal minerals produced, ranked according to value, were stone ($5,789,486), clay products ($3,324,461), crude feldspar ($295,800), sand and gravel ($762,827), talc ($241,337), mica ($249,477), gold ($65,730), silver ($3,556), miscellaneous ($11,988,186). In 1938, North Carolina's output of crude feldspar constituted 29% of the total quantity and 33% of the total value of that mineral produced in the United States. Feldspar was produced chiefly in Mitchell, Yancey and Avery counties. North Carolina also ranked first in the production of mica, which is found in the south-western portion of the mountain region. Granite, suitable for building stones and paving blocks, is found in most parts of the state west of the "Fall Line." Talc is found chiefly in Swain, Yancey, Mitchell and Avery counties.

**Manufactures.**—North Carolina in 1939 ranked second among the southern states and placed twelfth among the states of the union in the value of her manufactured products. This industrial pre-eminence has been gained since 1880. Industrial leadership in the manufacture of cotton goods, tobacco products and furniture has been achieved by an abundant supply of raw materials, favourable climatic conditions, a reliable supply of native labour and cheap hydroelectric power. The state department of conservation and development estimated in 1925 that over 50% of North Carolina's knitting mills, 50% of her furniture factories, 90% of her tobacco manufacturing industries and over 90% of her textile spindles were electrically driven. In 1939 there were 103 water-power plants in North Carolina with a total of 947,880 h.p. In 1938 the total production of electricity in kilowatt hours was 1,381,662,000 by water power and 804,648,000 by fuels. The total value of the manufactured products of the state in 1914 was $289,412,000; in 1929 it was $1,308,035,000.




RELATIVE IMPORTANCE OF THE PRINCIPAL MANUFACTURES OF NORTH CAROLINA, 1939

A comparison of the value of the manufactured products in 1929 with that of 1939 shows an increase of $113,294,578, or approximately 9%. In the latter year, the state's 3,225 industrial establishments, with a product exceeding $5,000, employed 270,210 wage earners and had an output valued at $1,421,329,578. The following table shows the principal industries in 1939, the number of establishments, the average number of wage earners and the value of the product:

| Industry | Number of Establishments | Wage earners | Value of Products |
|---|---|---|---|
| Cigarettes | 10 | 15,375 | $532,439,765 |
| Cotton goods | 341 | 109,795 | 324,208,238 |
| Knit goods | 263 | 46,230 | 119,739,791 |
| Silks and Rayons | 29 | 13,899 | 52,716,278 |
| Furniture | 185 | 19,981 | 60,304,039 |
| Lumber and timber products | 804 | 18,243 | 48,899,846 |
| Fertilizers | 70 | 1,923 | 17,855,023 |
| Flour and grain-mill products | 118 | 682 | 12,261,290 |
| Cotton-seed oil, cake and meal | 37 | 742 | 6,077,025 |
| Non-alcoholic beverages | 154 | 797 | 17,317,174 |
| Woollen manufactures | 7 | 3,252 | 17,616,916 |
| Paper | 7 | 1,100 | 9,627,226 |
| Publishing and printing | 273 | 2,274 | 14,220,851 |
| Men's work clothes | 17 | 3,052 | 9,069,277 |

Gaston county, with the industry centred chiefly at Gastonia and Belmont, was the leading textile producing county in the United States in 1933. Other important textile producing counties of North Carolina were Alamance, Guilford, Cabarrus and Mecklenburg. North Carolina was the leading tobacco manufacturing state. Winston-Salem was the chief centre of tobacco manufacture in the state. Durham ranked second in importance. Other towns in which the industry flourished were Greensboro, Reidsville and Statesville. The chief centre of the furniture industry was High Point in Guilford county. Other centres of importance were Winston-Salem, Thomasville, Hickory, Lexington, Mount Airy, Salisbury and Lenoir.

**Transportation.**—Railway building was begun in the state in 1836 with the Raleigh and Gaston line, opened from Raleigh to Gaston in 1840 and extended to Weldon in 1852. The steam railway mileage in 1940 was 4,596 as compared with 5,347 in 1925. Since 1920 great progress has been made in developing a great system of highways. The state highway and public works commission in 1940 maintained 11,309 mi. of state highways and 47,385 mi. of county roads, of which 10,946 mi. were hard-surfaced. The total highway expenditures made by or under the direction of the state department amount to about $30,000,000 annually. There were in 1940, according to the state utilities commission, 39 passenger bus lines operating on 6,756 mi. of road and 251 freight lines on 6,753 mi. of road. The total motor vehicle registration for the year 1939 was 573,497. Wilmington, the deepwater port, had in 1938 a water-borne trade of 1,715,723 tons received and 320,237 tons of shipments.

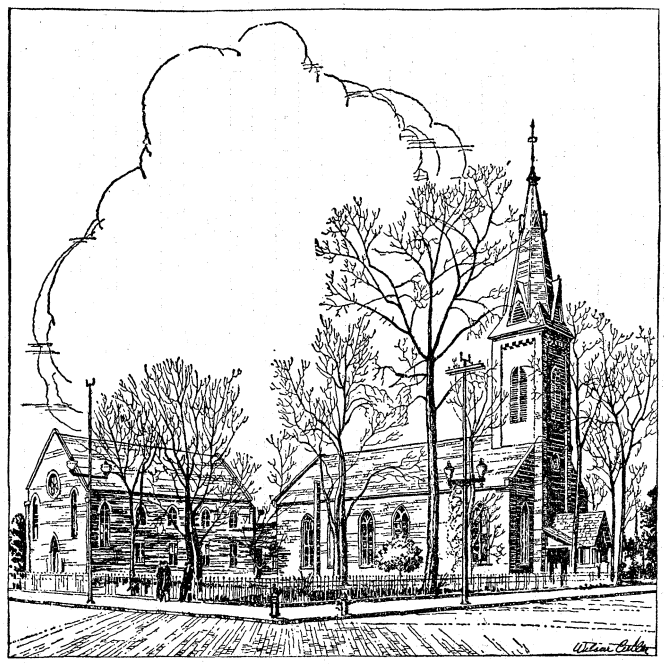
**History.**—The history of North Carolina may be divided into four main periods: the period of discovery and early colonization (1524–1663); the period of proprietary rule (1663–1729); the period of royal rule (1729–76); and the period of statehood (from 1776).

It is known that some of the early French and Spanish explorers visited the coast of North Carolina, but no serious attempt was made by Europeans to establish a settlement until near the close of the 16th century. After receiving from Queen Elizabeth a patent for colonization in the New World, Sir Walter Raleigh, in April 1584, sent Philip Amadas, or Amidas (1550–1618), and Arthur Barlowe (*c.* 1550–*c.* 1620) to discover in the region bordering on Florida a suitable site for a colony. They returned in September with a glowing account of what is now the coast of North Carolina, and on April 9, 1585, a colony of about 108 men under Ralph Lane (*c.* 1530–1603) sailed from Plymouth in a fleet of seven small vessels commanded by Sir Richard Grenville. The colony was established at the north end of Roanoke island on Aug. 17 and about a week later Grenville returned to England. Threatened with famine and with destruction from hostile Indians, the entire colony left for England June 19, 1586, on Sir Francis Drake's fleet. Only a few days after their departure Sir Richard Grenville arrived with supplies and more colonists, 15 of whom remained when he sailed away. Although greatly disappointed at the return of the first colony, Raleigh despatched another company, consisting of 121 persons under John White, with instructions to remove the plantation to the shore of Chesapeake bay. They arrived at Roanoke island July 22, 1587, and were forced to remain there by the refusal of the sailors to carry them farther. Of the 15 persons left by Grenville not one was found alive. White's granddaughter, Virginia Dare (b. Aug. 18, 1587), was the first English child born in America.

White soon returned to England for supplies, and having been detained there until 1590 he found upon his return no trace of the colony except the word "Croatoan" carved on a tree; hence the colony was thought to have gone away with friendly Indians.

In 1663 Charles II granted the territory between the 31st and 36th parallel and extending from sea to sea, to the earl of Clarendon (1609–74), the duke of Albemarle (1608–70), and six other favourites. By a second charter issued in 1665 the limits were extended to 29° and 36° 30′. The first permanent English colony in North Carolina was established at Albemarle on the Chowan river about 1660 by people from Virginia. Other settlers, chiefly Scotch, Scotch-Irish and Germans, followed down the valleys from Pennsylvania. The colony grew rapidly, and at the close of the colonial period (1776) the population numbered approximately 300,000, including about 40,000 Negroes. Economic advantages seem to have been the chief motives of colonization. The proprietary period (1663–1729) was a turbulent one. Several governors or deputy governors were driven from office between 1674 and 1712, and there were two uprisings which have been deemed worthy of the term rebellion. A war with the Tuscarora Indians, in 1711–13, resulted in the defeat of the Indians and the removal of the greater part of the tribe to New York, where they became the sixth nation of the Iroquois confederacy.

In 1729 an act was passed by parliament establishing an agreement with seven of the proprietors for the surrender of their claims to both provinces. They were allowed £17,500 for their rights and £5,000 for arrears of quit rents. Lord Carteret, the eighth proprietor, refused to sell, but in 1744 he gave up his claim in return for a strip of land in North Carolina lying between lat. 35° 34′ and the Virginia line (36° 30′). The political history during the royal period is, like that of other colonies, the story of a constant struggle between representatives of the people and the representatives of the Crown. There were disputes



BY COURTESY OF THE NEW BERN CHAMBER OF COMMERCE

CHRIST CHURCH, PROTESTANT EPISCOPAL, NEW BERN, N.C.

over questions of Government, of commerce, of finance and of religion. In the "back country" extortionate fees, excessive taxes, and the oppressive manner of collecting them brought about a popular uprising, known as the Regulation. Violence followed the refusal to pay taxes, and in Sept. 1768 Governor Tryon was forced to lead a military expedition against the Regulators. They, however, were not prepared to withstand the governor's forces and submitted without bloodshed. New outbreaks in the fall of 1770 provoked the second military expedition of the governor, and on May 16, 1771, with a force of about 1,000 men and officers, he met about twice that number of Regulators on the banks of the Alamance, where, after two hours of fighting, with losses on each side nearly equal, the ammunition of the Regulators was exhausted and they were routed. About 15 were taken prisoners, and of these seven were executed.

The first Provincial Congress met at New Bern Aug. 25, 1774 and elected delegates to the Continental Congress. A second Provincial Congress met in April 1775, and in the next month Gov. Martin sought safety in flight. A committee representing the militia companies of Mecklenburg county, on May 31, 1775, passed a series of resolutions which declared that the royal commissions in the several colonies were null and void, that the Constitution of each colony was wholly suspended, and that the legislative and executive powers of each colony were vested in its Provincial Congress subject to the direction of the Continental Congress; and the resolutions requested the inhabitants of the county to form a military and civil organization independent of the Crown of Great Britain which should operate until the Provincial Congress should otherwise provide or the British Parliament should "resign its unjust and arbitrary pretensions with respect to America." The Mecklenburg Declaration of Independence, which it is alleged was passed on May 20 by the same committee is of doubtful authenticity, though the date appears on the state flag by legislative act.

The first sanction of independence by any body representing the whole province was given by the fourth Provincial Congress on April 12, 1776, and the same body immediately proceeded to the

consideration of a new and permanent form of government. Their labours ended, however, in another provincial Government by a council of safety, and the drafting of North Carolina's first State Constitution was left to a Constitutional convention which assembled on Nov. 12, at Halifax.

North Carolinians fought under Washington at Brandywine and Monmouth and played a still more important part in the Southern campaigns of 1778–81. The State was twice invaded, in 1776 and in 1780–81, and two battles were fought upon her soil, Moore's Creek Feb. 27, 1776 and Guilford Court House March 15, 1781.

North Carolina sent delegates to the Philadelphia Constitutional convention of 1787, but the State convention, at Hillsboro, called to ratify the Constitution for North Carolina, did not meet until July 21, 1788, when ten States had already ratified. The document was most strongly opposed because it contained no bill of rights and on the ground that it would provide for such a strong central Government that the State Governments would ultimately be sacrificed. At the conclusion of the debate the convention by a vote of 184 to 84 declared itself unwilling to ratify the Constitution until a bill of rights had been added and it had been amended in several other particulars so as to guarantee certain powers to the States. But a second convention met at Fayetteville in Nov. 1789 and the Constitution was speedily ratified (on the 21st) by a vote of 194 to 77.

The period from 1790 to 1835 was marked by a prolonged contest between the eastern and the western counties. In 1790 the West began to urge a new division of the State into representative districts according to population and taxation. This was stubbornly resisted, and the West assumed a threatening attitude as the East opposed its projects for internal improvements for which the West had the greater need. In 1823 the West called an extra-legal convention to meet at Raleigh, and delegates from 24 of the 28 western counties responded, but a lack of agreement over the counting of slaves as well as whites as a basis of representation caused little to be accomplished. Finally in Jan. 1835 the legislature passed a bill for submitting the question of calling a Constitutional convention legally to all the voters of the State. When the popular vote was taken, in the following April, every eastern county gave a majority against the convention, but the West voted strongly for it and carried the election with a total majority in the State of 5,856 votes. In the convention, the East made some concessions: such as the popular election of the governor, the disfranchisement of free negroes, the choosing of senators from districts according to public taxes and the apportioning of commoners to districts according to population based on the Federal ratio. The electorate gave its approval to the revision by a vote of 26,771 to 21,606, and with this the agitation over representation ceased.

The fundamental points of difference between North Carolina and South Carolina were exemplified in the slavery conflict. South Carolina led the extreme radical element in the South and was the first State to secede. North Carolina held back, worked for a compromise, sent delegates to the Washington Peace convention in Feb. 1861, and did not secede until May 20, 1861, after President Lincoln's call for troops to preserve the Union. Liberal support was given to the Confederacy, both in men and supplies, but Gov. Vance, one of the ablest of the Southern war governors, engaged in acrimonious controversies with President Jefferson Davis, contending that the general Government of the Confederacy was encroaching upon the prerogatives of the separate States. Owing to its distance from the border, the State escaped serious invasion until near the close of the war. Wilmington was captured by the Federals in Feb. 1865; Gen. Sherman's army crossed the southern boundary in March; a battle was fought at Bentonville, March 19–21; Raleigh was entered on April 13; and the Confederates under Gen. Joseph E. Johnston surrendered near Durham station, in Durham county, on the 26th.

Reconstruction was a costly experience here as in other Southern States. Jonathan Worth (1802–69), elected governor under the presidential plan in 1865, was an honest and capable official, but the Government established in accordance with the views of Congress in 1868 was corrupt, inefficient and tyrannical. Carpet-baggers, Negroes and unscrupulous native whites, known as scalawags, were in control of affairs, while many people of wealth, refinement and education were disfranchised. Gov. William Woods Holden (1818–92; governor 1868–70) was so weak and tyrannical that he was impeached by the legislature in Dec. 1870. Under his successor, Tod R. Caldwell (1818–74), there was some improvement in the condition of affairs, and in 1875 a Constitutional Convention, in session at Raleigh, with the Democrats slightly in the majority, amended the Constitution, their work being ratified by the people at the State election in 1875. The native white element completely regained possession of the Government in the following year, when the Democrats came into office under Gov. Zebulon B. Vance. Since that time an interesting feature in the political history of the state was the rise and fall of the People's Party. The hard times which followed the panic of 1893 enabled them, in alliance with the Republicans, to carry the state in 1894. The race question dominated the election of 1898, when the Democrats came again into power; and two years later a constitutional amendment virtually disfranchising Negroes was adopted. In 1928 Mr. Hoover carried the State by 62,000. But in the national elections from 1932 to 1940 the State resumed its place with the "solid South" by voting Democratic.

BIBLIOGRAPHY.—The best bibliographies are S. B. Weeks, *A Bibliography of the Historical Literature of North Carolina* (1895); F. B. Laney and K. H. Wood, *Bibliography of North Carolina Geology, Mineralogy and Geography* (1909); Douglas C. McMurtrie, *Eighteenth Century North Carolina Imprints, 1749–1800* (1938). Of primary source materials, there are extensive manuscript collections of historical records and public archives in the North Carolina Historical commission at Raleigh, Duke university library at Durham and University of North Carolina library at Chapel Hill. There are published guides to these collections. The chief published sources are: *The Colonial and State Records of North Carolina*, 30 vol. (1886–1914); the *Publications* of the North Carolina Historical commission; H. T. Lefler, ed.; *North Carolina History Told by Contemporaries* (1934); reports and publications of various state departments and agencies, and U.S. Census reports and government documents.

Of secondary sources the best general histories are: R. D. W. Connor, W. K. Boyd, J. G. de R. Hamilton, *History of North Carolina*, 3 vol. of history and 3 vol. of biography (1919); S. A. Ashe, *History of North Carolina*, 2 vol. (1908–25); and R. D. W. Connor, *North Carolina: Rebuilding an Ancient Commonwealth, 1584–1925*, 2 vol. of history and 2 vol. of biography (1929). Other valuable works of broad scope are: G. G. Johnson, *Ante-bellum North Carolina: a Social History* (1937); and S. H. Hobbs, Jr., *North Carolina, Economic and Social* (1930). Among the best monographs are: J. S. Bassett, *Constitutional Beginnings of North Carolina, 1663–1729* (1894); *Slavery and Servitude in the Colony of North Carolina* (1896); and *The Regulators of North Carolina, 1765–1771* (1895); C. L. Raper, *North Carolina: A Study in English Colonial Government* (1904); E. W. Sikes, *The Transition of North Carolina from Colony to Commonwealth* (1898); S. B. Weeks, *The Religious Development in the Province of North Carolina* (1892), *Church and State in North Carolina* (1893) and *Southern Quakers and Slavery* (1896); Coralie Parker, *History of Taxation in North Carolina During the Colonial Period, 1663-1776* (1928); C. C. Crittenden, *The Commerce of North Carolina, 1763–1789* (1936); W. H. Hoyt, *The Mecklenburg Declaration of Independence* (1907); H. M. Wagstaff, *State Rights and Political Parties in North Carolina, 1776–1861* (1906); Louise I. Trenholme, *The Ratification of the Federal Constitution in North Carolina* (1932); D. H. Gilpatrick, *Jeffersonian Democracy in North Carolina, 1789–1816* (1931); A. R. Newsome, *The Presidential Election of 1824 in North Carolina* (1939); W. E. Dodd, *The Life of Nathaniel Macon* (1903); J. S. Bassett, *Slavery in the State of North Carolina* (1899); R. H. Taylor, *Slaveholding in North Carolina; an Economic View* (1926); J. G. de R. Hamilton, *Party Politics in North Carolina, 1835–1860* (1916); C. C. Norton, *The Democratic Party in Ante-bellum North Carolina, 1835-1861* (1930); C. K. Brown, *A State Movement in Railroad Development* (1928) and *The State Highway System of North Carolina* (1931); J. C. Sitterson, *The Secession Movement in North Carolina* (1939); D. H. Hill, *Bethel to Sharpsburg*, 2 vol. (1926); J. G. de R. Hamilton, *Reconstruction in North Carolina* (1914); Holland Thompson, *From the Cotton Field to the Cotton Mill* (1906); W. K. Boyd, *The Story of Durham, City of the New South* (1925); Josephus Daniels, *Tar Heel Editor* (1939) and *Editor in Politics* (1941); E. W. Knight, *Public School Education in North Carolina* (1916); P. W. Wager, *County Government and Administration in North Carolina* (1928). The best historical articles may be found in the *North Carolina Historical Review* (1924– ); the *James Sprunt Studies* (1900– ); *Historical Papers* of the Trinity College Historical society (1897– ); and the *South Atlantic Quarterly* (1902– ). (A. R. N.)

**NORTH CHICAGO,** a manufacturing city of Lake county, Illinois, U.S.A., on Lake Michigan, 35 mi. N. by W. of Chicago, between Waukegan (on the north) and the Great Lakes Naval

Training station. It is served by the Chicago and North Western, the Chicago, North Shore and Milwaukee, and the Elgin, Joliet and Eastern railways. Pop. 5,839 in 1920 (33% foreign-born white); in 1930 it was 8,466; in 1940, 8,465 by federal census.

**NORTHCLIFFE, ALFRED CHARLES WILLIAM HARMSWORTH** (1865–1922), VISCOUNT, British newspaper proprietor, was born on July 15, 1865 at Chapelizod, Dublin, the eldest of a family of fourteen. His father, Alfred Harmsworth (1837–1889), descended from an old Hampshire family, was a barrister-at-law of the Middle Temple. His mother, Geraldine Mary, who died Aug. 29, 1925, a woman of remarkable intellect and strong character, was a daughter of William Maffett.

Of the seven sons, the two eldest, Alfred and Harold, became members of the House of Lords as Lord Northcliffe and Lord Rothermere respectively; the third, Cecil Bisshopp (b. 1869), became in 1915 under-secretary for home affairs and in 1919 under-secretary for foreign affairs, having entered the House of Commons as Liberal M.P. for Droitwich (1906–10) and subsequently sitting for S. Beds; while the fourth, Robert Leicester (1870–1937), who was created a baronet in 1918, entered the House of Commons in 1900 as Liberal M.P. for Caithness, a seat which he retained till 1922. The other three sons were Hildebrand Aubrey (1872–1929), from 1901 to 1904 editor of *The New Liberal Review;* St. John (b. 1876), the creator of the Perrier mineral water business; and Vyvyan George (b. 1881).

**Early Journalism.**—The Harmsworths moved to London in the year 1867, and at Henley House school, West Hampstead, the boy Harmsworth started in 1878 the first of his journalistic adventures, a school magazine. This was originally issued in ms. but was afterwards printed and sometimes set up by himself in his spare time. At 15 he did some work for Mr. Jealous, then editor of *The Hampstead and Highgate Express.* As secretary and companion to one of Lord Lilford's sons, he travelled extensively in Europe. On his return to London he became assistant editor of *Youth* and contributed articles to *The Morning Post,* and to the *St. James's Gazette.*

But his health temporarily broke down in 1884. Ordered to live out of London, he went to Coventry in 1885 and worked for the firm of Iliffe and Sons, owners of many publications. With them he remained till 1886, and he then went back to London and joined a general publishing business. Among other ventures he started on June 16, 1888 *Answers to Correspondents,* a weekly periodical intended to be a more popular form of *Notes and Queries.* As *Answers* it laid the foundation of what eventually became the largest periodical publishing business in the world, the Amalgamated Press. Alfred Harmsworth had already been joined by his second brother, Harold (*see* ROTHERMERE, VISCOUNT). The two brothers revolutionized the current methods of periodical journalism. The profits of the accumulated publications soon soared to £50,000 a year. In the next few years Alfred Harmsworth travelled much in Europe, India, Africa, Canada and the United States. On April 11, 1888 he had married Mary Elizabeth, daughter of Robert Milner, a West Indian merchant.

On Aug. 31, 1894 he and his brother Harold acquired the London *Evening News,* in which the Conservative party had sunk some £300,000. It was then losing money heavily, but it was at once reorganized with such effect that the first working week yielded a profit of £7, and the first year one of £14,000. In the same year he fitted out an Arctic expedition under Mr. F. G. Jackson, which explored Franz Josef Land. In the general election of 1895 he stood unsuccessfully as a Conservative candidate for Parliament at Portsmouth.

**The Daily Mail.**—On May 4, 1896 a new halfpenny morning paper, *The Daily Mail,* was launched, "the busy man's newspaper," as he called it. It embodied many innovations, a very full service of cables, the employment of numerous famous writers, condensation of unimportant topics, and costly and daring enterprises of various kinds. A comparison of past files of the London Press shows how it revolutionized daily journalism. One of the three leading articles in the first number dealt with the then almost unknown motor-car, in the future of which Alfred Harmsworth had a firm belief, being himself already a qualified driver. *The Daily Mail* attained a sale of 600,000 copies a day in the Boer War, and acquired sound influence on national policy at home and abroad.

In 1903 he founded *The Daily Mirror;* it was at first a complete failure, losing £1,500 a week but after being transformed from a penny paper for women into a halfpenny illustrated morning journal, became as signal a success. In 1905 a Continental edition of *The Daily Mail* was established, with headquarters in France. In 1904 Alfred Harmsworth was created a baronet, and in 1905 he was raised to the peerage as Baron Northcliffe. In 1906 he and his brothers acquired for their companies about 3,000 sq.m. of forest land in Newfoundland, with lakes, rivers and water transport, for the manufacture of paper and wood pulp, the result being the formation of the Anglo-Newfoundland Development Co., a gigantic enterprise with its works at Grand Falls, and two lines of railway, a port and Atlantic and other steamers.

In 1908 Lord Northcliffe obtained control of *The Times,* to own which had always been one of the aims of his life. New machinery was installed, and the size of the paper greatly increased; in March, 1914, he reduced the price to one penny, with the result of a large increase in circulation, though the enormous rise of 600% in the cost of paper during the World War forced a subsequent increase in price. Meanwhile Lord Northcliffe had acquired *The Weekly Dispatch;* disposed of the Sunday *Observer,* which he for some time owned; and sold *The Daily Mirror* to his brother, Lord Rothermere. Among the reforms which Lord Northcliffe introduced into newspaper management were the five-day week for editors, sub-editors and reporters, a more generous payment of journalists and a system of profit-sharing by the chief members of his staffs.

From 1900 onwards, through his newspapers, he had exercised an ever-increasing influence on politics. He had at one time been anxious, like Edward VII. and Cecil Rhodes, to obtain a friendly understanding between England and Germany, but the Boer War caused him to abandon that idea as impracticable. His newspapers consistently pleaded the cause of a strong navy, and as consistently warned the nation for 20 years of the peril from Germany. From 1902 he sought to effect an entente with France, and also to promote agreements with Russia and the United States, whose sentiments and prejudices he had learnt in many visits. Through *The Daily Mail* he gave large prizes for airmanship, in which, from 1906 onwards, he took the warmest interest. His maiden speech in the House of Lords was devoted to the pressing claims of aircraft. He was a strong believer in the future of flying and a daily advocate of the value of aircraft in war. He was also interested from the first in submarines, in one of which craft he made an early and hazardous descent.

**The World War.**—In the World War he aimed at the vigorous conduct of the struggle, and was from the first of opinion that the War would be long and desperately contested. The chief newspaper campaigns which he carried out, always with the aims of victory and close union between the Allies, were: (1) for the organization of the munition supply and provision of high-explosive shells in April and May 1915, when he did not hesitate to lay the responsibility for the shortage of ammunition on Lord Kitchener in leading articles written by himself in *The Daily Mail* of May 19 and 21, the second of which was publicly burned on the London and other stock exchanges; (2) this campaign was one of the causes of the formation of the Coalition Ministry by Mr. Asquith; (3) throughout 1915 and early 1916, in the teeth of storms of abuse, he urged the necessity of introducing compulsory service; (4) he protested continuously against the excessive optimism of the Asquith Government and against official secretiveness; (5) he called for the strict enforcement of the blockade; (6) so far as the censorship would allow, he resisted the Dardanelles and Salonika campaigns, which absorbed so large a part of the national forces; (7) he continued his pre-War demand for the construction of aircraft—and "the right kind of aircraft"—on the largest possible scale; (8) he urged the necessity of creating a strong naval war staff and taking offensive measures against the enemy submarines; (9) he insisted on the need of compulsory food rationing. While always active with his pen and through

his Press, he went repeatedly to the various battle-fronts, British, French, Belgian, Italian and American, and kept in close touch with the various staffs. In Dec. 1916 he gave his support to Mr. Lloyd George in the political crisis which led to the fall of Mr. Asquith's Government, and dealt the final thrust which brought that Government down, though after the Armistice, by reason of his objection to the long-drawn-out after-war negotiations with the Germans, he became Mr. Lloyd George's most persistent critic. He was offered office but declined.

**Work in New York.**—Before the United States entered the War he was offered and declined the post of British ambassador at Washington. But he went to New York (June 2, 1917) as chairman of the much-needed British War Mission returning to London on Nov. 12, 1917, when he was created a viscount, as Viscount Northcliffe of St. Peter-in-Thanet, for his services. On Feb. 13, 1918, he became director of propaganda in enemy countries. To pave the way for operations among the nationalities subject to the Habsburgs, he secured an agreement between the Yugoslavs and the Italian Government, which played a big part in the defeat of the Austrian Army and was subsequently embodied, in substance, in the peace terms. An account of his work was given in Sir Campbell Stuart's *Secrets of Crewe House* (1920); Crewe House being the London headquarters of the organization.

**Last Days.**—During the Peace Conference Lord Northcliffe's Press and the *Continental Daily Mail* especially exerted a powerful influence on the British Government, extracting from Lloyd George a promise to fulfil election pledges and striving to maintain the closest and most cordial relations with France. In July 1921 he went for a prolonged tour of the world, as he was medically advised to take a rest cure. A complete breakdown followed, and after a long illness he died on Aug. 14, 1922 of ulcerative endocarditis. (H. W. W.)

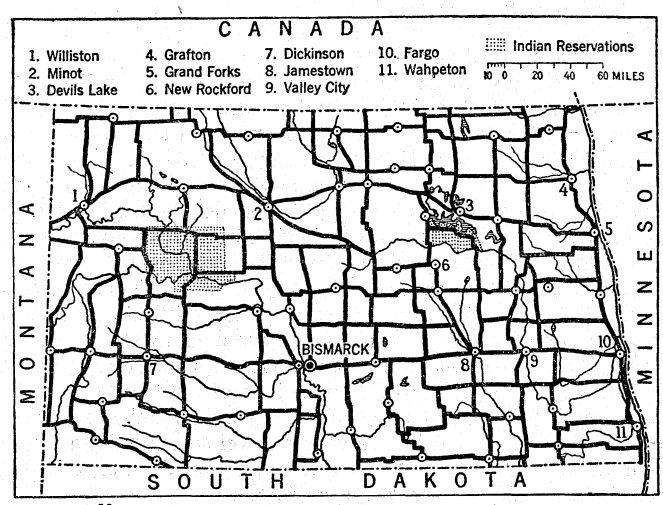
*See* his *My Journey Round the World* (1923); L. Owen, *The Real Lord Northcliffe* (1922); M. Pemberton, *Lord Northcliffe* (1922).

**NORTHCOTE, JAMES** (1746–1831), English painter, was born at Plymouth on Oct. 22, 1746. He was apprenticed to his father, a poor watchmaker, but in 1769 left his father and set up as a portrait-painter. In 1773 he went to London and was admitted as a pupil into the studio and house of Reynolds. At the same time he attended the Academy schools. In 1775 he left Reynolds, and, about two years later went to study in Italy. On his return to England he settled in London, where Opie and Fuseli were his rivals. He was elected associate of the Academy in 1786, and full academician in the following spring. Northcote's works are said to number two thousand, and he made a fortune of £40,000. Apart from his painting he wrote lives of Reynolds (1813), and of Titian (1830), and two series of *Fables*. He died on July 13, 1831.

**NORTHCOTE, STAFFORD HENRY,** 1ST BARON (1846–1911), was educated at Eton and at Merton college, Oxford. He became a clerk in the foreign office in 1868, acted as private secretary to Lord Salisbury, and was attached to the embassy at Constantinople from 1876 to 1877. From 1877 to 1880 he was secretary to the chancellor of the exchequer, was financial secretary to the war office from 1885 to 1886, surveyor-general of ordnance, 1886 to 1887, and charity commissioner, 1891 to 1892. In 1887 he was created a baronet. In 1880 he was elected M.P. for Exeter as a Conservative, and retained the seat until 1899, when he was appointed governor of Bombay (1899–1903), being created a peer in 1900. Northcote was appointed governor-general of the Commonwealth of Australia in 1903, and held this post till 1908. He died on Sept. 29, 1911.

**NORTH DAKOTA,** the "Flickertail State," is one of the North-central group of the United States, and lies between 45° 55′ and 49° N. and 96° 25′ and 104° 3′ West. It is bounded north by the provinces of Saskatchewan and Manitoba in Canada, east by Minnesota, from which it is separated by the Red river, south by South Dakota and west by Montana. Its extreme length east and west is 360 mi., its extreme width north and south is 210 miles. Its total area is 70,665 sq.mi. of which 611 sq.mi. are water surface. The original territory of Dakota was so called because of its being the home of the Dakota Indians, the word "Dakota" meaning "allied" in the language of these tribes.

**Physical Features.**—In crossing North Dakota from east to west three distinct plains are encountered, rising one above the other. The most easterly of these from 790 to 965 ft. in elevation, is the remarkably level valley floor of the Red river extending from the left river bank 30 to 40 m. westward into the State. This valley was once the bed of a great glacial lake (Lake Agassiz),




MAP SHOWING THE MAIN ROADS IN NORTH DAKOTA

formed by the retreating ice sheet damming the natural northern outlet. Its floor is covered by the rich, silty lake deposits, coloured black by decayed vegetation, which make it one of the most fertile tracts on the continent. Being free from rocks, trees and hills, its wide areas were quickly brought under cultivation by the pioneer, and the valley has continued one of the famous grain-producing regions of the United States.

West of this valley, and between it and the Missouri plateau, is an intermediate plain, ranging from 1,300 to 1,650 ft. in elevation, so covered everywhere with glacial drift that it is usually known as the drift plain. Its east and west width varies from about 70 m. at the south to over 200 m. along the Canadian boundary. The surface of this plain, varying from gently undulating to rolling and hilly, was largely determined by the irregular drift deposit which covers the pre-glacial surface to a depth of 150 to 300 feet. Across the plain from north-west to south-east, a number of irregular ridges or glacial moraines mark successive haltings of the retreating ice sheet. Especially in these moraines, but generally characteristic also of the entire drift area, are the little lakes, varying in diameter from a few yards to a few miles, which occupy the numerous sags and swales. Many of these have no outlet and are strong with salt and alkali. The largest of this character is Devils lake, an irregular body of water about 40 m. in length and 400 sq.m. in area, which forms a natural reservoir for a large area in the north-eastern part of the drift plain which has no other drainage. The drift plain has few rivers, and those of importance, the Mouse, James and Sheyenne have narrow valleys with sharp, steep banks. The lack of well-developed river valleys and the undisturbed surface of the glacial drift indicate a youthful land, little affected as yet by erosion. The soil of its rolling slopes is excellent for most grain crops and this region holds the major portion of the farming population in the State.

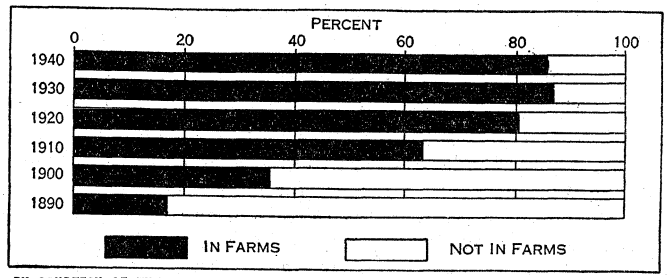
The drift plain is bounded on the west by an escarpment beyond which lies the third and highest plain, the so-called Missouri plateau. The escarpment itself extends from north-west to south-east in a great bow approximately parallel to, but 50 to 60 m. east of the Missouri river. In the north it forms the water-parting between the streams that run into the Missouri river and thus to the Gulf of Mexico and those that flow into the Mouse or Souris river and are carried to Hudson bay. For a long period this escarpment marked the division between farming lands of the east and grazing lands to the west, but dry-land farming methods have created many farming communities west of the ridge wherever the surface of the land is favourable.

As the Missouri river marks approximately the lower edge of the ice sheet and west of this stream the region is almost free from glacial deposits, a marked contrast in the nature of the country is presented. The sands and clays west of the river are fine and soft, and as there is scant vegetation to protect the hillsides they are easily eroded by the rains and winds. Much of the region is so cut by deep coulees and sharp embankments and travelling is so difficult that the early French explorers called the region *les terres mauvaises*, and in its English equivalent, "the bad lands," this appellation still remains. The picturesque effect of the sculpturing by wind and rain is enhanced by the brilliant colours along the faces of the hills and ravines—grey, yellow, black and every shade of red and brown. Here and there black seams of lignite coal protrude. Here too are found petrified forests, and other fossilized evidences of a vegetation and animal growth which long ago disappeared. While the lands are not inviting to the farmer, the ranchman finds deep grassy valleys which provide good winter shelter for his cattle. The "bad lands" are best developed along the principal tributary of the Missouri in this region, the Little Missouri river, together with its numerous branches, but they are by no means confined to that drainage basin. Other important tributaries of the Missouri from the west are the Knife, Heart and Cannonball rivers. A feature of this south-western portion of the State is the large number of buttes rising 400 to 700 ft. above the general level so as to form prominent landmarks, those best known being Black Butte, Sentinel Butte, Camel's Hump and Killdeer mountain.

In North Dakota, except where they have been planted by the farmers, trees are found only in the Turtle mountains, a group of high hills near the Canadian border, in the region about Devils lake, in the vicinity of streams, and in a few other places sheltered from the wind and sun. The woodland area of the State is estimated at but 600 sq.m., or less than 1% of its entire surface. The prairies of the more humid regions are covered with valuable grasses, and with masses of showy native flowers which bloom from spring to autumn. Cottonwoods flourish along the Little Missouri, and stunted cedars and junipers grow in the sheltered ravines of the "bad lands." Cactus and sage brush in this region are also common.

**Climate.**—Since there are no mountains, forests or large bodies of water to have a moderating effect, the climate is strikingly uniform over various portions of the State. Great extremes of temperature are likely to be encountered in any part of the State, but the dryness of the atmosphere makes them easier to bear. The seasons are sharply demarked; both winter and summer come rapidly. The summers are short, but long hours of sunlight make the vegetation grow rapidly. Killing frosts sometimes occur in May and return again in September. High winds are frequent and prairie houses are protected by rows of trees planted as "wind breaks." Tornadoes are not unknown, and hail storms are frequent in summer. During the growing season the winds are usually light; but in the late summer occasional dry, hot winds from the south prove very destructive to crops. The average rainfall for the State is 18 in. and is well distributed, but generally decreases east to west from 22 in. in the Red river valley to about 14 in. along the western boundary. While below normal for humid regions, the greater part of the rain comes in the spring and summer so that the crops receive full benefit. The snows are light, and the prairies are often swept bare by high winds so that cattle may graze throughout the winter.

**Government.**—The State is governed under its Constitution of 1889, as subsequently amended. Previous to 1918 the Constitution required that a proposed amendment pass two successive legislatures before it could be submitted to the people for ratification, but in that year the 28th amendment made it necessary that it pass but one. This amendment also gave the voters of the State the power of proposing amendments by an initiative petition which must be signed by 20,000 voters before the amendment can be voted upon. Another amendment in 1918 gave the voters power to initiate legislation (the initiative petition to require the signature of 10,000 voters), and the power of referendum (the referendum petition to require the signature of 7,000 voters). The veto power of the governor does not extend to measures initiated or referred to the electors and thereupon passed. Amendment 33 gave the electors the power of recalling any elective congressional, state, county, judicial or legislative official, the recall petition to contain the signatures of at least 30% of the voters voting at the preceding election. The legislative assembly of the state is composed of a senate and a house of representatives with a member-




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

PROPORTION OF LAND AREA OF NORTH DAKOTA IN FARMS: 1890 TO 1940

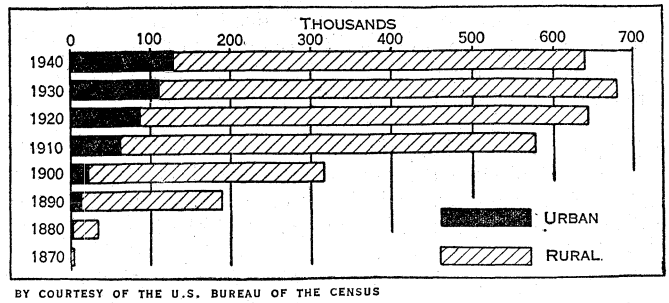
ship respectively in 1941, of 49 and 113 members. Senators are elected for four years and representatives for two years. The assembly meets the first Tuesday after the first Monday in January in odd-numbered years.

The executive officers who are elected for two years are the governor, lieutenant governor, secretary of state, auditor, treasurer, attorney general, commissioner of insurance, commissioner of agriculture and labour, superintendent of public instruction, tax commissioner and three public service commissioners. The executive department includes some 50 boards or commissions whose members are partly elected officials, whose service on these boards is part of their ex-officio duties, and partly officials appointed by the governor. The governor appoints an adjutant general, state engineer, state mine inspector, state examiner, three members of the board of administration, seven members of a board of higher education and members of many professional examining boards.

Since 1919 when the industrial program of the Non-partisan League was put into operation, one of the most important boards, composed of the governor, commissioner of agriculture and labour and the secretary of state, has been the industrial commission, which has the management of state industries and enterprises, including the Bank of North Dakota and the North Dakota Mill and Elevator, in its hands.

The supreme court of the state, having appellate jurisdiction only, is composed of five justices elected for six years each. A term is held on the first Tuesday of every month in the year, except July and August. There are six judicial districts in the state. The 1st, 2nd and 6th have three justices each, while the others have but two each, all elected for a term of four years. There are probate courts in each county, and justices of the peace in each township and village. Some cities are provided with police courts.

**Population.**—The area which now forms North Dakota had 2,405 inhabitants in 1870 and 36,909 in 1880. The population of the state in 1890 was 190,983; in 1910, 577,056; and in 1940, 641,935, which was 5·7% less than in 1930. The population per square mile was 9·2, as compared with 44·2 for the United States




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF NORTH DAKOTA: 1870 TO 1940

as a whole. Of the 1940 population, 131,923, or 20·6%, lived in urban places, that is, in cities of 2,500 or more. The number

of occupied dwelling units returned in the housing census of 1940 was 152,171, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 4·7 in 1930 to 4·2 in 1940. The white population of North Dakota formed 98·5% of the total in 1940, as compared with 98·7% in 1930, practically all the nonwhite population being Indians. The number of males per 100 females in the entire population of the state was 110·1; in the urban population, 95·4; and in the rural population, 114·3. The population of the state and of its principal cities is summarized in the following table:

| Area | Population | | | Percent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 641,935 | 680,845 | 646,872 | −5·7 | 5·3 |
| Urban | 131,923 | 113,306 | 88,239 | 16·4 | 28·4 |
| Rural | 510,012 | 567,539 | 558,633 | −10·1 | 1·6 |
| Percent urban | 20·6 | 16·6 | 13·6 | .. | .. |
| Principal cities: | | | | | |
| Fargo | 32,580 | 28,619 | 21,961 | 13·8 | 30·3 |
| Bismarck | 15,496 | 11,090 | 7,122 | 39·7 | 55·7 |

**History.**—The first white men to visit North Dakota were members of an expedition from Ft. La Reine (Portage la Prairie, Canada) led by Pierre Gautier de Varennes, usually known as Verendrye. They reached an Hidatsa earth lodge village on Dec. 3, 1738, a short distance southwest of the present city of Minot. From this point Verendrye's son was sent by him to another village on the Missouri river which he reached on Dec. 7. At this point the visit of this famous French fur trader to the Missouri river is marked by the Verendrye National monument established there in 1917 by the federal government near the present city of Sanish.

Two sons of Verendrye, 1742–43, crossed the Missouri at this point and explored the country to the southwest in an attempt to carry out their father's dream of establishing an overland trade route to the Pacific. After reaching the rugged slopes of the Big Horn mountains they abandoned their search and recrossed the Missouri river at Old Crossing, as it was known thereafter.

After the English occupation of Canada in 1763, two famous fur companies, the Hudson's Bay company and the North West company, operating from Ft. Garry (Winnipeg, Canada), established trading posts on the Missouri river at the mouth of the Knife river where they were found by the Lewis and Clark expedition that wintered at Fort Mandan, 1804–05, before proceeding to the Pacific the following year. The purchase of Louisiana territory by the United States in 1803 and the success of the Lewis and Clark expedition made St. Louis a rendezvous for American fur traders who exploited the fur resources of the upper Missouri. The American Fur company was the best known of these firms. They were the first to use steamboats on this river (1831). They built among others Ft. Clark (1826) and the best known of all, Ft. Union in 1831.

Two European travellers visited America at this time, Catlin (1832) and Maximilian (1833), and their published narratives with the accounts of many others, give a complete picture of this early fur trade and of the various Indian tribes living along the Missouri river. The North West company early penetrated southward from Ft. Garry to occupy the Red river valley. Chaboillez established the first post at Pembina, 1797, and Alexander Henry, Jr., built his first post near the mouth of Park river in 1800 and later located permanently at Pembina in 1801.

David Thompson, famous fur trader and surveyor, was connected first with the Hudson's Bay company and later, 1796, was employed by the North West company. His journal is a mine of information concerning the location of trading posts in the northwest. He visited the Five Villages of the Hidatsa and Mandan Indians at the mouth of the Knife in 1797, the Pembina post of Chaboillez in 1798 and the post built by Cadotte at the junction of the Red and Red Lake rivers at the well known Minnesota Point, opposite Grand Forks. The War of 1812 put an end to all British attempts to extend their Canadian frontiers southward by means of a number of well placed fur trade salients and by the assistance of the North West company and their Indian allies. In conformity with their new policy of American alliances, England turned over to the U.S. the entire Red river valley which had been in the possession of the Hudson's Bay company since 1670. By the treaty of Paris in 1818, the international boundary was fixed at the 49th parallel as far west as the Rocky mountains.

The first genuine settlement of homeseekers in North Dakota in this period was made by a band of settlers from Lord Selkirk's colony of Scottish Highlanders in Manitoba who migrated south of the boundary line and settled at Pembina in 1819. When Maj. Stephen H. Long, leading the first United States exploring expedition into the Red river valley in 1823, visited the place, the population numbered 600. Ft. Snelling (St. Paul) was established in 1823 and a brisk trade between this fort and Ft. Garry soon developed along both sides of the Red river. It was carried on principally by means of the well known Red river carts and continued to be important until after the early '50s when the flatboats and later the steamboats replaced this primitive form of transportation. Ft. Abercrombie was built in 1858 and Ft. Pembina in 1863 and these forts became the rendezvous for commercial and military operations in the northwest, as well as a rallying point for settlers.

Between 1850 and 1870 there was considerable difficulty with the Dakota Indians, whose lands in Minnesota had been largely appropriated by the whites, and whose buffalo herds on the Dakota prairies were fast being depleted by the hunting activities of traders and half-breeds. The Minnesota outbreak of 1862 was followed by campaigns by Gens. Sibley and Sully in 1863 and 1864 which finally drove the hostile Dakotas to the "bad lands" west of the Missouri river. All eastern North Dakota was now open for occupation and the completion of the first railroad to the eastern border in 1871 inaugurated the settlement period in earnest.

The following decade was a period of intensive development in the Red river valley, and by 1880 settlement was spreading out over the area of the drift plain, especially along the line of the Northern Pacific railway which in 1873 had reached the Missouri river at Bismarck. West of the Missouri the country was made attractive to settlers by the survey and extension of the Northern Pacific railway from Bismarck westward. The completion of the Great Northern railway across the northern part of the state in 1887 opened that region to eager settlers. The region forming North and South Dakota, which since 1861 had been known merely as Dakota Territory was divided in 1889 into a northern and southern half. A convention met in North Dakota in July and framed a constitution which was accepted by the people in an election held on Oct. 1. President Harrison declared the state's admission to the union on Nov. 2, 1889.

The years 1890-1915 were years of constant growth in population and intensive railroad development. Competing railway lines strove to forestall each other in tapping promising grain territory. Once there they did their best to bring settlers into the newly opened region by conducting land excursions. Nearly 18,000 immigrants annually for this span of years made new homes in the state. Settlement of the drift plain was practically completed and homesteaders invaded the good land beyond the Missouri river. The inrush continued with little abatement until the World War of 1914–18, after which, because of the general depression in agriculture, it practically ceased.

In politics North Dakota is normally Republican but its farmers have shown a tendency to desert the party in times of agricultural depression for third parties which usually promise more direct and radical remedies. In 1912 North Dakota, holding the first presidential primary election in the United States, showed its preference for La Follette. Resentment which had been gathering for a number of years against constant and wholesale abuses in grading and marketing grain resulted in 1915 in the formation of the Nonpartisan League (*q.v.*), a farmer political organization. This organization was so successful that by 1918 it had elected the governor and a majority of both houses of the legislature. An industrial commission was created to manage, operate and control all state-owned industries and business projects created by law, and three major enterprises were established, namely: a Bank of North

Dakota, a state-owned and state-operated mill and elevator, and a Home Builders' association. Despite efforts of conservatives to prevent, all these except the last-named continued in operation. League nominees for state office again carried the Republican primaries and the election of 1932, though on the national issue the Democrats won by a vote of 5 to 2, and again in 1936. In the presidential election of 1940, however, the Republican candidate won by a fair margin.

**Finance.**—State revenues in 1937 amounted to $19,834,000, or $28.13 per capita, as compared with a per capita revenue of $19.48 in 1932. Expenditures in the fiscal year 1937 were $20,521,000, of which $13,574,000 was for operation and maintenance of the general departments, $1,305,000 for interest, and $5,642,000 for outlays.

Revenues derived from taxation in 1937 amounted to $9,314,000; from sources other than taxes, $10,520,000. The sources of taxation and the income derived from each were as follows: Property, $1,951,000; income, $501,000; inheritance and estate, $20,000; sales, $5,547,000; business, $425,000; and non-business licence and permit, $867,000. The assessed valuation of property in 1937 was $487,000,000, about 50% of the actual estimated valuation of the property. Real estate comprised $356,000,000 of this total and personal property $131,000,000. The valuation of other property, including public utility property, was not given separately in that year.

The inheritance tax was enacted into law in 1913, a motor vehicle licence tax in 1917, income, gasoline and gross earnings taxes in 1919, a cigarette tax in 1925, and a retail sales tax in 1935. In addition to the taxes raised by the state, the counties, cities, towns, villages, school districts and townships levy annual taxes which in 1935 amounted to some $24,392,000.

The total funded state debt in 1937 was $25,305,000. Approximately $24,798,000 of this debt was in the form of rural credit bonds, the proceeds of which were loaned in turn to the farmers. These bonds are secured in all cases by first mortgages and the state only stands as surety for their payment. Aside from the rural credit bonds the state formerly had bonds of about $4,000,000 used to construct and finance its various industrial enterprises, notably the Bank of North Dakota and the State Mill and Terminal Elevator.

There were, June 30, 1940, 47 national banks, 120 state banks and one trust company. Total invested capital of the state banks and the trust company amounted to $4,548,000; total deposits, $24,447,000. The national banks reported invested capital of $5,866,000 and deposits of $49,895,000.

**Education.**—Public schools of secondary rank are under the control of the state department of public instruction, while the state institutions of higher learning are under the control of the board of higher education appointed by the governor.

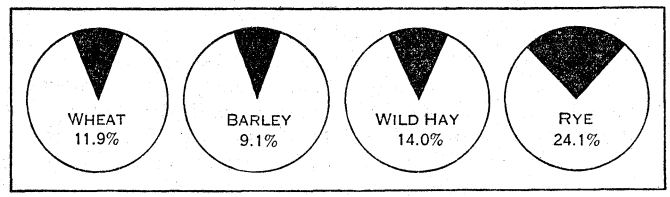
In the public school system of North Dakota in 1939–40 there were enrolled 139,629 pupils, or 71·3% of the total school population which numbered 195,611. The average daily attendance in 1940 was 130,642, and the average number of days attended per year per pupil 152·5, the greatest in the history of the state. Of the total enrolment (139,629) in 1940 33,895 were registered in all of the secondary schools of the state. In 1934 there were 9,881 pupils enrolled in the private and parochial schools of North Dakota, of whom 2,064 were in the private high schools. There were altogether 7,361 teachers in the public school system of the state during 1939–40, of whom 21·3% were male. They drew a total annual salary of $5,319,290 or an average salary of $722 each. Total public school expenditures in 1940 amounted to $9,979,781, an increase of nearly $480,000 beyond the amount spent in 1934. The cost per capita of population in 1934 was $13.63, or per capita of enrolment, $60.90.

The University of North Dakota, founded at Grand Forks in 1883, had 1,892 students and 130 teachers in 1940. It is composed of a college of liberal arts, schools of education, law, engineering, medicine and commerce, a graduate division and an extension division. The State Agricultural college at Fargo, founded in 1889 in accordance with the provisions of the state constitution, had, in 1940, 1,714 students regularly enrolled. There are state teachers' colleges at Valley City and Mayville (both founded in 1889), and at Minot (founded 1912), all giving four years of college work. There is also a state normal school at Dickinson (founded in 1916) and a state normal and industrial school at Ellendale. At Wahpeton is a state school of science, which operates as a trade school and junior college, giving instruction in the electrical trades, plumbing, bricklaying, printing, auto mechanics, dressmaking and business courses. The State school of forestry is at Bottineau and gives work of a junior college grade.

There are two private institutions of higher learning in North Dakota, Jamestown college at Jamestown, and Wesley college at Grand Forks. All institutions of higher learning, both public and private, in North Dakota are co-educational.

**Charities and Corrections.**—The State board of administration has general control over a state penitentiary situated at Bismarck, a hospital for the insane at Jamestown, an institution for the feeble-minded at Grafton, a state training school at Mandan, a school for the deaf at Devils Lake, a school for the blind at Bathgate and a state tuberculosis sanatorium at Sun Haven, Dunseith. There is a soldiers' home at Lisbon which is not under the control of the board. There is a state children's bureau which licenses and regulates hospitals and lying-in-places which receive maternal cases and institutions which receive children for temporary or permanent care. The bureau investigates homes into which children are placed for care or adoption, and co-operates with the juvenile courts in investigation of delinquents, with the county commissioners in administering the mothers' pension law, and in general works to enforce the child labour and all other laws relating to abuse or neglect of children.

**Agriculture and Livestock.**—Probably no other state in the Union depends so exclusively upon agriculture as a means of livelihood as does North Dakota. Of its total area 87·1%, or 39,118,000 ac. is classified as farm land. Of its population 51·1% (exceeded only in Mississippi and Arkansas) live on farms; the population of the small towns is almost entirely dependent upon farm trade for its support. The value of all crops was estimated in 1931 at $20,003,000, in 1933 at $43,373,000 and in 1935 at $48,500,000, 1934 representing an unusually poor year and 1935 an average one. The value of livestock upon farms amounted to $116,690,000 in 1930 and $54,518,000 in 1935. Land and buildings were valued in 1940 at $707,138,992, an increase of about $186,000,000 over the estimated value in 1939. The estimated value of the farm income for 1939–40 was $218,330,652, a considerable increase over that of the previous decade. Despite the hardships suffered during the period of agricultural depression, there was an increase in farm population from 372,886 in 1925 to 385,614 in 1935 and an increase in the number of farms actively operated from 75,970 to 84,606. In 1940 the state stood first in the number of bushels of wheat stored on federal loan, 54,343,015 bu.




PROPORTION OF TOTAL UNITED STATES CROPS OF CERTAIN GRAINS RAISED IN NORTH DAKOTA, 1940

North Dakota is divided into three very distinct farming belts. The black-earth belt occupies nearly half the state covering all east of a line drawn from the southern boundary at Dickey county northwestward to Rolette county on the Canadian border, and also including a small area in Divide and Burke counties in the northwest. In this zone the soils are dark, moisture conditions are favourable, production is the highest for the leading crops and the size of farms (averaging 480 ac.) is generally smaller than in other parts of the state. West of the black-earth belt, extending a short distance west of the Missouri river and including also the greater part of McHenry and Bottineau counties to the north is the farming-grazing belt. This is, in general, rougher in topography with soils somewhat lighter and production about 20%

lower than in the black-earth belt. The average size of farms in this division is 640 acres. In the southwestern quarter of the state is the grazing-forage crop belt. The region is hilly, the soils are residual in origin and the rainfall is less than in other parts of the state. The size of farms in this section averages 800 ac. and less than 30% of the farm land is devoted to crop production.

The main crop of North Dakota is wheat, in the production of which the state ranked first among the states in 1933 and second in 1935 with 71,314,000 and 53,855,000 bu. respectively. Its value for 1934 and 1935 was $20,404,000 and $42,932,000. Slightly less than 40% of the crop area of the state was devoted to this crop, varying from 30 to 35% of the acreage in the east to 50% in the west. The wheat has a high protein content and commands a premium in the market of from 10 to 16%. Oats in 1935 occupied about 7% of the crop area, being somewhat more important in the northern than in the southern part of the state. The value of the crop was $10,325,000 in 1929 and $9,431,000 in 1935. About 8% of the crop area in 1935 was devoted to barley, in the production of which the state ranked second in 1929 and fourth in 1935. Its value in 1935 was $10,710,000. In the growing of rye North Dakota leads all states with a production in 1929 and 1935 one-third larger than that of Minnesota, its nearest competitor. In 1935 12,754,000 bu. with a value of $3,571,000 were harvested. The state came second in the production of flax in 1934 with a crop valued at $1,504,526. Indian corn showed marked increase in acreage from 1920 to 1929 but decreased slightly from 1930 to 1935. In the latter year 1,305,000 ac. produced 22,838,000 bu. valued at $10,277,000. It is relatively more important in the southeastern portion of the state together with an area in Burleigh and Morton counties. Tame hay occupied about 20% of the crop area and was relatively more important in the western and southwestern parts of the state. The state in 1940 stood second in the production of certified seed potatoes, being exceeded only by Maine. The total production was 18,920,000 bu. and of this 2,361,040 bu. were certified seed potatoes, valued at $1,227,740. The average yield per acre for the leading grains during a period extending from 1928 to 1932 was approximately as follows: Indian corn 25 bu., wheat 17 bu., oats 26 bu., barley 20 bu., rye 13 bushels. Deficient moisture is the most important cause of damage to grain, especially in central and southwestern North Dakota; in the southeast wheat is subject to rust.

The raising of grain is supplemented on most farms by the raising of livestock. This becomes the major industry in the grazing-forage belt southwest of the Missouri. Beef cattle, sheep and horses are found in increasing numbers from east to west across the state. Swine are found mainly in the southeast where a large proportion of the corn is raised. They numbered 218,319 in 1935 valued at $1,058,847. Dairying showed a vigorous growth between 1927 and 1934, the number of dairy cows increasing from 365,038 to 569,351. The amount of butter made in creameries increased from 33,035,000 lb. to 47,163,000 lb. and the amount of milk produced increased from 199,037,293 gallons in 1924 to 265,800,000 in 1940. The beef cattle business was slow in recovering from the economic depression following 1929 but there was a notable improvement in 1935. Sheep showed a slighter decline than any other branch of the livestock business, the number decreasing from 856,621 in 1930 to 740,025 in 1935 and their value from $7,023,726 to $2,775,094. The total value of farm livestock for 1940 was $89,790,000.

**Mining.**—North Dakota is not a metal-producing state, but it possesses extensive coal and clay deposits which are sure to become more widely developed and prove of great economic value.

Lignite coal deposits of varying thickness underlie no less than 32,000 sq.mi. of surface in the western half of the state. The U.S. geological survey estimates that of total lignite deposits of 965,902 million tons in the United States 633,329 million are in North Dakota, and about 500,000 million are capable of being mined. Beds 6 to 8 ft. thick are common. In places they lie so close to the surface that the overlying soil can be stripped and the coal mined in open cuts; in other places the room and pillar method is used. In 1934 there were 200 mines in operation of which 150 were underground. The coal output amounted to 1,753,888 tons valued at $2,363,000. The increase in production is shown by comparison with 416,580 tons in 1910 and 878,969 tons in 1920. An economically practicable briquetting process has been perfected which doubles the heat value of the coal, makes it less liable to deterioration and more convenient to handle.

Clay is found in a large number of varieties ranging from common brick through tile to high grade art pottery clay. Deposits are large especially in the western part of the state where they are found near lignite beds, a proximity which enhances the value of both. Stone and gravel products in 1934 were valued at $130,813. The great gravel deposits of the state, found mainly in the ridges of glacial moraines, are becoming increasingly important with the construction of highways.

**Manufactures.**—Though in 1935 North Dakota had less manufacturing than any other state except New Mexico and Nevada, this branch of industry was showing a slight growth. There were then 329 establishments employing 2,905 wage earners and producing products valued at $42,913,328. The most important products were those closely connected with agriculture, namely, butter, cheese, condensed and evaporated milk products to the value of $10,110,000 and flour, feed and other grain products to the value of $5,318,000.

**Transportation.**—The state is crossed east and west its entire length by two transcontinental railways, the Great Northern and the Northern Pacific. Another transcontinental line, the Chicago, Milwaukee and St. Paul cuts across the southwestern corner, while the St. Paul and Sault Ste. Marie runs from the southeast corner diagonally northwestward to make a transcontinental connection with the Canadian Pacific at the Canadian border. Branches of these main lines intersect the wheat-raising areas in every direction. The railroad mileage increased from 4,201 in 1910 to 5,311 in 1920 but fell to 5,271 in 1940.

In the state highway system in 1940 there were 6,612 mi. of roads. Of these 1,674 mi. were hard surfaced, 4,659 mi. were gravel surfaced and 278 mi. were earth roads provided with drainage. Motor vehicles registered increased from 144,972 in 1925 to 183,019 in 1930 and to 185,158 in 1940.

BIBLIOGRAPHY.—For official information about the state and its activities the reports of the various departments, commissions and bureaus furnish the most complete figures and facts. This information is also found in the volumes of *Public Documents* and the *Blue Book*. For the general history of the state the most important reference works are the *Collections of the State Historical Society of North Dakota* (1906 *seq.*); *North Dakota Historical Quarterly* (1926 *seq.*); *South Dakota Collections* (1902 *seq.*); *Quarterly Journal of the University of North Dakota* (1910 *seq.*); *Report of the State Geological Survey* (1899 *seq.*); E. J. Babcock, A. G. Leonard and L. P. Dove, *Lignite Deposits of North Dakota* (1925); R. T. Young, *The Life of Devils Lake* (1924). Other books which contain useful material for reference are the following: *Original Journals of the Lewis and Clark Expedition, 1804–06,* reprinted by R. G. Thwaites (1904–05); Geo. Catlin, *Letters and Notes on the Manners, Customs, and Condition of the North American Indians* (1913); Maximilian, *Travels in the Interior of North America,* reprinted by R. G. Thwaites (1905); Washington Matthews, *Ethnography and Philology of the Hidatsa Indians* (1877); Elliott Colles, *New Light on the Early History of the Northwest* (Journal of Alexander Henry, Jr.) (1897); D. E. Willard, *Story of the Prairies* (1902); C. L. Young, *Government of North Dakota and the Nation* (1922); H. E. Gaston, *The Nonpartisan League* (1920); C. E. Russell, *Story of the Nonpartisan League* (1920); C. A. Lounsberry, *Early History of North Dakota* (1919); H. C. Fish and R. M. Black, *Brief History of North Dakota* (1925); H. Hagedorn, *Roosevelt in the Bad Lands* (1921); L. A. Lang, *Ranching with Roosevelt* (1926); Usher L. Burdick, *Tales from Buffalo Land, the Story of Fort Buford* (1940); Zdena Trinka, *Medora* (Life of Marquis de Mores) (1940); *Compendium of History and Biography of North Dakota* (1900); *Reports* of U.S. Bureau of the Census.

**NORTH DWINA AREA,** a unit of the northeastern region of European Russia, bordered on the west and north by Archangel, on the east and north by the autonomous Komi (Zirian) area, on the southeast by Vyatka, on the south by Gorky, on the southwest by Kostroma and on the west by Vologda. It has an area of 40,971 sq.mi. and a population (1926) of 678,255, of whom 80% are Great Russians and 18% Zirians. Over 80% of the region is clad with coniferous forest, the cleared areas being mainly along the river banks.

The Dwina and its tributaries, the Sukhona, Yug, Vychegda and Luza, drain the area; the Sukhona is most used for navigation, since it connects via the Württemberg canal both with Leningrad and with the Volga river. There are no bridges except the railway bridge over the Luza river.

Cultivation is most dense in the south, and along the river banks, but, apart from the 80% forest, there is 12·8% of marsh land, so that less than 10% is available for the production of the winter rye, oats, barley, flax and potatoes grown here. There is some meadow and pasture land, and horses, cattle, dairy cattle and pigs are bred, the latter in large numbers. The income from hunting and fishing is small, though the salmon and sterlet of the Dwina river are noted for their quality. Linen is the most important industry and exceeds pre-1914 level, as does production of hemp and jute rope.

In addition to river communications, the railway from Vyatka

reaches Kotlas (*q.v.*), which has wharves and grain elevators, and from which the railway is to be continued to Soroka on the Gulf of Onega, thus providing a further outlet for Siberian grain. From Ustyug-Velikiy (*q.v.*), the administrative centre, at the junction of the Sukhona and Yug, post roads, impassable in spring and autumn, go to Vologda and Gorky, and the town has telegraphic links with the south and also as far north as Krasnoborsk. Electrification proceeds rather slowly, though the few town centres have production plants. The peat reserves in the region should prove an asset in the future. The area needs much more intensive colonization for its full development. Recently the north India area ceased to exist as an independent unit and was divided between the Vologda and Archangelsk regions.

*See* M. I. Ivanovskiy, *The North Eastern Area* (1926) (in Russian).

**NORTHERN AUSTRALIA,** a term indefinite but applied generally to that portion of the continent which lies north of the Tropic of Capricorn (*c.* 1,150,000 sq.mi. = 0.386 or about $\frac{5}{13}$ of the whole territory), comprises the northern portions of Western Australia (364,000 sq.mi. = 0.373 of the state), of the (former) Northern Territory (426,320 sq. miles = 0.814) and of Queensland (359,000 sq.mi. = 0.535). Except for a practically continuous belt of coastal lowlands—broader along and up the river valleys of the northwest and north and around the Gulf of Carpentaria (*q.v.*), narrow to the point of disappearance along the northeast—almost the whole of this area consists of tablelands of 500–1,500 ft. general elevation with but few small and isolated higher areas in the west, northwest, northeast and central south. (*See* AUSTRALIA: *Geomorphology.*) Climate is thus the dominant factor and characteristic in this respect are prevailingly high temperature levels, 85°–75° F. (*c.* 68° in the central interior) and summer (monsoonal) rainfall: *c.* 60 in. along the north, sinking to 20 in. at about 18° lat. and to 10 in. and less farther inland. Thus, apart from the mineral wealth, of which little new has been discovered in recent years, the chief economic possibilities would appear to be pastoral development in the drier and more invigorating interior, scattered agriculture in the more humid lowlands and fishing—including pearl-oyster, etc., fishing (*see* BARRIER REEF)—around the coasts. The ultimate commercial and strategic importance of certain parts of the coasts are probably also considerable.

The regional differentiation inherent in so vast an area will increasingly invalidate generalizations about it and the tropical portions of Queensland and Western Australia are best dealt with under those States (*qq.v.*). The area which was till recently called the Northern Territory is on a somewhat different basis, and as it also offers a fair average cross section of northern Australia, a brief account of it is given here.

The area in question extends from the Western Australian to the Queensland border (Longs. 129°–138° E.) and from the north coast—including adjacent islands, *e.g.,* Melville, Bathurst, Groote Eylandt—to the South Australian border (26° S. lat.) and covers 523,620 square miles in all. After a chequered history it was handed over by South Australia to the commonwealth in 1911, and, as a result of further and on the whole unsuccessful experience, it was subdivided—in March, 1927, under the northern Australia act of 1926—into North Australia and Central Australia, lying respectively north and south of lat. 20° S., to the administered, from Newcastle Waters and Alice Springs (*q.v.*) respectively, as commonwealth territories, each by a government resident assisted by an advisory council of four. In 1931 the two sections were again united under an administrator at Darwin.

**North Australia** (287,056 sq.mi.) consists mainly of rolling country which rises from the coastal lowlands and valleys to a general level of 500–1,000 ft. inland. In the north is the rather higher (sandstone) tableland of Arnhem Land and on the east and west the land rises gradually to the Barkly tableland and the Kimberley plateau respectively. In the south the swell of the land forms (17°–20° S. lat.) an almost imperceptible watershed between the coastward and inward flowing drainage. The coast is mostly low, sand beaches and mangrove mud swamps alternating with cliffy bluffs, but some fine natural harbours ("drowned" river mouths) exist (*e.g.,* Port Darwin). There are two seasons, the wet (Nov.–May) and the dry, and the average ann. rainfall ranges from *c.* 40 in. in the north (Darwin: 62 in.) to 14 in. in the south, Temperatures are high, but the range is greater, the heat is drier and more bearable, and the winters are cooler towards the south (Darwin, av. ann. temp., 85.7°–77.2° F.; Daly Waters [300 miles inland], 88.2°–68.6° F. [*cf.* Alice Springs *inf.*]). In the wet season the streams are mostly swollen, swift and liable to flood and wide areas in the valley bottoms are then under water while inland are lagoons and swamps (Lakes Woods, de Burgh, etc.). The Victoria, Daly, Roper and McArthur are considerable streams but are normally navigable only in the dry season for small craft (4 ft. 6 in. draught; cargo capacity 35 tons). The valleys are often timbered and open forests occur in parts, but the prevailing vegetation is of the savanna type—grass with scattered trees—merging inland into poorer scrub with soft spinifex in the sandy southwestern corner. From Camooweal (Queensland) to Newcastle Waters, in the upper Victoria river basin, and also southwestward toward Hall's Creek (Western Australia) are broad belts and patches ("many thousands of square miles") of open black soil (limestone and volcanic) plains bearing first class fodder grasses (Mitchell, Flinders, etc.) and edible scrubs and here are the principal cattle stations (*e.g.,* Alexandra, Anthony's Lagoon, etc., on the Barkly tableland; Wave Hill, etc., on the Victoria river). Surrounding these and occupying the bulk of the central belt are great expanses of more mixed country, fairly well grassed and watered and containing good patches. The sandy plateaux of the north and of the coastal margins have many well-grassed valleys and the swampy flats mentioned above. Lateritic and travertine incrustations, products of climatic and soil conditions, render considerable areas unproductive. Water is, generally speaking, available on the surface or in underground supplies and various minerals are found around Pine Creek. The chief economic potentialities have been indicated. Efforts towards development have not hitherto been conspicuously successful and a summary of the present (1927) economic and social position will suffice.

**Population:** Europeans, *c.* 3,306; non-Europeans (mainly Asiatics) 744; aboriginals, 15,000. *Land Tenure:* Of the total area *c.* 750 sq.mi. have been alienated, *c.* 8,000 sq.mi. have been reserved for aboriginals and 1,025 for mission stations, while 160,850 sq.mi are leased for pastoral purposes, nearly one-half (or *c.* $\frac{1}{4}$ of the whole of North Australia) of which is held by six lessees. *Stock* (including Central Australia): cattle, 923,000; horses, 32,700; goats, 20,300; and sheep, donkeys, mules, camels, etc. (Cattle and horses do well; sheep do best on the Barkly tableland.

**Products:**—*Minerals:* output, gold £109,000, wolfram £78,277, mica £19,712, together with some tin and copper. *Fisheries:* pearl shell (179 tons) £14,350, besides small quantities of other products. *Nuts and Grains:* ground-nuts (peanuts), cotton and millet; coconuts are grown on a small scale. *Trade:* exports: cattle exported by land, 98,400 (Darwin exports £29,800, mainly cattle to Manila; this trade in cattle has since been discontinued). Imports £29,406. *Communications:* railways (3 ft. 6 in. gauge), from Darwin to Emungalan (199 miles), has been extended to Birdum, 316 miles from Darwin. Bush tracks: *c.* 3,500 miles. Telegraph and cables: Darwin overland line southwards (to Adelaide), also cables (3 lines) to Java, Singapore, etc. Wireless: Darwin and various cattle stations. Steamer: Darwin to eastern (Australian) states, monthly; to Western Australia, every two months. Inland mail services: 6-weekly (pack horse). After World War II was declared, a good motor road was made from Birdum to the railway at Alice Springs.

**General Social and Economic Conditions.**—Isolation, lack of communications, pioneering conditions, climatic influences have contributed to social and political unrest, lack of balance, and of continuity and stability. Wages have been high, labour scarce and exacting, much effort and expenditure has produced small results. The total cost of the Northern Territory to the commonwealth (1911–1926) was nearly £9,000,000, including deficits taken over from South Australia (*c.* £4,000,000). Climatic difficulties, though serious, do not appear insuperable, but more

attention must be devoted to hygiene (housing, ventilation, diet, etc.) and to economic adjustments and adaptations (*e.g.*, morning and evening hours of work).

Darwin (pop. 1,566 in 1933), at present the seat of the administration, is well built and well laid out with wide streets, has stone buildings and amenities (botanic gardens, etc.) and a natural harbour capable of improvement. The subtropical district around Darwin does not invite agricultural development. In the better grazing districts to the south the rainfall is not suited to most crops with which Australians are familiar, though some peanuts, millets and cotton may be possible in the distant future. It is significant that the first recommendations of the commission should be directed toward the improvement of communications—railways, particularly the linking of the Darwin-Daly Waters line with the Queensland system via Camooweal, motor roads, stock routes, ports, notably a port on the gulf coast at the Sir Edward Pellew Islands to serve the Barkly tableland and farther interior—besides increased telegraphic, wireless, aerial and coastal shipping services; toward improved water supply and hygienic and social facilities (*e.g.*, broadcasting), and toward the initiation of organized scientific research.

(*See* also CARPENTARIA, GULF OF.)

**Central Australia** (236,400 sq.mi.) is an oblong area lying between latitudes 20° S. and 26° S. and longitudes 129° E. and 138° E. The flat-lying sediments (sandstones, etc.) which were the floor of an ancient (Mesozoic) sea were subsequently elevated and denuded and now form a plateau, highest (*c.* 2,000 ft.) in the centre and sloping down gently eastwards and southeastwards to the Eyre-Diamantina basin in Queensland and South Australia. In the north an extension of the West Australian "platform" stretches eastwards. (*Cf.* Murchison and Davenport "ranges," *c.* 1,000 ft.) Across the centre lie the Macdonnell ranges (Mount Heughlin, 4,800 ft.), a series of parallel ridges and troughs composed partly of hard folded (Palaeozoic) rocks, the uptilted edges of the above-mentioned plateau. The main drainage lines originate amidst, and north of, the Macdonnell range and run southeast (Finke, Todd, etc.) towards Lake Eyre. These streams, during a former rainier epoch, incised their courses to keep pace with the uplift (*v. sup.*) and have sawn through the hard ridges remarkable transverse gorges valuable because of the facilities they offer for routeways and for the impounding of water. Today the beds contain streams only after rains, the lower courses being normally long tree-lined tracks of water-bearing sand and gravel. The climate is transitional between that of northern and southern Australia and shows continental extremes (Alice Springs [alt. 2,000 ft.]: av. ann. temps. 84°–52.5° F with cool and bracing winters; rainfall occurs throughout the year with summer maximum and variations from 28.5 in. to 5 in.). Mainly steppe country with sparse scrub (mulga, etc.), low scattered growths, and grass in good seasons, the earth lies bare and dust-swept in times of drought except where stream courses, soaks, and waterholes afford a little moisture. Clay and stone desert patches occur and in the little-known northwest and southwest, and again in the east, are areas of sandridge, spinifex, saline flats (Lake Amadeus), and some scrub. In the more humid northwest are areas of seasonal swamp. (*Cf.* North Australia.) After rains the country is transformed as by magic; flowery grasslands spread like seas to the horizon, streams and pools sparkle, life awakens and flourishes for a space. Apart from a little agriculture for home needs—some of it possibly by irrigation—the economic future seems to lie mostly in the direction of pastoralism and mining. Minerals—gold (*e.g.*, Arltunga), mica, nitrates—a recent discovery—exist, the mica crystals are large and rather valuable. Erratic rainfall, rabbits and dingoes are the bane of the pastoralist and little stability can be obtained until water resources—superficial and underground—have been tested and supplies assured. Some 76,000 sq.mi. have been let under pastoral leases or grazing licences but as in North Australia the conditions of land tenure seem to need revision. Given water—horses, sheep, cattle, and live stock generally thrive, as do also human beings, in the climate. (Live stock: *c.* 117,000 head—including 85,000 cattle, 15,000 horses.) But costs of all necessities—including fencing and mining machinery—have been prohibitive. Transport has been by camel, horse or mule train, but motor traction is possible and is increasing. The overland telegraph line traverses the heart of the area and along it—with its government wells—lies the chief route for stock and men. Apart, too, from a few mining, cattle, and mission stations and blacks' encampments, practically all the population (whites: *c.* 410; aboriginals: *c.* 4,000) lives in telegraph stations along this route. The railway line (3-ft. 6-in. gauge) from Oodnadatta (South Australia) was built by 1929, and this extension brings Alice Springs (*q.v.*) within 60 hours (*c.* 1,000 miles) of Adelaide. Another line may ultimately be built from Alice Springs to the proposed port at the Sir Edward Pellew Islands (Carpentaria, Gulf of, *q.v.*) thus giving the area a northern outlet as well. Except near Alice Springs most of Central Australia has not been found worth occupying. But with improved conditions of water supply, transport, fencing (against dingoes, etc.), its stock holding capacity, though it will never be high, will probably improve somewhat in the future. In particular new sheep areas await development here and facilities for movement (railways, stock routes, etc.) will help to combat drought. Much of the southwest portion has been made into an aboriginal reserve.

**NORTHERN IRELAND:** *see* IRELAND, NORTHERN.

**NORTHERN PACIFIC RAILWAY.** The main line of the Northern Pacific railway extends from Ashland, Wis., United States, through the states of Minnesota, North Dakota, Montana, Idaho, Washington and Oregon, to Seattle and Tacoma in Washington and to Portland, Oregon. Its main terminals in the east are St. Paul, Minneapolis, Duluth and Superior; in the west, Seattle, Portland and Tacoma. It was constructed under an act of congress approved by President Lincoln on July 2, 1864. With its completion in 1883 the vast territory adjacent to it was first made accessible to settlers, and the government's long-cherished aim of opening to the north Pacific coast a route following, roughly, that taken by the explorers Lewis and Clark in their expedition of 1804–06, was at length realized.

The Northern Pacific system consisted in 1939 of about 6,720 mi. of operated railroad. It owned also nearly one-half of the stock of the Chicago, Burlington and Quincy Railroad company, and exactly one-half of the stock and bonds of the Spokane, Portland and Seattle Railway company, operating together 11,000 mi. additional. A large part of the tonnage which it carries consists of the products of agriculture and of the forest; but its traffic is well diversified and its earnings, under normal conditions, are comparatively stable. It has outstanding 2,480,000 shares of stock of a par value of $100 each. Its bonded indebtedness in 1939 was $316,000,000. (C. E. DE.)

**NORTHFIELD,** a city of Rice county, Minnesota, U.S.A., on the Cannon river 35 mi. S. of St. Paul. It is on federal highway 65, and is served by the Chicago Great Western, the Chicago, Milwaukee, St. Paul and Pacific, the Minneapolis, Northfield and Southern, and the Rock Island railways, and by motor-bus lines. Population (1940) 4,533 by the federal census. It is the seat of St. Olaf college (Norwegian Lutheran, 1874) and of Carleton college (1866). The former is the home of the St. Olaf Lutheran choir, and a centre of Norse culture. Carleton is known for the work of its science departments and strong liberal arts faculty. Northfield is surrounded by a rich farming and dairying region, where the breeding of Holstein cattle is an important specialty. It was settled by New Englanders in 1856; named after John W. North, who platted it, and chartered as a city in 1875.

**NORTHFIELD,** a village of Washington county, Vermont, U.S.A., in the Green mountain region, 10 mi. S.S.W. of Montpelier; served by the Central Vermont railway. Pop. (1940) 2,129. It is the seat of Norwich university, founded in 1819 at Norwich (Vermont) by Capt. Alden Partridge (1785–1854), who had been a professor in the U.S. Military academy at West Point and its acting superintendent, and who became the first president of the new institution, serving until 1843. In 1866, after a fire had destroyed its buildings at Norwich, the university moved to Northfield. The charter requires "a course of military instruction, both theoretical and practical," and the discipline is military in

form and principle. The enrolment in 1940–41 was 465. This was the pioneer engineering school in the United States.

**NORTHFLEET,** an urban district of Kent, England, on the Thames, 22 mi. S.E. of London by the S.R. Pop. (1938), 17,850. Area, 6.5 sq.mi. The church of St. Botolph is of Norman foundation, but the nave is Decorated and the chancel Perpendicular, and the tower, having fallen down, was rebuilt in 1628. The church contains a brass of the 14th century. The nave and chancel have undergone modern restoration. The industries include cement works, chalk, lime and brick works, paper mills, printing firms and cable and rubber works. Swanscombe (pop. [1938] 8,230) almost adjoins Northfleet on the south-west. Its name is said to be derived from a camp formed here by the Danish king, Sweyn, and tradition fixes at this spot the meeting between William the Conqueror and the men of Kent, to whom was confirmed the possession of all their ancient privileges.

**NORTH HOLLAND,** a Netherlands province, lying between the North sea and the Zuider Zee, and bounded southward by the provinces of South Holland and Utrecht. The present area, including the islands of Texel, Vlieland and Terschelling, in the West Frisian group, and Marken and Urk in Zuider Zee, the isle of Wieringen having been incorporated with the mainland, as starting point of the Afsluitdijk (closing dike) which drains the Zuider Zee and connects provinces of North Holland and Friesland, is 1,065 sq.mi. with pop. (1938) 1,666,370, showing an increase during the 20th century from 905 per sq.mi. to 1,417 per sq.mi. Three natural divisions can be recognized: (1) foreshore and sand-dunes, (2) inner dunes and the *geest* grounds, (3) low fens and clay lands. The dunes form a long, smooth, unbroken protection for the other regions, and the absence of deep inlets explains the absence of commercial towns. Ijmuiden is a small town and its recent creation was solely dependent on its position at the exit of the artificial North sea canal from Amsterdam. Nevertheless, the broad, gently-sloping, sandy beach is admirable for sea-bathing, and permits the beaching of the characteristic flat-bottomed fishing boats used at Zandvoort and at smaller fishing villages. Bergen aan Zee, Egmond aan Zee and Wijk aan Zee are gay little unconventional resorts. In the second zone, behind recently planted woods, especially along the margin of the *geest* grounds, from about 5 mi. N. of Haarlem to 10 mi. S., hyacinths, tulips, narcissi and crocuses, in exact squares of brilliant and varied colours, attract numerous tourists each spring-time, while market gardens provide valuable and continuous products for home and foreign trade.

This part of North Holland was early inhabited and contains many old towns and villages. Some of the most interesting are Haarlem (pop. 137,578), the seat of government of the old counts of Holland, and the scene of the great resistance of 1573—one of the most glorious failures in history. Near to Haarlem are the extensive red brick ruins of Brederode castle, the seat of an old and illustrious family. Nearer to the south border is Bennebroek, the site of a 10th century nunnery. Alkmaar (*i.e.*, all water), (pop. 31,774), though originally belonging to the lowland zone, also has important historical associations, including its personal success against the Spaniards in the Eighty Years' War. Near Alkmaar are Schoorl—a village in the 9th century—Bergen, also of considerable antiquity, Heiloo, stated to be the site of a church built by St. Willibrord in the 8th century, and the villages of Beverwijk and Velsen. Other possessions of the same apostle still remain, while Egmond, near by, was famed for its great abbey. Nearer Helder (pop. 37,115) is Schagen, a flourishing village in the 12th century, a lordship in the 15th, but of no special importance to-day.

The third division comprises much the largest area, that lying at or below sea-level. Considerable land reclamation has been effected. To the north of the former Y (or IJ) the famous Purmer and Beemster lakes were drained in the beginning of the 17th century; but several sea-polders to the north of these were added to the mainland only in the first half of the 19th century. This region is traversed by the 46 m. North Holland canal (1819–25), between Amsterdam and Helder. The Y, formerly an inlet of the Zuider Zee, was drained, and the direct east to west 15 m. North sea ship canal was cut in its stead (1865–76); in the south, Haarlem lake (72 sq.m.) was drained between 1840 and 1853. The landscape in this lowland division is more typically Dutch than elsewhere. The province is very poor in minerals, consequently cattle-rearing and cheese manufacture (chiefly Edam) are the main industries, but agriculture and even market-gardening are also practised in the heavier clay lands of the polders. Purmerend, the natural focus of the Purmer, Wormer and Beemster polders, with street and canals too narrow to contain the present market-day produce, Alkmaar, the great cheese town with a famous weigh-house, and Enkhuizen, one of the "dead cities" of the Zuider Zee, are the chief market centres. The security offered by the Zuider Zee for trade and fishing was the prime factor in the commercial development of North Holland, and the cities of Medemblik, Enkhuizen, Hoorn, Edam and Monnikendam, though now of little more than local importance, possessed a large foreign commerce in the 16th and 17th centuries. This prosperity later concentrated itself upon the Y (that is, upon Amsterdam, *q.v.*) and upon the series of industrial settlements situated on its offshoot, the Zaan, of which Zaandam (pop. 36,442, with oil, saw, corn, cement and paper mills) is the most important.

Of the islands: Marken is rapidly learning how to commercialize its own quaintness, though it is not yet entirely spoiled; microscopic Urk has a population (about 3,000) largely dependent on the North sea fishery. Texel is noted for sheep and their products: wool and green cheese, and also for sea-birds' eggs, which are exported to Amsterdam. Vlieland and Terschelling are but slightly populated and relatively unimportant.

**NORTHINGTON, ROBERT HENLEY,** 1ST EARL OF (*c.* 1708–1772), lord chancellor of England, was the second son of Anthony Henley, a Whig member of parliament, and a well-known wit and writer. Robert was educated at Westminster school and St. John's college, Oxford; and was called to the bar in 1732. In 1747 he was elected member of parliament for Bath, of which he became recorder in 1751. He acquired a lucrative practice at the bar, and in 1756 was appointed attorney-general. In the following year he was promoted to the office of lord keeper of the great seal, being the last person so designated. For three years he presided over the House of Lords as a commoner, having incurred the hostility of George II. He was given the title of Baron Henley in 1760 so that he could preside at the trial of Earl Ferrers for murder. On the accession of George III. the office of lord chancellor was conferred on Henley, and in 1764 he was created earl of Northington. In 1765 he presided at the trial of Lord Byron for killing William Chaworth in a duel. Northington, who was a member of the group known as "the king's friends," was instrumental in procuring the dismissal of the marquess of Rockingham and the recall of Pitt to office in 1766, and he himself joined the government as lord president of the council, Lord Camden becoming chancellor. He resigned office in 1767, and died at his residence in Hampshire on Jan. 14, 1772.

*See* Lord Henley, *Memoir of Robert Henley, Earl of Northington* (1831); Campbell's *Lives of the Chancellors;* Foss's *Judges of England;* Horace Walpole's *Memoirs.*

**NORTH LITTLE ROCK,** a city of Pulaski county, Arkansas, U.S.A., on the Arkansas river, opposite Little Rock; served by the Missouri Pacific, the Rock Island and the St. Louis Southwestern railways. Pop. (1940) 21,137 federal census. It is practically an industrial district of Little Rock, with extensive railroad shops, hardwood lumber mills and other manufacturing industries.

**NORTH PACIFIC COAST INDIANS.** The Indians of the coast of southern Alaska, British Columbia, Washington, Oregon and northern California form a unit which has been recognized as distinct from other natives of North America. The principal tribes and stocks comprised are the Tlingit, Haida, Tsimshian, Kwakiutl, Nutka, Bella Coola and other Coast Salish, Chimakun, Makah, Chinook, Yakonan, Kus, Takelma, Yurok, Wiyot, Karok and the Hupa and other Athabascan groups. There is linguistic diversity, but the area lacks the usual Mexican features: agriculture, pottery, metallurgy, axes, shields, drums, sweat-houses, political organization, religious structures and altars,

group fetiches. Cultural stimulus has been derived from the backward tribes of north-east Asia, rather than from China and Japan. The culture is vigorously local and therefore complex. It is characterized by the following generic traits: dependence primarily on fish, especially salmon; coastal maritime navigation; development of wood working, including the carver's art; wealth accumulation, with an elaborate system of economic exchange and property law; the organization of society on the basis of hereditary rank dependent on economic status; religious cults heavily influenced by proprietary rights. Particular traits exemplifying these trends are: deep-sea fishing; whale hunting; large dug-out canoes with plank lashings for higher freeboard; mat sails; clothing largely of mats, with basketry hats; twined basketry with overlay decoration; villages of large, all-frame houses facing the beach or a river; totem poles and wooden grave monuments; boxes for cooking, storage, etc.; clubs, spoons, and most utensils, also rattles, masks, etc., elaborately carved or painted in a peculiar totemic-symbolic art style; dentalium shells, plates of native copper, boxes, etc., serving as standardized media of exchange, often with high fictitious credit values; potlatches or competitive socio-religious festivals with wealth distribution for prestige; loans with high rate of interest; division of society into rich nobles with titles, crests and privileges, commoners and slaves; marriage by purchase; secret religious societies with elaborate ranks and masks. The secret societies extend south to Juan de Fuca, the potlatch to Columbia river; the basic elements of the culture—canoes, frame houses, dentalia, wealth display and ranking, slavery—persist as far as northern California.

*See* P. E. Goddard, "Indians of the Northwest" (*Amer. Mus. Nat. Hist.*, 1924); also *Monographs* by F. Boas, G. M. Dawson, M. Eells, G. T. Emmonds, G. Gibbs, P. E. Goddard, E. Gunther, C. Hill-Tout, G. Hunt, A. Krause, A. L. Kroeber, A. B. Lewis, T. F. McIlwraith, C. F. Newcombe, A. P. Niblack, E. Sapir, G. M. Sproat, J. G. Swan, J. R. Swanton, G. Vancouver and T. T. Waterman. (A. L. K.)

**NORTH PLATTE,** a city of Nebraska, U.S.A., 280 m. W. of Omaha. It is on the Lincoln highway, the main transcontinental airway, and the main line of the Union Pacific railroad. The population was 10,466 in 1920, 85% native white, and 12,429 (1940 U.S. census). The city has one of the largest icing plants in the country. The irrigated region raises sugar beet and hay. There is a station of the U.S. Weather Bureau and a State agricultural experiment station 4 m. S. "Scouts Rest," the ranch of Colonel W. F. Cody ("Buffalo Bill") is 3 m. N.W. North Platte was incorporated in 1871.

**NORTH SEA,** a sea bounded east by the continent of Europe and west by Great Britain. Its area was given by Murray (1888) as 162,600 sq.m., and by Kossinna (1921) as 575,000 sq.km., or 222,000 sq. statute miles. Murray estimated the volume of the North sea at 11,200 cu.m., and Kossinna at 54,000 cu.km., or 12,960 cu.m., giving mean depths of: 61 fathoms (112 metres) and 51·4 fathoms (94 metres) respectively. The North sea is thus shallow; its bed is part of the continental shelf on which the British Isles stand, and it slopes upwards with fair regularity, from north to south. In the south and east there is a broad coastal strip, over which the depth nowhere exceeds 40 metres. In about its middle latitude the Dogger Bank crosses the North sea from east to west, extending for about one-third of the whole distance; near the English coast the depth here is under 20 metres and it increases eastwards to about 40 metres. In one part of the Dogger, where the depth is not more than 13 metres, surf is observed in stormy weather as well as dirty water owing to the bottom deposits being stirred up. South of the Dogger there are local depressions, mostly of small area, in which the depth is as much as 45 fathoms, as in the "Silver pit." A bottom configuration strange to the bed of the North sea is known as "Norwegian channel." This is a gully broad and more than 250 metres deep, closely following the Scandinavian coast, and extending into the Skagerrack, in which the depth increases to as much as 660 metres.

**History.**—According to Jukes-Browne, the North sea, in its present form, first took shape as a result of the tectonic movements indicated by the break between the older and newer Pliocene deposits. The southern end of the North sea was probably little affected by the general subsidence which occurred during the Glacial period; its boundary in this direction was apparently within the present land area of France and Belgium, while a narrow inlet may have run westwards between France and England in the present position of the Strait of Dover. Meanwhile immense quantities of ice detritus from Scotland and Scandinavia were deposited in the North sea, to a thickness of perhaps 200 metres, and the whole region was subsequently raised above sea-level, constituting the "structural surface" upon which the present river system was developed as a series of tributaries to a great river which formed a continuation of the Rhine. Finally the land subsided again, the plain of the North sea was again submerged.

**Coasts.**—The coasts of the southern part of the North sea are of no great height. In England they consist of low cliffs with sandy beaches, while on the continental side are immense flats and marshes, with parts below sea-level protected by sand-dunes and artificial dykes. It is not certain whether the rapid changes of coast-line now taking place in many parts are wholly due to the action of the sea or whether a secular sinking of the shores produces this effect. The erosion of the North sea coasts has been made a subject of minute study (in England especially by the British Association and a committee of the Royal Geographical Society), and Harmer has obtained interesting results by comparing the British and continental coasts as characteristic "weather" and "lee" shores.

**Temperature and Salinity.**—The physical conditions of the waters of the North sea have been extensively studied—since 1902 by expeditions sent out by the Swedish, Norwegian, Danish, German and British governments—under the supervision of the International Council for the study of the Sea (Copenhagen). The waters found in the North sea are classified as follows: (1) oceanic water of 35 *pro mille* salinity or more; (2) water of salinity 34 to 35 *pro mille,* called "North sea" water; (3) water of salinity 32 to 34 *pro mille,* found along the coasts of Holland, Germany, Denmark and Norway, and called "bank-water"; (4) water of 32 *pro mille* salinity or less, belonging to the stream flowing out from the Baltic. The Atlantic water enters the North sea by the passage between the Orkney and Shetland islands, in which way the whole volume of water in the North sea could be recruited in two years. Oceanic or Atlantic water also enters through the Strait of Dover; this inflow is, however, much smaller, and it would take some 20 years to fill the North sea.

**Tides.**—The tides of the North sea are of great complexity; their nature has been widely investigated during the last 20 years. On the north-east coast of Great Britain the tide runs southward, so that the co-tidal lines, or the lines of equal time of high water, go from north to south; *e.g.,* high water is at 12 o'clock in the Moray firth, it is high water in the Humber five hours, and at Lowestoft nine hours, later. A second tide comes through the Strait of Dover into the southern part of the North sea, and moves to the right side, *i.e.,* the Dutch-German coast, towards the north and the east. A third weak tide flows south-east towards the Norwegian coast. The three systems—the Scottish, the Channel and the Norwegian—meet to the east of the Dogger, so that there the co-tidal lines radiate from this centre. The range of the tides on the Scottish coast is mostly 4 metres and over, on the Dutch-German coast from 2 to 3 metres, and on the Norwegian coast less than 1 metre. (*See* also maps in the article TIDES.)

**Fisheries.**—The North sea is particularly rich in organisms of all kinds, and the abundance of food attracts fish in such quantities that the North sea fisheries are some of the most productive in the world. Flat fishes, and those feeding at the bottom on smooth ground, are chiefly caught by means of the trawl. The favourite trawling-grounds are the Dogger Bank in winter, and the shallow waters off the Continental coasts in summer. In rough ground, where the trawl cannot be used, hook-and-line fishing is carried on most successfully, and "mid-water" fish are also taken in this way, although the trawl and line fishing overlap considerably. Herring and mackerel are caught by means of drift-nets; herring are also caught by trawling, and in greater quantities than by drifting. The herring fishing off the British coasts exhibits a remarkable variation during summer and autumn, beginning in Shetland in June, and becoming progressively later southwards,

until it ends off the Norfolk coast in November.

The approximate landings of the North sea fisheries amounted in 1924 to 1,069,000,000 kg., consisting of herrings 683,500,000 kg., or 64% of the total catch. Then came haddock 10%, cod 6%, plaice 4%, whiting 3%, mackerel 1%, turbot, sole, halibut, etc. As regards the value of the catch, the North sea herring also came first, but only with 37% of the total value. One of the chief objects of the International Council for the Study of the Sea is to discover the true connection between the varying results of the high seas fishing in the North sea and the changing physio-chemical nature and movements of the waters of the North sea.

BIBLIOGRAPHY.—O. Pettersson, various papers in the *Svenska Vetenskaps-Akademie Handlingar*, also in *Scottish Geographical Magazine* (1894) and the *Geographical Journal;* H. N. Dickson, *Journal of the Scottish Meteorological Society*, third series, vol. viii., p. 332; *Twelfth Report of the Fishery Board for Scotland*, pt. iii., p. 336; *Fifteenth Report of the Fishery Board for Scotland*, pt. iii., p. 280; T. Wemyss Fulton, *Fifteenth Report of the Fishery Board for Scotland*, pt. iii., p. 334; papers by J. T. Cunningham, W. Garstang, and others in the *Journal of the Marine Biological Association*, various years; North Sea Fisheries Investigation Committee of the Fishery Boards for Scotland, *Reports;* Ministry of Agriculture and Fisheries: *Fishery Investigations*, vol. i.–x. (1913–27), *Hydrography*, vol. i.–iv. (1919–21). Conseil permanent international pour l'exploration de la mer: W. Thompson, *Bulletin statistique des pêches maritimes par D'Arcy;* M. Knudsen, *Bulletin Hydrographique* (Copenhagen, 1903–28); F. Deutsche Seewark, *Atlas für Temperatur, Salzgehalt und Dichte der Nordsee* (1927); G. Böhnecke, *Salzgehalt und Stromungen der Nordsee*, (1922). (G. Sc.)

**NORTH SEA FISHERIES CONVENTION:** *see* FISHERIES, LAW OF.

**NORTH SHIELDS,** seaport, Northumberland, England, within the borough of Tynemouth (*q.v.*, for history, etc.), which adjoins it on the east. It lies immediately above the mouth of the Tyne, opposite to South Shields, 7½ mi. E. of Newcastle by a branch of the L.N.E. railway. It is a town of modern growth. Coal and coke are largely exported, and corn, timber and esparto grass are imported. There is an extensive fish quay. There are marine engineering (engines, chain-cables, anchors), salt, rope, earthenware and stained glass works and some shipbuilding is carried on. The town was specially affected by the depression of the 1930s, over 27% of the insured population being unemployed in June 1934.

**NORTH TONAWANDA,** a city and a port of entry of Niagara county, New York, U.S.A., on the Niagara river, at the western terminus of the State Barge canal (opposite Tonawanda) 14 mi. N. of Buffalo. It is on the boulevards connecting Buffalo and Niagara Falls, and is served by the Erie, the Lehigh Valley, the New York Central, and motor-bus lines. Pop. (1930) 19,019 (20% foreign-born white); in 1940 it was 20,254 by the federal census. Though separately incorporated, the two Tonawandas are practically one community. They have a fine harbour, with 7 mi. of docks and traffic in 1930 amounting to 665,044 tons by lake and 4,689,037 tons by canal. Electric power rates are among the lowest in the United States. The cities have a great diversification of industry, and manufacture, among other things, musical instruments, office equipment, nuts and bolts, bakelite, chains and hoists, paper products, steam pipes, silk products, skis, wagons and sleds, furniture, chemicals and roofing supplies. North Tonawanda was settled in 1809, incorporated as a village in 1865 and chartered as a city in 1897.

**NORTHUMBERLAND, EARLS AND DUKES OF.** The earldom, and later the dukedom, of Northumberland, are famous in English history by their connection with the house of Percy (*q.v.*).

In the year 1377 Henry de Percy, 4th Baron Percy, officiated as marshal of England at the coronation of Richard II. and was created earl of Northumberland. With his son Sir Henry Percy, the celebrated "Hotspur," the earl played a leading part in the history of the period, especially in bringing about the deposition of Richard II. and the accession of Henry IV. The quarrel of Northumberland and his son with King Henry over the ransom of their Scottish prisoners taken at Homildon Hill on Sept. 14, 1402 has been immortalized by Shakespeare; and in consequence of their rebellion all the earl's honours were forfeited in 1406. He was not himself present at the battle of Shrewsbury in July 1403, when Hotspur was killed, but he was slain, heading a fresh rebellion, at Bramham Moor on Feb. 19, 1408.

The 1st earl of Northumberland was succeeded by his grandson, Hotspur's son, HENRY (*c.* 1394–1455), who was restored to the earldom and the estates of the Percies in 1414 and was killed at the battle of St. Albans in May 1455. The title then descended in the male line till the death of the 6th earl in 1537. During the Wars of the Roses the Percies took the Lancastrian side, which led to the attainder of Henry the 3rd earl (1421–1461) during the time of the Yorkist triumph, his forfeited title being conferred in 1464 by Edward IV. on John Neville, Lord Montagu (*see* the separate article, p. 538), by a patent which was cancelled a few years later. The earldom, together with the barony of Poynings which his father had obtained by marriage, was restored in 1473 to Henry Percy, son of the 3rd earl, who attached himself to Edward IV., acquiesced in the accession of Richard III., and submitted to Henry VII., by whom he was received into favour. His grandson Henry, the 6th earl (*c.* 1502–1537), left no direct heir, and the latter's nephew, Thomas Percy, was debarred from the succession by an attainder passed on his father for his participation in the Pilgrimage of Grace. In 1549, however, Thomas was restored in blood, and in 1557 he became by a new creation earl of Northumberland, 7th of his line. Meantime, in 1551, John Dudley, earl of Warwick, was created duke of Northumberland (*see* the separate article, p. 537), his title being, however, forfeited by attainder in 1553.

The earldom restored to the house of Percy by the creation of 1557 continued without interruption in the male line till 1670. The 7th earl was beheaded in 1572 for sharing in a conspiracy in which he was joined by the earl of Westmorland with the object of securing the release of Mary Queen of Scots and the free exercise of the Catholic religion. By the earl's attainder the baronies of Percy and of Poynings and the earldom of Northumberland of the older creation were forfeited, but owing to a clause in the patent the newer earldom of Northumberland and the other honours conferred in 1557 passed to his brother Henry (*c.* 1532–1585), who is usually known as the 8th and not the 2nd earl.

Henry's grandson, ALGERNON PERCY, 10th earl of Northumberland (1602–1668), son of Henry the 9th earl (1564–1632), became a peer in his father's lifetime as Baron Percy in 1626. Northumberland played a distinguished part in the Civil War. He was a friend of Strafford, and gave evidence at his trial which, though favourable on the important point of bringing the Irish army to England, was on the whole damaging; and he afterwards leaned more and more towards the popular party, of which he soon became leader in the House of Lords. He was a member of the committee of safety, and later of the committee of both kingdoms; and he took an active part in the attempts to come to terms with the king, whom he visited at Oxford for that purpose in 1643 and at Uxbridge two years later. Northumberland helped to organize the new model army; and in 1646 he was entrusted by parliament with the charge of the king's younger children. He led the opposition in the House of Lords to the proposal to bring Charles I. to trial, and during the Commonwealth he took no part in public affairs. At the Restoration he was called to the privy council by Charles II., and with his habitual moderation deprecated harsh proceedings against the regicides. His second wife, Elizabeth (d. 1705) daughter of Theophilus Howard, 2nd earl of Suffolk, brought him Northumberland House in the Strand, London, which was demolished in 1874 to make room for Northumberland avenue. On the death of his son Joceline, the 11th earl, in 1670, the male line became extinct.

George Fitzroy (1665–1716), third son of Barbara, duchess of Cleveland, the wife of Roger Palmer, earl of Castlemaine, by King Charles II., was created by his father earl of Northumberland in 1674, and duke in 1683. This second dukedom of Northumberland became extinct on his death at Epsom on July 3, 1716.

Meanwhile Elizabeth Percy, daughter of Joceline, the 11th earl, had married Charles Seymour, 6th duke of Somerset; and her son Algernon, the 7th duke, was in 1749 created Baron Warkworth and earl of Northumberland, with remainder to

his son-in-law, Sir Hugh Smithson, Bart., son of Langdale Smithson of Langdale, Yorkshire. Sir Hugh Smithson (*c.* 1714–1786) took the name and arms of Percy on inheriting the earldom in 1750; in 1766 he was created Earl Percy and duke of Northumberland; and in 1784 he was further created Baron Lovaine of Alnwick, with special remainder to his second son, Lord Algernon Percy. He took a prominent part in politics as a follower of Lord Bute, and was one of George III.'s confidential advisers, holding the office of lord-lieutenant of Ireland from 1763 to 1765, and that of master of the horse from 1778 to 1780. He was a man of cultivated tastes, and spent much money in repairing and improving Alnwick castle and his other residences. His wife, Elizabeth (1716–1776), inherited in her own right her father's barony of Percy. The duke was succeeded by his eldest son Hugh; and his second son Algernon, Lord Lovaine, was created earl of Beverley in 1790.

Hugh, 2nd duke of this line (1742–1817), first inherited his mother's barony of Percy. He was present at the battle of Minden, and although in parliament, where he was member for Westminster from 1763 to 1776, he had opposed the policy that led to the American war, he proceeded to Boston in 1774 as colonel commanding the 5th Fusiliers, a regiment that has since then been known as the Northumberland Fusiliers. He succeeded to the dukedom in 1786, and became general in 1793. His son Hugh, 3rd duke (1785–1847), was lord-lieutenant of Ireland in 1829–1830, when the Catholic Emancipation Act was passed, and was pronounced by Sir Robert Peel "the best chief governor that ever presided over the affairs of Ireland." Both he and his brother Algernon, 4th duke (1792–1865), who was created Baron Prudhoe in 1816, died without issue; the barony of Percy devolved on their great-nephew, the duke of Atholl, and the dukedom passed to George (1778–1867), eldest son of Algernon, 1st earl of Beverley, and so to his son, the 6th duke (1810–1899), and grandson, the 7th duke (1846–1918).

*See* Edward Barrington de Fonblanque, *The House of Percy* (2 vols., 1887); G. E. C(okayne), *Complete Peerage,* vol. vi. (1895).

**NORTHUMBERLAND, ALAN IAN PERCY,** 8TH DUKE OF (1880–1930), was born on April 17, 1880, a son of the 7th duke. He succeeded to the title in 1918. As one of the largest coal-owners in the north of England, he was summoned to appear as a witness before the Sankey Coal Commission (1919) and came much into public notice owing to his prolonged controversy with Robert Smillie, the leader of the miners, and subsequently to his anti-Communist campaign. In 1924 the duke acquired an interest in *The Morning Post* newspaper, sold by Lady Bathurst. He died Aug. 23, 1930.

**NORTHUMBERLAND, JOHN DUDLEY,** VISCOUNT LISLE, EARL OF WARWICK, and DUKE OF (*c.* 1502–1553), was the eldest son of Henry VII.'s minister, Edmund Dudley (*q.v.*), by his second wife Elizabeth, daughter of Edward Grey, Viscount Lisle, and co-heiress of her brother John, Viscount Lisle. He was probably descended from the old baronial house of Sutton *alias* Dudley; but his father's attainder and execution in 1509 clouded his prospects. His mother, however, married as her second husband in 1511 Arthur Plantagenet, the illegitimate son of Edward IV., who in 1523 was created Viscount Lisle in his wife's right; and Lisle's rise in Henry VIII.'s favour brought young Dudley into prominence. In 1512 he was restored in blood, and in 1538 he was made deputy to his step-father, who was governor of Calais, and he does not appear to have suffered by Lisle's temporary disgrace and imprisonment in the Tower. Lisle died early in 1542, and Dudley was created Viscount Lisle on March 12 and was made warden of the Scottish marches in November, and lord high admiral of England in 1543 in succession to his future rival, Edward Seymour, earl of Hertford. He was also created a knight of the garter and sworn of the privy council. In 1544 he accompanied Hertford to the capture and burning of Edinburgh. On the capture of Boulogne in September Lisle was given command of the town and of the Boulonnais; in 1545 he directed the operations of the fleet in the Solent which foiled the French attack on Portsmouth and the Isle of Wight; and he was sent to Paris to ratify the peace concluded in 1546.

Lisle had thrown in his lot with the reforming party, and he took an active share in the struggle at Henry VIII.'s court for control of affairs when Henry should die. Hertford and he were described by the Spanish ambassador as holding the highest places in Henry VIII.'s affections and as being the only noblemen of fit age and ability to carry on the government. The Howards were infuriated by the prospect, and Surrey's hasty temper ruined their prospects. Lisle quarrelled bitterly with Bishop Gardiner, served as commissioner at Surrey's trial, and was nominated one of the body of executors to Henry's will from which Norfolk and Gardiner were excluded. On Henry's death Lisle was raised to the earldom of Warwick and promoted to be lord great chamberlain of England, again in succession to Hertford, who became duke of Somerset and Protector. He accompanied Somerset on his Pinkie campaign, and materially contributed to the winning of that victory. Nor did he exhibit any sympathy with the intrigues of the Protector's brother, Thomas Seymour, the lord high admiral; his subtler policy was to exasperate the brothers and thus weaken the influence of the house of Seymour. He helped to bring the admiral to the block in March 1549; and then used the Protector's social policy to bring about his deposition. Warwick detested Somerset's ideas of liberty and his championship of the peasantry against the inclosure movement; one of his own parks was ploughed up as a result of a commission of enquiry which Somerset appointed; and when the peasants rebelled under Kett, Warwick gladly took the command against them. His victory at Dussindale made him the hero of the landed gentry, and as soon as he had returned to London in Sept. 1549, he organized the general discontent with the Protector's policy into a conspiracy. He played upon the prejudices of Protestants and Catholics alike, holding out to one the prospect of more vigorous reform and to the other hopes of a Catholic restoration, and to all gentry the promise of revenge upon the peasants.

The coalition thus created effected Somerset's deposition and imprisonment in Oct. 1549; and the parliament which met in November carried measures of political coercion and social reaction. But the coalition split upon the religious question. Warwick threw over the Catholics and expelled them from office and from the privy council, and the hopes they entertained were rudely dashed to the ground. But it was difficult to combine coercion of the Catholics with the proscription of Somerset; the duke was therefore released early in 1550 and restored to the privy council; and his daughter was married to Warwick's son. Warwick himself assumed no position of superiority over his colleagues, and he was never made protector. But he gradually packed the council with his supporters, and excluded his enemies from office and from access to the king. His plan was to dominate Edward's mind, and then release him from the trammels of royal minority. He abandoned the Tudor designs on Scotland, and made a peace with France in 1550 by which it recovered Boulogne and was left free to pursue its advantage in Scotland. Nor did the betrothal of Edward to Henry's daughter Elizabeth prevent the French king from intriguing to undermine English influence in Ireland. In domestic affairs Warwick pushed on the Reformation with none of the moderation shown by Somerset; and the difference between the two policies is illustrated by the change effected between the first and second Books of Common Prayer. Warwick, however, was widely distrusted; and the more arbitrary his government grew, the more dangerous became Somerset's rivalry. A parliamentary movement had early been started for Somerset's restoration. Warwick therefore kept parliament from meeting, and the consequent lack of supplies drove him into the seizure of church plate, sale of chantry lands, and other violent financial expedients. At length he resolved to get rid of his opponent; his opposition was magnified into conspiracy, and in Oct. 1551, after Warwick had made himself duke of Northumberland and his ally Dorset, duke of Suffolk, and had scattered other rewards among his humbler followers, Somerset was arrested, condemned by the peers on a charge of felony, and executed (Jan. 22, 1552).

Parliament was permitted to meet on the following day, but for the next 18 months Northumberland grew more and more unpopular. He saw that his life was safe only so long as he con-

trolled the Government and prevented the administration of justice. But Edward VI. was slowly dying, and Northumberland's plot to alter the succession was his last desperate bid for life and power. Its folly was almost delirious. Edward had no legal authority to exclude Mary, and the nation was at least nine-tenths in her favour. Northumberland bullied the council and overawed London for a few days; but the rest of England was in an uproar, and as he rode out to take the field against Mary, not a soul cried "God speed." A few days later he returned as Mary's prisoner. He was tried for treason, professed himself a Catholic in the delusive hope of pardon, and was executed on Aug. 22. He was a competent soldier and one of the subtlest intriguers in English history; but he had no principles. The violence of his pretended Protestantism was largely responsible for the reaction of Mary's reign. His best-known son was Robert Dudley, earl of Leicester, Queen Elizabeth's favourite.

See *Letters and Papers of Henry VIII.; State Papers, Domestic and Foreign, Edward VI. and Mary;* ms. 15,888, *Bibliothèque Nationale de France;* G. E. C(okayne), *Complete Peerage;* A. F. Pollard, *England under Somerset* (1900), *Life of Cranmer* (1904) and vol. vi. of the *Political History of England* (1910).

**NORTHUMBERLAND, JOHN NEVILLE,** EARL OF (*c.* 1430–1471), English soldier, was the third son of Richard Neville, earl of Salisbury, and a brother of Richard Neville, earl of Warwick, the "king-maker." In 1459–61 he was twice a prisoner of the Lancastrians and in 1463 as warden of the east marches towards Scotland, he was responsible for the Yorkist victories at Hedgeley Moor and at Hexham in April and May 1464. In this year (1464) he was created earl of Northumberland, the Percies being now crushed, and their head, Henry Percy, being in prison. Northumberland did not at first join his brother Warwick and the other Nevilles when they revolted against Edward IV., but neither did he help the king. Edward, doubtless suspecting him, restored the earldom of Northumberland and its vast estates to Henry Percy, while John Neville's only recompense was the barren title of marquess of Montagu. At Pontefract in 1470 he and his men declared for Henry VI., a proceeding which compelled Edward IV. to fly from England, and under the restored king he regained his position as warden, but not the earldom of Northumberland. He did not attempt to resist Edward IV. when this king landed in Yorkshire in March 1471, but he fought under Warwick at Barnet, where he was slain on April 14, 1471.

**NORTHUMBERLAND,** the northernmost county of England. The area, included in the North of England basin, is 2,018.7 sq.mi. The higher land, including the north Pennines and the Cheviots, lies in the west and north. The Cheviot hills, rising to 2,676 ft., are formed by the intrusion of an igneous dome in Tertiary times, and between them and the northern Pennines we have the lower line of the Tyne Gap, giving an important way for routes from west to east. The larger rivers generally flow eastward, the chief exception being the Till which flows northward, to join the Tweed, along a bed of shales less resistant than the remainder of the region.

The number of weapons of Neolithic age which have been found in the county show that it was occupied by man in those times. Most implements have been found along a broad band of country north-eastward from Hexham to Alnwick, that is, along the lower levels of the limestone lands. In later times, the evidence of beaker-pottery shows that Northumberland was probably invaded from across the North sea at the dawn of the Metal age. The evidence for the pre-Roman Iron age is not great and the Bronze age may have continued far longer than in the south of England. The county was occupied by the Romans some time after A.D. 80 and about 124. Hadrian built his wall from the Tyne to the Solway to defend his northern frontier, but the region as a whole was not thoroughly Romanized like the south-eastern parts of Britain. Hadrian's wall marked the frontier south of which the Romans never retreated until they finally left Britain, but they often advanced farther north which northern region was crossed by military roads. The wall ran across the county a few miles north of the Tyne from near Haltwhistle to Wallsend. On the wall there was the fort of Magnae, near Haltwhistle, where the road from Kirkby Thore along the south Tyne abutted on the wall. There was a settlement at Corbridge where the main road from the south crossed the Tyne and a fort near Halton where the road met the wall. At the eastern end of the wall there was a fort and another at Newcastle guarding a route across the Tyne. Within the wall, from Halton to Magnae through the Tyne Gap, ran another road.

**History.**—The first English settlement in the kingdom of Bernicia, which included what is now Northumberland, was effected in 547 by Ida, who pushed through the narrow strip of territory between the Cheviots and the sea, and set up a fortress at Bamburgh, which became the royal seat of the Saxon kings. About the end of the 6th century Bernicia was first united with the rival kingdom of Deira under the rule of Aethelfrith, and the district between the Humber and the Forth became known as the kingdom of Northumbria. In 634 Cadwalla was defeated at Hefenfeld (the site of which lies in the modern parish of St. John Lee) by Oswald, under whom Christianity was definitely established in Northumbria, and the bishop's see fixed at Hexham, where Bishop Wilfrid erected the famous Saxon church. Oswald also erected a church of stone at Tynemouth, which was destroyed in 865 in an incursion of the Danes. The Danes later overran the region, but in Northumberland, the English princes continued to reign at Bamburgh as vassals of the Danes, and not a single place-name with the Danish suffix "by" or "thorpe" is found north of the Tyne. The English names are, however, often associated with those of Gaelic or Cymric origin. In 938 Aethelstan annexed Northumberland to his dominions, and the Danish authority was annulled until its re-establishment by Canute in 1013. The vigorous resistance of Northumbria to the Conqueror was punished by ruthless harrying. The Normans rebuilt the Saxon monasteries of Lindisfarne, Hexham and Tynemouth; Eustace Fitz John founded Alnwick abbey, and other Norman abbeys were Brinkburn, Hulne, the first Carmelite monastery in England, Blanchland and Newminster. Castles were set up at Alnwick, Warkworth, Prudhoe, Dunstanborough, Morpeth, Ford, Chillingham, Langley, Newcastle, Bamburgh, Wark and Norham, a stronghold of the palatine bishops of Durham.

The term Northumberland is first used in its contracted modern sense in 1065 in an entry in the Saxon Chronicle relating to the northern rebellion. The county is not mentioned in the Domesday Survey, but the account of the issues of the county is entered in the Great Roll of the Exchequer for 1131. In the reign of Edward I. the county of Northumberland comprised the whole district between the Tees and the Tweed, and included liberties belonging to the bishop of Durham, archbishop of York, the king of Scotland, the earl of Lancaster and the earl of Angus. These franchises were all held exempt from the ordinary jurisdiction of the shire. By statute of 1495–96 the lordship of Tynedale was annexed to Northumberland on account of flagrant abuses of the liberties of the franchise; that of Hexham in 1572; Norhamshire, Islandshire and Bedlingtonshire continued to form detached portions of Durham until 1844, when they were incorporated with Northumberland. The division into wards existed at least as early as 1295, the Hundred Roll of that year giving the wards of Coquetdale, Bamburgh, Glendale and Tynedale.

The shire-court for Northumberland was held at different times at Newcastle, Alnwick and Morpeth, until by statute of 1549 it was ordered that the court should thenceforth be held in the town and castle of Alnwick. The assizes were held at Newcastle, and the itinerant justices, on their approach to the county, were met by the king of Scotland, the archbishop of York, the bishop of Durham and the prior of Tynemouth, who pleaded their liberties either at a well called Chille near Gateshead, if the justices were proceeding from York, or, if from Cumberland, at Fourstanes. In these franchises the king's writ did not run, and their owners performed the office of sheriff and coroner. The burgesses of Newcastle claimed return of writs in their borough and the town was made a county by itself by Henry IV. in 1400, and has jurisdiction in admiralty cases. The county was in the diocese of Durham, but in 1882 Northumberland was formed into a separate diocese with its see at Newcastle. Northumberland was the scene of perpetual inroads by the Scots, and the churches were

often so built as to form refuges against the invaders. Norham, Alnwick and Wark were captured by David of Scotland in the wars of Stephen's reign, and in 1290 it was at Norham castle that Edward I. decided the Scottish succession in favour of John Baliol.

In 1295 Robert de Ros and the earls of Athol and Menteith ravaged Redesdale, Coquetdale and Tynedale. In 1314 the county was ravaged by Robert Bruce, and in 1382 by special enactment the earl of Northumberland was ordered to remain on his estates in order to protect the county from the Scots. In 1388 Henry Percy was taken prisoner and 1,500 of his men slain at the battle of Otterburn. Alnwick, Bamburgh and Dunstanborough were garrisoned for the Lancastrian cause in 1462, but after the Yorkist victories of Hexham and Hedgley Moor in 1464, Alnwick and Dunstanborough surrendered, and Bamburgh was taken by storm. In 1513 the king of Scotland was slain in the battle of Flodden Field on Branxton moor. During the Civil War of the 17th century Newcastle was garrisoned for the king by the earl of Newcastle, but in 1644 it was captured by the Scots under the earl of Leven, and in 1646 Charles was led there a captive under the charge of David Leslie. The county of Northumberland was represented by two members in the parliament in 1290, and in 1295 Bamburgh, Corbridge and Newcastle-upon-Tyne each returned two members. Today, the parliamentary divisions of the county are Berwick-upon-Tweed, Hexham and Wansbeck, each returning one member; while the parliamentary borough of Newcastle-upon-Tyne returns four members, and Morpeth, Wallsend and Tynemouth one each.

**Industries and Agriculture.**—The early industrial development of Northumberland was much impeded by the constant ravages of internal and border warfare. Again Aeneas Sylvius Piccolomini (Pope Pius II.) who passed through the county disguised as a merchant in 1436, leaves a picture of its barbarous and desolate condition, and as late as the 17th century, Camden, the antiquary, describes the lands as rough and unfit for cultivation. The mineral resources, however, appear to have been exploited to some extent from remote times. It is certain that coal was used by the Romans in Northumberland. In a 13th-century grant to Newminster abbey a road for the conveyance of seacoal from the shore about Blyth is mentioned, and the Blyth coal-field was worked throughout the 14th and 15th centuries. The coal trade on the Tyne did not exist to any extent before the 13th century, but from that period it developed rapidly, and Newcastle acquired the monopoly of the river shipping and coal trade. The building of ships to carry the coal laid the foundations of the great modern shipbuilding industries. Lead was exported from Newcastle in the 12th century, probably from Hexhamshire, the lead mines of which were very prosperous throughout the 16th and 17th centuries. In a charter from Richard I to Bishop Puiset creating him earl of Northumberland, mines of silver and iron are mentioned, and in 1240 the monks of Newminster had an iron forge at Stretton. A saltpan is mentioned at Warkworth in the 12th century; in the 13th century the salt industry flourished at the mouth of the river Blyth, and in the 15th century formed the principal occupation of North and South Shields.

In the reign of Elizabeth glasshouses were set up at Newcastle by foreign refugees, and the industry spread rapidly along the Tyne. Tanning, both of leather and of nets, was largely practised in the 13th century, and the salmon fisheries in the Tyne were famous in the reign of Henry I. The height of the land and the composition of the soil together prevent the county from being rich agriculturally. In 1939 the total area under crops and grass was 640,153 ac., of which 133,771 ac. were arable land. As would be expected in a northern county, the chief grain crops are oats (27,720 ac. in 1939) and barley (9,929 ac.), though turnips and swedes occupied 15,681 ac. Potatoes covered nearly 5,000 ac., and the area under clovers and rotation grasses for hay was 30,921 ac. The number of cattle is fairly large, but the great acreage of hill-land makes it pre-eminently a sheep country, these animals numbering 1,147,383 in 1939. Manufactories centre on the Tyne, which is a region of ironworks, blast furnaces, shipbuilding yards, ropeworks, coke ovens, chemical works and manufactories of glass, electrical apparatus, pottery and firebricks, from above Newcastle to the sea. Machines, appliances, conveyances and tools are the principal articles of manufacture in metal. The National Trust owned 339 ac. in the county in 1942, besides the Wallington estate of 13,000 ac. presented by Sir Charles Trevelyan in that year. Communications are provided almost wholly by the L.N.E. Ry. The area of the administrative county is 1,994.1 sq.mi., with a population (1938) of 405,900. The population of the county was reduced 5% between Sept. 1939 and Feb. 1941 owing to wartime movements. Normally it is especially dense in the southeast portion, where the mining district and the Tyneside industrial area are situated. The latter area was particularly affected by the depression of the 1930s and was included in the "Special Area" over which a commissioner was appointed under the act of 1934. There are two county boroughs, Newcastle-upon-Tyne (a city) and Tynemouth; four municipal boroughs, Berwick-upon-Tweed (a county of itself), Blyth, Morpeth and Wallsend; and 12 urban districts. The county is in the northern circuit, and assizes are held at Newcastle. There is one court of quarter sessions for the county and one for Berwick and there are 13 petty sessional divisions.

BIBLIOGRAPHY.—Northumberland County History Committee, *A History of Northumberland* (in process) (Newcastle-upon-Tyne, 1893, etc.); John Hodgson, *A History of Northumberland,* in 3 parts (1827–40); E. Mackenzie, *An Historical View of the County of Northumberland* (2nd ed., 2 vols., Newcastle, 1811); Society of Antiquaries, Newcastle-upon-Tyne, *A History of Northumberland,* pt. i., containing the general history of the county, state of the district under the Saxon and Danish kings, etc. (Newcastle, 1858); *Archaeologia Aeliana,* or *Miscellaneous Tracts relating to Antiquity,* published by the Society of Antiquaries of Newcastle-upon-Tyne (4 vols., Newcastle-upon-Tyne, 1822–55; new series, 1857, etc.); William Wallis, *The Natural History and Antiquities of Northumberland* (2 vols., London, 1769); W. S. Gibson, *Descriptive and Historical Notices of some remarkable Northumbrian Castles, Churches and Antiquities,* series 1 (London, 1848); *Early Assize Rolls for Northumberland,* edited by William Page, Surtees Society (London, 1891).

**NORTHUMBERLAND,** a manufacturing borough of Northumberland county, Pennsylvania, U.S.A., immediately north of Sunbury, at the confluence of the east and west branches of the Susquehanna river. It is served by the Lackawanna, the Pennsylvania and the Reading railways. Pop. (1920) 4,061 (95% native white); it was 4,469 (1940) by federal census. Northumberland was the home of Joseph Priestley, the English chemist, from 1794 until his death (1804), and his dwelling has been preserved as a memorial.

**NORTHUMBRIA,** one of the most important of the Anglo-Saxon kingdoms, extended from the Humber to the Forth (*regnum Northanhymbrorum*). Originally it comprised two independent kingdoms, Bernicia and Deira (*q.v.*), each of which had a dynasty of its own. The first known king of the former was Ida, who, according to tradition, acquired the throne in 547 and reigned twelve years. To him the foundation of Bamburgh is attributed. Four of Ida's sons successively occupied his throne: Glappa 559–560, Adda 560–568, Aethelric 568–572 and Theodoric 572–579. Of the first three nothing is known, but Theodoric is said (*Historia Brittonum*) to have been besieged by the Welsh under Urien in Lindisfarne. Theodoric was succeeded by Frithuwald 579–585/6 and Hussa 586–592/3. Then Aethelfrith (*q.v.*), son of Aethelric, came to the throne. He greatly extended his territories at the expense of the Welsh, and eventually provoked an invasion of Aidan, king of the Scots, whom he defeated at a place called Daegsastan (603). The first king of Deira of whom we know was Ella, or Aelle, who, according to Bede, was still reigning when Augustine arrived in 597. Aethelfrith eventually acquired possession of Deira, expelling Aelle's son Edwin (*q.v.*). Thenceforward, with rare intervals, the two kingdoms remained united.

Aethelfrith became involved in war with the Welsh towards the end of his reign and captured Chester, probably about 613. Shortly afterwards, in 616, he was slain in battle on the river Idle by Edwin, who was assisted by the East Anglian king Raedwald. Edwin now became king over both Northumbrian provinces. By his time the kingdom must have reached the west coast, as he is said to have conquered the islands of Anglesea and Man. Under Edwin the Northumbrian kingdom became the chief power in the country. At his death in 633 the kingdom was again divided, Deira falling to his nephew Osric, while Bernicia was occupied by Eanfrith son of Aethelfrith. Both these kings were slain by Cadwallon in the following year, but shortly afterwards the Welsh king was overthrown by Oswald (*q.v.*), brother of Eanfrith, who reunited the whole of Northumbria under his sway and acquired a supremacy analogous to that previously held by Edwin. After Oswald's defeat and death at the hands of Penda in 642 Bernicia fell to his brother Oswio, while Oswine son of Osric became king in Deira, though probably subject to Oswio. Oswine's death was compassed by Oswio in 651, and the throne of Deira was then obtained by Aethelwald son of Oswald. He is not mentioned, however, after

655, so it is probable that Deira was incorporated in the Bernician kingdom not long afterwards. After Oswio's victory over Penda in 654–655 he acquired a supremacy over the rest of England similar to that held by his predecessors. The Mercians, however, recovered their independence in 658, and from this time onward Northumbria played little part in the history of southern England. But Oswio and his son Ecgfrith greatly extended their territories towards the north and north-west, making themselves masters of the kingdoms of Strathclyde and Dalriada, as well as of a large part of the Pictish kingdom. Ecgfrith (*see* EGFRITH), who succeeded on Oswio's death in 671, expelled the Mercians from Lindsey early in his reign, but was in turn defeated by them in 679, his brother Aelfwine being slain. From this time onwards the Humber formed the boundary between the two kingdoms. In 684 we hear of the first English invasion of Ireland, but in the following year Ecgfrith was slain, and his army totally destroyed by the Picts at a place called Nechtansmere (probably Dunnichen Moss in Forfarshire). The Picts and Britons now recovered their independence; for Aldfrith, apparently an illegitimate son of Oswio, who succeeded, made no attempt to reconquer them. He was a learned man, and during his reign the Northumbrian kingdom partially recovered its prosperity. He was succeeded in 705 by his son Osred, and under him and his successors Northumbria began rapidly to decline through the vices of its kings. Osred was slain in 716. He was succeeded by Coenred 716–718, and Coenred by Osric 718–729. The next king was Ceolwulf, to whom Bede dedicated his *Historia Ecclesiastica* in 731. In the same year he was deposed and forced to become a monk, but was soon restored to the throne. In 737 he voluntarily retired to a monastery and left the kingdom to his cousin Eadberht. The latter appears to have been a vigorous ruler; in the year 740 we hear of his being involved in war with the Picts. Aethelbald of Mercia seems to have taken advantage of this campaign to ravage Northumbria. In 750 Eadberht is said to have annexed a large part of Ayrshire to his kingdom. Finally in 756, having now allied himself with Oengus king of the Picts, he successfully attacked Dumbarton (Alcluith), the chief town of the Britons of Strathclyde. Eadberht showed considerable independence in his dealings with the church, and his brother Ecgberht was from 734 to 766 archbishop of York. In 758 Eadberht resigned the kingdom to his son Oswulf, and became a monk.

Oswulf was slain by his household at a place called Mechil Wongtun in 759. Moll Aethelwald, who may have been a brother of Eadberht, succeeded, and after a victory over a certain Oswine, who fell in the battle, abdicated and became a monk probably under compulsion in 765. His successor Alchred sent an embassy to Charlemagne in 768 and was deposed in 774, whereupon he fled to Bamburgh and afterwards to the Picts. His deposition has been ascribed to a formal act of the Witan, but this seems an antedating of constitutional methods and the circumstances point to a palace revolution. The successor of Alchred was Aethelred son of Moll Aethelwald. In 778 three high-reeves were slain at the instigation of the king. Aethelred was expelled during the next year, perhaps in consequence of this event, and Aelfwald son of Oswulf became king. Aelfwald was murdered by Sicga in 789, whereupon Osred his nephew the son of Alchred succeeded. In 790 the banished Aethelred returned to the throne and drove out Osred, whom he put to death in 792. Aethelred, who had married Aelflaed the daughter of Offa, also killed Aelf and Aelfwine, the sons of Aelfwald and was murdered himself at Corbridge in 796. Oswald, who is called *patricius* by Simeon of Durham, succeeded, but reigned only twenty-seven days, when he was expelled and eventually became a monk. Eardwulf *dux*, who had apparently fled abroad to escape the wrath of Aethelred, was now recalled and held the crown until 807 or 808. Aelfwald then became king but Eardwulf was restored in 808 or 809 after appealing to the emperor and the pope. Eanred, son of Eardwulf, probably came to the throne in 809 and reigned until 841. It was during his reign in 827 that Northumbria acknowledged the supremacy of Ecgberht, king of Wessex. Eanred was succeeded by his son Aethelred, who was slain in 850, when Osberht came to the throne and reigned until 863. On the expulsion of Osberht, Ella or Aelle, succeeded. The chroniclers emphasize the fact that this king was not of royal descent. He is said to have slain Ragnarr Loðbrok. In the year 866 Loðbrok's sons Ingwaere (Ivarr, *q.v.*), Healfdene, Ubba and others brought a vast army to England to avenge the death of their father. In the following year they obtained possession of York. Ella seems now to have made peace with the exiled king Osberht, and their united forces succeeded in recovering the city. In the great battle which ensued the Northumbrian army was annihilated and both kings were slain (the death of Ella, according to Irish tradition, being due to the treachery of one of his followers). The southern part of Northumbria now passed entirely into the hands of the invaders, but they allowed a certain Ecgberht to reign over the portion of the kingdom north of the Tyne. Ecgberht was expelled in 872 and died in the course of the following year. His successor Ricsig died in 876 and was followed by Ecgberht II., who reigned until 878. He was the last English king who reigned in Northumbria. After him the chief power north of the Tyne came into the hands of a certain Eadulf of Bamburgh, who did not take the kingly title, but accepted the overlordship of Alfred the Great perhaps in 886. In the winter of 874–75 Healfdene returned to Northumbria, which he partitioned next year among his followers. After an interregnum of a few years a certain Guthred became king in 883. He is said to have been a slave and to have been appointed king at the command of St. Cuthbert who appeared to Eadred the abbot of Carlisle in a dream. There is some reason for the conjecture that he belonged to the family of Loðbrok. He died in 894, after which date little is known of Northumbrian history for some years.

About 919 the country was invaded by vikings from Ireland under Ragnall, grandson of Ivarr, who seized York and occupied the lands of St. Cuthbert. Aldred, the son of Eadulf, who now ruled north of the Tyne, appealed to Constantine II., king of the Scots, for help, but the Scottish and Northumbrian armies were defeated at Corbridge. Shortly after this, however, all the northern princes submitted to Edward the Elder. Ragnall was succeeded by Sihtric, who married Aethelstan's sister. He died in 926, and his brother and successor Guthfrith was soon afterwards expelled by Aethelstan and fled to Eugenius, king of Strathclyde. The Welsh and Scottish kings, however, both submitted to Aethelstan, and Guthfrith was again driven into exile. He died in 934, leaving a son Anlaf (Olafr) Godfredsson or Godfreyson. In 934 Aethelstan invaded Scotland as far as the Tay. In 937 a great fleet and army were brought together by Constantine and Anlaf Godfreyson from Ireland. Aethelstan, however, won a complete victory over them at a place called Brunanburh. Anlaf Godfreyson escaped to Ireland but returned to England after Aethelstan's death, occupied York and compelled Edmund to cede to him all Danish Mercia north of Wattling street. He died in 941, and a series of obscure Scandinavian kings of York followed him until 954 when Northumbria was conquered by Edred king of Wessex. Eadred placed Northumbria in the hands of a certain Osulf, who is called high-reeve at Bamburgh. In the reign of Edgar, Oslac was appointed earl of southern Northumbria, but he was banished at the beginning of the following reign. The next earl was Waltheof and after him Uhtred, who defeated Malcolm II., king of the Scots, in 1006. Twelve years later, however, the Northumbrians were completely defeated at Carhan, and Lothian was annexed by the Scots (*see* LOTHIAN). Uhtred was slain by the orders of Canute, who gave the province to Eric (Eirikr) earl of Lade. Shortly afterwards, however, part of it at least came into the hands first of Eadulf and then of Aldred and another Eadulf, the brother and sons respectively of Uhtred. The younger Eadulf was slain by Siward, probably in the reign of Harltacuut. Siward held the earldom till his death in 1055, when it was given to Tostig, son of earl Godwine, and after his banishment to Morkere, son of Aelfgar, earl of Mercia. Tostig's banishment led to the invasion of Harold Hardrada, king of Norway, and the battle of Stamford Bridge, in which both perished.

AUTHORITIES.—Bede, *Historia Ecclesiastica*, ed. C. Plummer (Oxford, 1896); *Anglo-Saxon Chronicle*, ed. Earle and Plummer (Oxford, 1899); "Annales Lindesfarnenses," in the *Monumenta historica Germanica*, Band xix. (Hanover, 1866); *Simeon of Durham* ("Rolls"

series), ed. T. Arnold (1882); J. C. H. R. Steenstrup, *Normannerne* (Copenhagen, 1876–82). (F. G. M. B.)

**NORTH-WEST FRONTIER PROVINCE,** the most northerly province of British India, created on Oct. 25, 1901. Roughly it may be defined as the tract of country north of Baluchistan, lying between the Indus and Afghanistan. More exactly it consists of (1) the cis-Indus district of Hazara; (2) the comparatively narrow strip between the Indus and the hills constituting the settled districts of Peshawar, Kohat, Bannu and Dera Ismail Khan; and (3) the rugged mountainous region between these districts and the borders of Afghanistan, which is inhabited by independent tribes. This last region is divided into five agencies: Dir, Swat and Chitral, with headquarters at Malakand; Khyber, Kurram, Tochi and Wana. The province lies between 31° 4′ and 36° 57′ N., and 69° 16′ and 74° 7′ E. The approximate area is 39,249 sq.mi., of which 14,263 sq.mi. are British territory and the remainder is held by tribes under the political control of the agent to the governor-general.

**Rivers and Mountains.**—The mountains of the Hindu Kush running from east to west form the northern boundary of the province, and are met at the north-east corner of the Chitral agency by the continuation of an outer chain of the Himalayas after it crosses the Indus above the Kagan valley. From this chain minor ranges run in a south-westerly direction the whole length of Bajour and Swat, till they merge into the Mohmand hills and connect the mid-Himalayas with the Safed Koh. The Suliman system lies south of the Gomal unconnected with the northern hills. To the east the Safed Koh extends its spurs into the Kohat district. The Salt Range crosses the Indus in the Mianwali *tahsil* of the Punjab, and forms the boundary between Bannu and Dera Ismail Khan, merging eventually in the Waziri hills. The chief peaks in the province are Kaisargarh (11,300 ft.) and Pir Ghol (11,580 ft.) in Waziristan; Shekh Budin (4,516 ft.), in the small range; Sikaram (15,621 ft.) in the Safed Koh; Istragh (18,900 ft.), Kachin (22,641 ft.) and Tirach Mir (25,426 ft.), in the Hindu Kush on the northern border of the Chitral agency; while the Kagan peaks run from 10,000 ft. to 16,700 ft.

With the exception of the Kunhar river, which flows down the Kagan valley to the Jhelum, the whole drainage of the province finds its way into the Indus. (*See* INDUS; KABUL RIVER.)

**The Pathan Races.**—The North-West Frontier Province as now constituted may be described as the country of the Pathans (*q.v.*). The true Pathan is possibly of Indian extraction. But around this nucleus have collected many tribes of foreign origin. The whole have now become blended by the adoption of a common language, but remain tribally distinct; all alike have accepted Islam, and have invented traditions of common descent which express their present association. For centuries these tribes maintained their independence in the rugged hills which flank the present kingdom of Afghanistan. In the 15th century they began to settle in the plains. The 16th century saw the Pathan tribes established in their present homes. The spirit of independence which always characterized them soon brought them into collision with the Mogul empire. In the 17th century, after a long struggle, the settlers in the plains wrested from Aurangzeb terms which left them almost as independent as their brothers in the hills. The invasion in 1738 of Nadir Shah, who traversed the province from Peshawar to Dera Ismail Khan, is a landmark in the history of the frontier. From his death to the rise of Ranjit Singh, the frontier districts remained an appendage of the Durani empire. Little control was exercised by the rulers of Kabul, and the country was administered by local chiefs or Afghan Sirdars very much as they pleased. The Sikh invasions began in 1818, and from that date to the annexation by the British government the Sikhs were steadily making themselves masters of the plain tracts. After the Second Sikh War, by the proclamation of March 29, 1849, the frontier districts were annexed by the British Government. From that time until the creation of the North-West Frontier Province the settled districts formed part of the Punjab, while the independent tribes were controlled at different times by the Punjab government, and the government of India. Their turbulence still continued, and since 1849 they have been the object of over fifty punitive expeditions. The chief tribes, under the political control of the N.W. Frontier agency, besides Chitralis and Bajouris, are the Utman Khel, Yusafzais, Hassanzais, Mohmands, Afridis, Jowakis, Mullagoris, Orakzais, Zaimukhts, Chamkannis, Khattaks, Bangashes, Turis, Mahsuds, Wazirs, Bhitanis and Sheranis, etc.

**Creation of the Province.**—The North-West Frontier Province differs from the older provinces of India in having been artificially built up out of part of a previous province together with new districts for a definite administrative purpose. The proposal to make the frontier districts into a separate province, administered by an officer of special experience, dates back to the viceroyalty of Lord Lytton, who, in a famous minute of April 22, 1877, said:—

"I believe that our North-West Frontier presents at this moment a spectacle unique in the world; at least I know of no other spot where, after 25 years of peaceful occupation, a great civilized power has obtained so little influence over its semi-savage neighbours, and acquired so little knowledge of them, that the country within a day's ride of its most important garrison is an absolute *terra incognita*, and that there is absolutely no security for British life a mile or two beyond our border."

The result of this minute was that a frontier commissionership, including Sind, was sanctioned by the home Government, and Sir Frederick (afterwards Lord) Roberts had been designated as the first Commissioner when the outbreak of the Second Afghan War caused the project to be postponed. It was afterwards shelved by Lord Ripon. Twenty-three years elapsed before the idea was revived and successfully brought to completion by Lord Curzon, whose scheme was on a more modest scale than Lord Lytton's. It omitted Sind altogether, and confined the new province to the Pathan trans-Indus districts north of the Gomal. The present administration of the province is conducted by a chief commissioner and agent to the governor-general. It has been specially omitted from the scope of the "reforms" in India.

**Population.**—The census of 1901, omitting the great majority of the frontier tribes, gave a total population of 2,125,480. In 1941, the inclusive total was 5,415,666. The province is mainly agricultural. The towns, except Peshawar and Dera Ismail Khan, are either expansions of large agricultural villages or bazaars which have grown up round the many cantonments of the province. The great majority of the population are Pathan by race and Mohammedan by religion. The predominant language is Pushtu (*q.v.*). The conquered strata of the population speak servile Indian dialects, called Hindki in the north and Jatki in the south, while Gujari is spoken by the large Gujar population in Hazara and north of Peshawar.

**Crops, Climate, Etc.**—The area under cultivation represents an average of 1·3 acres per head of the total, and of nearly 1·5 acres per head of the rural population. The limit of profitable cultivation has almost been reached. The Pathan, however, is a slovenly cultivator and slow to adopt new methods. The principal crops are—in the cold weather, maize and *bajra;* in the spring, wheat, barley and gram. Rice and sugar-cane are largely grown on the irrigated lands of Hazara, Peshawar and Bannu districts, and the well and canal irrigated tracts of Peshawar district produce fine crops of cotton and tobacco. In the trans-border agencies the valleys of the Swat, Kurram and Tochi yield much rice.

The climatic conditions of the province are extremely diversified. Dera Ismail Khan district is one of the hottest areas in the Indian continent, while over the mountain region to the north the weather is temperate in the summer and intensely cold in the winter. The air is generally dry, and hence the daily and annual range of temperature is frequently very large. There are two seasons of rainfall over the province; the monsoon season, when supplies of moisture are brought up by the ocean winds from the Arabian Sea and the Bay of Bengal; and the winter season, when storms advancing eastwards from Persia and the Caspian districts occasion winds, widespread rain and snowfall. Both sources are precarious and instances are not infrequent of the almost entire failure of either the winter or the summer rainfall.

Canals are the main source of irrigation in the province, and fall under three heads: (1) Private canals in the various districts, the property of the people and managed on their behalf; (2) the

Michni Dilazak and Shabkadar branch in Peshawar, constructed by the district board, which receives water rates; and (3) the Swat and Kabul river canals, which were constructed by and are the property of government, and are managed by the irrigation department. About 20% of the cultivated area is irrigated by canals, 2% by wells and 3% by perennial streams. In the year 1925–26 the irrigated area was 368,481 acres.

**Railways.**—The railways of the province are mostly intended in the first instance for strategic purposes. The main line of the North-Western railway from Rawalpindi to Peshawar after being first extended 9 mi. to Jamrud at the entrance to the Khyber pass, in Nov. 1925 received further extension of 27 mi., through the Khyber to the Afghan frontier. From Nowshera a branch runs to Dargai at the foot of the Malakand pass. From Rawalpindi again another branch crosses the Indus at Kushalgarh (*q.v.*) and runs to Kohat, whence a 2-ft. line runs to Thal at the foot of the Kurram valley.

BIBLIOGRAPHY.—*North-West Frontier Province Gazetteer* (Calcutta); Administration Report (annual, Calcutta); Paget and Mason, *Record of Frontier Expeditions* (1884); Sir T. Holdich, *The Indian Borderland* (1901), *The Countries of the King's Award* (1904); Sir J. Douie, *The Panjab, North-West Frontier Province and Kashmir* (1916); C. M. Enriquez, *The Pathan Borderland, from Chitral to Dera Ismail Khan* (Calcutta, 1921); C. C. Davies, *Problem of the North-West Frontier* (1932); W. Barton, *India's North-West Frontier* (1939).

(T. H. H.; X.)

**NORTHWEST TERRITORIES,** official name of the portion of Canada lying outside the provinces, and to the north of them, but excluding the Yukon Territory (*q.v.*). The territories extend from their apex at the north pole to the 60th parallel of north latitude. The boundary of the territories follows the height of land between the Yukon and Mackenzie watersheds from the Arctic mainland to the 60th parallel; thence along that parallel to Hudson bay and thence through Hudson strait to the open sea; down the straits and channels separating Greenland from the Arctic archipelago and along the 60th meridian of west longitude to the apex of Canada at the north pole and thence by the 141st west meridian to its starting point. The offshore islands in Hudson and James bays and the Arctic archipelago are included in the territories. The territories were divided into the districts of Mackenzie and Keewatin, on the mainland, respectively east and west of the meridian 102° W., and the district of Franklin, covering the Arctic archipelago. The divisions were made merely for administrative convenience. Total area, 1,309,682 sq.mi.

**Government.**—The territories were placed entirely under federal control (lands and forests branch of the department of mines and resources), with the seat of government at Ottawa. The Northwest Territories act (142. R.S.C. 1927) provided for a territorial government composed of the commissioner of the Northwest Territories, the deputy commissioner and five councillors, all appointed by the governor-general in council. The commissioner was given power to make ordinances under instructions from the governor-general in council or the minister of mines and resources, respecting direct taxation and establishment of territorial offices, prisons, municipal institutions, solemnization of marriage, property and civil rights, administration of justice and in general all local matters. Appointment of a superintendent for the eastern Arctic and one for the Mackenzie district was provided. An agent stationed at Fort Smith, the point of entry from Alberta, was also given duties as superintendent of the Wood-Buffalo National park, as land and crown timber agent, mining recorder and magistrate and sheriff.

The territories were divided into medical districts with appointed officers in charge at Forts Smith, Simpson, Resolution and Norman, and at Aklavik, Yellowknife, Chesterfield and Pangnirtung. The station at Great Bear lake was temporarily attached to Fort Norman. The medical officers were to act also as coroners and have jurisdiction over hospitals, schools and industrial homes (Chesterfield and Pangnirtung). Public hospitals were opened under government subsidy, by the Anglican and Roman Catholic missions at Fort Smith, Resolution, Hay River, Simpson, Aklavik (both denominations), Rae, Chesterfield and Pangnirtung.

Five stipendiary magistrates and the Royal Canadian Mounted Police were charged with maintaining law and order. The total strength in 1940–41 in the "G" division of the police (Northwest Territories and the Yukon) was 93 men. Detachments were stationed at various points in the territories to carry out patrols by dog-sled, boat, aeroplane, motorcar and on foot. Of a total mileage of 90,403 covered (in 1940–41) in the territories, 41,301 was by dog-sled, 36,234 by boat. Police were responsible for carrying out the criminal law; and customs, game laws, fur-trade regulations and many duties under the War Measures act of 1939.

**Physical Geography.**—Apart from division by latitude and longitude, the territories are physically divided into distinct areas. There is first the broad northeastern stretch formerly called the Barren Lands or the Sub-arctics, often described as the Arctic Prairies. This is a treeless country, flat or of low, rolling elevation, of barren slate and rock partly covered with thin soil, over which shallow, rapid rivers, expanding into considerable lakes, run northeast (the Thelon, Dubawnt and Kazan) to the Chesterfield inlet on Hudson bay, or north to form the Back and the Coppermine rivers to the Arctic. The Arctic Prairies are in part covered with vegetation that includes more than 750 species of flowering plants and forms thus a rich grazing ground for caribou and musk oxen. A few stunted willows grow in sunken or sheltered spots. The line of delimitation between the Arctic Prairies and the line of real forest runs irregularly from Fort Churchill to the Mackenzie delta, the trees advancing northward in favoured places. A midway division, named on official maps the Northern Transition Section, in the territories about 100 mi. wide, may be distinguished as between the Arctic Prairies proper and the line of real forest that runs from the eastern end of Lake Athabasca and Great Slave lake to the western end of Great Bear lake. This wooded section covers all the basin of the Mackenzie and its great tributaries, but in the territories is narrower on the west bank where it passes into plains of grass and then changes to the forests of the Rockies. The trees of the Mackenzie basin are chiefly spruce, balsam, white birch, poplar and Jack pine.

The third physical division is the Arctic archipelago in which Baffin Island, bordering the Hudson strait, covers about 201,600 sq.mi. A few stunted willows grow on Baffin Island, and coal is mined in small quantities, but for the most part the Arctic islands are desolate, the Eskimos inhabiting only the coastal edge.

**Climate.**—The line of the Arctic circle (lat. 66° 32′ N.) runs through the north mainland of the territories across the upper corner of the Great Bear lake, thus leaving the Mackenzie delta (Aklavik, Fort Macpherson) and the centre coastal region in the Arctic winter night. Temperatures are more extreme on the east (coastal) side than on the west (mountain) side of the territories. Midsummer is represented by a July isothermal line of 55° F. slanting down from the Mackenzie delta across Great Bear lake and Great Slave lake to Fort Churchill. The line of 60° practically follows the Mackenzie valley. Midwinter shows a January average of −20° from the Yukon down to Lake Athabasca (Fort Churchill −25°). The Great Bear lake average is −30°; the coast at the delta about −25°. Lowest average annual figures are −55° to −60°, in the Mackenzie Valley. The summer months are June, July and August; in parts of the territories summer temperatures may rise to 90° in the shade and average 70° in the daytime. Great Bear lake in midwinter freezes over with ice 7 to 8 ft. thick but is open for navigation from mid-July till the end of September. Great Slave lake also freezes over completely each winter, the ice having an average thickness of from 2½ to 4 ft., depending on the snowfall during the early part of the winter. The shore waters begin to freeze about the middle of October, and freight trucks and tractors are able to cross the lake early in January. Navigation opens about June 10.

**History.**—The territories represent in origin, though not in boundaries, the area handed over to the jurisdiction of the Hudson's Bay company under their charter of 1670. This area included all the land drained by rivers flowing to Hudson bay and the Arctic ocean—roughly speaking, all of Canada from the Rocky mountains to the St. Lawrence watershed. The term "Rupert's Land" was the original official name of the whole area, but the name Hudson's Bay Territory early began to replace it

in common speech. The name Northwest Territory was used to mean the western half and Rupertsland the east.

These were names current at the time of the confederation in 1867 and were adopted by the British North America act in providing for their inclusion in the dominion. But the area now known as the territories was quite unknown and unexplored except for the coast of the bay, for a century after the charter of 1670. The company traded by way of the Hudson bay, but their posts were established on the Churchill, Nelson, Red, Saskatchewan and other rivers, at points entirely within Manitoba and Saskatchewan. Further exploration began with the journeys of Samuel Hearne, a company employee, northwestward from Fort Churchill across the Barren Lands. In his third journey (1770–72) he discovered the Coppermine river, reached the Arctic coast and brought home a 4-lb. lump of copper. His explorations were followed by those of Sir Alexander Mackenzie, in the service of the Northwest company. Mackenzie discovered and descended the river named after him and reached the Polar sea (1789). A journey over the Rocky mountains took him to the Pacific (1792–93).

British interest in the will-o'-the-wisp of the Northwest Passage brought Sir John Ross (1818) and Sir William Edward Parry (1820) to the Arctic archipelago and led to the discovery by Ross's nephew, Sir James Ross (1831) of the magnetic pole on the Boothia peninsula, and prompted the overland journeys of Sir John Franklin to the Coppermine and Coronation gulf (1819–22) and to Great Bear lake and the Arctic coast (1825–27). Franklin's ill-starred expedition by sea (1845–48), his disappearance and the loss of his ships, with all his men, occasioned the famous search (1848–59) which incidentally added much to the knowledge of the Arctic coast. Meanwhile Dr. John Rae, in the service of the Hudson's Bay company, carried on numerous inland journeys (1846–54) and learned much of the Eskimos and of how to live in the north. These explorations had led to the establishment of trading posts by Alexander Mackenzie at Fort Chipewyan on Lake Athabasca (1792), at Edmonton (1795), Fort Resolution on Great Slave lake, Fort Providence on the Mackenzie below, Fort Simpson at the mouth of the Liard, and Fort Good Hope almost on the Arctic circle. The entire area of the territories remained under the jurisdiction of the company till the transfer of 1869, when it became part of Canada, the company retaining only a commercial footing.

The province of Manitoba was created out of the Northwest Territory in 1870, the rest of which, with Rupertsland, passed under dominion control. The Northwest Mounted Police was established in 1873. The rapid immigration and land settlement under the Homestead act (1874) necessitated new government. The Northwest Territories Act of 1875 set up a lieutenant governor and council. In 1882 the area below parallel 60° was divided into the provisional districts of Assiniboia, Saskatchewan, Athabasca and Alberta. An act of 1887 gave representation to the territories at Ottawa, and an act of 1888 set up an elected territorial legislature at Regina. The gold discoveries on the Klondike (1896) led to the separation of the Yukon Territory in 1898. In 1905 the situation was entirely changed by the creation of the provinces of Alberta and Saskatchewan. The Boundaries Extension Act of 1912 carried Manitoba to Hudson bay and gave to Ontario and Quebec the rest of the southern and the eastern coast of the bay and what was left of Rupertsland, thus reducing the territories to their present boundaries.

**Population.**—The population of the territories, made up of officials, police, missionaries, transport and company workers, was placed by the census of 1931 at 9,723 and by the census of 1941 at 12,028. It underwent a proportionately rapid increase by the influx into the Yellowknife mining district, which itself had a population in 1941 of 1,400. The native population of the territories was estimated at 8,800 in 1943. Various tribes of Athabascan Indians (the main stock of northwest Canada), grouped along the Mackenzie river systems in the wooded country, numbered more than 4,000 in 1943. All of the Indians were placed under "treaty" arrangements guaranteeing certain rights (annual subsidy, free schools, hunting rights, etc.) and imposing certain disabilities as to liquor, right to vote, etc.

Entirely separate in life and culture, though distantly related by race, are the Eskimos occupying the Arctic coast from the Mackenzie river mouth to Hudson bay along the Baker-Lake Chesterfield inlet. In the territories proper there were about 4,760 Eskimos in 1943, but another 1,590 lived on the Ungava coast, on the south shore of Hudson strait, formerly a part of the territories but later joined to Quebec. A few bands of Eskimos in the territories left the coast to live inland, depending on caribou for both food and clothing. By 1943 only a handful of Eskimos lived on the Yukon coast and on that of Manitoba.

The majority of the Indians and Eskimos are, at least nominally, Christians, the Indians mostly Roman Catholic as the result of early missions, the Eskimos Anglican by British contact by sea. The belief and practices of both are much affected by their earlier spirit doctrines. Roman Catholic missions began with the Abbé Thibault in 1845. The Church of England created a bishopric of the Mackenzie as early as 1884, but the first wintering Anglican missionary in the Arctic was the famous I. O. Stringer (Hershel Is. 1892–1902, Bishop of Yukon, 1905).

**Resources.**—The natural resources of the territories are undoubtedly great but in 1943 were scantily explored and little exploited. Apart from the seals and salt water fish of the Arctic and the Hudson bay, the fish of Great Bear lake (11,660 sq.mi.) and Great Slave lake (11,172 sq.mi.) and apart from the forest and grazing grounds, there is undoubtedly great wealth to develop in oil and minerals. Oil and natural gas had been known to underlie the Mackenzie valley ever since Alexander Mackenzie saw flaming coal seams on his journey of 1789. Prospecting for oil began in 1914 and a strike was made in 1920 at Fort Norman, below the mouth of the Great Bear river. There was a stampede to stake claims, but it was soon found that the heavy cost of transport prevented oil development. The radium discoveries on Great Bear lake and the opening of the Yellowknife gold fields created a market and put the oil wells at Fort Norman and its small refinery (Great Bear) into active operation. Production for the fiscal year 1940–41 was 17,946 bbl.

A striking feature among the resources of the territories is the radium of Great Bear lake. Silver-pitchblende at the east end of the lake was discovered in 1930, and a milling and mining plant was established. Silver, copper, cobalt and lead, as well as radium and uranium, are recovered from the ores. The radium and uranium products are sent for treatment to a refinery at Port Hope, Ont. Canadian production of radium had cut the price of radium 62% by 1938. Radium and uranium shipped in 1939 were valued at $1,121,553. The Eldorado property was closed temporarily in 1940–42 owing to an accumulated supply at Port Hope.

Following reports from the Geological survey (1935), active prospecting for gold began on the north side of Great Slave lake. The resulting discoveries opened up rich mines at Yellowknife on the north arm of the lake and created a boom town with a population of 1,000 people in 1941. Production by the three chief mines which began operation in 1938 had reached a total value of $4,715,000 by March 31, 1942.

A stock of 2,370 reindeer was driven in from Alaska in 1935 and established on a reserve near the Mackenzie delta. This main herd had increased to 5,000 head by 1942, and 3,000 other deer were in minor herds near the Anderson and Horton rivers. Surplus reindeer, about 200 head, were slaughtered each year, and about one-half of the carcasses were given to the local mission stations. The Wood-Buffalo park (17,300 sq.mi.), overlapping the provincial border at Fort Smith, was set aside for the protection of buffalo. The Thelon Game sanctuary east of Great Slave lake was created to protect all game, especially musk oxen which may not be killed anywhere in the territories. In 1940 an area of about 14,000 sq.mi. around the Mackenzie delta was declared a beaver sanctuary in which all trapping was forbidden.

Land fit for agriculture is very limited and is found only in the immediate Mackenzie basin. Common garden vegetables—potatoes, cabbages, peas, lettuce, etc.—are raised at all posts, the long daylight counteracting the short summer season. The greater part of the Mackenzie valley carries a forest, as described, which

supplies both timber and firewood.

**Water Power.**—The Mackenzie river itself, without rapids, offers no water power. But there is extensive water power in the territories which in 1943 was neither developed nor accurately estimated. Official statistics of 1940 showed water power (1,000–100,000 h.p. in each location) on the Great Bear river, on the inland feeders of Great Bear lake, in various rapids of the Dubawnt and above all (at least 200,000 h.p.) in the Great Slave river, and even more at the gathering of waters at Clinton Golden and Aylmer lakes. In 1941 power to the extent of 4,200 h.p. was developed on the Yellowknife river and transmitted to the mines.

**Communications.**—There were no railways in the territories in 1943. Communication was by water, by sled and by aeroplane. The Mackenzie river, which from its sources in the provinces is in all 2,514 mi. in length—the longest river in Canada—affords an admirable central artery. It offers an unimpeded water course for steamers, motorboats and barges, extending 1,292 mi. from Fort Smith on the Slave river to Aklavik on the Arctic. From the refrigerator cars at the railhead waterways (Alberta), refrigerator barges, chemically chilled, carry fresh frozen meats, vegetables and even ice cream into the Arctic as far as Great Bear river during the open season, and carry out fish. Communication with Great Bear lake is difficult, since the Great Bear river (75 mi. long) is shallow and swift with abrupt banks and is broken in mid-course by many miles of rapids, round which a portage road for trucks was constructed. The coming of the aeroplane and communication by radio ended the isolation of the Arctic.

The department of transport operates meteorological stations at Chesterfield, Nottingham Island, Resolution Island and Coppermine. The Alaska highway, constructed as a military measure in 1942 from Dawson Creek, B.C. to Fairbanks, Alaska, cut past the southwest corner of the territories and afforded a new means of access. A winter tractor road following the course of the Hay river connected Grimshaw (Alta.) with Great Slave lake.

BIBLIOGRAPHY.—Government Publications; *Canadian Census,* 1941; *The Canada Year Book* (Annual); *Report of the Department of Mines and Resources* (annual); Sir F. Stupart, "The Climate of Canada," *Year Book, 1929;* R. A. Gibson, "The Government of Canada's Arctic Territory," *Year Book, 1938;* Sir Alexander Mackenzie, *Voyages to the Frozen and Pacific Oceans* (1801); Sir John Franklin, *Narrative of a Journey to the Shores of the Polar Sea* (1823); John Rae, *Narrative of an Expedition to the Shores of the Arctic Sea in 1846–47* (1850); Warburton Pike, *The Barren Grounds of Northern Canada* (1891); J. W. Tyrell, *Across the Sub-Arctics of Canada* (1897); G. M. Douglas, *Lands Forlorn* (1914); Vilhjalmur Stefansson, *The Northward Course of Empire* (1921); Richard Finnie, *Canada Moves North* (1942). (S. LEA.)

**NORTHWEST TERRITORY,** the name given by congress in 1787 to that portion of the then United States west of the Allegheny mountains and north of the Ohio river. Previous to 1763 it belonged to France; by the treaty of peace at the close of the Revolutionary War, this vast area of more than 250,000 sq.mi. became part of the United States. Its ownership was claimed by various states, but by 1786 all but the Western Reserve (*see* OHIO), which was retained by Connecticut, was ceded to the federal government. In the ordinance of 1787 passed by congress for the government of the territory, provisions were made which long played a prominent part in American history, especially that by which slavery was forever prohibited within it. Out of this territory, Indiana, Illinois, Wisconsin, Michigan and part of Minnesota were subsequently carved.

**NORTHWICH,** a market town and urban district of Cheshire, England, 171 mi. N.W. of London, on the L.M.S. railway. Pop. (1938) 19,370. Area, 3.3 sq.mi. It lies at the junction of the rivers Weaver and Dane and is located in Great Britain's most important salt-producing area. In the narrow and irregular streets of Northwich many of the houses have sunk and are at fantastic angles, being strongly bolted to keep them secure, because of subsidences resulting from the pumping of brine. This latter method of salt production has largely replaced the mining of rock salt. The salt is conveyed to the Mersey ports for export, by the river Weaver, which is connected by a hydraulic lift with the Trent and Mersey canal on higher level.

**NORTON, CAROLINE ELIZABETH SARAH** (1808–1877), afterwards Lady Stirling-Maxwell, English writer, was born in London in 1808. One of the three beautiful granddaughters of Richard Brinsley Sheridan, daughters of his son Thomas, the "three Graces" of London society in the reign of George IV., she began to write before she was out of her teens. Her two sisters Helen and Georgina became respectively Lady Dufferin and duchess of Somerset. At the age of 17, Caroline published a merry satire, *The Dandies' Rout,* illustrated by herself; this was followed by *The Sorrows of Rosalie* (1829), and *The Undying One* (1830), a version of the legend of the Wandering Jew. She married in 1827 the Hon. George Norton, brother of Lord Grantley. The husband's persecutions culminated in 1836 in an action brought against Lord Melbourne for seduction of his wife, which the jury decided against Norton without leaving the box. The case against Lord Melbourne was so weak that it was suggested that Norton was urged to make the accusation by Melbourne's political enemies, in the hope that the scandal would prevent him from being premier when the princess Victoria should succeed William IV. In 1853 legal proceedings between Mrs. Norton and her husband were again entered on, because he not only failed to pay her allowance, but demanded the proceeds of her books. Mrs. Norton made her own experience a plea for addressing to the queen in 1855 an eloquent letter on the divorce laws, and her writings did much to ripen opinion for changes in the legal status of married women. George Meredith, in *Diana of the Crossways,* used her as the model for his "Diana." Mrs. Norton was not a mere writer of elegant trifles; her *Voice from the Factories* (1836) was a most eloquent and rousing condemnation of child labour. *The Dream, and other Poems* appeared in 1840. *Aunt Carry's Ballads* (1847), dedicated to her nephews and nieces, are written with charming tenderness and grace. Later in life she produced three novels. She wrote a preface to *The Rose of Jericho,* a translation from a German fable by her mother, Mrs. Sheridan. She died on June 15, 1877. Her husband died in 1875; and Mrs. Norton in the last year of her life married Sir W. Stirling-Maxwell.

*See* Jane G. Perkins, *The Life of Mrs. Norton* (1909).

**NORTON, CHARLES ELIOT** (1827–1908), American scholar and man of letters, was born at Cambridge, Mass., on Nov. 16, 1827. The descendant of a long line of clergymen and of Anne Bradstreet, the Puritans' "tenth muse," in his idealism, restraint and dignity he was a member of the New England group already passing into its decline. Yet in him there was, too, an alien strain that made him, after graduation from Harvard in 1846, take employment with an oriental trading firm, for which as supercargo he travelled out to India. The leisurely trip through Europe on his return and his early contact with the culture of an older civilization made him feel sharply what he had been losing in life—"pleasure, opportunities, happiness, indeed, of a sort that nothing else can supply." He felt himself to be "half starved" in America, yet he knew that in the old world he would be "half starved for this strange new one." Thenceforth his work was to be largely that of torchbearer and interpreter. As lecturer on and first professor of the history of art at Harvard (from 1874 to 1898 when he became emeritus), he was long considered the "oracle of the humanities." From his first publication of church hymns (1852), he turned to *Notes of Travel and Study in Italy* (1860), and to his later *Historical Studies of Church Building in the Middle Ages* (1880). A translator of *The New Life of Dante Alighieri* as early as 1859, he did what was probably his best literary work in his prose translation of the *Divine Comedy* (1891–92). He helped to develop the creative abilities of his own countrymen in his editorship (1864–68) with Lowell of the *North American Review.* For long years with unfailing grace and tact he edited the literary remains of many of his friends. *The Correspondence of Thomas Carlyle and Ralph Waldo Emerson* (1883), *Letters of John Ruskin to Charles Eliot Norton* (1904)—records of a rare friendship mutually profitable—the *Orations and Addresses of George William Curtis* (1894), *Henry Wadsworth Longfellow; a Sketch of his Life, together with Longfellow's Chief Biographical Poems* (1907), the *Letters of James Russell Lowell* (1894) all bear testimony to the variety of his

friendships in England and America and to his editorial discrimination. In allusion to this phase of his life, he suggested to Lowell as an inscription over his grave, "He had good friends, whom he loved." Yet his was never too exclusive a disposition. A lover of the beautiful in art, he was also a worker for the beautiful in life. Between 1846 and 1849 when he was still in the counting-house, he opened a night school for men and boys in Cambridge; he was a director of the movement for model lodging-houses in Boston; he was a zealous worker for the Union cause, especially through his editorial labours for the New England Loyal Publication Society. When he died (Oct. 21, 1908) at "Shady Hill," the gracious house in which he had been born, he left the memory of a serene and well-ordered life.

The best record of his life is afforded by his *Letters,* which were edited with biographical comment by his daughter Sara Norton and M. A. De Wolfe Howe (1913). Tributes to his work and personality may be found in *The Harvard Graduates' Magazine* (vol. 16, Dec. 1907; vol. 17, Dec. 1908) and in T. W. Higginson, *Carlyle's Laugh* (1909).

**NORTON, THOMAS** (1532–1584), English lawyer, politician and writer of verse, was born in London in 1532. He was educated at Cambridge, and early became a secretary to the protector Somerset. In 1555 he was admitted a student at the Inner Temple, and married Margery Cranmer, the daughter of the archbishop. From his eighteenth year Norton had begun to compose verse. He contributed sonnets to *Tottel's Miscellany,* and in 1560 he composed, in company with Sackville, the earliest English tragedy, *Gorboduc,* performed before Queen Elizabeth in the Inner Temple on Jan. 18, 1561. In 1562 Norton, who had served in an earlier parliament as the representative of Gatton, became M.P. for Berwick, and entered with great activity into politics, especially religious politics, and was employed on official business in the Channel islands and at Rome. Towards the end of his life he was a fanatical anti-Catholic. His punishment of the Catholics, as their official censor from 1581 onwards, led to his being nicknamed "Rackmaster-General." At last he was deprived of his office and thrown into the Tower. Walsingham presently released him, but he died on March 10, 1584.

For *Gorboduc see* DORSET, THOMAS SACKVILLE, 1ST EARL OF. The best account of Norton, and his place in literary history, is that of Sidney Lee in his *Dictionary of National Biography.* (E. G.)

**NORWALK,** a city of Fairfield county, Connecticut, U.S.A., 42 mi. N.E. of New York city, on Long Island sound at the mouth of the Norwalk river. It is on federal highway 1, and on the Merritt parkway, is served by the New York, New Haven and Hartford railroad. Population (1930) was 36,019 (24% foreign-born white) and 39,849 in 1940, a gain of 11%. The city's area 24.7 sq.mi. embraces districts of very diversified character: the port and manufacturing centres, summer resorts along the sound and residential sections old and new. Churches and colonial houses surround the historic green. There are four parks and a municipal bathing beach. The city has 130 industries manufacturing a variety of products. Valuable oyster fisheries are also found in Norwalk. It is there that steam was first used in this industry and there, too, the first derby hat in the U.S. was made. The assessed valuation of property for 1940 was $73,461,574. The site of Norwalk was purchased from the Indians in 1640 by Roger Ludlow and Daniel Patrick. The first settlement was made in 1649 by a small company from Hartford, and the town was incorporated in 1651. The city was formed by its consolidation in 1913 with the city of South Norwalk (chartered 1870). It was from Norwalk that Nathan Hale, disguised as a Dutch school teacher, started on his fatal errand to Long Island in Sept. 1776. The village was burned by the British under Governor Tryon on July 12, 1779, and a chair is preserved in which (the story goes) Tryon sat and watched the flames from Grumman's hill.

**NORWALK,** a city of northern Ohio, U.S.A., on federal highway 20; the county seat of Huron county. It is served by the N.Y. Central and Wheeling and Lake Erie railways and by a truck line. Pop. was 7,776 in 1930 (92% native white) and 8,211 in the census of 1940. Century-old maple trees line most of the streets, and the manufacturing industries include food products, woodworking, rubber and printing plants. Norwalk was settled in 1817 by colonists from Norwalk, Connecticut. It was incorporated as a town in 1829 and chartered as a city in 1881. It lay within the "Fire Lands" grant made in 1792 by the State of Connecticut to the people of eight Connecticut towns, to indemnify them for losses by fire during the British expeditions under Governor Tryon in 1779 and Benedict Arnold in 1781.

**NORWAY** (*Norge*), a kingdom of northern Europe, occupying the west and smaller part of the Scandinavian peninsula. Its east frontier marches with that of Sweden, except in the extreme north, where Norway abuts on Finland. On the north, north-west, west, the boundaries are the Arctic ocean, Norwegian sea (Atlantic ocean) and North sea respectively. The Skagerak washes it on the south and south-east. The south extremity of the country is the island of Kraage near Mandal in 57° 57′ N., and the north that of Cape Knivskjerodden (71° 11′ N.), west of the North cape on the island of Magerö. Of the mainland, the promontory northernmost is Nordkyn, in 71° 8′ N., the southernmost, Lindesnes in 57° 59′ N. Hence the south extremity of Norway lies in the same latitude as Dornoch firth (Scotland) and of mid-Kamchatka. The most western island, Steinsö, lies off the mouth of the Sogne fjord (4° 30′ E.), and the easternmost point is Hornö (31° 10′ E.) near Vardö. The direct length of Norway (south-west to north-east) is about 1,100 miles. The extreme breadth (about 61° N.) is 260 m.; the average is about 60 m., but the Swedish frontier approaches within 5 m. of a head-branch of Ofoten fjord, and the Finland frontier within 22 m. of Lyngs fjord. The length of the coast line is difficult to estimate; disregarding indentations it is about 2,110 m., but including the fjords and greater islands it is probably 12,000 miles. The total area is 119,085 sq.mi.

**Physical Features.**—The main highland mass of the whole Scandinavian peninsula is a very much eroded plateau which, probably on account of forming, in the main, the watershed between the rapid western rivers and the normally longer and slower eastern rivers of Sweden, has received the name of Kjolen (the Keel). Although the plateau as a structural feature may be considered to extend from south-west Norway to North cape and even beyond into Spitsbergen, yet its ridge-like character is most marked where it coincides most closely with the Swedish boundary, *i.e.,* north of 63° N., and there is a desirable tendency to restrict the name to this portion. The high plateau consists of early Palaeozoic rocks which represent one of the oldest structural elements in Europe. An Archaean zone stretches along the west coast from Bergen to Hammerfest interrupted towards the north by overlying patches of Palaeozoic deposits. Gneiss predominates, but other crystalline rocks occur subordinately. The Lofoten islands consist chiefly of eruptive granite, syenite and gabbro. South of a line drawn from the head of the Hardanger fjord to Lake Mjösen is another great Archaean area.

A line drawn from the Nase to the North cape coincides roughly with a marked change in the character and structure of the Palaeozoic rocks. East of this line even the Cambrian beds are free from overfolding, overthrusting and regional metamorphism. They lie flat upon the Archaean floor, or have been faulted into it in strips, and they are little altered except in the neighbourhood of igneous intrusions. West of the line the rocks have been folded and metamorphosed to such an extent that it is often difficult to distinguish the Palaeozoic rocks from the Archaean. They form in fact a folded mountain chain of ancient date which has subsequently been worn down and then faulted up. No volcanic rocks of recent date are known in Norway. This faulting largely accounts for the almost unique character of the river and coastal topography of Norway. Differential erosion, partly glacial, has caused many of the highland masses to form prominent mountain summits not only on such islands as the Lofoten chain, but on the plateau itself. The average height of Norway is probably about 1,600 ft. and may be compared with approximately 1,000 ft. for Europe as a whole. This high figure for Norway is not dependent so much on the height of individual summits as on the absence of extensive lowlands; south-east Norway is the lowest part and even this is of a hilly nature. In the area north-west of the Norway-Finland boundary a few peaks reach slightly

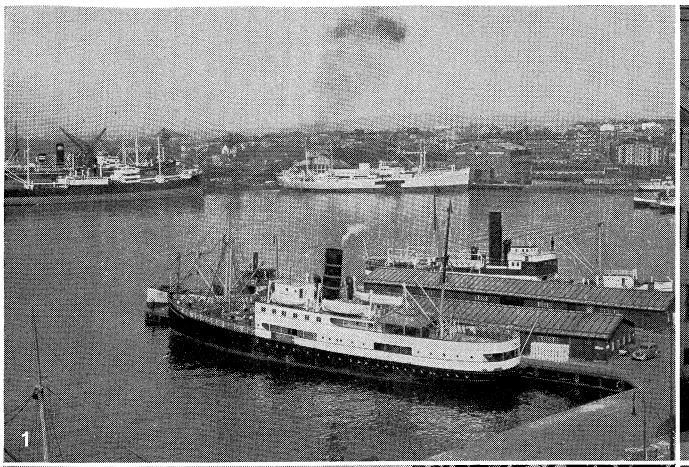
over 4,000 ft., but immediately south of the junction of the three countries the general height increases considerably, though the most lofty summits are entirely Norwegian only in the extreme north of this area. (*See* SWEDEN.) Here Jaeggesvarre (6,283 ft.) lies between Lyngs and Uls fjords, and Kistefjeld (5,653 ft.) provides right bank water for the Barduelv, which runs westward north of Torneträsk. Sulitjälma (6,158 ft.) lies actually on the frontier. Nearer the coast and centred approximately on the Arctic circle is the great icefield of Svartisen (*see* GLACIERS), through which projects Snetind nunatak (5,246 ft.). The only important peaks immediately south of this are Okstinderne (6,273 ft.), and the rather better known Stora Börgefjeld (5,587 ft.). At about Lat. 63½° N. is the southern limit—Trondhjem fjord—of a remarkable depression which runs for upwards of 200 m. south-west to north-east dividing the narrowest part of Norway into almost equal eastern and western strips. Its exit is at Saltfjord (near Bodö) and it is characterized by numerous rivers, some draining north, others south; the depression is of the greatest importance for internal communication and for future railway routes. Due east of Trondhjem fjord the plateau is lowest and narrowest, again offering a relatively easy communication route already utilized by a railway. Also from this fjord southwards is a valley line and a railway route to the Upper Glommen valley and down this to Oslo. South of the Trondhjem "narrowing" the plateau swings westwards, becoming higher, wider and more definitely Norwegian. The Sogne fjord (61° N.) and its branches reach out towards a giant horseshoe of the highest ridges in Norway; northwards are the Jostedalsbrae; the Jotunheim lies north and north-east; the Hardanger fjeld is south-east and the Voss lies south. North-east of the Jotunheim beyond the deep cleft of Gudbrandsdal and its north-west counterpart the Romsdal, is the Dovre fjeld, and south-east of this, the Rondanefjeld. South of the Hardanger fjeld, beyond Hardanger fjord, is the lake-sprinkled Hardanger Vidda, the most expansive tract of open high plateau in Europe; south-eastwards this plateau merges into the lower hummocky Telemark mountains which are drained south and south-east to the Skagerak. The most lofty summits occur in the Jotunheim with Galdhöpiggen (8,097 ft.) as the highest Norwegian mountain, though if the 100 ft. or so of snow on the top of Glitterkind is included, then this reaches to 8,140 ft.; nearly 30 peaks in all exceed 6,500 ft. in the Jotunheim mass. The other mountain areas are lower, though the Dovre fjeld and the Rondanefjeld have Snehaetta (7,550 ft.) and Rundvashögda (6,890 ft.) as their respective summit masses.

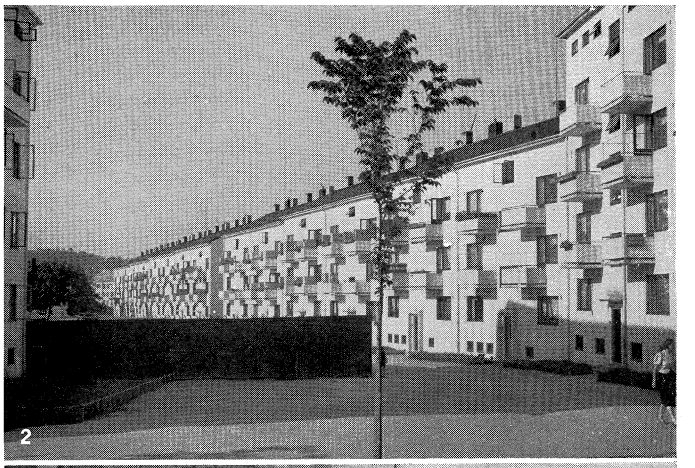
**Coast.**—The Norwegian mountains fall abruptly to the sea, and the coastline almost throughout is cliffbound. The land features are continued as numerous islands, estimated at 150,000, which fringe the mainland. This island fringe, occurring also in a modified form along the Swedish coast, is, in Norway, termed the *Skärgård* (skerry-fence). This fringe and the fjord-coast are most fully developed from Stavanger nearly as far as the North cape, but only between Stavanger and Flekkefjord can the coast be considered smooth and moderately free from islands. Here, particularly north of Egersund, a narrow lowland, abundant in peat bogs, is fringed by a flat, open coast, dangerous to shipping. The channels within the island line are of incalculable value to a people largely dependent on coastwise navigation. In fact, the voyage northward from Stavanger may be made in quiet waters almost throughout. Only at rare intervals, as off the port of Haugesund, or when crossing the mouth of some large fjord, need the open sea be encountered. At some points large steamers follow the carefully marked deep-water channel, between cliff edges which seem to overhang the vessel on either side. Small vessels, fishing or trading between the fjord-side villages, navigate narrow ramifying "leads" (*leder*) where the sole danger is the tidal current, often exceedingly strong. The largest island is Hindö (Lofoten and Vesteraalen group), about 850 sq.m. in area.

**Glaciers.**—The relatively insignificant Norwegian glaciers of to-day have unimportant effects compared with the glaciation consequent on the presence of the enormous ice-fields in the last Ice age. To these latter glaciers is owed much of the smoothing of islands and the fjord character of the coast. The rounded nakedness of the mountains, the U-shaped valleys, the shelf-like ledges over which the rivers plunge, to produce the "white coal" of Norway, and the pockets of finely divided fertile soils in rock basins are all direct legacies. The level terraces and raised beaches which exist on some of the coasts and prove such desirable sites for settlement are mainly composed of glacial débris once deposited below sea-level but now elevated by land oscillation. To-day Norway still contains the largest European icefield—the Jostedalsbrae. This is some 400–500 sq.m. in extent: from it glaciers run to within 150–200 ft. of sea-level. Jotunheim, though glaciated, has the ice-cap broken by deep valleys, also as it lies further east the precipitation is lower and the summer temperatures higher—two factors seriously affecting the size of ice-caps. Between Hardanger fjord and its branch, Sörfjord, is Folgefond—110 sq.m.—and the most southerly considerable area in Norway. Second in point of size to the Jostedalsbrae, but not inferior in interest, is Svartisen—230 sq.m. in area, from which glaciers descend almost to sea-level. In about lat. 70° a small glacier, the Engabrae, actually enters the sea in Jokulfjord (a branch of Kvenangfjord) and gives birth to miniature icebergs. The Seiland glacier (46 sq.m.), on the island of the same name south of Hammerfest, is the most northerly Norwegian example. The snow line in Norway varies in height with aspect and amount of precipitation, but it is everywhere fairly low—ranging from below 3,000 ft. in Seiland to slightly above 5,000 ft. in south Norway.

Many islands, chiefly northern, are of great elevation; thus the jagged granite peaks characteristic of the Lofotens reach about 4,000 feet. Other interesting islands are Hornelen, near the mouth of Nordfjord, rising nearly sheer for 3,000 ft. above the sea; the well-named Torghatten ("the market hat"), north of Namsos, completely pierced, 400 ft. above the sea, by a vast natural tunnel, which on occasion reaches upwards of 200 ft. in height and 80 ft. in width; the quaintly shaped small Hestmannö ("horseman island"), intersected by the Arctic circle, justly named from its form. Bare rock is the dominant feature of the coast and islands, save where a few green fields surrounding a farmstead occupy a miniature level terrace. The oscillation of the land relative to sea-level is illustrated by marine terraces, 600 ft. above the present sea-level, near Trondhjem, and by the numerous former beach lines of north Norway, which are occasionally in pairs at different heights. Nevertheless, at some points (as on the Jaderen coast) glaciated "giants' kettles" may be observed even below the level of high tide thus indicating the greater level of the land towards the close of the Glacial epoch.

**Fjords.**—Oslo fjord, opening from the north angle of the Kattegat and Skagerak, differs from the great fjords of the west. Its shores are neither high nor precipitous. It is shallower, wider, and is surrounded by the most extensive lowland in Norway. It is studded with numerous small islands. Thence, past Lindesnes, to Bokn fjord there are many small fjords, 300 fathoms in extreme depth, but even the intermittent inner lead which can be traced to Flekkefjord ceases to exist beyond. Bokn fjord is broad and island-studded, but throws off several inner arms, of which Lyse fjord, due east of Stavanger, is 25 m. long and half a mile wide, with precipitous walls. It is the most beautiful and mysterious fjord in south-west Norway. Hardanger fjord (355 ft. extreme depth) penetrates the land for 70 m. and is frequently visited, for it lies near to shipping routes which converge on Bergen, but its beauty is exceeded by that of Sogne fjord and Nordfjord farther north. Sogne is the largest and deepest fjord of all; its head is over 100 m. from the sea; its maximum width scarcely exceeds 2 m., and the main channel is 500–660 fathoms deep. Some of the northern arms intersect the snow-clad Jostedalsbrae, and their dark blue waters have a surface layer showing a milky tinge imparted by glacier-fed streams. Nordfjord (340 ft. in extreme depth) touches the northern side of the Jostedalsbrae and is popular with tourists. Stor fjord opens inland from Aalesund; it is over 70 m. long and is wild and imposing. Trondhjem fjord (300 ft. in extreme depth), the next great fjord northward, broadens inland from a narrow entrance, but lacks

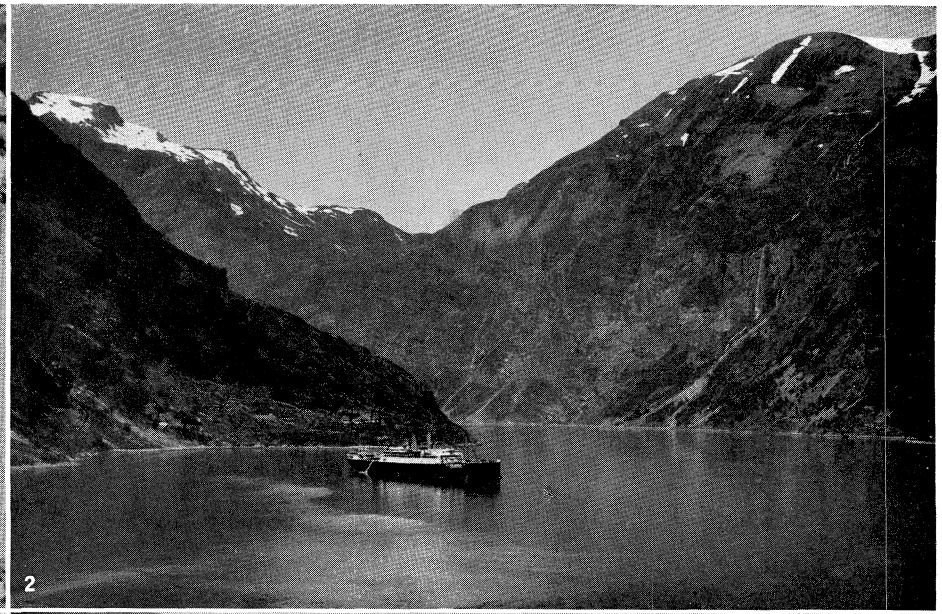


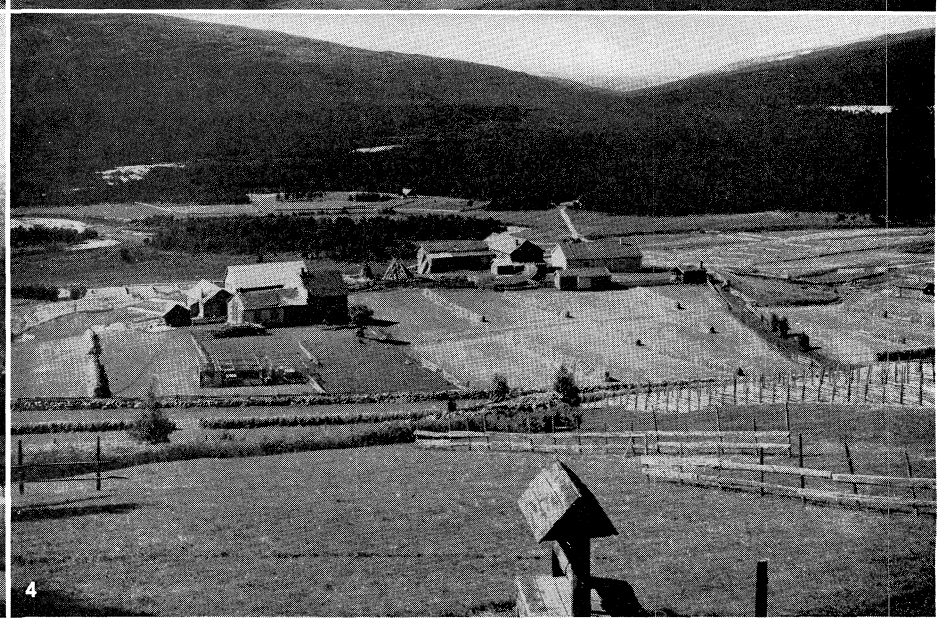


PHOTOGRAPHS, (1-4) BURTON HOLMES FROM EWING GALLOWAY, (5) EWING GALLOWAY

## NORWEGIAN CITIES

1. The harbour of Oslo
2. Modern apartment houses in Trondhjem
3. Torval Menning, the main business street of Bergen
4. The great fish market at Bergen
5. View of Trondhjem from the bay



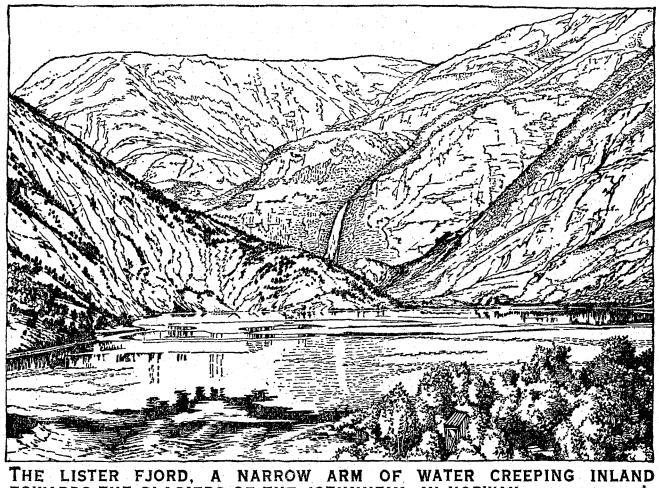


PHOTOGRAPHS, (1) PIX, (2) EWING GALLOWAY, (3) DE COU FROM EWING GALLOWAY, (4) BURTON HOLMES FROM EWING GALLOWAY

## TYPICAL SCENES IN NORWAY

1. An open-air flower market in Oslo
2. Gerangerfjord, one of the numerous picturesque fjords of Norway
3. A Norwegian farmhouse with roof of sod in which flowers grow
4. Farm land in the upper Romsdal valley, where the Germans speedily pushed northward from Oslo during the invasion of 1940

grandeur as the elevation of the land is reduced at the Trondhjem "narrowing." Immediately north of Trondhjem, the fjords, though long, are not so extensive and the coastline loses its grandeur, but north of Salt fjord, which lies beyond the great Svartisen icefield, the scenery is unsurpassed. Salt fjord is connected with Skjerstad fjord by three narrow channels, where the water, at ebb and flow, forms powerful rapids. The Lofoten islands and Vesteraalen are separated from the mainland by the Vest fjord (340 ft. deep), which is continued inland by Ofoten fjord, on which is situated Narvik, the railhead town for the line from Sweden. The main fjords north of Vesteraalen have a general northerly direction; among them is Lyngs fjord near Tromsö, with high flanking cliffs. The softer and looser schists are more prevalent in the north, hence the fjords are wider, branched and interlaced, particularly in Finmark. The Alte fjord (225 ft. extreme depth) is remarkable for the vegetation on its shores. From Lofoten north there is a chain of larger islands: Senjen, Kvalö, Ringvadsö, Sorö, Seiland and Magerö, thus extending to the most northerly point, but hereafter the Skärgård ends abruptly. The coast to the east is of widely different character; flat mountain wastes descend precipitously to a sea destitute of islands, save Vardö, with two low islets at the eastern extremity of Norway. The chief fjords are Porsanger and Tana, opening north, and Varanger opening east. North of the last fjord the land is low and the landscape monotonous; on the south of it a few islands and branch fjords break the smoothness of the coast line.



THE LISTER FJORD, A NARROW ARM OF WATER CREEPING INLAND TOWARDS THE GLACIERS OF THE JOTUNHEIM, IN NORWAY

**Hydrography.**—Both in respect of rivers and of lakes Norway is well supplied. As a rule, the rivers are short and have a small basin; and the lakes are long, of little area, but of great depth, for many give soundings showing their beds to be well below the present sea-level. In this connection, Mjösen, the largest Norwegian lake, 140 sq.m. in area at an altitude of 397 ft., has a maximum depth of 1,482 ft. (nearly 1,100 ft. below sea-level); Tyrifjord (alt. 207 ft., area 51 sq.m.) has its maximum depth 700 ft. below sea-level; Tinsjö (alt. 605 ft., area 17½ sq.m.) with its bed over 800 ft. below sea-level; but the most remarkable case is Hornindalsvand, 6 m. beyond the head of Nordfjord —20 sq.m. in area, 180 ft. alt.; its maximum depth is 1,414 ft. below sea-level. Many of the high level lakes are also of great depth, *e.g.*, Bygdin—area 17½ sq.m., alt. 3,485 ft., greatest depth 705 ft. The total number of lakes, tarns and pools is very high: in all they probably cover nearly 2,950 sq.m. (2½% of entire country). In many cases the low-lying lake near the head of a fjord is separated from sea water by a narrow but steep-sided neck of land which on further land subsidence would resemble the submerged sill which is so characteristic of the underwater topography of the fjords. The majority of the river valley lakes resemble mere expansions of the width of the river, and possess strong currents, hence their value for internal transport is, on the whole, less important as routes for water-borne traffic than for providing through lines for land communication in the difficult mountainous sections of the country. Stora Le on the frontier in the south-east is somewhat exceptional, for it provides a definite water-transport link between a canal system of Norway and one of Sweden. The majority of the rivers run swiftly between steeply sloping valley walls, particularly in their upper and middle courses, and are there of little or no value for any form of navigation though they are extremely useful as gigantic flumes for the gravity carriage of timber. They are utilized as water-heads for hydro-electric schemes by which nearly 1,400,000 horse-power are now being developed and used.

The unexploited sources are still enormous, over 10 million horse-power, and the people are fully aware of this source of natural wealth. Its development becomes easier on account of the numerous rapids and falls which characterize the rivers. As Norway also fully realizes the financial value of her remarkable scenery and of her anglers' haunts, the mode of utilizing this smokeless-power in the industrialization of any area will be given much thought. A limiting factor in the "white coal" schemes is the seasonal character of many Norwegian streams which run low in winter on the freezing of their upper courses and rise rapidly during the period of maximum rainfall—here the lakes are of supreme value as safety-valves controlling spring thaw-water and autumnal rain water. Nevertheless, disastrous floods are not unknown. The lakes themselves in the north and interior freeze for varying periods each year, but in the south, where the majority of the large lakes are situated, it is only during very severe winters that these reservoirs become icebound. In a land where rivers possess so many and so varied interests selection becomes difficult.

The principal river of Norway is the Glommen, about 400 m. long, which rises about 2,300 ft. above sea-level in the highlands south of Trondhjem fjord. It is a swift stream with numerous falls, and even within 8 m. of its mouth, in Oslo fjord, there is a series of seven falls of which Sarpsfos (60 ft. high and 164 ft. wide) is the best known. The river, which runs mainly north to south, drains about 16,000 sq.m., pierces the richest timber area and provides an important railway route from Oslo to Trondhjem. Above Öieren (area 36 sq.m.) the largest lake of the numerous ones in its course, the Glommen makes a remarkable bend (at Kongsvinger). Here, in post-glacial times, the river which formerly ran due south to Väner lake (Sweden) made a sudden swing to the west capturing the upper waters of the Laagen, formerly an independent stream. (The old bed still carries occasional flood water from the Glommen to the lake.) The Laagen, 200 m. long, has, for a Norwegian river, a large upper basin receiving water from the Jotunheim and the Dovre fjeld. Its sources lie near Romsdals fjord, for which it is providing the following railway route direct from Oslo: along its lower course (River Vormen) past the shores of Lake Mjösen up the Gudbrandsdal, over the water parting and down Romsdal—another railway line links Trondhjem with the head of Gudbrandsdal. This last name illustrates a common practice, in Norway, of using different names for a river in its different courses, and different names for a river and for its enclosing valley—the valley name being also frequently employed for surrounding districts. Of the other important streams entering Oslo fjord, the Tistedalelv reaches its eastern seaboard after draining through a series of long, narrow lakes connected by rapids; the Dramselv (Drammen), a large river with a considerable basin extending into Hemsdals fjeld, Valdres and File fjeld, enters on the western sea-board. Its upper tributaries, the Randselv and the Aadalselv (plunging over Hönefos), unite to form the Storelv which expands into the Tyrifjord lake. Below this the real Dramselv begins and receives, on the right bank, the Hallingsdalelv which flows through Lake Kröderen—all these valleyways afford important but not easy routes; and, though the rivers are not navigable for any long stretches yet steamers are employed on the lakes. Numerous streams drain southwards from the plateau and lake district of Hardarger Vidda, one of these, the Numedalslaagen (nearly 200 m.) is noted for its falls, *e.g.*, Hammerfos and Labrofos, and for its wealth in salmon. From the Telemarken district, runs the Skienelv (150 m.) flowing through the very deep Tinsjön and the slightly larger, deep Nordsjön; the former lake receives the river Maane, on which is the famous Rjukanfos (415 ft. high).

The most notable falls occur in the courses of the shorter and more rapid western streams. Some of the most striking, in order from the south, are: Vöringfos (535 ft.) on the Bjoreia and Skjaeggedalsfos (525) on the Tyssaå—these two are in the Hardanger fjord area. Around Sogne fjord are several, of which Vettisfos (850 ft.) on the Morkedöla is probably the most interesting. The famous "Seven Sisters Falls" are in a branch of the Storfjord, while the Namsenelv (85 m.) a popular salmon river entering Namsenfjord has Fiskumfos (105 ft.) and several others. The Arctic ocean rivers have gentle gradients, occasional rapids but no important waterfalls. Two longer ones are the Altenelv (112 m.), which drains into the Alte fjord, but unfortunately its valley affords no route of importance and the Tanaelv (120 m. long—third longest river of Norway) which drains á considerable area in Norway and Finland, but the absence of lakes results in summer floods increased by the presence of ice dams. The lower river is wide (about 2,000 yd.) and tidal for 6 or 7 m., and is ascended by small vessels. River boats are used along certain river stretches below and above the Storfos rapids which occur about 45 m. from the mouth of the river and have a fall that averages 23 ft. in 1,000 yards.

**Flora.**—The forests of Norway consist chiefly of conifers. The principal forest regions are in the south-east and south. In the Trondhjem area and in Nordland there are extensive forests of pine and spruce with the pine on the drier, higher, and less congenial parts. In south-east Norway the conifer tracts extend from sea-level to 2,500 to 3,000 ft.; in the inland parts of the Trondhjem region the upper limit sinks to 2,000 ft.; while on the coast the upper limit is only from 600 to 1,200 ft.; farther north the spruce disappears and the pine limit falls to 700 ft. about 70° N. Above and north of the conifers is the birch belt; next follow various species of willows, and the dwarf birch, and last of all, before the snow-line, the lichen belt, in which the reindeer "moss" is always conspicuous, but a few flowering plants, shrubs and trees of the willow belt sometimes extend close up to the snow line. Even among the conifers there is a sprinkling of other trees—lowland birches, aspens and rowans in the high north, while in the south and less elevated districts the lowest zone of forests includes the ash, elm, lime, oak, beech and black alder; but the beech is much rarer than in Sweden and, in fact, flourishes only near the Skagerak; here and elsewhere the extreme coast region is destitute of forest. The richest flora is found in the inland fjord valleys, but the Dovre fjeld is the district in which Arctic flora may be studied in great variety and within narrow limits. Marine flora is very finely developed on the coastal banks.

**Fauna.**—The great forests are still the haunt of the bear, the lynx, and the wolf. Bears are chiefly restricted to the uplands north of Trondhjem, and the cutting of forests has limited their range to the least accessible highlands. The wolves decreased very suddenly in south Norway about the middle of the 19th century, probably owing to disease, and during the last half-century have continued to decrease in the north; but they are still abundant in Finmark, and are the worst enemy of the reindeer. The elk occurs in the eastern forests, and near the coast in the Trondhjem district, but is now becoming rare. The red deer is confined chiefly to the west coast districts; its principal haunt is the island of Hitteren, off the Trondhjem fjord. It is usually regarded as a survival of the oak age. On the high fjelds are found the wild reindeer, glutton, lemming and the fox. The wild reindeer, which occurs in Finmark has decreased, though large tame herds are kept by the Lapps. The lemming is noted for its curious non-periodic migrations; at such times vast numbers of these small animals spread down country, even swimming lakes and fjords. They are pursued by beasts and birds of prey, and even the reindeer kill them for the sake of the vegetable matter they contain. Hares are very common all over Norway up to the snow line. The beaver, formerly widespread, decreased seriously, but strict protection has saved it, and it is fairly plentiful in the south Norway valleys.

Game birds are fairly abundant in most districts. Black grouse are widely distributed in the region of conifers and birches south of Finmark. Hazel grouse are found mainly in the spruce forests of the south-east and east, and fairly generally in the north, as are capercailzie, but the former is lacking in the west, and the latter is found near certain fjords only. Woodcock and snipe are moderately plentiful. The partridge, an immigrant from Sweden, occurs principally in the east and south-east. A severe winter causes a marked scarcity of them. A very large proportion of the Norwegian avifauna consists of migratory geese and ducks, various birds of prey, golden plover, etc. These birds leave in autumn by three well-defined routes—one from Finmark into Finland, one by the Cristiania valley, and one by the west coast, where they congregate in large numbers on the lowlands immediately south of Stavanger; but certain high Arctic birds as the king-eider, Spitzbergen guillemot and the little auk move on to the north Norway coast from higher latitudes at the end of summer. The Arctic type of bunting, the snowy owl, and the rough-legged buzzard are exceedingly numerous. In some localities the puffin and kittiwake form great colonies (*fugleberge,* bird cliffs).

The common seal is very frequent; and Arctic seals visit the northern coasts; among these the harp, or Greenland, seal is believed to be particularly destructive to the fisheries. A large number of the best European food-fisheries occur along the coasts, including cod, herring, mackerel, sprat and flat-fish. Various species of whales visit the coast; the most important is the rorqual, or finner—the largest is the blue whale, which appears off the coast of Finmark from June to August. Other finners are the *true finner* and the smaller fish-whale. The most important of other types of whales are the bottle-nose, the humpback and the caaing whale. Of freshwater fish the *Salmonidae* are by far the most valuable. Next to these, perch, pike, grayling and minnow are most common.

South Norway is richer than west Norway in insects, and north Norway has numerous characteristic Arctic types.

Norway is much frequented by British anglers. The *Salmonidae* have penetrated considerable distances inland, and though the trout is the only one to reach many of the upland lakes yet it is very abundant there. (Most of the owners of water rights have a full appreciation of the value of good fishing to sportsmen, especially when netting rights are given up for the sake of rod-fishing.)

**Climate.**—The striking and unique feature of the climate of Norway is the presence of the largest positive temperature anomaly on the surface of the globe, which results in such unusual conditions as average temperatures within the Arctic circle which are higher than those of places farther east and 20° of latitude farther south. Again, Hammerfest, a thriving settlement of over 3,000 inhabitants, is actually north of King William's Land, which witnessed the tragedy of the Franklin polar exploration party. This temperature anomaly is consequent on the warm water and air-drift across the Atlantic ocean on to the shores of Norway. February is the coldest month, and south-east Norway then has a mean temperature of below 32° F (Oslo 23·9°), but the coldest parts in this area are the Glommen valley, between Tönset and Röros (near the Swedish border). At the latter place (altitude 2,067 ft.) the February mean is 12·2° and an absolute minimum of approximately 80° F of frost has been recorded. Even this intense cold has been exceeded at stations near the Norway-Sweden boundary in Lapland. A somewhat unusual phenomenon is that lower-lying stations occasionally show lower winter averages than upland stations near to them; *e.g.,* Tönset 11° average against Röros 12·2°. Tromsö, Skudenes (on an island north of Stavanger) and Bergen have averages of 25·0°, 34·5° and 33·6° respectively. The number of days on which frost occurs varies between 60 at Skudenes and 240 in certain parts of Finmark; North Cape has about 190. The fjords are not penetrated by the cold water from the open ocean and are always ice-free except for patches along shallow coastal stretches during unusually severe winters. Summer temperatures range between slightly below 50° in the extreme north (Tromsö 51·8° F July average), and 60·6° at Oslo in July. Röros, with much greater altitude, has 52·2° average in the same month. The south-east of Norway is the warmest part in summer. At Bergen and Sku-

denes the warmest month is August (57·9° average for each). Absolute maxima are high, and the following have been recorded: Skudenes, 84°; Bergen 86°; Oslo 93°; and even Karasjok, in Lapland, has recorded 88°. The annual range increases from west to east generally and from south to north along the coast.

Though the south-west wind is usually prevalent over Norway and very marked in summer yet the winter high pressure area causes outflowing winds. These may be roughly classified thus:—

| In Winter | (Skagerak) N.E. | West Coast S. and S.E. | North Coast S.W. |
|---|---|---|---|

Gales are frequent on the west coast, averaging three to four per month in winter and about one to two per month in summer. In the interior and east gales are comparatively rare. Gales from the south-west bringing rain are the most common; next in frequency are gales from the north-west bringing snow. Calm weather is rare on the west coast but frequent in the interior. December and January are the stormiest months. Hailstones and thunderstorms are not of frequent occurrence in any part of Norway.

The number of days on which rain or snow falls is greatest on the north-west and north coasts, least in the south-east districts and the interior of Finmark. In the former area, precipitation occurs on about 200 days in the year. On Dovre fjeld and the south-east coast the average is about 100 days. Snowfall occurs least frequently in the south (*e.g.*, at Mandal, 25 snowy days out of 116 on which precipitation occurs), increasing to 50 at Oslo, and Dovre fjeld, to 90 at Vardö, and to 100 at the North cape. Hence in the north and in the upland tracts, snow occurs at least as frequently as rain. Snow may fall in any month on the coast as far south as the Lofotens. The amount of precipitation exceeds 100 in. per annum in the mountains a few miles from the coast north and south of Sognefjord. On the outer islands there is a slight decrease; inland the decrease is rapid and great. In the extreme south of the country the average is about 39 in. There is a diminution eastward along the north coast and a further rapid decrease towards the northern interior, where the average is 16 in., but strongly marked local variations are observed.

The amount of cloudiness is great. The coast of Finmark has over three cloudy days to one clear day; in the interior of the country clear and cloudy days are about equally divided. Summer fog is frequent on all coasts but fog is rare in winter, though occasionally experienced in the south-east. Sometimes, in severe winters, a frosty fog ("smoke-frost") appears on the west coast fjords, and is caused by the piercingly cold land wind passing over the relatively warm water.

BY COURTESY OF NORWEGIAN GOVT. RAILWAYS
WOMEN DRESSED IN THE NATIVE COSTUME OF GUDBRANDSDAL AND SETESDAL

**The "Midnight Sun."**—Part, at least, of the sun's disc is above the horizon at the North cape continuously from May 12 to July 29, and at Bodö, in lat. 67° 17′ N., from July 3 to July 7. Even at Trondhjem there is practically no night from May 23 to July 20, while the long twilight gives the extreme south of Norway no real darkness from the end of April to the middle of August. In winter, on the other hand, the sun does not rise above the horizon at the North cape for over two months and there is only a twilight at midday. In the extreme south mid-winter night is 17½ hours long.

**Population.**—The actual population of Norway according to the census of 1930 was 2,814,194. The table shows the area and population of each of the 18 *fylker* (counties) and of the two largest towns, according to the decennial census taken in 1930. The estimated population of 1938 was 2,921,000.

| Counties | Population 1930 | Area in sq. mi. |
|---|---|---|
| Southern— | | |
| Östfold | 167,030 | 1,504 |
| Akershus | 236,939 | 1,933 |
| Oslo (city) | 253,124 | 6 |
| Buskerud | 143,073 | 5,400 |
| Vestfold | 134,107 | 872 |
| Telemark | 127,754 | 5,430 |
| Aust-Agder | 73,816 | 3,380 |
| Vest-Agder | 81,233 | 2,642 |
| South-eastern (inland)— | | |
| Hedmark | 157,942 | 10,141 |
| Opland | 137,710 | 9,152 |
| Western— | | |
| Rogaland | 173,258 | 3,366 |
| Hordaland | 164,376 | 5,821 |
| Bergen (city) | 98,303 | 14 |
| Sogn og Fjordane | 91,808 | 6,880 |
| More | 165,064 | 5,657 |
| Sör Tröndelag | 174,946 | 6,929 |
| Northern— | | |
| Nord Tröndelag | 96,016 | 8,117 |
| Nordland | 186,920 | 13,953 |
| Troms | 97,467 | 9,781 |
| Finmark | 53,308 | 18,106 |
| Total | 2,814,194 | 119,085 |

This gives an average population per square mile of but 23.6, hence, Norway, on average, is the most thinly populated political unit in Europe. The most sparsely populated English county, Westmorland, had 83⅓ persons per square mile in 1921. This was exceeded only in the *fylker* of Vestfold, Akershus and Östfold with 153.8, 122.6 and 111.1 respectively. The next in order was Rogaland with 51.5. The first three are the smallest Norwegian counties and are in the immediate neighbourhood of Oslo. Rogaland is in the extreme southwest of the country. A vast area practically uninhabited, save in the north by nomadic Lapps, reaches from the extreme north as far south as the middle of Hedmark, apart from small local patches of denser population such as those in the outer Lofoten islands and across the Trondhjem depression. The most northerly *fylke*, Finmark, is the least thickly populated (2.9 per square mile); in many highland regions habitations are hardly less scanty than in the lowland regions of the extreme north. The vast majority of the population dwell by the coast and fjords. In 1930, 2,013,680 were living in rural districts and 800,514 in towns. Of the chief towns of Norway, Oslo, the capital, had a population in 1930 of 253,124, Bergen of 98,303, Trondhjem of 54,458, Stavanger of 46,780, Drammen of 25,493. The towns with populations between 20,000 and 15,000 were the ports of Aalesund, Kristiansand, Haugesund and Skien.

The population of Norway in 1801 was less than one million; the increase was very marked from 1815 to 1835, after which rates of increase gradually diminished. The second half of the century, down to 1890, was the period of heaviest emigration, chiefly to the United States of America. Emigration slackened in the last decade of the 19th century, during which period the movement from rural districts to towns, which had decreased from about the middle of the century, revived. The number of Norwegians abroad is probably about 400,000. In 1926, 9,326 emigrated (6,497 to U.S.A. and 2,570 to Canada). The Lapps, 19,108 in 1930, called Finns by the Norwegians, were confined especially to Finmark, and are estimated at about 1% of the population. There were also 7,804 Finns, whom the Norwegians call Kvoener. Of Lapp-Finns there were 3,192. The excess of births over deaths, about 1·8 to 1 in 1926, is much above the European average; the death-rate is unusually low. The number of marriages is rather low, the average marriage age being high. The percentage of illegitimacy, about 6·7% of total births in 1926, has shown a recent decrease, but is still above that for many European countries. The preponderance of females over males (1,442,275 to 1,371,919 in 1930) is partly accounted for by the number of males who emigrate, whilst the higher mortality of males is traced in part to the dangers of a seafaring life.

**Government.**—Norway is a constitutional and hereditary monarchy. The Constitution rests on the fundamental law (*Grundlov*) promulgated by the National Assembly at Eidsvold on May 17, 1814, and altered in detail at various times, particularly after the dissolution of the union with Sweden on June 7, 1905. The executive is vested in the king, who comes of age at 18. His authority is exercised through a council of State consisting of a prime minister (*statsminister*) and at least seven other councillors (*statsraader*), who are the heads of finance, church and education, justice, defence, public works, commerce and industry, agriculture and social affairs. The prime minister is normally in charge of foreign affairs. The king has the command of land and sea forces and makes all appointments, but contrary to the custom in most other countries the king has no power to dissolve the parliament (*storting*). The 150 members of this legislative body are elected directly by the people, divided into electoral divisions in such a manner that the towns are represented by one-third of the total members. Elections are direct, proportional, and take place every three years. The franchise is extended to all Norwegian citizens, male and female, who have completed their twenty-third year and have resided five years in the country. There are certain mild legal conditions of citizenship. A parliamentary member (*stortingsmand*) must possess the franchise in his constituency; must have resided ten years in the country; and must not be less than 30 years of age. Women, since 1915, have been entitled to membership of the King's Council, but up to 1928 none have been so appointed. The *storting* meets at Oslo on the first weekday after Jan. 10 each year and remains assembled as long as may be found necessary. After the opening the assembly divides itself into two sections, the upper (*lagting*) consisting of 38 members and the lower (*odelsting*) of the remainder. The inspection of public accounts and revision of the Government belong exclusively to the *odelsting*, which also first receives each new bill; if passed there it is sent to the *lagting*, and if carried there it is sent forward for the royal assent. If the *odelsting* and *lagting* do not agree, a joint session is held and the fate of a measure is decided by a two-thirds majority of the combined sections. The king has a veto, but if a vetoed measure is passed unaltered by three successive parliaments it becomes law *ipso facto*. Members of parliament are now paid 6,000 k. per annum and their travelling expenses. Parliament has both legislative and administrative authority, it also fixes taxation, and has control of the members of the Council of State, who though they may take part in discussions may not vote in the *storting*.

**Justice.**—An outstanding characteristic of Norwegian legal procedure is that civil cases are usually brought first before the town or district commission of mediation (*forliksraad*) from which an appeal lies to the local inferior courts, which are also tribunals of first instance, and are worked by judges on circuit and by assessors. There are three superior courts of appeal (*overrettene*) at Oslo, Bergen and Trondhjem, and one supreme court (*höiesteret*). Criminal cases are tried either in jury courts (*lagmandsret*) with three judges and 10 jurors or courts of assize (*meddomsret*) with one judge and two assistant judges. The first is for more serious offences; the second deals with minor offences and is a court of first instance. Military crimes are dealt with by a military judicial organization. Finally, there is a High Court of the Realm (*rigsret*) composed of the *lagting* and the ordinary members of the *höiesteret*, before which members of parliament, the Government, etc., are tried for misdemeanours committed in their public capacity.

**Local Government.**—The country is divided into 20 districts, viz., 18 counties (*fylker*) (see *population*) and the cities of Oslo and Bergen. Other towns are formed into 65 communes, governed by representatives, from whom a council of one quarter of the total representatives is elected by themselves; 672 rural communes (*herreder*) are similarly administered, and their chairmen form a county council (*fylkesting*) for each county. At the head is the *fylkesmann*, the county governor. The electoral system for local councils is the same as the parliamentary system, and has been extended to women under similar conditions.

**Religion and Customs.**—The endowed State religion, to which the king must conform, is Evangelical Lutheran. In 1920 there were but 71,062 dissenters, though all Christian sects except Jesuits are tolerated. The king nominates the clergy of the Established Church.

Norway is divided into seven bishoprics (*Bispedömmer*), Oslo, Hamar, Khristiansand, Bergen, Trondhjem, Tromsö, and Stavanger; and these into 91 archdeaconries (*prostier*) with subdivisions into 514 clerical districts (*prestegjeld*), parishes, and sub-parishes. The clergy take a leading part in primary education, which, in spite of the difficulties arising in a sparsely populated country, reaches a high standard.

Down to the middle of the 19th century drunkenness was a strongly-marked characteristic of Norwegians. A strict licensing system was then introduced with success. Local boards were given a wide control over the issue of licences, and in 1871 incorporated societies (*samlag*) on the Swedish model were introduced to monopolize and control the retail trade in spirits. Their work practically ceased when the existing prohibition came into force. A plebiscite in 1919 gave 487,999 votes for and 304,297 against prohibition. On account of existing and potential trade treaties with France, Spain and Portugal it was decided that the plebiscite should have an advisory force. At present all production and trade in spirits as beverages is prohibited, and the wine monopoly severely controls the sale of wine and beer even in those districts where the local municipal authorities have issued a licence, without which sale is impossible.

In Norway there is a strongly individual national character, as is shown in the case of modern music and painting, combined with conservatism of ancient rites and practices. Such peculiar customs as those associated with weddings, lighting of the midsummer fires and the attendant celebrations still survive. In coastwise trade and fishing, high-prowed square-sailed boats, the direct descendants of the Viking vessels, are still frequently employed. Examples of the ancient farmstead, composed of a group of single-chambered wooden buildings, are preserved, and mediaeval ornamental woodwork remains important. Wood is the principal building material except in some larger towns. In the rural areas fires have left few really old domestic buildings, but the preservation of ancient wooden houses elsewhere makes several of the Norwegian towns peculiarly picturesque. Norway retains a few of the peculiar richly carved small wooden churches (*stavekirke*) dating from the 11th to the 14th century. They have high-pitched wooden shingle roofs rising in tiers so as to give the building something of the form of a pyramid. The roofs overhang so deeply (to offer weather-protection to the wooden walls) that the lowest often shelters a species of external colonnade. The most famous of these churches is that of Borgund —19 m. from Laerdalsören; another fine example is at Hitterdal on the Kongsberg Telemark road. There are also a few Romanesque and Gothic stone churches. In some of these the influence of English architecture is clear, as in the magnificent metropolitan cathedral of Trondhjem, and the nave of Stavanger cathedral. A good example of the smaller stone church is at Vossevangen, on the Oslo-Bergen railway, and there are several of Late Romanesque character in the Trondhjem district. Remains of pure Early English work are occasionally found, but the later Gothic styles were not developed to any extent in Norway.

BIBLIOGRAPHY.—A valuable publication, including an extensive bibliography, but now somewhat out of date on the economic side, is *Norway* (official publication for the Paris Exhibition), Eng. trans., Christiania (1900). Other authoritative reference works include A. N. Kiaer and others, *Norges Land og Folk* (Christiania, 1885–1916): 20 district volumes have appeared, but the work has been suspended in an incomplete condition. *Statistisk Aarbok for Kongeriket Norge* (Oslo, annual). In addition to this annual summary, the Government issues publications frequently on the work of various State Departments. Reports on Norway are also issued in Foreign Office Reports (annual, London), and the Geographical Section of the Intelligence Dept., Admiralty, also issued a *Handbook of Norway and Sweden* (H.M.S.O., 1920).

A general book of considerable value is Hans Reusch, *Norges Geografi* (Christiania, 1915–17). Other books are Y. Nielsen, *Reisehaanbok over Norge* (10th ed., Christiania, 1903), various guidebooks in English, *e.g.*, Nielsen (Christiania, 1908); Baedeker (1912), Mur-

ray (1904), Ward Lock and Co. (1927); S. C. Hammer, *The Norway Year Book* (No. 1, 1924, Christiania); and *Things Seen in Norway* (London, 1926); H. L. Braekstad, *The Constitution of the Kingdom of Norway* (London, 1905); F. Nansen, *Norway and the Union with Sweden,* and supplementary chapter, separate (London, 1905). K. Gjerset, *History of the Norwegian People,* 2 vols. (London and New York, 1915); G. G. Hardy, *Norway* (London, 1925); O. B. Grimley, *The New Norway* (1937); B. A. Arneson, *The Democratic Monarchies of Scandinavia* (1939); Per Vogt, *The Norway Year Book* (1938); *The Northern Countries in World Economy* (1937; 1939). Travel and sectional books include: S. J. Beckett, *Norway and its Treasures* (London, 1914); and *The Fjords and Folk of Norway* (London, 1915); W. C. Slingsby, *Norway, the Northern Playground* (on mountaineering) (Edinburgh, 1904); *Jahrbuch des Norwegischen Meteorologischen Instituts* (Christiania); H. Mohn, "Klima Tabeller for Norge," in *Videnskabsselsk. Skrifter* (1895 *seq.*); Karel Capek, *Travels in the North* (1939).

*See* also *Board of Trade Rep. on Production and Consumption of Alcoholic Liquors* (London, 1899). Finally, the current volume of the *Statesman's Year Book* (London, annual), normally contains an extensive bibliography. (O. J. R. H.; W. E. WH.; X.)

**Defence.**—The early military history of Norway was one of storm and stress, marked by wars with Scandinavian neighbours and invasion of England up to the 11th century, of union with Denmark and Sweden (1389), separation (1523) and union with Sweden (1814) which endured until October 1905. Stable military conditions were established by a Treaty of Nov. 2, 1917, in agreement with Great Britain, France, Germany, Russia and Norway. From that date the Norwegian independent army can be said to derive. Neutrality was maintained in the War of 1914–18, and painstakingly attempted from Sept. 1939 to April 1940.

The Department of Defence serves as a co-ordinating body for army, navy and air force. The Minister of Defence is president of a Defence Council which includes the Minister for Foreign Affairs, his Secretary-General, the Commander-in-Chief of the Army, the Admiral of the Navy, and the President of the Council for Economic and Industrial Mobilization. An Aviation Council is affiliated with the Department of Defence and includes representatives of the military, naval and civil aviation. The king is titular Commander-in-Chief of Army and Navy.

The permanent personnel of the army included (in 1935) 1,135 officers, plus 765 N.C.O.'s and men. Most of the soldiery is made up of the recruits called up each year, serving 84 days each. Approximately 30,000 become liable to service annually, of whom two-thirds are called for training. The compulsory service begins at age 20, and holds each man for 12 years' liability in the regular army and 12 years in the territorial army (Landvaern). Men aged 18–20 and 44–55 are enrolled in the Landstorm. Conscientious objectors are permitted to substitute civil work for military duty, working 1½ to 2 times the military period.

The Navy had (in 1938) 2,032 effectives, manning 4 small battleships of about 4,000 tons each, 6 destroyers, 2 minelayers, 9 submarines, 24 torpedo boats and a few small and obsolete craft. Total tonnage was listed as 31,013. The air force had not yet attained its quota of 64 planes. Fifty rifle clubs partially supported by the State gave training to about 40,000 men.

Expenditures on defence rose from 36,600,000 kroner in 1933–34 to 48,800,000 in 1938–39. In March 1938 a special loan of 52,000,000 kroner was set aside for strengthening neutrality defence.

BIBLIOGRAPHY.—Lord Brassy, *Naval and Shipping Annual;* F. T. Jane, *Jane's Fighting Ships* (annual); League of Nations, *Armaments Year Book.* (F. D. S.)

## ECONOMIC AND FINANCIAL CONDITIONS

**The Pre-War Position.**—For more than 30 years the economic life of Norway had developed on an increasingly industrial scale when the dissolution of the Union between Norway and Sweden, in 1905, gave it a fresh impetus. Very soon an extraordinary expansion set in, which continued practically undiminished up to the outbreak of the World War. The use of the waterfalls became an urgent question in politics.

Agriculture was, as it had been for centuries, the principal resource of the country by which, roundly, 890,000 persons gained their livelihood out of a population of two and one-third millions. The total number of farmers was 188,000, of which hardly one-tenth were tenants and leaseholders; the remainder freeholders. The chief cereals were oats, barley, rye and wheat, and the principal root crop potatoes. Cattle breeding was also developing on a satisfactory scale, and as an article of export of growing importance, condensed milk appeared in the statistics.

Next to agriculture, forestry is the most important trade of Norway, owing to the mighty industry which has grown up in connection with it. In 1913 about 85% of the forests were owned by private persons or companies, and 12½% by the State, while the remaining 2½% was owned jointly. From the latter half of the 16th to the latter half of the 19th century, sawn and planed timber constituted the chief articles of export derived from the forest industry, but within the last 40 years prior to the war, the development of the mechanical and chemical wood-pulp industries as well as of the paper industry, had increased to an extent which made the timber industry lag far behind.

The mining industry, which in Norway dates from the beginning of the 17th century, experienced a renaissance, especially between 1897 and the outbreak of the war, owing to the increasing number of mines, mostly of iron ore, opened up in north Norway. From an annual output at the turn of the century valued at £260,000–270,000 the output expanded to a value of approximately £1,388,000 in 1913.

A fishing fleet of steam vessels, larger sailing vessels supplied with auxiliary engines, and decked motor boats had to a great extent replaced the former old-fashioned fleet, while modern implements and methods had given the fisheries quite a new turn all round. As another important economic conquest within these years, allied to the fisheries, should be mentioned the whaling in the Antarctic, which, initiated in 1906, very soon proved a remarkable success. In 1913 the fisheries and the whaling yielded a profit of approximately £6,861,000 and £2,080,000, respectively. In connection with the fisheries should be mentioned the foundation of the canning industry which within the 30 years prior to the war became one of the most flourishing industries of Norway.

In 1900, the net register of steam and motor vessels was 498,447 tons. In 1914, it amounted to 1,223,009. Simultaneously, the net tonnage of sailing vessels decreased from 930,442 to 561,462; in fact only Great Britain, the United States and Germany had at the time larger mercantile fleets than Norway. About one-tenth of the fleet was engaged in regular trade along the coast of Norway, while another one-tenth was engaged in transport to and from foreign countries; the remainder sought employment in trade between foreign countries, which, in practice, means that the great bulk of Norwegian tonnage in pre-war days, as at present, was engaged in ordinary tramp trade all over the world.

Increased use of water-power has developed manufactures, for instance, the saltpetre industry, based on the principle of manufacturing nitrogen from the atmosphere, which was worked out in practice between 1906 and 1914. Owing to this extraordinary development in practically all fields, the trade balance of Norway improved materially within the period, from about £32,740,000 in 1906 to £52,994,000 in 1913. (S. C. H.; X.)

The high rate of emigration from Norway in the 19th century was due primarily to the meagre economic opportunities at home. Norwegian statistics from 1905 to 1925 show this to be the chief reason for 170,000 out of 215,000 emigrants. Altogether over 800,000 migrated from 1820 to 1930, about 96% of them to the U.S. Norwegian economic and social progress may have been hampered somewhat by this significant loss of young male vigour, but the very danger was a challenge and spur to reform. The development of freeholding, for example, is partly the result of the large migration of the cotter or *husmand* class.

**Wartime Conditions.**—The War of 1914–18 suddenly upset the economic stability of Norway, and the nation had to make strenuous efforts to adapt herself to the new state of affairs. She insisted on continuing her commerce, though the submarine war cost her 1,237,000 gross registered tons of shipping and some 2,000 lives. Revenues from shipping rose to extraordinary heights; factories, farms and fisheries were kept working to produce at high prices; wages responded; and speculation was rife. But then arose serious difficulties about supplies of foodstuffs, and a grain monopoly had to be installed. The fishing fleet had trouble in obtaining supplies such as coal and nets, though Germany agreed to permit certain purchases from Britain, hoping to be able to buy some of the product. The sum total was, of course, abnormal disruption of conditions and the necessity of rebuilding her lost shipping—an achievement rather surprisingly accomplished in 10 years.

**Twenty Years of World Peace.**—During the years after the peace of 1919 Norway succeeded exceptionally well in consolidating her economic position, and continuing the transition to industrialization shown by the table of her exports below:

TABLE I.—*Norwegian Exports*

| | Per cent. | | | |
|---|---|---|---|---|
| | 1876–80 | 1901–05 | 1936 | 1937 |
| Total exports | 100·00 | 100·00 | 100·00 | 100·00 |
| Norwegian goods | 97·77 | 93·59 | 98·43 | 98·49 |
| Agriculture, cattle breeding, etc. | 4·72 | 9·91 | 7·20 | 7·46 |
| Forestry and timber trades | 34·50 | 21·04 | 2·42 | 2·56 |
| Wood-pulp and paper industries | 2·59 | 18·95 | 22·13 | 24·33 |
| Sealing and hunting | 1·14 | 1·09 | 1·10 | 0·76 |
| Fisheries | 41·73 | 29·34 | 21·46 | 19·31 |
| Minerals, crude | 2·74 | 2·83 | 7·07 | 6·53 |
| Minerals, semi- or wholly mfd.; also metals | 3·39 | 5·29 | 18·28 | 19·22 |
| Spinning and weaving | 2·96 | 0·66 | 0·70 | 0·76 |
| Other industrial products | 4·00 | 4·48 | 18·07 | 17·56 |
| Foreign goods | 2·23 | 6·41 | 1·57 | 1·51 |

This shows how pulp and paper industries, for example, have displaced the old timber trade; how agricultural and general industrial products have increased in ratio. The balancing of her economy helped Norway to weather the depression better than most countries. By 1936 Norwegian imports had risen to 36.8% of the 1929 level, and exports to 50.3%, the latter being the best figure for any country on record. Her imports of 1937 (884,326,000 kroner) were about 68% raw materials, ships and machinery; about 31% foodstuffs and other consumption goods—which, incidentally, is a complete reversal of the kinds of imports of about 1880. The total value of her exports in 1937 was 823,259,000 kroner, of which some 221,000,000 represented forest products. In 1938 exports declined to 786,500,000 kroner, and imports rose to 1,192,650,000. The post-war economic reaction had reached its most serious point in 1921, and from 1924 on the recovery was fairly steady, guided by vigorous state policy. Inflation brought considerable hardship, but by 1928 the krone was restored to gold parity. In 1931, of course, the country was forced to abandon the gold standard, but she succeeded fairly well in pegging the krone to the pound. (On Sept. 1, 1939, the rate was 18¼-19¼ kr.=£1.)

Norwegian registered shipping in 1939 stood at 4,835,000 gross tons, one of the largest merchant fleets in the world, and far the largest on a per capita basis. In June 1939 there were only 20,800 unemployed, and the industrial production index for the year stood at nearly 150, compared with 100 in 1928. A development of both economic and political importance has been the rapid expansion of the port of Narvik and the export therefrom to Britain and Germany of over 5,000,000 tons of Swedish iron ore annually.

BIBLIOGRAPHY.—*Norges Offisielle Statistikk* (annual; also monthly bulletin; *Norges handel, 1938*, etc.); *Statistisk aarbok for kongeriket Norge* (annual); Per Vogt, *The Norway Year Book* (1938); Norges Bank, *Monthly Report on the Economic Conditions in Norway;* W. Keilhau, *Sweden, Norway, Denmark and Iceland in the World War* (1930); O. B. Grimley, *The New Norway* (1937). (F. D. S.)

## HISTORY

Archaeological and geological researches have revealed a fishing and hunting population in Norway, possibly as far back as *c.* 6000 B.C. Until lately this aboriginal people, which was certainly non-Aryan, was held to be Lappish, but recent investigations seem to show that the Lapps only entered Norway about A.D. 900–1000, and that the original population was probably of Finnish race, though only distantly allied to the Ugro-Finns now inhabiting Finland. To them belong perhaps certain non-Aryan names for features of the country, such as Toten, Vefsen, Bukn.

### EARLY HISTORY

**Teutonic Immigration.**—The time of the immigration of a Teutonic element is uncertain. It did not extend N. beyond the Trondhjem district until about the beginning of our era, but the evidence of archaeology suggests that the Teutonic element entered S. Norway towards the end of the (Scandinavian) later Stone age, *c.* 1700 B.C. (*see* SCANDINAVIAN CIVILIZATION). The language of the older race was superseded by Teutonic, and those aborigines who were not incorporated (probably as slaves) were driven into the mountains or the islands that fringe the coast. In the highlands the "Finns" maintained some independence down to historical times. The old English poem *Beowulf* mentions a "Finnaland" which should perhaps be located in S. Norway in about the 6th century, and later on the ancient laws of this region forbid the practice of visiting the "Finns" to obtain knowledge of the future. But only in Finmark, which even in the 13th century stretched far into Sweden and included the Norwegian district of Tromsö, could the earlier inhabitants live their old life, and here they finally fell into the utmost want. Their existence is mentioned as a thing of the past by a North Trondhjem writer in 1689. The Teutonic element flowed into Norway from two centres; one western, probably from Jutland, the other eastern, from the W. coast of Sweden.

**Early Kingship.**—When history first sheds a faint light over Norway we find each small district or "fylke" (Old Norse *fylkir,* from *folk,* army) settled under its own king, and about twenty-nine *fylker* in the country. The king always possessed a *hird,* or company of warriors sworn to his service, and indeed royal birth and the possession of such a *hird,* and not land or subjects, were the essential attributes of a king. There was no law of primogeniture, and on the death of a king some of his heirs would take their share of the patrimony in valuables, gather a *hird,* and spend their lives in warlike expeditions (*see* VIKINGS), while one would settle down and become king of the fylke. There are indications that these conditions were fostered by a matriarchal system, and that it would often occur that a wandering king would marry the daughter of a fylkes-king and become his heir. Probably the king's power was only absolute over his own *hird.* He was certainly commander-in-chief and perhaps chief priest of the fylke, but the administrative power was chiefly in the hands of the *herser* and possibly of an earl. The position of earls is vague, but it is noticeable that both those of whom we hear in Harald Haarfager's time take the opposite side to their king.

The eight Trondhjem *fylker* had a common *Thing* or assembly very early, but these districts were remote, while the wealthy western districts were too much cut off from each other to unite effectively, though here also a common Thing was early established. The first successful attempt at unification originated round Vestfold, the modern Jarlsberg and Laurvik Amt on the Christiania fjord, where it is possible that national feeling was fostered by proximity to the Danish and Swedish kingdoms. Tradition made the royal family a branch of the great Yngling dynasty of Uppsala, which claimed descent from the god Frey. Through several generations this family had extended its kingdom by marriage, conquest and inheritance, and by the end of the reign of Halfdan the Black, it included the greater part of Hamar and Oslo Stift, and the fylke of Sogn, the district round the modern Sognefjord.

BY COURTESY OF CAMMERMEYERS FORLAG

NORWEGIAN HORSEMEN IN THE BRONZE AGE. FROM A ROCK CARVING IN BAAHUSLEN, FORMERLY SOUTHERN NORWAY

**Harald Haarfager.**—Halfdan's son, Harald Haarfager, having no brothers, succeeded to the whole kingdom. By 866 his power was so well established in S. Norway that he contemplated the conquest of the whole land. There can be no doubt that Harald introduced a feudal view of obligations towards the king, and landowning families, who had regarded their *odel,* or inherited property, as absolutely their own, resented being forced to

pay dues on it. In each district Harald offered the *herser* the opportunity of becoming his vassals, answerable to him for the government of the district but many quitted the lands which were their real title to influence, rather than suffer the new order. Only the little kingdoms made futile attempts at combination, except in the western districts of Agde (comprising the modern Lister and Mandal and Nedenaes), Rogaland and Hordaland. Here was the home of the "western Vikings" who for nearly a century had owed wealth and fame to their raids on the British Isles. Attack by land was impossible, and Harald had to gather men and ships for three years before he could meet the fleet of the allied kings at Hafsfjord. The battle (872) resulted in a victory to him, and with it all opposition in Norway ended. An expedition to Scotland and the Scottish isles (*c.* 891) dispersed enemies who could harry the Norwegian coast, many of them taking refuge in Iceland; and the earldom of the Orkneys and Shetlands became an appanage of the Norwegian Crown. For the moment the whole country was under a single king, but Harald destroyed his work by giving about twenty of his sons the title of king, and dividing the country among them, only qualifying this retrograde step by installing his favourite son Erik Blodöxe as over-king (930). Moreover, Harald had established no common Thing for the whole of his kingdom, and the three natural divisions of the country remained more or less separate for centuries, even having separate laws until the second half of the 13th century.

**The Successors of Harald.**—Erik Blodöxe (Bloody-axe) only managed to rid himself of two rival over-kings, Olaf and Sigfred, his half-brothers, for on hearing of his father's death (933), another son, Haakon (*q.v.*), called the Good, who had been brought up at Aethelstan's court, came to Norway and succeeded in ejecting Erik (934). After Haakon's death in 961 at the battle of Fitje, where his long struggle against Erik's sons and their Danish allies terminated, these brothers, headed by Harald Graafeld (grey-cloak) became masters of the W. districts, though the ruling spirit appears to have been their mother Gunhild. Earl Sigurd of Lade ruled the N., and the S. was held by vassal kings whom Haakon had left undisturbed. By 969 the brothers had succeeded in ridding themselves of Sigurd and two other rivals, but the following year Harald Graafeld was lured to Denmark and treacherously killed at the instigation of Earl Haakon, son of Sigurd, who had allied himself with the Danish king Harald Gormssön. With the latter's support Earl Haakon won Norway, but threw off his yoke on defeating Ragnfred Erikssön at Tingenes in 972. The S.E. districts were, however, still held by Harald Grenske, whose father had been slain by the sons of Erik. Haakon ruled ably though tyrannically, and his prestige was greatly increased by his victory over the Jomsvikings, a band of pirates inhabiting the island of Wollin at the mouth of the Oder, who had collected a large fleet to attack Norway. The landed proprietors revolted and, in 995, there landed in Norway Olaf, great-grandson of Harald Haarfager and son of the king Tryggve of the Vik whom Gudröd Eriksson had slain, and whose father Olaf had been slain by Erik Blodöxe.

The earl was treacherously killed by his thrall while in hiding, and Olaf entered unopposed upon his short and brilliant reign. His great work was the enforced conversion to Christianity of Norway, Iceland and Greenland. Both Olaf and his successor and namesake looked for help to England, whence they obtained a bishop and priests; hence it comes that the organization of the early church in Norway resembles that of England. The hierarchical party in Norway only rose to power after the establishment of an archiepiscopal see at Trondhjem in 1152.

**Relations with Denmark.**—In the year 1000 Olaf fell at the battle of Svolder off Rügen, fighting against the combined Danish and Swedish fleets. The allies shared Norway between them, but the real power lay in the hands of Erik and Svein, sons of Earl Haakon, In 1015, when Erik was absent in England, another descendant of Harald Haarfager appeared, Olaf, the son of Harald Grenske, a great-grandson of Harald Haarfager (*see* OLAF II. HARALDSSÖN). He defeated Svein at Nesje in 1016, which left him free to work towards a united and Christian Norway, but he strained the loyalty of his subjects too far, and on the appearance of Knut the Great in 1029 he fled to Russia. His death at the battle of Stiklestad on his return in 1030 was followed by a few years of Danish rule under Svein Knutssön, which rendered Olaf's memory sweet by contrast, and soon the name of St. Olaf came to stand for internal union and freedom from external oppression. In 1035 his young son Magnus, afterwards called the Good, was summoned from Russia, and was readily accepted as king. A treaty was made with Hardeknut which provided that whichever king survived should inherit the other's crown. Hardeknut died in 1042, and Magnus became king of Denmark, but a nephew of Knut the Great, Svein Estridssön, entered into league with Harald Haardraade (*see* HARALD III.), the half-brother of St. Olaf, who had just returned from the East. As soon, however, as overtures were made to him by Magnus, he forsook the cause of Svein, and in 1046 agreed to become joint king of Norway with Magnus. The difficulties arising out of this situation were solved by Magnus's death in 1047.

**The End of Harald Haarfager's Line.**—Harald's attempts to win Denmark were vain, and in 1066 he set about a yet more formidable task in attacking England, which ended with his death at Stamford Bridge in 1066. His son Olaf Kyrre (the Quiet) shared the kingdom with his brother Magnus until the latter's death in 1069, after which the country enjoyed a period of peace. In 1093 Olaf was succeeded by his turbulent son Magnus Barfod (barefoot) and by Haakon, son of Magnus the Good. The latter died in 1095. Besides engaging in an unsuccessful war against the Swedish king Inge, in which he was defeated at Foxerne in 1101, Magnus undertook three warlike expeditions to the Scottish isles. It was on the last of these expeditions, in 1103, that he met his death. He was succeeded by his three sons, Eystein, Sigurd and Olaf. Olaf died young. Sigurd undertook a pilgrimage, from which he gained the name of Jorsalfar (traveller to Jerusalem). He won much booty from the Moors in Spain, from pirates in the Mediterranean, and finally at Sidon, which he and his ally Baldwin I. of Jerusalem sacked. Eystein died in 1122. Sigurd lived till 1130, and was the last undoubted representative of Harald Haarfager's race, for on his death his son Magnus was ousted by Harald Gille, or Gilchrist, who professed to be a natural son of Magnus Barfod.

**Disputed Successions.**—Harald Gille was slain in 1136 by another pretender, and anarchy ruled during the reign of his sons Eystein, Inge and Sigurd Mund. At last Inge's party attacked and killed first Sigurd (1155) and then Eystein (1157). Inge fell in a fight against Sigurd's son Haakon Herdebred in 1161, but a powerful baron, Erling, succeeded in getting his son Magnus made king, on the plea that the boy's maternal grandfather was King Sigurd Jorsalfar. In 1164 the archbishop of Trondhjem crowned Magnus, demanding that the crown should be held as a fief of the Norwegian Church. Owing to such concessions the Church was gaining a paramount position, when a new pretender appeared. Sverre (O.N. Sverrir) claimed to be the son of Sigurd Mund, and was adopted as leader by a party known as the Birkebeiner or Birchlegs. In spite of help from Denmark, the support of the Church and of the majority of barons, Magnus was defeated time after time, till he met his death at the battle of Nordnes in 1184. The aristocracy could offer little further opposition. In joining hands with the Church against Sverre, the local chiefs had got out of touch with the small landowners, with whose support Sverre was able to build up a powerful monarchy.

**Magnus.**—Sverre died in 1202. His son, Haakon III. died two years later, perhaps of poison, but the Birkebeiner party in 1217 succeeded in placing Haakon's son and namesake on the throne (*see* HAAKON IV.). In 1240 the last of the rival claimants fell, and the country began to regain prosperity. The acquisition of Iceland was at length realized. Haakon's death occurred after the battle of Largs in 1263. The war with Scotland was soon terminated by his son Magnus, who surrendered the Hebrides and the Isle of Man at the treaty of Perth in 1268. He gained his title of Law-Mender from the revision of the laws, which until 1274 had remained very much as in heathen days. The new code repealed all the old wergild laws, and provided that the major

part of the fine for manslaughter should be paid to the victim's heir, the remainder to the king. Henceforward the council comes more and more to be composed of the king's court officials, instead of a gathering of the *lendermaend* or barons of the district in which the king happened to be. During Magnus's reign we hear of a larger council, occasionally called *palliment* (parliament), which is summoned at the king's wish. The old landed aristocracy had lost its power so completely that even after Magnus's death in 1280 it did not recover during the minority of his son Erik.

**Paralysis of the Aristocracy.**—Erik was succeeded in 1299 by his brother Haakon V., who in 1308 felt himself strong enough to abolish the dignity of the *lendermaend*. This paralysis of the aristocracy is no doubt partly to be ascribed to the civil wars, but in part also to the gradual impoverishment of the country, which told especially upon this class. Russia had long eclipsed Norway as the centre of the fur trade, and other industries must have suffered, not only from the civil wars, but also from the supremacy of the Hanseatic towns, which dominated the North, and could dictate their own terms. In earlier times the aristocratic families had owed their wealth to three main sources: commerce, Viking expeditions and slave labour. Trade had been a favourite means of enrichment among the aristocracy up to the middle of the 13th century, but now it was almost monopolized by Germans, and Viking enterprise was a thing of the past. The third source of wealth had also failed, for it is clear from the laws of Magnus that the class of thralls had practically disappeared. This must have greatly contributed to shatter the power of the class which had once been predominant.

**Union of Norwegian, Swedish and Danish Thrones.**—Haakon's daughter Ingeborg had married Duke Erik of Sweden, and on Haakon's death in 1319 their three-year-old son Magnus succeeded to the Norwegian and Swedish thrones, the two countries entering into a union which was not definitely broken till 1371. In 1343 Magnus handed over the greater part of Norway to his son Haakon VI., who married Margrete, daughter of King Valdemar III. of Denmark. Their young son Olaf V., already king of Denmark, succeeded to his father's throne on Haakon's death in 1380, but died in 1387, leaving the royal line extinct, and the nearest successor to the throne the hostile King Albrecht of Sweden, of the Mecklenburg family. The difficulty was met by filling the throne by election—an innovation in Norway, though it was the custom in Sweden and Denmark. The choice fell on King Haakon's widow Margrete, but a couple of years later, chiefly in order to gain German support in a coming struggle with the Mecklenburgers, the Norwegians elected as king the young Erik of Pomerania, great-nephew of the queen, who henceforth acted as regent. Erik had claims on the Swedish and Danish thrones, and in 1397, at Kalmar, he was solemnly crowned king over the three countries, which entered into a union "never to be dissolved."

*Reigns of the Kings of Norway*

| | | |
|---|---|---|
| Harald (I.) Haarfager | 872–930 | (d. 933) |
| Erik Blodöxe | 930–934 | |
| Haakon (I.) den Gode | 935–961 | |
| Harald (II.) Graafeld | 961–970 | |
| (Earl Haakon of Lade 970–995) | | |
| Olaf (I.) Tryggvessön | 995–1000 | |
| (Earls Erik and Haakon 1000–1016) | | |
| Saint Olaf (II.) | 1016–1029 | (k. 1030) |
| Svein, son of Knut the Great | 1030–1035 | |
| Magnus (I.) den Gode | 1035–1047 | |
| Harald (III.) Haardraade | 1047–1066 | |
| Olaf (III.) Kyrre | 1066–1093 | |
| Magnus (II.) | 1066–1069 | |
| Magnus (III.) Barfod | 1093–1103 | |
| Eystein (I.) | 1103–1122 | |
| Sigurd (I.) Jorsalfar | 1103–1130 | |
| Olaf (IV.) | 1103–1116 | |
| Magnus (IV.) | 1130–1135 | |
| Harald Gille | 1130–1136 | |
| Sigurd (II.) Mund | 1136–1155 | |
| Eystein (II.) | 1136–1157 | |
| Inge | 1136–1161 | |
| Haakon (II.) Herdebred | 1161–1162 | |
| Magnus (V.) | 1162–1184 | |
| Sverre | 1184–1202 | |
| Haakon (III.) | 1202–1204 | |
| Haakon (IV.) den gamle | 1217–1263 | |
| Magnus (VI.) | 1263–1280 | |
| Erik | 1280–1299 | |
| Haakon (V.) | 1299–1319 | |
| Magnus (VII.) | 1319–1343 | |
| Haakon (VI.) | 1343–1380 | |
| Olaf (V.) | 1381–1387 | |
| Margrete | 1387–1389 | |
| Erik of Pomerania | 1389– | |

BIBLIOGRAPHY.—P. A. Munch, *Det norske Folks Historie indtil 1397* (1852–63); R. Keyser, *Norges Stats-og Retsforfatning* (1867); J. E. Sars, *Udsigt over den norske Historie,* Deel i. ii. (1873–77); A. C. Bang, *Staat und Kirche in Norwegen bis zum Schlusse des 13ten Jahrhunderts* (Munich, 1875); A. Taranger, *Den Angelsaksiske kirkes Indflydelse paa den norske* (1891); A. Bugge, *Studier over de norske Byers selvstyre og handel för Hanseaternes tid* (1899); F. Bruns, *Die Lübecker Bergenfahrer und ihre Chronistik* (Berlin, 1900); A. M. Hansen, *Landnàm i Norge* (1904); articles by G. Storm, Y. Nielsen, E. Hertzberg and others in the *Historisk Tidskrift* (Christiania) and other periodicals; also the articles by K. v. Armira, O. Bremer, K. Kaalund and V. Gudmundsson in *Pauls Grundriss der germanischen Philologie* (vol. iii., Strassburg, 1900). The above works are published in Christiania except where otherwise stated. In English, there is a history of Norway by H. H. Boyesen in the *Story of the Nations* series (1900), and K. Gjerset's *Hist. of the Norwegian People,* 2 vols. (1915) and also historical notes in G. Vigfusson and F. Y. Powell's *Corpus poëticum Boreale* (Oxford, 1883). The most important original sources are: Snorre Sturlasson's *Heimskringla,* or Lives of the Kings of Norway up to 1177, of which there are Eng. trans. by W. Morris and E. Magnússon, with a valuable index volume in the *Saga Library,* vols. iii.-vi., (1893–1905) and in the *Everyman Library* (1915). The original Icelandic text is edited by F. Jónsson (Copenhagen, 1893–1901). For a critical investigation into the sources of Snorri and the contemporary historians, *see* G. Storm, *Snorre Sturlasson's Historieskrivning* (Copenhagen, 1873, with map of ancient Norway), and F. Jónsson, *Den oldnorske og oldislandske Litteraturs Historie* (Bd. ii. Del. ii., Copenhagen, 1901). Of later sagas, Sverre's Saga (*Fornmanna Sögur,* vol. viii., Copenhagen) is translated by J. Sephton, *Northern Library* (vol. iv., 1899), and *Haakon's Saga* is given with a translation by G. W. Dasent in vols. ii. (text) and iv. (translation) of the *Chronicles and Memorials of Great Britain and Ireland* (London, 1894). Other important sources are: *Diplomatarium Norvegicum,* ed. C. Unger, Christiania, and *Norges Gamle Love indtil 1397,* ed. R. Keyser and P. A. Munch (5 vols., Christiania, 1846–95). (B. S. P.)

### 1397–1814

The history of Norway from 1397 down to the union with Sweden in 1814 falls naturally into four divisions. First, in 1450, the triple bond gave place to a union in which Norway became more firmly joined to Denmark. Next, in 1536, as the result of the Reformation, Norway sank almost to the level of a province. After 1660 she gained something in status from the establishment of autocracy in Denmark, and in 1814 she became a constitutional kingdom on a footing of approximate equality with Sweden. But for the convulsions to which some of these changes gave rise, Norway possesses during this period but little history of her own, and she sank from her former position as a considerable and independent nation. The kings dwelt outside her borders, her fleet and army decayed, and her language gradually gave place to Danish. Germans plundered her coasts and monopolized her commerce, and after 1450 Danes began to appropriate the higher posts in her administration. When in 1448 Karl Knutsson was chosen king by the Swedes, and Christian of Oldenburg by the Danes, it was by force that Norway fell to the latter. The Norwegians protested, but the next year the Swedes assented to a separation. Christian I. (1450–81) gave estates and offices in Norway to his Danish subjects and raised money by pawning her ancient possessions, the Orkneys and Shetland islands, to the king of Scotland. His son Hans (1482–1513) purchased the obedience of the Norwegian nobles by concessions to their power. The imposing union continued in name, but the weakness of the nation and its government was strikingly illustrated when the Germans in Bergen besieged a monastery in which a high official had taken refuge.

After the downfall of Christian II. (1513–24) the position of Norway was changed for the worse. She was ruled for a century and a quarter by Danish officials; her churches and monasteries were sacked by Danes, and Danes were installed as pastors under the Lutheran system, which the Norwegians were compelled to accept in 1539. Soon Norway was dragged by Denmark into the

so-called Seven Years' War of the North (1563–70). However, the power of the Hanse League in Bergen was broken. The rule of the Oldenburg dynasty proved neglectful rather than tyrannical, and under it the mass of the peasants was not flagrantly oppressed. Christian IV. (1588–1648), who founded Christiania (Oslo), may almost be said to have discovered Norway anew. He reformed its government and strove to develop its resources, but his policy involved the loss of Jemtland and Herjedalen, which were ceded to the Swedes by the peace of Brömsebro (1645). The Danish war of revenge against Charles X. of Sweden resulted in further loss by Norway. By the peace of Roskilde (1658) she was compelled to renounce Trondhjem and Baahus, and although the former was restored by the peace of Copenhagen, (1660), her population fell below half a million. The Swedes had now acquired the rich provinces in the south and south-west of the Scandinavian peninsula, and their ambition to extend their frontiers to the North sea grew. From the middle of the 17th century, however, the Dutch and English made their influence felt, and the political status of Norway could no longer be regarded as a purely Scandinavian affair. The establishment of hereditary autocracy in Denmark by Frederick III. in 1660 conferred many benefits upon Norway. The Norwegian peasant remained a freeman while his counterpart in Denmark was a serf. Norwegian law was revised and codified under Christian V. (1670–99), who was well served by the Norwegians in his attempt to regain the lost provinces from Charles XI.

Under the sons of these monarchs, Frederick IV. and Charles XII., Norway was once more compelled to pay for Danish aggression. Her shipping was destroyed, and in 1716, when driven from continental Europe, Charles XII. fell upon her. Only his death, in 1718, averted the danger. During this war Peter Tordenskjold, the greatest among a long series of Norwegian heroes who served in the Danish fleet, won undying fame. Before the close of the 18th century something had been done towards dispelling the intellectual darkness. Holberg, though he flourished outside Norway, by stemming the tide of German influence made the future of Norwegian literature possible. At the close of the century Hauge, the Wesley of Norway, appeared, while the growth of the timber trade with England gave rise to a great increase in wealth and population. In a century and a half the number of the Norwegian people was doubled, so that by 1814 the population was 900,000. In 1788 the oppressive law that grain should be imported into Norway only from Denmark was repealed, and thanks to Danish policy, Norway actually drew financial profit from the wars of the French Revolution.

The Norwegian national movement was to render a decade at the beginning of the 19th century more memorable in Norwegian history than any century which had passed since the Calmar Union. In 1800 the Danish Government committed the Norwegians to the second Armed Neutrality, and therefore to a share in the battle of Copenhagen, by which it was broken up. It was not until 1807, however, that Norway was fully involved in the Napoleonic wars. Then, after the bombardment of Copenhagen, she was compelled by Danish policy to embrace the cause of Napoleon against both England and Sweden. Commerce was annihilated, and the supply of food failed. The national distress brought into the forefront of politics national leaders, among whom Count Wedel-Jarlsberg was the most conspicuous. As yet, however, patriotism went no farther than a demand for a national administration and university; concessions which were accorded by Denmark in 1807 and 1811.

## UNION WITH SWEDEN

Three years later the nascent nation found itself suddenly transferred to the rule of the king of Sweden. The Swedes, with Bernadotte as the heir-apparent, had fought against Napoleon, while the Danes, under Frederick VI., had espoused his cause. The result was the treaty of Kiel (Jan. 14, 1814), which, as was generally understood, compensated Sweden for her loss of Finland to Russia by giving her Norway. But the Norwegians, who had not been consulted in the matter, declared that, while the Danish king might renounce his right to their crown, it was contrary to international law to dispose of an entire kingdom without the consent of its people. A meeting was convened at Eidsvold, where, on May 17, 1814, a constitution, framed upon the constitutions of America, of France (1791), and of Spain (1812), was adopted. It made the *storting*, or National Assembly, a single-chamber institution, and gave the king no absolute veto, or right of dissolution. The Danish governor of Norway, Prince Christian Frederick, was unanimously elected king. Bernadotte invaded Norway, but after a fortnight opened negotiations. A convention at Moss proposed that the Norwegians should accept the Swedish king as their sovereign, but that the Eidsvold constitution should remain. An extraordinary *storting* at Christiania, on Nov. 4, 1814, declared Norway "a free, independent, and indivisible kingdom, united with Sweden under one king." Prince Christian Frederick had already left the country.

**The Act of Union.**—The Act of Union, which was accepted by both countries in the following year, stated that the union was accomplished "not by force of arms, but by free conviction," and the Swedish foreign minister declared to the European Powers that the Treaty of Kiel had been abandoned, and that the union was due to the confidence of the Norwegians in the Swedish people. The Eidsvold constitution henceforward formed the *Grundlov*, or fundamental law. The union thus concluded was really an offensive and defensive alliance under a common king, each country retaining its own government, parliament, army, navy and customs. The Swedish people, none the less, believed that they had won Norway by arms. As the national principle grew more powerful, and the Norwegians richer, more numerous and more self-conscious, a tension developed on the question of union which was eased only by severance in 1905.

From 1814 to 1829 the king was represented by a Swedish viceroy, while the government was, of course, composed only of Norwegians. Count Wedel-Jarlsberg was its first head while several of Prince Christian Frederick's councillors of state were retained. Over the first two viceroys Count Wedel exercised considerable influence.

The end of the Napoleonic wars brought to Norway poverty and depression of trade, and her finances were in a deplorable condition. The *storting* therefore cut down the army by one-half and founded a bank of Norway. The paid-up capital was procured by an extraordinary tax, and this, together with the growing discontent among the peasantry, brought about a rising in Hedemarken, designed to dissolve the *storting* and to reduce taxation. The rising, however, soon subsided, and the bountiful harvest of 1819 brought more prosperous times. Meanwhile, however, the financial position had endangered independence. The settlement with Denmark of Norway's share of their joint national debt threatened to provoke the intervention of the Powers. Bernadotte, now Charles XIV. of Sweden (Feb. 5, 1818), accepted England's mediation, and in Sept. 1819 concluded a convention with Denmark, by which Norway was held liable for only 3,000,000 specie dollars (nearly £700,000). The obstinacy of the *storting* in 1821, however, nearly occasioned a fresh interference of the Powers. When at last the Norwegians yielded, the king doubted their sincerity, and in July 1821 assembled 3,000 Swedish and 3,000 Norwegian troops near Christiania (Oslo), ostensibly for manoeuvres. A circular note (June 1) to the Powers complained bitterly of his treatment by the *storting* and courted their sympathy for any attempt to revise the Norwegian constitution. The *stortings* of 1815 and 1818, moreover, had passed a bill for the abolition of nobility, which the king had refused to sanction. The Norwegians maintained that the few remaining counts and barons were all Danish and of very recent origin, while the true nobility of the country were the peasants, descendants of the old jarls and chieftains. According to the constitution, any bill passed by three successive *stortings*, elections being held every third year, became law without the king's sanction, and, though the king did everything to obstruct it, the bill was carried.

In 1822 Count Wedel-Jarlsberg retired. In 1821 he had been impeached before the Rigsret, the supreme court of the realm, for having caused the state considerable losses. Jonas Collett (1772–1851) succeeded as minister of finance. The king,

apparently abandoning his plans for a *coup d'état,* now substituted proposals for removing from the constitution all that was at variance with a monarchical form of government. These changes had been suggested in his circular note to the Powers, and were designed to please his Swedish subjects. In 1824 and subsequently, however, the *storting* unanimously rejected not only the king's proposals, but also others by private members. In 1830 they were discussed for the last time, with the same result. The *storting* thus became regarded as the defender of the constitution against a would-be absolutist king, while the king began to consider the celebration of May 17 (Independence day) as a demonstration against himself, and when Collett was impeached for having made payments without the sanction of the *storting,* he regarded it as an attack upon his royal prerogatives. Although Collett was acquitted, he dissolved the *storting* with every sign of displeasure. The Swedish viceroy tried to convince him that his prejudice against the celebration of May 17 was groundless, but in 1827 it was celebrated in a very marked manner, and was followed by a demonstration against *The Union,* a foolish political play. The king therefore appointed Count Platen, whose first act was a proclamation against celebrating the day of independence. In April 1828 the king, against the advice of his ministers, summoned an extraordinary *storting,* to recover the supremacy lost to the *storting* in 1827. He also intended to prevent the celebration of May 17, and assembled 2,000 Norwegian soldiers near the capital. Though present in person, he did not accomplish any constitutional changes, but the *storting* decided to omit the celebration, and the people quietly acquiesced. In the following year, however, trouble broke out again. Crowds paraded the streets, singing and shouting, and gathered finally in the market-place. A little rioting, and its suppression with sword and musket, became known as the "battle of the market-place," and did much to increase the ill-feeling against Count Platen. He died in Christiania (Oslo), at the end of the year, and his post remained vacant for several years.

**Development of the National Movement.**—The July revolutions of 1830 stimulated political consciousness in Norway at a time when the peasants in the *storting* were challenging the representatives of the official classes, hitherto supreme. This party was ably led by Ole Ueland, a member of every *storting* from 1833 to 1869. The *storting* of 1833 was the first of the so-called "peasant *stortings,*" their numbers rising from 20 or less to 45, nearly half of the total representation. They found a champion in the youthful poet Henrik Wergeland, who soon became one of the leaders of the "Young Norway" party. He was a republican in politics, and the most zealous upholder of the national independence of Norway and of her full equality with Sweden. Another rising poet, J. S. Welhaven, led the upper classes against Wergeland and the peasants, who sought to make the cultural separation from Denmark as complete as possible, and in every way to encourage national feeling among the people. Though zealous for the education of the people and beloved by the poorer classes, Welhaven could form no political party and at his death in 1845 stood almost isolated. His opponents then became the leaders in the field of literature, and carried on the work of national reconstruction with more restraint.

While the violent agitation of 1830 died away, the tension between king and *storting* reached its height during the session of 1836, when all the royal proposals for changes in the constitution were laid aside, without even passing through a committee. The king decided to dissolve; but Lövenskiold, one of the ministers, was impeached for this decision, and eventually fined 10,000 kroner (about £550), though retaining his post. Collett, who had greatly displeased the king, was dismissed; but unity in the government was brought about by the appointment of Count Wedel-Jarlsberg as viceroy. From this time the relations between the king and the Norwegian people began to improve, whereas in Sweden he was, in his later years, not a little disliked.

When the king's anger had subsided, he summoned an extraordinary session, in which the *storting* urged that steps should be taken to place Norway upon an equal footing with Sweden, especially in the conduct of diplomatic affairs. The same address contained a petition for the use of the national or merchant flag in all waters. The constitution gave Norway her own merchant flag, and in 1821 the *storting* had resolved that this should be scarlet, divided into four by a blue cross with white borders. The king gave permission only for its use in waters near home. Beyond Cape Finisterre the naval flag, which was really the Swedish flag, with a white cross on a red ground in the upper square, must be borne. Royal permission in 1838 for all merchant ships to carry the Norwegian flag in all waters was hailed with great rejoicings, but the question of the national flag for general use had yet to be settled, and in 1839 the king appointed a committee of four Norwegians and four Swedes, to consider the question raised about diplomacy and the equality of Norway in the union.

Its powers were extended to consider a comprehensive revision of the Act of Union, with the limitation that fundamental conditions must in no way be interfered with. But before the committee had finished their report the king died (March 8, 1844), and was succeeded by his son Oscar I. According to the constitution the Norwegian kings must be crowned in Trondhjem cathedral, but as the bishop doubted whether the queen, a Roman Catholic, could be crowned, the king decided to forgo coronation. He soon showed his desire to meet the wishes of the Norwegian people, decreeing that in all documents concerning her internal government Norway was to stand first in the royal title; that Norway and Sweden should each carry its own national flag as the naval flag, with the mark of union in the upper corner; and that the merchant flag should bear the same mark of union.

The condition of the country had now considerably improved, and King Oscar's reign was marked by the carrying out of important legislative work and reforms. New roads were made, the first railway built, steamship routes established, lighthouses erected, and trade and shipping developed. During the Schleswig-Holstein rebellion (1848–50) and the Crimean War, Norway and Sweden remained neutral and Norwegian shipping especially benefited. The abolition of the English navigation acts in 1850 opened up a great future for the Norwegian merchant fleet.

In 1826, by the treaty with Russia, the frontier in the Polar region was definitely delimited; but in 1851 Russia demanded for her frontier Lapps the right to fish on the Norwegian coast, and to settle upon a portion of the coast on the Varanger fjord. The Norwegian Government refused, and serious complications might have ensued if the attention of Russia had not been turned in another direction. During the Crimean War the king concluded a treaty with England and France by which these countries guaranteed Norwegian and Swedish territory against Russia. Relations with Russia therefore became strained; but after the peace of Paris in 1856, and the accession of Alexander II., the Russian ambassador at Stockholm restored harmony.

Owing to the king's ill-health his son was appointed regent in 1857, and two years later succeeded as Charles XV. This gifted, genial and noble king desired to inaugurate his reign by proof of his willingness to acknowledge the claims of Norway, but he did not live to see his wishes carried out. According to the constitution, the viceroy might be either a Norwegian or Swede. Since 1829 no Swede had held the post, and since 1859 no appointment had been made. But the paragraph in the constitution still existed, and the Norwegians naturally wished to have this stamp of "provinciality" obliterated. A proposal to abolish the office was passed by the *storting* in 1859. The king had privately promised that he would sanction the proposed change in the constitution; but a violent outcry arose in Sweden. Under pressure the king eventually refused to sanction the resolution; but he added that he shared the views of his Norwegian counsellors, and would, when "convenient," himself propose the abolition.

In the following year the Swedish Government pressed the demands of the Swedish Estates for a common parliament which, according to population, would contain two Swedish members to every Norwegian. The Norwegian Government did not seem at all disposed to entertain the proposal; but some dissensions arose with regard to the form of its reply. The more obstinate members of the ministry resigned, and others, of a more pliable nature, were appointed under the presidency of Fredrik Stang, min-

ister of the interior from 1845 to 1856. Both the new and old governments agreed that no proposal for the revision of the Act of Union could then be entertained. The king, however, advocated a revision based upon full equality. In 1863 the *storting* assented to his appointment of a second Union committee. It was not until 1867 that its report was made public, and it could not be discussed by the *storting* before 1871. Meanwhile, the Danish complications in 1863–64 threatened to draw the two kingdoms into war. The king favoured a defensive alliance with Denmark, but the *storting* would only consent if an alliance could also be effected with at least one of the Western Powers.

In 1869 the *storting* passed a resolution by which its sessions were made annual instead of triennial. The first yearly *storting* in 1871 had once more to consider revision. The Norwegians steadily postulated (1) the full equality of the two kingdoms, and (2) no extension of the bonds of the union. However, the new draft implied the supremacy of Sweden and introduced important extensions of the bonds of the union. Strangely enough, the new Stang ministry accepted it and it was even supported by some of the most influential newspapers under the plausible garb of "Scandinavianism." In these circumstances the "Lawyers' Party," under the leadership of Johan Sverdrup, and the "Peasant Party," led by Sören Jaabaek, allied to defend the constitution of 1814. Thus was founded the great national party of the "Venstre" (the left). The proposed revision in 1871 was rejected by an overwhelming majority.

In 1872 a private bill proposed that ministers should be admitted to the *storting* and take part in its proceedings. After stormy debates, Sverdrup carried the bill by a large majority, but the Government, jealous of the new Liberal Party, advised the king to refuse his sanction. In the preceding half-century the Government Party had several times introduced a similar bill, but the opposition had feared lest the superior skill in debate and political experience of the ministers should turn the scale too readily in favour of Government measures. Now, on the contrary, the opposition had gained more experience and had confidence in its own strength; but the Government saw in the proposed reform the introduction of full parliamentary government, by which they could not remain in office unless supported by a majority. The Liberals carried a vote of censure against the Government but the king declared that the ministers enjoyed his confidence. Three, however, resigned, and enthusiastic public meetings were held all over the country in support of the proposed reform.

In Sept. 1872, Charles XV. was succeeded by his brother, Oscar II. In the following year the king sanctioned the abolition of the office of viceroy, and the president of the ministry was afterwards recognized as the prime minister. Stang was the first to fill this office. In the same year Norway celebrated its millenary with great festivities.

**Struggle Between the King and the Storting.**—In 1874 the government, in order to show the people their goodwill, laid before the *storting* a royal proposition for the admittance of the ministers to the national assembly. But this was to be accompanied by certain other constitutional changes, such as the royal right of dissolving the *storting*, and providing fixed pensions for ex-ministers, as a guarantee against the majority misusing its new power. The bill was unanimously rejected by the *storting*, who in the same year, and again in 1877, passed a modified version of the bill of 1872. On both occasions the king refused his sanction. The *storting* accordingly resorted to the procedure provided by the constitution to carry out the people's will. In 1880 the bill was passed for the third time, by 93 votes out of 113. To the general surprise, the king again refused his sanction, declaring that his right to the absolute veto was "above all doubt." Sverdrup, the Liberal leader and president of the *storting*, therefore proposed that the bill, which had been passed three times, should be declared to be the law of the land. This was carried by a large majority on June 9, 1880, but the king and his ministers declared the resolution invalid. The faculty of law at the Christiania (Oslo) university with one dissentient upheld the king's right to the absolute veto in questions concerning amendments of the constitution, although they could not find that it was expressly stated in the fundamental law of the country. The ministry also advised the king to claim a veto in questions of supply, which still further increased the ill-feeling in the country against them.

The prime minister, Stang, now resigned, and C. A. Selmer (1816–89) became his successor—an appointment which indicated that the conflict was to be continued. In June 1882 the king came to dissolve the *storting*, and astonished the people by censuring their representatives in a speech from the throne. Sverdrup and Björnstjerne Björnson, the popular poet and dramatist, called upon the people to support the *storting* in upholding the resolution of June 9. In the elections the Liberals won 83 seats to the Conservatives' 31. The ministry, however, showed no sign of yielding, and, when the new *storting* met in Feb. 1883, the Odelsting (the lower division of the national assembly) decided to impeach the whole of the ministry. They were charged with having acted contrary to the interests of the country by advising the king to refuse his sanction—first, to the amendment of the law for admitting the ministers to the *storting;* secondly, to a bill involving supply; and thirdly, to a bill by which the *storting* could appoint additional directors on the state railways.

After ten months' trial, the Rigsret sentenced Selmer and seven of his ministers to be deprived of their offices; while three, who had either recommended the king to sanction the bill for admitting the ministers to the *storting*, or had entered the cabinet at a later date, were heavily fined. The excitement in the country rose to fever-height. It was generally believed that the king would attempt a *coup d'état*. Fortunately, after some hesitation, he issued (March 11, 1884) an order in council announcing that the judgment would be carried into effect. King Oscar, however, in his declaration upheld the constitutional prerogative of the crown, and in April asked Schweigaard, one of the ministers who had been fined, to form a ministry. His "April ministry" sent in its resignation in the following month; a similar nomination failed, and the king was at last compelled to appoint Sverdrup. Thus the first Liberal ministry in Norway came into being (1884). The *storting*, to satisfy the king, passed a new resolution admitting ministers, and this received formal sanction.

During the following years a series of important reforms was carried through. In 1887 the jury system in criminal matters was introduced after violent opposition from the Conservatives. A bill intended to give parishioners greater influence in church matters, however, was eventually rejected, the result being a break-up of the ministry and a disorganization of the Liberal Party. In June 1889 Sverdrup resigned, and a Conservative ministry was formed by Emil Stang. After two fruitful years this was wrecked on the diplomatic question. In 1814 nothing had been settled about the conduct of diplomatic affairs; in 1835 a resolution was issued which in effect gave Norway a right of inspection of business transacted on her behalf by the Swedish foreign minister with the king. The Swedes were willing to grant equal representation in a joint council, but on the assumption that the minister of foreign affairs should continue to be a Swede, and this the Norwegians would not accept. In 1891, after a deadlock, the Stang ministry resigned, and a Liberal ministry under Sverdrup's successor, Steen, was appointed.

A new deadlock was produced by the resolve of the *storting* in 1892 to establish a separate consular service for Norway, which provoked the king's veto and the resignation of the ministry. By a compromise, the ministry returned to office, on the understanding that the question was postponed. In 1893 the *storting* again passed a resolution for the establishment of the proposed consular service, but the king again refused his sanction. Upon this the Liberal ministry resigned (May 1893), and the king appointed a Conservative Government, with Stang as its chief. At the end of 1894, when the triennial elections took place, the majority declared in favour of national independence on the great question then before the country. In 1895, after over four months without a responsible Government, a coalition ministry was formed, with Professor G. F. Hagerup as prime minister. A new committee of Norwegians and Swedes spent over two years in fruitless labour on the question of separate diplomatic representation. At the elections in 1897, 79 Liberals and 35 Conservatives were

returned, and in Feb. 1898 Hagerup was replaced by Steen. Soon afterwards the bill for the general adoption of the national or "pure" flag was carried for the third time, and became law without the king's sanction. In 1898 universal political suffrage for men was passed by a large majority, but the proposal to include women received only 33 votes.

## NORWAY INDEPENDENT

**The Consular Crisis.**—In Jan. 1902, on the initiative of the Swedish foreign minister, another joint committee on the consular question was appointed. It unanimously reported that "it was possible to appoint separate Norwegian consuls exclusively responsible to Norwegian authority and separate Swedish consuls exclusively responsible to Swedish authority." Further negotiations resulted in the so-called *communiqué* of March 24, 1903, announcing an agreement for separate consular services. In due course the Norwegian Government submitted to the Swedish their draft of the proposed regulations, but received no reply for several months. The friendly Swedish foreign minister, Lagerheim, resigned, and in Nov. 1904 Boström, the premier, suddenly submitted to Norway new conditions for the establishment of separate consuls. These placed the Norwegian consuls under the Swedish foreign minister, who could remove them. Hagerup proceeded to Stockholm, but no satisfactory agreement could be arrived at. The Norwegians felt themselves compelled to take matters into their own hands. On March 1, 1905, Hagerup resigned and was succeeded by Michelsen, and a ministry from both parties. It was resolved to establish a Norwegian consular service not later than April 1, 1906. During the king's illness the crown prince vainly attempted to reopen negotiations. In April Boström resigned, apparently to facilitate negotiations. On May 23 the *storting* unanimously passed the bill, but on May 27, despite the entreaties of his Norwegian ministers, the king refused his sanction. The Norwegian ministry immediately resigned. The king refused their resignation, but they declined to withdraw it. On June 7 Michelsen informed the *storting* that, since an alternative Government could not be formed, the personal union with Sweden was dissolved. The resigning ministry was unanimously authorized to exercise the authority vested in the king.

**Separation from Sweden.**—Against this the king sent a telegraphic protest to Michelsen and to the *storting,* and an extraordinary session of the Riksdag (parliament) on June 20 appointed a special committee on the crisis. On July 25 it reported to the Riksdag that Sweden should negotiate about the severance of the union, if requested by a newly elected *storting* or a referendum. The report was unanimously adopted on July 27, and next day the *storting* decided on a general plebiscite. On August 13, 368,211 voted for the dissolution and only 184 against it. It was thereupon agreed that representatives of Norway and of Sweden should arrange for the separation. After more than three weeks' negotiation, agreement was reached on September 23. This provided for a neutral zone on both sides of the southern frontier, the Norwegians undertaking to dismantle some fortifications within that zone. The agreement was to remain in force for 10 years, renewable for a similar period, unless one country gave notice to the contrary. On October 27, after ratification by *storting* and Riksdag, the king relinquished the crown of Norway. Failing acceptance by a Bernadotte, it was conferred upon Prince Charles of Denmark by a second popular vote (259,563 against 69,264) and by the *storting* with no dissentients. On November 25 the king, now Haakon VII, and Queen Maud, the youngest daughter of Edward VII of England, entered the Norwegian capital.

In 1907 parliamentary suffrage was granted to women with the same limitation as the municipal granted in 1901, *viz.,* to unmarried women over 25 who pay taxes on an income of 300 kroner (about £16) in the country districts or 400 kroner (about £22) in the towns, and married women whose husbands pay taxes on similar incomes. Norway was thus the first sovereign country in Europe where women gained the vote.

**1907–1914.**—The Michelsen Government, which achieved these results, functioned in a *storting* composed of some 77 Liberals and Left, 36 Conservatives and 10 members of the new Labour Party. In Oct. 1907 the premier was succeeded by his foreign minister, Lövland. Most of the Left then reorganized as the Consolidated Left under Knudsen, who became premier in March 1908, and carried the "concession laws," making it impossible to buy waterfalls of more than 1,000 h.p., forests, mines and other real property without a government concession.

The Conservatives strongly opposed the proviso that concessions should be limited to 60 years, and that all waterfalls and power stations should then become national property without compensation. In March 1909 a group of the old Liberals reorganized as the Liberal Left. In the general elections of Oct. 1909 the Conservatives and Liberals secured 63 seats, as against 47 Radicals, 11 Socialists and 2 Independents, and on Feb. 1, 1910, formed a Coalition Government under the old Liberal leader Konow. In 1911 the government passed a new taxation law introducing compulsory declaration of income and limiting rights of municipal taxation. Owing to persistent friction on the *landsmål* question (*see* NORWEGIAN LANGUAGE AND LITERATURE), Konow resigned (Feb. 1912) and was succeeded by the Conservative leader, Bratlie. But this friction had weakened the coalition; the elections of 1912 returned 76 Radicals against 24 Conservatives and Liberals and 23 Socialists. Knudsen again became premier, with Castberg the leading member of his cabinet. Controversy centred around the so-called "Castberg laws," giving illegitimate children equal rights of inheritance with legitimate, except in the case of peasants' farms, and increasing the obligations of the fathers towards illegitimate children and their mothers. The laws were passed in 1915 by the Radical majority, after Castberg had left the cabinet. In 1914 the centenary of the Norwegian constitution was celebrated.

**1914–1920.**—A controversy with Sweden concerning the sovereignty over a group of submarine skerries, Grisebaaerne, was decided by The Hague Tribunal in 1908. The World War of 1914–18 brought the three Scandinavian countries closer together. In Aug. 1914 they proclaimed strict neutrality and agreed to remove any possibility of inter-Scandinavian hostile action. On December 18–19 the three kings with their premiers and foreign ministers met in Malmö to discuss joint action regarding questions raised by the war. Similar conferences of the premiers and foreign ministers were held in Copenhagen (March 1916), Oslo (Sept. 1916), Stockholm (May 1917), Copenhagen (June 1918), Stockholm (May 1919), Oslo (Feb. 1920) and Copenhagen (Aug. 1920).

After the first panic at the outbreak of war, both public and private enterprises made vast profits and spent extravagantly. Wages and salaries rose rapidly; the shipping companies paid huge dividends; all sorts of new financial and industrial enterprises were started; imports reached an enormous height. The elections of 1915 increased the government majority; 80 Radicals were elected, 20 Conservatives, 19 Socialists and 4 Independents. The government received extraordinary powers. A victualling commission controlled prices and imports, and a price directorate controlled retail prices. In 1916 grains and cereals, meat, sugar, coffee and tea were rationed. Temporary prohibition was initiated in Dec. 1916, and extended in June 1917 to all trade in wines of an alcoholic strength of over 12%. In July 1916, as the result of a violent struggle in the labour market, an emergency measure was passed—under protests from both Labourites and Conservatives—prohibiting strikes and lock-outs and enforcing public arbitration in industrial conflicts. In spite of extraordinary revenues, however, the needs of defence and bonuses to officials swelled the national debt from 362,300,000 kroner in 1914 to 736,600,000 kroner in 1917 and 1,008,000,000 at the end of 1918.

At the elections in the autumn of 1918, therefore, the Radicals lost 26 seats, and the Socialists 1, while the Conservative-Liberals gained 30. The unfair electoral system had hitherto secured the Left a number of seats out of all proportion to the votes cast for them. The Conservatives, assisted by Labour—where the moderates were losing power in consequence of the impossibility of achieving results by parliamentary methods—were now able to establish proportional representation. The Knudsen cabinet re-

signed in Jan. 1919, but as the Conservatives had no working majority it continued to sit till June 1920, when Halvorsen, the Conservative leader, succeeded Knudsen.

**1920–1939.**—Halvorsen's cabinet was immediately faced with formidable labour troubles. After 1906 the Socialists had gained rapidly in influence. They collaborated closely with the trade unions, which in 1889 had been merged into a national federation under a central committee, elected partly by the trade unions and partly by Labour. The trade unions were similarly represented in the Labour executive. Under the influence of the Russian revolution of 1917, the Radicals gained the upper hand at the party congress and in the executive committee in 1918. In 1919 the Norwegian Labour Party joined the Third International, and sent a member to the executive committee in Moscow. The moderate leaders then selected and founded the Social Democratic Party.

A wave of revolutionary feeling caused the "revolutionary" railway strike of Dec. 1920 and the national strike of May 1921. The cabinet met both strikes successfully; the railwaymen (who were State employees) capitulated unconditionally after 17 days, and the national strike proved a fiasco and caused much bitterness against the Radical leaders and Moscow. The Conservatives gained strength; but in June 1921 the Government was defeated on the prohibition question and resigned.

In Oct. 1919 a referendum had sanctioned the temporary prohibition of 1916 and 1917 by 489,660 votes to 305,241, over 410,000 votes not being cast. But the policy produced a trade war with Spain and Portugal, which cost Norwegian shipowners and the whole fishing population heavy losses. Smuggling, too, increased enormously, as did secret home distilling. The Prohibitionists, supported by the Left, Labour and Socialists, replied by greater severity.

The elections of 1921, on the revised basis, gave 57 seats to the Conservative-Liberal coalition, 39 to the Left, 29 to the Labour Party, 8 to the Socialist and 17 to the new Farmers' Party. The Government, though weakened, remained in power, the Left holding the balance between Conservatives and Labour. Blehr, who had succeeded Halvorsen, failed, and a second Halvorsen Government (March 1923) sanctioned the importation of port and sherry. A new treaty was concluded with Portugal, and the commercial war with Spain came to an end. The importation and sale of wines and brandies is a monopoly under Government control. The shareholders get 6%, the surplus (in 1925, 5,000,000 kroner) goes to public funds. The enforcement of public arbitration in industrial disputes expired in April 1923. In May 1923 Halvorsen died. His minister of finance, Berge, who succeeded with an insecure majority, endeavoured to replace prohibition by a well controlled sale of highly taxed brandies. The Left, Labour and some of the Farmers' Party, however, stood out for another referendum, and Berge gave place to Mowinckel.

In autumn 1923 the Labour Party withdrew from the Third International; whereupon their left wing organized the Communist Party, which remained affiliated with Moscow. In Oct. 1924 the Social Democrats secured 8 seats, the Labour Party 24, the Communists 6, the Left 36, the Conservative coalition 54 and the Farmers' Party 22. The Conservative Parties thus had a majority of two in the new *storting;* but as the Farmers' Party refused to form an active coalition, the Mowinckel Government retained office till March 1926. The municipal elections of Nov. 1925 brought victories to the "bourgeois" parties at the expense of Labour and the Communists.

The Spitzbergen archipelago had from time immemorial been under the suzerainty of Norway, but the discovery of coal caused various international conferences to be held in Oslo. The Versailles Treaty gave this group of islands and Beeren island to Norway (1925). On March 4, 1920, the *storting* resolved that Norway should join the League of Nations. In the following years there was friction with Denmark concerning Greenland, which had belonged to Norway until 1814. Norway had always resented its loss, and its east coast had been regarded as the fishing and hunting ground of her west coast population. Denmark's request in 1919 for recognition by the Powers of Danish suzerainty over the whole of Greenland led to a separate agreement between the two countries, both agreeing to regard the east of Greenland as no-man's-land *vis-à-vis* the other. From 1924 onwards treaties of unconditional arbitration were concluded with Germany, Uruguay and other Powers.

Since, despite all progress, Norway remains a relatively small, scattered and isolated nation, its political history still depends largely upon economic and financial conditions. The unrest due to the War of 1914–18 is to some extent perpetuated by the existence of a highly educated class more numerous than are the openings for professional employment within the country. The task of 1926–27 continued to be the restoration of the pre-1914 equilibrium. The connection of the extreme Socialists with Moscow, indeed, inspired a national attempt to place Dr. Nansen, the explorer, at the head of a non-party Government. Failing this, Lykke returned to office early in 1926, with a program of economic and financial reconstruction. In July, the discovery that during the crisis of 1923–24 Berge had secretly supported the Handelsbank with state funds and a guarantee for 40,000,000 kroner led to the impeachment of himself and his colleagues, though the patriotism of his motives was not in question. All, however, were acquitted on every count (March 1927).

Meanwhile a referendum (October 1926) had shown that although the number of votes cast for prohibition had increased since 1919, the majority of 184,344 was now replaced by a minority of 108,943. A Government committee therefore recommended that adults should be empowered to buy liquor with an alcoholic strength exceeding 21%, and in May 1927 prohibition ended on these terms. The sale was entrusted to incorporated societies and restricted to the hours between 11 A.M. and 5 P.M. At the same time arbitration in industrial disputes was made compulsory, in spite of the strenuous resistance of Labour. In Jan. 1927 a new united Labour Party had been formed. The Moscow-led Communists were excluded, but in June, when the Soviet minister at Oslo charged Britain with responsibility for the murder of his colleague in Poland, Madsen, its leader, defended the Soviet reprisals, declaring that the lives of 20,000 Soviet hostages were not equal to that of a single Communist. The *storting* condemned Madsen by nearly four to one, and the police raided the offices of Communist newspapers for seditious propaganda among the British fleet. The autumn elections reduced the Communist deputies to 3, and Labour gained 27 seats and attained a strength of 50. Conservatives and Liberals numbered 32; Farmers' Party, 26; Radicals, 29; and Labour Democrats, 1.

After a prolonged crisis in which both Farmers and Liberals declined office, a Labour Government, under Hornsrud, was formed (Jan. 26, 1928). This declared that the interests of the workers were paramount, and that it would prepare for complete disarmament and the Socialist state. Widespread panic followed, and the Norwegian Credit Bank was for a time in danger. The Labour Government survived, however, for only a fortnight, yielding place to Mowinckel and the Liberals. On May 1 the gold standard was reintroduced, but was abandoned in 1931.

The world economic crisis, indeed, profoundly affected the history of Norway during the decade which preceded the war of 1939. Shipping fell idle, unemployment spread and the Socialists came into power. In 1935 they formed a minority Government, and next year it was confirmed in office. In 1938 the normal term for the *storting* was extended from three years to four. Moderate Social Democracy then embraced the whole Scandinavian north. With it, however, Norway happily combined a constitutional monarchy which greatly contributed to harmony with her chief neighbouring associates, Sweden, Denmark and Britain. The popularity of the royal house was conspicuously demonstrated on the occasions of King Haakon's jubilee (1930) and of Queen Maud's death in England (Nov. 1938).

Moderation, socialism and neutrality are the hall-mark of Norwegian policy. In 1933 the dispute with Denmark over part of East Greenland was settled by action of the World Court. In 1935 her desire to support the League of Nations and Britain caused Norway to join in sanctions against Italy. Next year an act applicable to most employees in industry, commerce and transport provided that daily hours of labour should not exceed 8, and weekly 48. The year 1937, which witnessed some Norwegian rearmament, began with the formation of the so-called "Oslo powers," Denmark, Finland, Norway and Sweden combining with Belgium and the Netherlands to promote trade and to uphold the rights of the smaller states. (W. F. RE.; X.)

**The War of 1939.**—The new conflict between Norway's great power neighbours in 1939 threatened her security and disrupted her economy in much the same way as had the struggle of 1914–18. Now the danger was greater because of the perfected instruments of mechanical warfare, vastly increasing the range of operations. The attack on Finland created a demand for passage of Allied troops through Norway. The government refused the demand, clinging tenaciously to a strict neutrality. But incidents occurred such as that of the "City of Flint" and the "battle" of Jössing fjord. Basically, one difficulty was that Germany still obtained iron through Narvik. Early in April 1940 Britain took the bull by the horns and mined Norwegian territorial waters at several points. The Norwegian Government issued a heated protest, threatening war. Hardly was the ink dry on the protest when Norway found herself attacked and invaded at a number of points, not by the British, but by the Germans. (*See* WORLD WAR II.)

BIBLIOGRAPHY.—In addition to the volumes mentioned above on early history the following newer general history is valuable: E. Bull, W. Keilhau, H. Shetelig and S. Steen, *Det Norske folks liv og historie* (10 vols., 1930–35, plus an additional volume, *Vår Egen Tid* (1938).

On recent events and problems the files of the Norwegian *Historisk Tidsskrift* are useful, and many books: Halvdan Koht, *1814,* and a great variety of other historical studies by this scholar-statesman; Yngvar Nielsen, *Norges historie efter 1814* (3 vols., 1882); Fridtjof Nansen, *The Norwegian North Polar Expedition* (1900–06); *Norway* (Official publication for the Paris Exhibition, 1900); J. E. Sars, *Norges Politiske Historie, 1815–1885* (1904); *Udsigt over den norske Historie* (1905); K. Gjerset, *History of the Norwegian People* (1915); C. Laurin, E. Hannover, J. Thiis, *Scandinavian Art* (1922); O. I. K. Lodoen, *Norges Historie,* (Syvende Oplag, 1922); B. J. Hovde, *Diplomatic Relations of the U.S. with Sweden and Norway* (1920); G. Gathorne Hardy, *Norway, The Modern World Series* (1925); E. Bull, *Grunnriss av Norges historie* (1926); W. Keilhau, *Norge og Verdenskrigen* (1927), and an English abridgement in W. Keilhau and others, *Sweden, Norway, Denmark and Iceland in the World*

*War* (1930); Andreas Elviken, *Die entwicklung des norwegischen nationalismus* (1930); T. C. Blegen, *Norwegian Migration to America* (1940); P. G. Vigness, *The Neutrality of Norway in the World War* (1932); Oscar Falnes, *National Romanticism in Norway* (1933); S. S. Jones, *The Scandinavian States and the League of Nations* (1939); J. E. Nordskog, *Social Reform in Norway* (1935); O. B. Grimley, *The New Norway* (1937); P. Vogt, *The Norway Year Book* (1938); Oscar Falnes, *Norway and the Nobel Peace Prize* (1938); Ben A. Arneson, *The Democratic Monarchies of Scandinavia* (1939); E. Stanford, *The London Atlas Map of Sweden and Norway; Le Nord* (quarterly since 1938). (F. D. S.)

**NORWAY,** a city of Dickinson county, Michigan, U.S.A., in the southern part of the Upper peninsula, on the Chicago and North Western railway and federal highway 2, near the Menominee river. The population was 4,016 in 1930 and 3,728 in 1940. Iron mining and lumbering are the principal interests.

**NORWEGIAN LANGUAGE AND LITERATURE.** The language used in almost all great newspapers, in commerce and by the best known authors differs in many ways from the spoken language even of people of literary education, still more from that of less educated classes in the towns and of the rural population. "The ordinary literary language," as it is officially styled, or the "Norwego-Danish" as it is scientifically termed, or *"Riksmaal"* in colloquial speech, is the Norwegian variety of the Danish language which came in during the union with Denmark (1380–1814).

Up to the beginning of the 19th century Danish in Norway was chiefly a written language, its oral use being limited to reading, preaching and, towards the end of this period, society purposes. During the 19th century the upper classes, especially of the towns, developed a spoken Norwego-Danish, with Norwegian sounds and intonation, and progressively influenced by the Norwegian popular idiom. Pure Danish was spoken by some actors as late as 1889. In 1887 Norwego-Danish was recognized for standard reading in the secondary schools, and gradually it penetrated even the church, the last stronghold of the Danish tradition. In 1907 some important characteristics of Norwegian pronunciation were adopted into the orthography of the language, and in 1917 orthography took a further step away from modern Danish.

**Colloquial Varieties.**—The colloquial form varies greatly according to the locality and the social class of the speaker. Locally Norwego-Danish speech may be divided into four principal dialects: the southern dialect, comprising the towns Arendal, Christianssand and Stavanger and others on that part of the coast, with *b-d-g* for Norwegian p-t-k following a vowel; the western dialect (Bergen), with a peculiar accent and great fluency of diction, and with the same (uvular) *r* as the southern dialect; the northern dialect (Bodø Tromsø) with a somewhat monotonous "singing" accent; and the eastern dialect (Oslo-Trondhjem), now the principal form of the spoken Norwego-Danish.

This Norwego-Danish literary language, with its dignified pronunciation especially as heard in the capital, is presented as "Norwegian" in school and reference books written for foreigners. Through different social strata this language is connected with the dialects of the towns and of the factory workers in the country. These town dialects exhibit the same phonetic and inflectional traits as the surrounding country dialects and are thus fundamentally Norwegian; but they are susceptible of modifications in the direction of the Norwego-Danish speech of the upper classes. There are thus three strata in the speech of the towns: upper, middle and lower class dialects, the first originally Danish, the last essentially Norwegian. The town dialects are little represented in literature, being limited to writings of a light and humorous kind; modern authors, however, frequently use the colloquial (middle class) and vulgar forms of speech in dialogues and as a means of characterization, and on the stage. Only exceptionally has it found its way into serious drama.

**New Norwegian.**—The New Norwegian National Language (*Landsmaal*) is a common standard literary form for the dialects, propounded on a scientific basis by Ivar Aasen (1813–1896) in his grammar of Norwegian speech (1848, 1864) and in his *Dictionary* (1850, 1873), and since 1853 cultivated in literary works. From that time the Landsmaal has been further developed by a series of authors, by newspapers, by periodicals, by scientific and educational works (especially on national philology and history, on pedagogics and theology), and by school books of all kinds.

Landsmaal is supported by the national democratic parties and a strong Young People's Association movement. In 1885 the Storting passed a resolution declaring the equality of the popular language and the Norwego-Danish language. In 1892 the school circuits were allowed to make Landsmaal the principal language of the elementary school; and it has been adopted by more than 2,000 school circuits, mostly in the west and midland districts, and by the great majority of the free adult schools. In the secondary schools and, from 1908, in the university, students may use Landsmaal, but only in three State schools is it the principal language; and in some other secondary schools founded by private individuals or corporations. In some 200 churches the liturgy is in Norwegian, and an increasing number of clergymen preach in Norwegian.

In the districts from Møre to Telemark, statutes have been promulgated in Landsmaal. Two hundred district authorities have asked that the central administration and the Government officials use Landsmaal when writing to them. Since 1894 the Storting has voted a few laws in Norwegian.

The official orthography of the names of towns, districts, estates and other localities is now in course of revision in order to do away with the Danicized forms and establish an orthography corresponding with their national origin and pronunciation.

**Dialects.**—Dialect differences are not great enough to prevent intercourse between people of different provinces. Some dialects exhibit strongly marked peculiarities, *e.g.,* that of Setesdal with its diphthongization of old long vowels and its characteristic vocabulary. The country dialects are eastern, western and northern, with many transitional forms especially in the coast districts. The vocabulary is not uniform, and some of the dialects have simplified inflection; but the chief differences are due to the varying development of sounds. The eastern groups have cacuminal and supradental sounds; the northern and greater part of the country palatalizes *nn, ll, dd, gg;* eastern and northern dialects and still others have to a great extent assimilated *nd, ld, ng, gn, mb.* In eastern dialects *rd* is mostly pronounced [*ṭ*] (thick l), in western [*r*]. Other assimilations are still more wide-spread, such as *rn* to [*nn*].

**The Character of New Norwegian.**—Landsmaal is rooted in old Norse. The principal features of the spoken language are the same; it has kept up the old diphthongs and to a great extent the old West Scandinavian vocal system of the stem syllables, differing in this respect from Swedish and Danish (the chief exceptions being rather important changes in the original short syllables, the weakening of sounds in terminations, especially of adjectives, and a certain number of apocopes).

**Vocabulary.**—The vocabulary is extremely rich, especially in the midland, western and Trøndelag dialects, but it varies greatly from coast districts to mountain and forest districts. It has many literary words, frequently compounds or words of a wider meaning than that given to them in popular speech; these are sometimes termed neologisms and are used as substitutes for established foreign literary and technical terms. While as a spoken and popular language, Landsmaal is more puristic than Swedish and Danish; a number of loan-words come from Old Norse, being borrowed from and through Old English, Old French, and, in the latter period of the Middle Ages, from Low German (the Hanse), and in later times through Danish, from High German. Many Danish words, especially such as belong to the field of religion, found their way into Norwegian, although their number is smaller than might have been expected.

BIBLIOGRAPHY.—*New Norwegian.*—School books: K. Brekke, *Lærebok i engelsk, landsmaalsutgaava* (English-Norwegian, 2nd ed., 1917); L. Heggstad, *Norsk grammatik* (1914); M. Skard, *Nynorsk ordbok* (2nd ed., 1921; orthography). Dictionaries: Ola Raknes, *Engelsk-norsk ordbok* (English-Norwegian, 1927); Ivar Aasen, *Norsk Ordbog* (reprinted 1918); H. Ross, *Norsk Ordbog* (1895–1913); S. Schjøtt, *Norsk ordbok* (1914); S. Schjøtt, *Dansk-norsk ordbog* (Dano-Norwegian, reprinted 1926); L. Heggstad, *Fornorskings-ordbok* (2nd ed., 1924; Norwego-Danish—Landsmaal). Synonyms: Ivar Aasen, *Norsk Maalbunad* (1925). Etymology: Torp, *Nynorsk etymologisk ordbok* (1919); Aasen, *Norsk Navnebog* (reprinted 1912; Christian

names); O. Rygh, *Norske Gaardnavne,* i.–xviii. (1897–1924; place names; bibl.); G. Indrebø, *Norske innsjønamn,* i. (1924). Grammar: Ivar Aasen, *Norsk Grammatik* (reprinted 1899). Literature 1646–1925, bibliography: A. Aure, *Nynorsk Boklista,* i.–iii. (1916–26). History: M. Hægstad, *Norsk maalsoga* (latest ed., 1924); D. A. Seip, *Norsk sproghistorie* (1920); G. Indrebø, *Norsk namneverk* (1927); P. Hovdan, *Fraa folkemaal til riksmaal* (1928; expansion of Landsmaal). *See* also Grøndahl and Raknes, *Chapters in Norwegian Literature* (1923). Discussion: J. Storm, *Landsmaalet som Kultursprog* (1903); K. Liestøl, *Maalreising* (1927). Spelling reform: Hægstad og Garborg og Flo, Framlegg til skrive-reglar for landsmaale i skularne (in *Universitets- og skoleannaler,* 1899); Eitrem og Larsen og Schjøtt, Utredning av spørsmaalet om et mulig samarbeide mellem landsmaal og riksmaal i retskrivningen (in *Universitets- og skoleannaler,* 1909); *Indstilling fra Retskrivningskomiteenø* (1917). Dialects: J. Storm, Norsk Lydskrift (in *Norvegia,* 1884–1908); A. B. Larsen, *Oversigt over de norske bygdemaal* (1898); H. Ross, *Norske bygdemaal* (1905–09); *Festskrift til Amund B. Larsen* (1924). Town dialects: Larsen og Stoltz, *Bergens bymaal* (1912), Berntsen og Larsen, *Stavanger bymaal* (1925); A. B. Larsen, *Kristiania bymaal* (1907).

*Norwego-Danish.*—Manuals, conversation books: P. Groth, *A Norwegian Grammar* (3rd ed., 1924); I. Grøndahl, *Norwegian Self-Taught* (Marlborough's Series); Poestion, *Lehrbuch der Norwegischen Sprache* (3rd ed., 1914 in Hartleben's *Bibliothek der Sprachenkunde*). Dictionaries: J. Brynildsen, *A Dictionary of the English and the Dano-Norwegian Languages* (1902–07; Norwegian words are marked as provincialisms); J. Brynildsen, *Norsk-Engelsk Ordbog* (2nd ed., 1917); T. Evanths, *Norsk og dansk handels-leksikon* (commercial; 1917); Tønnessen, *Norsk og fremmed ordbok* (1926); Krogsrud og Seip, *Norsk riksmaalsordbok* (orthography; 1924). Etymology: Falk og Torp, *Norwegisch-dänisches etymologisches Wörterbuch* (1910–11); D. A. Seip, *Laaneordsstudier* (loan words; 1915–19). Grammar: Torp og Falk, *Dansk-norskens lydhistorie* (1898); Falk og Torp, *Dansk-norskens syntax* (1900); A. Western, *Norsk riksmaals-grammatik* (1921; description of the modern literary language). Pronunciation: I. Alnæs, *Norsk uttale-ordbok* (1924; eastern dialect). *See* also I. Alnæs, *Norsk sætningsmelodi* (1916, eastern dial.). Norwegianization: Seip, *Norskheg i sproget hos Wergeland og hans samtid* (1914); Seip, *Dansk og norsk i Norge i eldre tider* (1921); T. Knudsen, *P. A. Munch og samtidens norske sprogstrev* (1923); A. Burgun, *Le développement linquistique en Norvège depuis 1814* (1919–21). Spelling reform: Aars og Hofgaard og Moe, "Om en del retskrivnings- og sprogpørsmaal" (in *Universitets- og skoleannaler,* 1898; *see* also 1900 and 1901). J. Storm, *Norsk Retskrivning,* i.–ii. (1904–06). Regulations 1907 and 1917, *see* above, New Norwegian.

(S. K.)

## LITERATURE

From a linguistic and artistic aspect the literature of ancient Norway is inextricably bound up with Icelandic; Old Norse literature is, therefore, dealt with under Iceland (*q.v.*); yet it should not be forgotten that the psychological features revealed through the so-called *Older Edda,* as well through the sagas, are so typically Norwegian in all essentials that this literature forms the very basis on which the literary fabric of Norway has been raised in the course of centuries.

The literature of the Old Norse language came to an end in the beginning of the 14th century simultaneously with the decline and fall of Norway as a sovereign State with a culture of her own. The chief characteristic of this literature, formed as it was in "an age of axes, an age of swords," is the remarkable fighting spirit by which it is pervaded, and which quite naturally makes it abound in dramatic scenes and striking personalities; at the same time, in poetry as well as in prose, it is imbued by a serene view of life, which reveals a remarkably high moral standard. Another very distinct feature is its decidedly aristocratic leaning, with a pronounced hero-worshipping tendency, as might be expected in an age when the king generally appeared surrounded by his faithful chieftains, and frequently with a young poet before him, singing his praises in glowing terms.

**The Literary Revival.**—Meanwhile the political union between Denmark and Norway (concluded in 1380) gradually brought Danish nobles and officials to the front in this country, with the result that the Old Norse language was replaced by Danish. This development which constitutes perhaps the most remarkable event in the cultural history of the nation, may be considered as completed by the middle of the 16th century. Accordingly, when about the same time the literary revival set in, which to some extent is due to the introduction into Norway of the Lutheran Reformation, the new literature came to be composed in the Danish language, which for nearly three centuries was to hold an unchallenged position as the official language of Norway.

The first outcome of the revival of literary interest in Norway was the appearance of the first book ever printed in Norway, an almanac, printed in Christiania in 1643. During the following years Christen Bang (1580–1678) published a number of religious tracts and also a *Description of Christiania* (1651), which at that time had only recently completed the 25th anniversary of its foundation. These curiosities have, however, nothing to do with literature in the true sense of the word, and the first name of importance in Norwegian literature after the spiritual revival in the Reformation century was Peder Claussön (1545–1614), a clergyman by profession and at the same time a highly gifted author who by his translation of Snorre Sturlassön (*q.v.*) as well as by his independent works on Norway, has got a lasting reputation. The next striking personality in Norwegian literature is Petter Dass (1647–1708) whose *Nordlands Trompet* (Clarion) with its lyric-topographical description of the scenery and life of north Norway is still considered one of the gems of Norwegian literature. On the other hand, Dorthe Engelbrechtsdatter (1635–1716), who among her contemporaries enjoyed a great reputation as an author of religious poetry, is now practically forgotten owing to the melancholy tone of her work.

**Holberg.**—Contrasted with these authors, who all spent their life in Norway, Ludvig Holberg (1684–1754) (*q.v.*) early found his way not only out of Norway, but out of Denmark. Leaving Norway for ever at the age of 21, after having taken his degrees at the University of Copenhagen, he went to England, where he studied for more than 18 months at Oxford, from which he carried with him an indelible impression of England and the English. Later travels brought him to France, Germany and Italy, but wherever he went he lived in the English world of thought and reasoned on the basis of his Oxford experiences. In this way, thanks to his inborn genius and his unbiased mind, he prepared himself for the lifework by which he became the founder of modern Norwegian and modern Danish literature. He revolutionized the conception of life in two kingdoms and paved the way for the intellectual and political liberty of the future. His most famous works next to his *Comedies* (*see* DRAMA: *Norway*) are *Peder Paars* (1719), a heroic poem, the humour and satire of which has stood the test of two centuries; *Niels Klim's Underground Travel* (1741), originally written in Latin, a classic evidence of his mental independence, and finally from the closing years of his life his *Epistles* and *Moral Reflections,* which are the best source of information for Holberg students. Holberg restored the cultural connection between Norway, England and western Europe in general, which had been broken off since the end of the saga period. This fact cannot be emphasized too strongly, for it constitutes the connecting link between the Old Norse literature and the literature of modern Norway, and gives the clue to some of the most outstanding features of the latter, *e.g.,* its independent conception of life and its absolute acceptance of facts, however disagreeable.

English native poets, like James Thomson and Edward Young, had their counterpart in Norway in Christian Tullin (1728–65), a manufacturer and merchant of importance in the business community of Christiania, and a central figure in the extremely sociable life of the city. By his famous poem, *The May-Day* (1758), composed on the occasion of a wedding among "the upper ten" of Christiania, Tullin became the first interpreter in Norwegian literature of the long pent-up love of nature which three-quarters of a century later should find such splendid expression in the poetry of Wergeland.

**Det Norske Selskab.**—Meanwhile, the importance of Holberg's work, along with a number of other factors, among them a constantly growing awareness of being an individual nation with historical traditions and cultural and economic possibilities, gradually began to prevail. The centre of this movement was Copenhagen, where the Norwegian students, partly graduates staying there in search of employment, felt themselves aliens in the midst of a display of public sympathy which made the name of Norway and the Norwegians resound in a way bearing promise for

the future. In 1772, to mention a particular year of lasting importance in Norwegian literature, the Norwegian poets and other men of letters were so strong in Copenhagen that they formed a society which was to become famous under the name of *Det Norske Selskab* (the Norwegian Society). The two most conspicuous members of this society with whom its name has for ever been associated were Johan Herman Wessel (1742–85) and Johan Nordahl Brun (1745–1816); besides them should be mentioned Claus Fasting (1746–91), Claus Frimann (1746–1829), and his brother Peter Harboe Frimann (1752–1839), as also their younger contemporaries, Jonas Rein (1760–1821) and Jens Zetlitz (1761–1821). No student of Norwegian literature who wants to understand the under-currents in the Norwegian nation in the last 40 years prior to the dissolution (1814), should pass by these poets, among whom Claus Frimann still lives in a few songs of popular reputation. The sovereign talent among them is, however, Wessel (*see* DRAMA: *Norway*), the spiritual inheritor of Holberg, a champion in the fight against pedantry and prejudices, a *gamin* spirit full of irony and good humour in the midst of adversities.

Norwegian literature has no finer display of comic fiction than his three immortal poems, "The Smith and the Baker," "The Dog-murder" and "The Fork," while a number of his pithy and pointed epigrams have long ago become classic. Nordahl Brun's fame with posterity rests less on the poetic value of his works than on the tradition of his striking personality, which in his lifetime made him the very embodiment of the national aspirations of Norway; his famous song "To Norway, giants' country, hail," still sung, bears witness to it.

**The Renaissance of 1814.**—In literature this renaissance, in its first stage, was represented by three poets, Henrik Anker Bjerregaard (1792–1842), Mauritz Christopher Hansen (1794–1842) and Conrad Nicolai Schwach (1793–1860). Bjerregaard was famous for his *Sönner av Norge* (Sons of Norway), written in 1820, which for half a century was the national anthem of Norway. His merry musical piece, *A Highland Adventure* (1824), is inspired by a genuine love of nature and a sound common sense.

**Wergeland and Welhaven.**—The commanding genius of this generation is Henrik Arnold Wergeland (1808–45) (*q.v.*), who, as has justly been said, contrived within the limits of a life as short as Byron's to concentrate the labours of a dozen ordinary men of letters. As a poet he is inspired alike by an intense love of nature. Besides larger poems, among which may especially be mentioned *The English Pilot* (1844), he has written in addition a quantity of lyrics with dramas, essays, historical works and journalistic articles—all stamped by his vivid imagination, his sound common sense and his high moral standard.

His contemporary, Johan Sebastian Cammermeyer Welhaven (1807–73), is primarily known for his highly critical nature, with its keen sense of beauty and harmony. His early poems are associated with his literary clash with Wergeland, but notwithstanding the interest attached to them for their polemic character, the memory of Welhaven as a poet chiefly rests upon his beautiful romances. This romantic movement was evident about 1840 and it is the same spirit which led to the discovery of the folk-lore, with its wonderful prose and poetry, in which the soul of the nation and the nature of the country faithfully reflected themselves.

The ideal was that every piece of folk-lore should be rendered in the form given to it by the people in the course of time, and here the Norwegian nation was particularly fortunate. At the right moment the two friends, Peter Christen Asbjörnsen (1812–85) and Jörgen Moe (1813–82), whose names are for ever associated with the Norwegian folk-tales which bid fair to challenge the most famous folk-tales in any European country, made their appearance in literature. Asbjörnsen was a first-rate story-teller with a broad, jovial nature; Moe was a true poet with humour and a rare gift of self-criticism. There was also the Rev. Magnus Brostrup Landstad (1802–80), who in 1853 published his famous collection, *Norwegian Folk-Songs*, the poetical part of the Norwegian folk-lore of which the folk-tales constitute the prose. The former are older than the latter, and accordingly differ from them in several ways; but jointly they constitute what up to the middle of last century was "the missing link" between the eddas and the sagas on one side, and the literature of modern Norway on the other.

**The Landsmaal Movement.**—Along with this literary revival there also set in a linguistic and historical renaissance of paramount importance to literature as a whole. In 1848 Ivar Aasen (1813–96) published a grammar and in 1850 a dictionary of the Norwegian folk-language, whereby the intimate connection between the peasant dialects of the day and the Old Norse language was revealed in the most convincing way. Some years after Aasen's appearance in literature the famous historian, Peter Andreas Munch (1810–63), published his mighty work, *History of the Norwegian Nation* (8 vols., 1852–63)—an event of paramount importance in the field of literature.

This Romantic movement leading to the foundation of the national stage in Norway, with Björnson and Ibsen as the two pioneers (*see* DRAMA: *Norway*), it is easy to see why both of them turned to the saga period for suitable subjects and characters. At the same time, however, realism had already set in. During the '50s the Rev. Eilert Sundt (1817–75) started his epoch-making investigations of life and manners in the rural districts, which made the Norwegian peasant appear in a light considerably different from that in which he appeared in the flattering illumination of the former "peasant worship." Accordingly, Björnson's famous peasant novels, the first of which was *Synnöve Solbakken* (1857), of a decidedly poetical turn, must be described as imbued by romanticism more than by realism so far as the outward surroundings are concerned.

**The Big Four.**—In 1855 Madame Camilla Collett (1813–95), Henrik Wergeland's sister, published her famous novel, *The Governor's Daughters*, the first true description in Norwegian literature of ordinary life, while at the same time it dealt a heavy blow to the conventional marriage and education of young girls. In this way Madame Collett became a pioneer in the movement for the emancipation of women in Norway to whom both Björnson and Ibsen felt themselves indebted. Next to Madame Collett, the fame of the realistic novel is chiefly developed through Jonas Lie (1833–1908) and Alexander Kielland (1849–1906), who, together with Ibsen and Björnson, constitute the famous constellation in the golden age of Norwegian literature popularly known as "the big four." Lie is the author of a number of pure, fresh and eminently characteristic novels dealing with various aspects of every-day life within different ranks of society. *The Pilot and his Wife* (1874), *Rutland* (1880) and *Go On!* (1882), should be mentioned in this connection, no less for the spirit of the white sails and foaming sea by which they are imbued, than for their intimate humanity in substance and psychological analysis. The latter qualities are also splendidly displayed in *The Commander's Daughters* (1886) and *Matrimonial Life* (1887), which, together with his beautiful novel, *The Family at Gilje* (1883), a master-piece of historical review and human psychology dealing with life and characters of the '40s, rank among the crowning works of Lie's extensive authorship. Contrasted with Lie, whose highly impressionistic style not infrequently becomes colloquial to a fault, Kielland is a sovereign master of form, and at the same time a keen psychologist with a decided vein of irony and a heart full of compassion for human suffering. His social novels, *Garmann and Worse* (1880) and *Skipper Worse* (1882), have long ago become classic, as have a number of his short stories, which by their delicacy of style represent the highest attainment of modern Norwegian prose.

Among other authors from the same epoch should be mentioned Kristian Elster (1841–81), who showed great talent in his pessimistic novels, *Tora Trondal* (1879) and *Dangerous People* (1881), and Amalie Skram (1847–1905), wife of the Danish novelist, Erik Skram, whose novels, while deficient in literary beauty, are of a considerable crude force and excellent in their local colour, dealing chiefly with Bergen and west coast life. The outstanding feature of all the authors of the '80s, which may broadly be described as an age of entirely prosaic writers, is the "problem setting," to which there is no parallel in Norwegian literature, and to which Björnson himself contributed in his great novel, *Town and Harbour Beflagged* (1884), to mention one of the most

typical "problem" novels of the age.

**Vinje and Garborg.**—The *landsmaal* literature produced two remarkable authors, Aasmund Olafsen Vinje (1818–70) and Arne Garborg (1851–1924). Vinje was a man of rare gifts, a fine lyric poet, a brilliant essayist and a keen critic, who exercised a great influence on Ibsen in his first period as a dramatist and who, broadly speaking, was one of the most striking literary figures of the '60s. Garborg, who was brought up under sternly pietistic influences in the south-west corner of Norway known as Jaeren, carried with him from these surroundings a gloomy view of life, but being at the same time a revolutionary spirit and an imaginative thinker with a considerable training, principally as a critic, he seemed predestined to make his appearance in literature. His great novel, *Peasant Students* (1883), is of a polemic nature. This novel, like the rest of Garborg's novels through the '80s, is written in the *landsmaal,* which at the time to a certain extent was a drawback to their circulation. In 1891, however, he suddenly turned to the *riksmaal* in his extraordinary novel, *Tired Men,* an exquisite example of Norwegian prose.

**Hamsun.**—Meanwhile another author had already made his appearance in Knut Hamsun (b. 1859) (*q.v.*), whose powerful romance *Hunger* (1888), marks a new departure in Norwegian literature. He is, in fact, its central figure throughout the '90s in the midst of a number of authors of an entirely different stamp from those of the '80s. The most unmistakable genius was, however, Hans Kinck (1865–1926), to whom we propose to return presently. As a typical feature of the '90s it should especially be mentioned that the art of poetry, which had been practically banished from Norwegian for a number of years, again got its exponents, chiefly in Niels Collett Vogt (b. 1864) and Vilhelm Krag (b. 1871). The sensitive spirit of the age is, however, revealed nowhere more remarkably than in Sigbjörn Obstfelder (1866–1900), whose exquisite poetry, as we can study it in his *Posthumous Works,* is rivalled only by his fascinating prose. In both he gives promise of something new in Norwegian literature which was cut short by his early death. At the same time the *landsmaal* poetry witnessed a revival, chiefly through Per Sivle (1857–1904), an excellent national poet whose poems dealt with the episodes and characters of the saga period.

The most consummate work in the *landsmaal* lyric during the '90s is, however, Garborg's *Haugtussa* (1895), inspired by the strange and impressive scenery of the Jaeren. Thus, at the end of the 19th century, there was a revival both in the *riksmaal* and in the *landsmaal* literature.

The first decade of the 20th century will for ever be memorable for the passing away of the four great classics of the preceding age: Ibsen, Björnson, Lie and Kielland. Thereby the field of fiction was thrown open to a new generation of authors, who found themselves confronted with problems essentially different from those which had taxed the attention of the former generation. Norway was no longer the country of consuls, shipowners, vicars, rectors, chamberlains and estate owners, representing official views and opinions against which persons not "made of that self metal" occasionally revolted, and always with deplorable result to their own social interests; nor was Norway the country of women suffering in silence under slow torture of an apparently correct marriage, or a country of workers imbued by a patriarchal respect for their employers, based on personal connections from generation to generation. She was a community in which democracy had established itself on a broad basis.

**Recent Literature.**—No dramatic work of lasting influence has appeared since the age of Ibsen and Björnson, but an examination of the history of the Norwegian novel leaves a more satisfactory impression. Hamsun produced works, generally written in an exquisite style and filled with an exuberant vitality, of which *Pan* (1895) ranks particularly high. Compared with this work, the *Growth of the Soil* (1917; Eng. trans. 1920), by which Hamsun has become famous all over the English-speaking world, does not approach it in range of passion and in mystic grandeur.

Kinck, who is by all critics admitted to be an author of rare gifts, has not yet received general recognition either at home or abroad. Yet by his daring metaphors, his exuberant passions, his deep psychology supported by extensive historical studies, he is one of the most intimate guides to the depths of the Norwegian mind. His Hardanger novel, *The Avalanche* (1919–20), is considered his greatest work, but generally speaking he is at his best in the short story. Another classic writer is Trygve Andersen (1867–1920), a self-controlled author with a limited production.

Besides these three poet-artists and classics should be mentioned Johan Bojer (b. 1872), whose novels, notwithstanding their fame in the English-speaking world and elsewhere, are not considered by Norwegian critics as revealing any particular feature typical of the Norwegian mind. A more intimate author is Peter Egge (b. 1869), a conscientious writer with an artistic style which adds to his original gifts as a narrator and psychologist. These qualities are happily displayed in *Hanna Solstad* (1926), one of the finest novels written in recent years.

The most remarkable figure in recent Norwegian literature is, however, Madame Sigrid Undset (b. 1882) (*q.v.*), who holds a position of her own by her mighty cycles of historical novels, of which *Kristin Lavransdattar,* i.–iii., shows a remarkable psychological insight and a rare power of appreciating bygone ages.

One of the chief characteristics of Norwegian literature during the last generation is the ever-increasing number of local authors who, substituting particular districts for the country as a whole, have given rise to local literature, partly written in the literary tongue of the country known as the *riksmaal,* partly in the *landsmaal,* or in a *riksmaal* coloured to a marked degree by local dialects. The most conspicuous of these authors are Oskar Braaten, Hans Aanrud (b. 1863), who scored success as a playwright of broad humour in the '90s, and Johan Falkberget (b. 1879)—all typical East Norway novelists. Braaten's literary domain, not only as a playwright but as a novelist, is the industrial quarters of Oslo and its surrounding districts. Aanrud is a keen observer of life and manners in the midland countries round Lake Mjösen. Falkberget is intimately acquainted with the miners of the mountain districts of the valley of Österdalen.

Gabriel Scott has, in an idyllic novel, *The Source* (1918), found an exquisite expression of the typical Sörland (literally Southerland) nature and Sörland temper as they reveal themselves all through the charming coastland. West Norway country life has been ably sketched by Jens Tvedt (b. 1857), who writes in the *landsmaal.* The particular district of the North Trondhjem country, known as the valley of Namdalen, has in Olav Duun (b. 1876), whose works all deal with life and manners in his native valley, produced the most gifted author of modern times writing in the *landsmaal.* Another significant author in the same language is Kristofer Uppdal (b. 1878), originally a navvy, whose works are imbued by the ideals of the labour movement.

In poetry Niels Collett Vogt has continued to proclaim his emotions in stanzas of vigorous and beautiful metaphors. Olaf Bull (b. 1882) combines to a rare degree a refined versification with silent resignation and lofty enthusiasm. Herman Wildenvey (b. 1885), a genial troubadour talent, sings out his joys, his cares and his whims in easy verses and metaphors, striking for felicity of phrase. Simultaneously with this lyric flourishing in the *riksmaal,* no adequate revival has taken place in the *landsmaal.* The gem of lyric poetry in that tongue is still *Haugtussa,* a lasting tribute to the genius of Arne Garborg, by whose death the *landsmaal* literature lost its first rate lyric poet.

BIBLIOGRAPHY.—J. B. Halvorsen, *Norsk Forfatterlexikon* (1814–1880), 6 vols. (1885–1908); Kristian Elster, *Illustreret Norsk Literaturhistorie,* i.–ii. (1923–1924); I. Gröndahl and O. Raknes, *Chapters in Norwegian Literature* (1923); Francis Bull and Fredrik Paasche, *Norsk Litteraturhistorie,* 5 vols. of which have appeared (in 1924), vol. i. dealing with "Norway's and Iceland's literature until the end of the Middle Ages" (by Professor Paasche), and (in 1928) vol. ii. "Norway's Literature from the Reformation to 1814" (by Professor Bull). (S. C. H.)

**NORWICH** (nŏr'rĭj), **GEORGE GORING,** EARL OF (1583?–1663), English soldier, son of George Goring of Hurstpierpoint and Ovingdean, Sussex. He was knighted in 1608, and became a favourite at court, benefiting largely from monopolies granted by Charles I. He became Baron Goring in 1628, and privy councillor in 1639. When the troubles between Charles and his

parliament became acute Goring devoted his fortune freely to the royal cause; and the king in November 1644 renewed for him the title of earl of Norwich which had become extinct at his uncle's death. He went with the queen to Holland in 1642 to raise money for the king, and in the autumn of the next year he was seeking arms and money from Mazarin in Paris. His proceedings were revealed to the parliament in January 1644 by an intercepted letter to Henrietta Maria. He was consequently impeached of high treason, and prudently remained abroad until 1647 when he received a pass from the parliament under a pretext of seeking reconciliation. Thus he was able to take a prominent part in the Second Civil War of 1648 (*see* GREAT REBELLION). He commanded the Kentish levies, which Fairfax dispersed at Maidstone and elsewhere, and was forced to surrender unconditionally at Colchester.

He was condemned to death on March 6, but petitions for mercy were presented to parliament, and Norwich's life was spared by the speaker's casting vote. He then joined the exiled court of Charles II, by whom he was employed in fruitless negotiations with the duke of Lorraine. He became captain of the king's guard at the Restoration, and in consideration of the fortune he had expended in the king's service a pension of £2,000 a year was granted him.

He died at Brentford on Jan. 6, 1663.

**NORWICH,** city and county borough of Norfolk, England, 114 mi. N.E. by N. from London. Pop. (est. 1938) 122,300. Area 12 sq.mi. Served by the L.N.E., the L.M.S., and the M. and G.N. railways. Caistor-by-Norwich, 4 mi. S. of Norwich, is on the site of what was probably a Romano-British town. According to tradition Uffa made a fortification here about 570, but its history as a royal borough cannot be traced before the reign of Aethelstan (924–940), when it possessed a mint. After being destroyed by the Danes, Norwich enjoyed a period of prosperity under Danish influence and was one of the largest boroughs in the kingdom at the Conquest. Ralph de Guader, earl of East Anglia under William I, formed the nucleus of a French borough with different customs from the English, and after his forfeiture a castle was built and the centre of burghal life gradually transferred to the new community west of it. By 1158, when Henry II granted the burgesses a charter confirming their previous liberties, the two boroughs seem to have amalgamated. A fuller charter given by Richard I and confirmed by later sovereigns made Norwich a city enjoying the same liberties as London. The city lies in the valley of the Wensum, which joins the Yare immediately below. The ancient city lay in a deep bend of the Wensum, and the walls (1294–1342), with their many towers and 12 gatehouses, of which fragments only remain, were 4 mi. in circuit. These narrow limits, however, were outgrown even by 1671. Of the castle, only the early Norman square keep remains, with four tiers of arcading without, and an ornate doorway into the great tower. The building was acquired in 1884 by the corporation and in 1894 adapted as a museum and art gallery. It contains one of the finest collections of raptorial birds in Europe. The city established in 1608 a public library, the oldest provincial library with a continuous history.

The cathedral church of the Holy Trinity lies between the castle and the river. In 1094 the seat of the East Anglian bishopric was removed by Bishop Herbert de Lozinga or Lorraine from Thetford to Norwich, where in 1096 he laid the foundation of the cathedral and dedicated it in 1101, establishing at the same time a Benedictine monastery. As completed before the middle of the 12th century the cathedral was purely Norman; and it still retains its original plan. The Perpendicular spire belongs to the 15th century; the west window and porch and the lierne stone vaulting of the nave, with its 328 bosses, to the 15th, and to the 16th the vaulting of the transepts and Bishop Nix's chantry, while the fine cloisters, with 45 windows, were begun in 1297 and not completed till 1430. The chief entrance on the west is a Perpendicular archway, above which is a window of modern stained glass. The nave is divided by 14 semicircular arches, whose piers are in two instances ornamented with spiral mouldings. The triforium is composed of similar arches. The choir is of unusual length, and terminates in an apse. The oak stalls and *misereres* are of the 15th century. Of three circular apsidal chapels two remain. The War Memorial chapel (1932) replaced the old Lady chapel. In 1942 the cathedral was damaged in an air raid, the north transept suffering most. Two richly sculptured gateways lead to the cathedral—the Erpingham gate (1420) and the Ethelbert gateway (*c.* 1300).

The citizens obtained a charter (1404), making their city a county with a mayor and two sheriffs instead of four bailiffs, and Henry V added 24 aldermen and 60 common councilmen (1418). The cathedral precinct became parcel of the city at the Dissolution and in 1556 the neighbouring hamlets were incorporated in the county of Norwich. The charter of Charles II (1683) remained in force till 1835. The city in 1943 was governed by 16 aldermen and 48 councillors. The chief magistrate was created lord mayor in 1910. After 1298 Norwich was represented in parliament by two members. Two annual fairs, existing before 1332, were formally granted to the city in 1482. These have been succeeded by the Maunday Thursday horse and cattle fair, and the pleasure fairs of Easter and Christmas.

The market, which must have existed before the Conquest, was held daily in the 13th century, when citizens enclosed stalls by royal licence. Edward III made Norwich a staple town, and the importance of its trade in wool and worsted dates from his reign.

The majority of the Norwich churches are of Perpendicular flint work, mostly of the 15th century. Six churches and a synagogue were destroyed in 1942 during an air raid. At Carrow, east of the city, there remain the hall, a doorway, and other fragments of a Benedictine nunnery. The house in which Borrow resided with his parents when in Norwich is now a Borrow museum, and the Stranger's Hall, a 15th century house on Charing Cross, is an English Folk museum. In 1921 the city was presented with the Lazar House, a Norman relic contemporary with the cathedral, for a branch public library.

In 1925 Miss E. M. Colman, the first lady in England to be lord mayor, and her sister restored and presented to the city the 14th century Suckling House. The city Bridewell, late 14th century, is a museum of local industries, opened in 1925.

The grammar school is in a Decorated edifice, formerly a chapel of St. John, of *c.* 1316, with crypt below. Sir Edward Coke, Lord Nelson, Raja Brooke and George Borrow were educated here. St. Andrew's Hall is the seven-bayed nave of the Black Friars' church, rebuilt with the aid of the Erpinghams between 1440 and 1470. It is Perpendicular, with 28 clerestory windows and chestnut hammer-beam roof, and has served since the Reformation as a public hall. The guild-hall is a flint Perpendicular structure of 1408–13; the mayor's council-chamber, with furniture of the time of Henry VIII, is a specimen of a court of justice of that period.

The city regalia, kept here, include several objects of historical interest, among them a sword of a Spanish admiral captured by Nelson, with his autograph letter presenting it to the city, and a curious figure formerly used in the procession of the mayor elect through the city. A new city hall, however, was opened in 1938. The corporation owns an aerodrome on the outskirts of the city. The charitable institutions include St. Giles's or old men's hospital (an ancient foundation), and Doughty's hospital (1687).

The industries of Norwich include foundries and engineering works, ironware, brewing, brick works, chemical works, tanneries, and the production of mustard, starch, malt vinegar, chocolates, and crêpe, gauze and lace; and there are large boot and shoe factories.

The great cattle market lies below the castle.

The establishment of large housing estates on the outskirts of the city led to considerable changes in the centres of population.

**NORWICH,** a city of southeastern Connecticut, U.S.A., situated at the confluence of the Yantic and the Shetucket rivers to form the Thames. It is served by the Central Vermont and the New York, New Haven and Hartford railways and steamers to New York city. Pop. 1930, 23,021; 1940, 23,652 by federal census (native-born 75%). It is the seat of a state hospital for

the insane and a state tuberculosis sanatorium. Under a monument in Sachem street is buried the Mohegan chief Uncas, a friend to the early settlers; and in the eastern part of the city is a monument to Miantonomo, a Narragansett sachem who was put to death there. The channel of the Thames river is 25 feet deep to Norwich. Its manufactures are varied, including cotton and woollen goods, velvets, thermos bottles, locks, leather goods, shoes, paper boxes, textile printing, metals and machinery. Norwich was settled in 1659 by colonists from Saybrook, led by Capt. John Mason, who had crushed the Pequots in 1637, and the Rev. James Fitch, who became a missionary to the Mohegans. The land was bought from three Mohegan chiefs, and until 1662 the settlement was called Mohegan. It was the home of the Huntington family, which furnished many leaders in the civil and military affairs of the colony, the state and the nation; and the birthplace of Benedict Arnold, Mrs. Lydia H. Sigourney and Donald G. Mitchell ("Ik Marvel"). Before and during the Revolution the people of Norwich were ardent Whigs, boycotting English goods in 1767, ostracizing a schoolmaster (1770) who continued to drink tea, and disregarding the Stamp Act in 1776. The town was chartered as a city in 1784. The *Courier,* a newspaper established in 1796, is still published.

**NORWICH,** a city of New York, U.S.A., on the Chenango river and the Chenango trail, 42 mi. N.E. of Binghamton; the county seat of Chenango county. It has an airport, and is served by the Lackawanna and the New York, Ontario and Western railways. Pop. (1930) 8,378; (1940 U. S. census) 8,694. Norwich is a manufacturing city, in one of the principal dairying districts of the state. Its leading products are pharmaceutical preparations, condensed milk, silos, wire baskets, silk and knit goods, hammers and hangars. There are railroad shops there. Norwich was settled in 1792, incorporated as a village in 1857 and as a city in 1915.

**NORWOOD,** a residential area of London, England, partly in Surrey and partly in the county of London (metropolitan borough of Lambeth). The district is hilly and well wooded. It is divided into Upper, Lower, South and West Norwood.

**NORWOOD,** a town of Norfolk county, Massachusetts, U.S.A., 14 mi. S.W. of Boston, on the Neponset river, and served by the New York, New Haven and Hartford railroad. Pop. (1920) 12,627 (34% foreign-born white), 15,049 in 1930 and 15,383 in 1940 by federal census. It is a residential suburb, and it has important manufactures, notably the plants of three large printing and publishing houses. Norwood was incorporated (from parts of Dedham and Walpole) in 1872. Since 1915 it has had a municipal-manager form of government.

**NORWOOD,** a city of Hamilton county, Ohio, U.S.A., adjoining Cincinnati on the northeast. It is served by the Baltimore and Ohio, the Pennsylvania and the Norfolk and Western railways.

The population was 24,966 in 1920 (93% native white); 33,411 in 1930; 34,010 in 1940 by federal census. Developed originally as a residential suburb, it has extensive manufacturing industries, with an output in 1937 valued at $94,255,516. Playing cards, office furniture, safes, stationery, electric goods, pianos, tools and house furnishings are leading products, and there are large printing and lithographing establishments. Norwood was founded (as Sharpsburg) about 1798, laid out in 1873, incorporated as a village in 1888 and chartered as a city in 1903.

**NOSARI** or **NAVSARI,** a town in India, in the state of Baroda, and the capital of the Gaekwar's southern possessions. It lies on the left bank of the Purna river, 147 m. by rail N. of Bombay. Pop. (1941) 35,445. It is an ancient place, known to Ptolemy as Nasaripa. It was one of the earliest settlements of the Parsees in Gujarat, after their banishment from Persia in the 12th century. It is still the home of their *mobeds,* or sacerdotal class, and contains their most venerated "fire temple." The public buildings and the private houses, especially those in the suburbs, are unusually good.

**NOSE,** the organ of the sense of smell (*q.v.*) in man and other animals (*see* OLFACTORY SYSTEM).

**NOSOLOGY,** that branch of medical science which deals with classification of diseases; also, a collection of diseases.

**NOSSI-BÉ,** properly Nòsy-bé, *i.e.,* "Great island," an island about 8 m. off the N.W. coast of Madagascar, in 13° 23′ S., 48° 15′ E. It has an area of 130 sq.m. Nossi-bé is volcanic, the North and South parts of older, the central part of more modern date. There are numerous volcanic craters and crater-lakes. (Lòkobé, the highest point, is 1,486 ft. above the sea.) The climate is trying, but European colonization is, nevertheless, highly developed. Pop. about 10,000. Hellville, the chief town (pop. 2,500) is a port of call for the Messageries Maritimes and a centre for the coasting trade along the western shores of Madagascar. There is excellent anchorage. The soil is very fertile, and there are forests of palms and bamboos. The chief products are coffee, the sugar-cane, cocoa, vanilla and tobacco. There are numerous sugar factories and rum distilleries. Shellfish, shells, mother of pearl, pearls and sponges are objects of trade.

In 1837 Tsioméko, chieftainess of one of the numerous divisions of the Sàkalàva, was expelled by the Hova and fled to Nossi-bé and to the neighbouring islet of Nossi-komba. She accepted French protection in 1840, ceding such rights as she possessed on the N.W. coast of the mainland. The French took possession in 1841. Nossi-bé is placed under the administration of Madagascar (*q.v.*).

**NOSTRADAMUS** (1503–1566), the assumed name of MICHEL DE NOTREDAME, French astrologer, of Jewish origin, who was born at St. Remi in Provence on Dec. 13, 1503. After studying humanity and philosophy at Avignon, he took the degree of doctor of medicine at Montpellier in 1529. He settled at Agen, and in 1544 established himself at Salon near Aix in Provence. Both at Aix and at Lyons he acquired great distinction by his labours during outbreaks of the plague. In 1555 he published at Lyons a book of rhymed prophecies under the title of *Centuries,* which secured him the notice of Catherine de' Medici; and in 1558 he published an enlarged edition with a dedication to the king. The seeming fulfilment of some of his predictions increased his influence, and Charles IX. named him physician in ordinary. He died on July 2, 1566.

The *Centuries* of Nostradamus have been frequently reprinted, and have been the subject of many commentaries. Nostradamus wrote a number of smaller treatises. *See* Bareste, *Nostradamus* (Paris, 1840).

**NOTARY** or **NOTARY PUBLIC.** In Roman law the *notarius* was originally a slave or freedman who took notes (*notae*) of judicial proceedings in shorthand. The modern notary corresponds rather to the *tabellio* or *tabularius* than to the *notarius.* In canon law it was a maxim that his evidence was worth that of two unskilled witnesses.

The office of notary in England is a very ancient one. It is mentioned in the Statute of Provisors, 25 Edward III. stat. 4. The English notary is an ecclesiastical officer, nominated, since the Peterpence Dispensations Act 1533–34, by the archbishop of Canterbury through the master of the faculties (now the judge of the provincial courts at Canterbury and York), in order to secure evidence as to the attestation of important documents. All registrars of ecclesiastical courts must be notaries. A notary's duties, however, are mainly secular. "The general functions of a notary consist in receiving all acts and contracts which must or are wished to be clothed with an authentic form; in conferring on such documents the required authenticity; in establishing their dates; in preserving originals or minutes of them which, when prepared in the style and with the seal of the notary, obtain the name of original acts; and in giving authentic copies of such acts" (Brooke, *On the Office of a Notary*). The act of a notary in authenticating or certifying a document is technically called a "notarial act." In most countries the notarial act is received in evidence as a semi-judicial matter, and the certificate of a notary is probative of the facts certified. But English law does not recognize the notarial act to this extent. An English court will, in certain cases, take judicial notice of the seal of a notary, but not that the facts that he has certified are true, except in the case of a bill of exchange protested abroad. The file of a year's documents is often termed the protocol.

The most important part of an English notary's duty is the noting and protest of foreign bills of exchange in case of non-acceptance or non-payment. This must be done by a notary in

order that the holder may recover. He also prepares ship protests relating to mercantile matters, and authenticates and certifies copies of documents and attests instruments to be sent abroad. The office of notary is now usually held by a solicitor. In London he must be free of the Scriveners' Company.

In Scotland the office of notary is *munus publicum* and his notarial acts are probative. A roll of notaries public is kept, and under the Law Agents (Scotland) Act, 1873, any law agent is entitled to admission to the roll on payment of additional stamp duty. In addition to noting and protest of bills of exchange, notaries in Scotland have important functions in relation to completion of titles to land. They act as commissioners of the Sheriff Court of Chancery for taking affidavits in the process of service of heirs, they prepare and execute notarial instruments for giving service in land, and they may execute deeds notarially on behalf of persons who cannot write. Notaries also are supposed to keep their protocol books which are probative of the intimation of certain protests by mariners and others. Modern legislation, however, has made serious inroads on the exclusiveness of the notary's functions.

In France, notaries receive all acts and contracts to which the parties thereto must give or desire to give the authenticity attached to the acts of a public authority; they certify the date, preserve the originals and give copies or duplicates. Notaries are nominated by the president of the republic on the recommendation of the keeper of the seals. They cannot act as notaries and also practise as advocates, or hold any magisterial office, nor must they engage in business.

In the more important British colonies and in foreign countries generally notaries are governed by special statutory legislation.

In the United States, the President appoints notaries in the District of Columbia, and the governor alone appoints them in most States. Many states have laws limiting the numbers who may be appointed for a particular county, usually a number in proportion to the population. Notaries are not empowered to act outside their own states, and often not outside their own counties. In most cases their seals must be affixed to the affidavit or other document. They attest deeds and other instruments, take affidavits and depositions and protest bills of exchange. Certain other officials may have notarial functions in addition, such as commissioners of deeds in New York state.

**NOTE,** a mark, particularly a sign by which a musical sound (also called a note) is indicated in writing (*see* MUSICAL NOTATION). A comment or addition, added to a passage in a book, or a communication in writing shorter or less formal than a letter. The term is also applied to an abstract or memorandum of documents, speeches, etc., especially in the process of the transfer of land by fine and recovery (*see* FINE).

The ordinary distinction between note and letter is reversed in diplomacy. *Diplomatic notes* are written communications exchanged between diplomatic agents or between them and the ministers of foreign affairs of the government to which they are accredited. Sometimes, by agreement, a mere exchange of notes has the force of a convention. *Collective notes* are those signed by the representatives of several powers acting in concert. Sometimes *identical notes* are substituted for collective, *i.e.,* notes identical as to form and substance, but signed and delivered separately by the representatives of the several powers. *Circular notes* are those addressed by one power to the other powers generally. *Confidential notes* are directed to inspiring confidence by giving an explicit account of the views and intentions of the plenipotentiaries and their governments. The so-called *notes verbales* are unsigned, and are merely of the nature of memoranda of conversations, etc. *Notes ad referendum* are addressed by diplomatic agents to their own governments asking for fresh powers to deal with points not covered by their instructions. Diplomatic notes are usually, but not invariably, written in the third person.

For notes of hand or promissory notes *see* NEGOTIABLE INSTRUMENT and BILL OF EXCHANGE, and for notes passing as currency *see* BANKS, HISTORY OF, BANK-NOTES and POST.

**NOTHOMB, JEAN BAPTISTE,** BARON (1805–1881), Belgian statesman and diplomat, was born at Messancy in Luxemburg on July 3, 1805. He was educated at the Athenaeum of Luxemburg and the university of Liége. He was in Luxemburg when the revolution of August broke out, but was nominated a member of the commission appointed to draw up the constitution. He was a member of the national congress, and became secretary-general of the ministry of foreign affairs under Surlet de Chokier. He supported the candidature of the duke of Nemours, and joined in the proposal to offer the crown to Prince Leopold of Saxe-Coburg, being one of the delegates sent to London. When the Eighteen Articles were replaced by the Twenty-four less favourable to Belgium, he insisted on the necessity of compliance, and in 1839 he faced violent opposition to support the territorial cessions in Limburg and Luxemburg, which had remained an open question so long as Holland refused to acknowledge the Twenty-four Articles. His *Essai historique et politique sur la révolution belge* (1838) won for him the praise of Palmerston and the cross of the Legion of Honour from Louis Philippe. In 1837 he became minister of public works, and to him was largely due the rapid development of the Belgian railway system, and the increase in the mining industry. In 1840 he was sent as Belgian envoy to the Germanic confederation, and in 1841, on the fall of the Lebeau ministry, he organized the new cabinet. In 1845 he retired. He died at Berlin on Sept. 6, 1881.

*See* T. Juste, *Souvenirs du baron Nothomb* (Brussels, 1882); and F. de Ryckman de Betz, *Le Baron Nothomb et la question Luxembourg* (1918).

**NOTICE,** a term primarily meaning knowledge as in "judicial notice"; thence it comes to signify the means of bringing to knowledge, as in "notice to quit"; at last it may be used even for the actual writing by which notice is given. The most important legal uses of the word are judicial notice and the equitable doctrine of notice. Judicial notice is the recognition by courts of facts or events without proof. Thus in England and the United States the courts take judicial notice of the existence of States and sovereigns recognized by the sovereign of England, of the dates of the calendar, the date and place of the sittings of the legislature, etc. The equitable doctrine of notice is that a person who purchases an estate, although for valuable consideration, after notice of a prior equitable right, will not be enabled by getting in the legal estate to defeat that right. On the other hand, a purchaser for valuable consideration without notice of an adverse title is as a rule protected in his enjoyment of the property. Other common uses of the word are notice to quit, *i.e.,* a notice required to be given by a landlord to tenant, or by tenant to landlord in order to terminate a tenancy (*see* LANDLORD AND TENANT); notice of dishonour, *i.e.,* a notice that a bill of exchange has been dishonoured; notice of action, *i.e.,* a notice to a person of an action intended to be brought against him, which is required by statute to be given in certain cases; notice of trial, *i.e.,* the notice given by a plaintiff to a defendant that he intends to bring on the cause for trial; notice in lieu of personal service of a writ, *i.e.,* by advertisement or otherwise; notice given by one party in an action to the other, at a trial, to produce certain documents in his possession or power; notice to treat, given under the Land Clauses acts by public bodies having compulsory powers of purchasing land as a preliminary step to putting their powers in force. Notice may be either express or constructive. The latter is where knowledge of a fact is presumed from the circumstances of the case, *e.g.,* notice to a solicitor is usually constructive notice to the client. In the United States the doctrine of constructive notice is particularly important in view of the recording acts subordinating purchasers of real estate who have no actual notice of prior encumbrances on land to those whose rights have been placed on record in the registry of deeds, such purchasers being deemed to have constructive notice of whatever could have been discovered by an examination of the records. (*See* LAND TITLES.)

**NOTKER,** a name of frequent occurrence in the ecclesiastical history of the middle ages. NOTKER BALBULUS (*c.* 840–912) was a native of northern Switzerland, and for many years *magister* in the school of St. Gall. He compiled a martyrology and other works, but is famous for his services to church music and for the "sequences" of which he was the composer. He was canonized in

1513. His life is in the Bollandist *Acta Sanctorum,* April 6th. NOTKER LABEO (d. June 29, 1022) was also an instructor at St. Gall. His numerous translations, including those of the Old Testament Psalms, the categories of Aristotle, the *De nuptiis Mercurii et Philologiae* of Martianus Capella, and the *De consolatione* of Boëthius, into Old High German, may possibly have been the work of his pupils.

**NOTO,** city, Sicily, Italy, province of Syracuse, 20 mi. S.W. of it by rail, 520 ft. above sea-level. Pop. (1936) 18,923 (town), 29,992 (commune). The town, rebuilt after the earthquake of 1693, has some fine buildings of the early 18th century. The older town lies 10 mi. direct to the north (1,378 ft.). It was the ancient *Netum,* a city of Sicel origin, left to Hiero II. by the Romans by the treaty of 263 B.C. Little remains but the ruins of the mediaeval town.

**NOTRE DAME, UNIVERSITY OF,** situated at Notre Dame, Ind., on a campus of 1,200 acres, was founded in 1842 by the Rev. Edward Sorin, C.S.C., and six Brothers of the Congregation of Holy Cross, a religious community originating in France. The government of the University is vested in a corporation, which includes the trustees and an Associate Board of Lay Trustees, seven members of which are selected by the Alumni Association. The University is Roman Catholic, though seven per cent. of the student body is non-Catholic. Until 1865 the only courses offered were classics and letters. Science was added the same year and in 1869 a law course, the first at any Catholic college in the United States. Engineering was inaugurated in 1873 and commerce in 1920. The more important buildings are the Administration Building with administrative offices, classrooms and two dormitories, the University Chapel, the library (containing in June, 1935, 170,140 volumes). Special collections are the Zahm Dante library, the Edward L. Greene Botanical Library and the Wightman Memorial Art Gallery. Other buildings are Washington Hall, the student auditorium with a wing for the Department of Music, the buildings for science, law, architecture, chemistry, commerce (donated by E. N. Hurley), engineering (donated by J. F. Cushing of the class of '06), a gymnasium, post office, cafeteria, student infirmary and thirteen residence halls for students. The bachelor and master degrees are conferred in practically all courses offered and the degree of doctor of philosophy in chemistry, biology, metallurgy and philosophy only. In June 1935 the faculty consisted of 59 religious and 148 laymen. There were 2,709 students from 47 states and 13 foreign countries. (P.R.B.)

**NOTT, ELIPHALET** (1773–1866), American divine, was born on June 25, 1773 at Ashford (Conn.). He was pastor and teacher at Cherry Valley (N.Y.) (1796–97), pastor of the Presbyterian church in Albany (1798–1804), and thereafter president of Union college, Schenectady (N.Y.), a position which he held till his death on Jan. 29, 1866. He found the college financially embarrassed, but succeeded in placing it on a sound footing. He invented the first stove to burn anthracite coal.

**NOTT, SIR WILLIAM** (1782–1845), English general, was the second son of Charles Nott, a Herefordshire farmer, obtained a cadetship in the Indian army and proceeded to India in 1800. In 1839, he held a command at Quetta and in November 1840 he captured Khelat, and in the following year compelled Akbar Khan and other tribal chiefs to submit to the British. On receiving the news of the rising of the Afghans at Kabul in November 1841, Nott took energetic measures. On Dec. 23, the British envoy, Sir William Hay Macnaghten, was murdered at Kabul; and in Feb. 1842 the weak and incompetent commander-in-chief, General Elphinstone, sent orders that Kandahar was to be evacuated. Nott at once decided to disobey, on the supposition that Elphinstone was not a free agent at Kabul; and as soon as he heard the news of the massacre in the Khyber Pass, he urged the Government at Calcutta to maintain the garrison of Kandahar with a view to avenging the massacre and the murder of Macnaghten. In March he inflicted a severe defeat on the enemy near Kandahar, and in May drove them with heavy loss out of the Baba Wali Pass. In July he received orders from Lord Ellenborough, the governor-general of India, to evacuate Afghanistan, with permission to retire by Kabul. Nott arranged with Sir George Pollock, now commander-in-chief, to join him at Kabul. On Aug. 30 he routed the Afghans at Ghazni, and on Sept. 6 occupied the fortress, from which he carried away, by the governor-general's express instructions, the gates of the temple of Somnath; on the 17th he joined Pollock at Kabul. The combined army recrossed the Sutlej in December. (*See* AFGHANISTAN: *History.*) Nott was appointed resident at Lucknow and received the G.C.B. and a pension. He died at Carmarthen on Jan. 1, 1845.

**NOTTINGHAM, EARLS OF.** The English title of earl of Nottingham has been held by different families, notably by the Mowbrays (1377 to 1475; merged in the Norfolk title from 1397), the Howards (1596–1681), and the Finches (1681; since 1729 united with that of Winchilsea).

HENEAGE FINCH (1621–1682), first earl of Nottingham in the Finch line, lord chancellor of England, was descended from an old family (*see* FINCH, FINCH-HATTON), and was the eldest son of Sir Heneage Finch, recorder of London. He was educated at Westminster and at Christ Church, Oxford, and was called to the bar at the Inner Temple in 1645. He was a member of the convention parliament of April 1660, and shortly afterwards was appointed solicitor-general, being created a baronet. He sat in parliament for Oxford. In 1670 he became attorney-general, and in 1675 lord chancellor. He was created Baron Finch in 1674, and earl of Nottingham in May 1681. He died in Great Queen Street, London, on Dec. 18, 1682, and was buried in the church of Ravenstone in Bucks.

**NOTTINGHAM, CHARLES HOWARD,** 1ST EARL OF (in the Howard line) (1536–1624), English lord high admiral (also known as 2nd Lord Howard of Effingham), was the eldest son of William, 1st Baron Howard of Effingham, lord high admiral. He was nearly connected with Queen Elizabeth, his father's sister, Elizabeth Howard, being mother of Anne Boleyn. In 1559 he was sent as ambassador to France to congratulate Francis II. on his accession, and in 1569 was general of the horse under the earl of Warwick for suppressing the Roman Catholic rebellion in the north. The next year he commanded a squadron to watch the Spanish fleet which came to conduct the queen of Spain from Flanders. In the parliaments of 1563 and 1572 he represented Surrey, and succeeded to his father's title in 1573. He was installed a knight of the Garter in 1574, and made lord chamberlain of the household, an appointment which he retained till May 1585, when he became lord high admiral of England. He also filled the offices of lord lieutenant of Surrey and high steward of Kingston-upon-Thames. He was one of the commissioners at the trial of the conspirators in the Babington Plot and of Mary, queen of Scots, in 1586.

In Dec. 1587 he hoisted his flag on the "Ark." His letters at this time reflect vividly his sense of the impending danger. "For the love of Jesus Christ, Madam," he writes to Elizabeth, "awake thoroughly and see the villainous treasons round about you, against your Majesty and your realm, and draw your forces round about you like a mighty prince to defend you. Truly, Madam, if you do so, there is no cause for fear." On the approach of the Armada on July 6, 1588, Howard describes thus the disposal of his forces: "I have divided myself here into three parts, and yet we lie within sight of one another, so as if any of us do discover the Spanish fleet we give notice thereof presently the one to the other and thereupon repair and assemble together. I myself do lie in the middle of the channel with the greatest force. Sir Francis Drake hath 20 ships and 4 or 5 pinnaces which lie beyond Ushant and Mr. Hawkins with as many more lieth towards Scilly." He directed the various engagements (*see* ARMADA), and stayed himself to conduct the attack on the "San Lorenzo," stranded off Calais, arriving in consequence at the great fight off Gravelines some time after the engagement had begun. His tactics have been criticized both by contemporary and by later authorities. Instead of risking all in a pitched battle with the enemy, he resolved to pursue the less heroic method of "plucking their feathers little by little"; and his prudence, while justified by the extraordinary results, was also greatly praised by so good a judge as Raleigh. Shortly afterwards, under Howard's directions, a "Relation of Proceedings" was drawn up (now printed in the *Navy Records*

*Society Publications,* i 1–18).

In 1596 Howard and Essex commanded the expedition against Cadiz, when a squadron of the enemy's ships was destroyed and two of the number brought home. Essex insisted on landing, and Howard, who had been specially charged by Elizabeth to protect her favourite, was obliged to follow in his support. The town was sacked and the forts destroyed. Howard was created (Oct. 22, 1596) earl of Nottingham.

In February 1598, and again in 1599, when there were fears of invasion, Howard was appointed "Lord Lieut.-general of all England," and exercised full authority both over the army and the navy. He took a leading part in suppressing the rebellion of Essex, and served as a commissioner on his trial in 1601. It was to Nottingham that Elizabeth named James as her successor on her deathbed. He continued to hold office as lord high admiral under the new king, and in 1605 was despatched as ambassador to Spain, where he secured peace. He served on numerous commissions, including those on the union of the two kingdoms in 1604, for the trial of the conspirators of the Gunpowder Plot and of Henry Garnett in 1606, and for reviewing the articles and rules of the order of the Garter in 1618, and he attended Princess Elizabeth on her marriage to the elector palatine with a squadron to Flushing in 1613. Nottingham, who, unlike many of the Howards, was a staunch Protestant, was commissioner in Surrey for inquiring after recusants, and in the diocese of Winchester for hearing ecclesiastical causes; he sat on the government commission for discovering and expelling Roman Catholic priests, and was mentioned in 1602 from Douay as one of the three enemies most feared by the recusants.

On the report of the commission on the navy in 1618 and of the abuses then exposed, Lord Nottingham, though no blame was attached to himself, being now over 80 years of age, vacated his office of lord high admiral. He died at Haling house, near Croydon, on Dec. 14, 1624, and was buried at Reigate, a monument being afterwards placed to his memory in St. Margaret's church at Westminster. He was a striking and almost heroic figure in the Elizabethan annals. By his splendid character and services he was placed beyond the reach of the intrigues which troubled the reputation of many of his contemporaries.

Lord Nottingham married (1), in 1563, Catherine, daughter of Henry Carey, 1st Lord Hunsdon, (2), when in his 68th year, Margaret, daughter of James Stuart, earl of Murray.

**NOTTINGHAM,** a city, county borough, municipal and parliamentary borough and the county town of Nottinghamshire, England. Pop. (1938) 278,300. Area 25.3 sq.mi.

The highly advantageous position of Nottingham (*Snotengaham, Notingeham*) on the Trent, where it was crossed by an ancient highway, accounts for its origin. The Saxon form of the name is taken to refer to the caves, anciently used as dwelling-places, which were hollowed out in the Castle rock, in the Rock Holes west of the castle, in the suburb of Sneinton and elsewhere. It was chosen by the Danes for their winter quarters in 868, and constituted one of their five burghs. In 922 it was secured and fortified by Edward the Elder, who in 924 built a second "burgh" opposite the first and connected with it by a bridge over the river. In the time of Aethelstan, the successor of Edward the Elder, there was a royal mint there. In 1013 the town submitted to Sweyn. William I erected a castle, and mention of a new borough occurs in Domesday Book, and this seems to be the first evidence of the existence of the "French borough" which grew up in Nottingham under the Normans, and was distinguished from the English borough by the different customs which prevailed in it. Parliaments were held at Nottingham in 1334, 1337 and 1357, and it was the scene of the conference of the judges with Richard II in August 1387. David II of Scotland was imprisoned in the castle. Edward IV assembled his troops at Nottingham in 1461; and it was the headquarters of Richard III before the battle of Bosworth in 1485. In 1642 Charles I finally broke with the Parliament by setting up his standard at Nottingham, and during the ensuing Civil War the castle was held by each of the two parties more than once. In 1644 it was dismantled by Cromwell's orders.

The first charter (Henry II) confirmed to the burgesses the liberties they had under Henry I, referred to a market on Saturdays, and forbade the working of dyed cloth, except in Nottingham, within ten leagues of the borough. John confirmed this and granted a guild merchant. Henry III allowed the burgesses to hold the town in fee-farm, and Edward I granted them a mayor and two bailiffs, one to be chosen from each borough. Henry VI in 1448–49 confirmed all preceding privileges, first incorporated the mayor and burgesses, and granted that the town, except the castle and gaol, should be a county of itself. This grant was superseded by that of Victoria in 1897. Henry's charter remained, except for temporary surrenders under Charles II and James II, the governing charter of the corporation until the Municipal act of 1835. Nottingham returned two members to parliament from 1295 until 1885, when the number was increased to three, and again to four in 1918. Edward I granted an eight-days' fair in September and a fifteen-days' fair in November, the last altered by Richard II to a five-days' fair in February. Two other fairs were granted by Anne; one large fair, Goose fair, is still held. This begins on the first Thursday in October and lasts three days. The markets on Mondays and Saturdays are held by prescriptive right. Besides the Reform riots of 1831, Nottingham witnessed in 1811 the Luddite disturbances. In 1870 Nottingham was made the seat of a bishop suffragan in the diocese of Lincoln, but is now in the diocese of Southwell, created in 1884. In 1924 the Elizabethan Wollaton hall and park (744 ac.) were bought from Lord Middleton by the corporation. The hall in 1926 was made the natural history museum. In 1931 Sir Julien Cahn bought Newstead Abbey, 11 mi. N. of Nottingham, and presented it to the corporation. It was the home of the poet Lord Byron. In 1943 the city owned about 2.3 sq.mi. of parks and recreation grounds.

Nottingham stands on the Trent and Leen, 125 mi. N.N.W. of London by the L.M.S.R.; it is also served by the L.N.E.R. Water communications are afforded by the Grantham canal, the Nottingham and Erewash canals, communicating with the Cromford canal in Derbyshire, and by the Trent, which affords the city a highway to the sea. A railway line to Mansfield was opened in 1917, giving access to the docks at Immingham. An airport was established at Tollerton in 1938. The plan of the town is irregular and in the centre is an open market place $5\frac{1}{2}$ ac. in area, but no longer used for market purposes. Its successor is the Central market, opened in 1928. Nottingham castle occupies a fine site to the south, on an abrupt rocky hill. The ancient remains include a restored Norman gateway and fragments of the fortifications. The site was acquired on a 500-yr. lease from 1875 by the corporation, and the building was opened as the Nottingham and Midland Counties Art museum. The church of St. Mary is a Perpendicular cruciform structure, with a central tower. St. Peter's church is mainly Perpendicular, but shows traces of an earlier building.

The University college, opened in 1881, contains the free municipal library. New buildings were built for the college by Sir Jesse Boot (later Lord Trent) on the west side of the town, on a site of 220 ac. called Highfields, and were opened in 1928. The free grammar school, founded in 1513, for some time in disuse, was revived in 1807, and on its removal in 1868 to new buildings, became known as the High school. There are also the Nottingham High school for girls; the blue-coat school, founded in 1723; and the Nottingham school of art, for which a fine building was erected in 1865 in the Italian style. The Midland Baptist college was transferred from Chilwell to Nottingham in 1882. The new Council House was opened in 1929. The General hospital was founded in 1781.

To the northwest, but within the city boundaries, are the industrial districts of Radford and Basford, beyond which lies Bulwell, with collieries, limestone quarries and earthenware manufactories. To the north, Sherwood is a growing residential district; another extends toward Gedling on the east. Southward, across the Trent, West Bridgford is another large residential suburb. To the west is Lenton; and Beeston has become a populous suburb mainly owing to the establishment of large cycle and motor works.

Nottingham itself became an important seat of the stocking trade toward the close of the 18th century. It was here that Richard Arkwright in 1769 erected his first spinning frame, and here James Hargreaves had the year previously removed with his spinning jenny, after his machine had been destroyed by a mob at Blackburn. Nottingham has devoted itself chiefly to cotton, silk and merino hosiery. Up to 1815 point lace was also an important manufacture. In 1808 and 1809 John Heathcoat obtained patents for machines for making bobbin net, which inaugurated a new era in the lace manufacture. The industries also include bleaching, the dyeing, spinning and twisting of silk, the spinning of cotton and woollen yarn, hosiery and drugs; the leather industry has grown considerably, and manufacture of boots and shoes, furniture making, rubber manufacture, engineering and brewing, cycle works and particularly tobacco factories are important, and the industries, especially the iron and steel and manufacture of machinery, have the advantage of the close proximity of coal mines. There is a large cattle market and a new wholesale fruit and vegetable market was opened in 1938.

**NOTTINGHAMSHIRE,** a county of England, area 844 square miles. The highest land, in places exceeding 600 ft., is found in the west between Nottingham and Mansfield. The hills die away eastward towards the basin of the Trent and Idle. In the Dukeries portions of the Sherwood forest are still preserved.

**Early History.**—In the limestone caves near Cresswell implements of presumably the Paleolithic age have been found along with remains of the mammoth, cave-lion, rhinoceros, etc., otherwise Nottinghamshire does not seem to have been inhabited until Neolithic times. The chief evidences of settlement in the Neolithic and Bronze ages come from the more open county of the south-east. The town of Nottingham, even in pre-Roman times, seems to have marked the point where the Trent was crossed by the tracks along which salt was distributed from Cheshire and Worcestershire. The presence of river and forest seemed to have caused the Romans to deflect the course of the Fosse Way north-eastward from Leicester via Newark to Lincoln, and so they did not influence the history of the county profoundly. The earliest Teutonic settlers were an Anglian tribe who, not later than the 5th century, advanced from Lincolnshire along the Fosse Way, and settled in the fertile districts of the south and east. At the end of the 6th century Nottinghamshire already existed as organized territory, though its west limit probably extended no farther than the Saxon relics discovered at Oxton and Tuxford. Nottingham after the treaty of Wedmore became one of the five Danish boroughs. On the break-up of Mercia, Nottinghamshire was included in the earldom of the Middle English, but in 1049 it again became part of Leofric's earldom of Mercia. The first mention of the shire of Nottingham occurs in 1016, when it was harried by Canute. The boundaries have remained practically unaltered since the time of the Domesday Survey.

The most interesting historic figure in the Domesday Survey of Nottinghamshire is William Peverel. His fief represents the honour of Nottingham, and in 1068 he was appointed constable of the castle which William the Conqueror had raised at Nottingham. The chief lay tenant was Roger de Busli, while the majority of the church lands belonged to the archbishop of York. The Cliftons of Clifton and the Byrons of Newstead held lands in Nottinghamshire at the time of the Survey. Holme Pierrepoint belonged to the Pierrepoints from the time of Edward I.; Shelford was the seat of the Stanhopes, and Langer of the Tibetots, afterwards earls of Worcester. Archbishop Cranmer was a descendant of the Cranmers of Aslockton near Bingham. Of the old castles the principal remains are those at Newark, but there are several old mansions, as at Kingshaugh, Scrooby, Shelford, Southwell, Wollaton Hall, near Nottingham (*c.* 1580). The more modern mansions are Welbeck and others in the Dukeries (*q.v.*). Nottinghamshire was originally included in the diocese and province of York, and in 1291 formed an archdeaconry. After the Conquest several monastic establishments were founded, and at the dissolution of the monasteries there were no fewer than 40 religious houses. The only important monastic remains, however, are those at Newstead.

Until 1568 Nottinghamshire was united with Derbyshire under one sheriff, the courts and tourns being held at Nottingham until the reign of Henry III., when with the assizes for both counties they were removed to Derby. In the time of Edward I., the assizes were again held at Nottingham, where they are held at the present day. The Peverel Court, founded before 1113 for the recovery of small debts, had jurisdiction over 127 towns in Nottinghamshire, and was held at Nottingham until 1321, in 1330 at Algarthorpe and in 1790 at Lenton, being abolished in 1849.

In the Wars of the Roses the county as a whole favoured the Yorkist cause, Nottingham being one of the most useful stations of Edward IV. In the Civil War of the 17th century most of the nobility favoured the Royalist cause, but Nottingham Castle was garrisoned for the parliament, and in 1651 was ordered to be demolished.

**Industries.**—The malting and woollen industries flourished in Norman times. The latter declined in the 16th century, and was superseded by the hosiery manufacture which sprang up after the invention of the stocking loom in 1589. The earliest evidence of the working of the Nottinghamshire coalfield is in 1259, when Queen Eleanor was unable to remain on account of the smoke of the sea coal. Worksop was formerly famous for its liquorice. Numerous cotton mills were erected in Nottinghamshire in the 18th century, and there were silk mills at Nottingham. The manufacture of tambour lace existed in the 18th century, and was facilitated in the 19th century by the manufacture of machine-made net. Coal is mined chiefly around Nottingham, Mansfield and Worksop. Clay, sandstone and limestone are also extensively raised. Nottingham is the principal centre of the lace and hosiery industries. There are silk, worsted and cotton mills, machinery works and cycle and motor manufactures. The manufacture of tobacco is considerable at Nottingham and Hucknall.

In 1939, 403,155 ac. were under crops and grass, the most fertile land lying on the alluvium along the Trent. The chief grain crops were wheat and oats, with 48,522 ac. and 28,732 ac., respectively, barley occupying only 8,636 ac. Turnips and swedes at 10,211 ac. occupied almost as much acreage as potatoes and mangolds, while there were 22,111 ac. of clover and rotation grasses for hay. Beans occupied 4,505 and sugar beets 7,882 ac. Apples and pears are grown. The shire raises cattle, chiefly shorthorn, and dairying is extensively practised. Sheep are not numerous, the chief breed being Leicesters and various crosses.

**Communications, Population.**—The L.M.S.R. and L.N.E.R. serve the county. The Trent is navigable throughout the county and the Idle between Bawtry and the Trent. A few canals centre upon Nottingham. There were 1,371 mi. of roads in the county in 1943. Area of administrative county 818.5 sq.mi.; pop. (1938) 470,900. Population movements of World War II had raised the population of Nottinghamshire by only 1% by Feb. 1941. The county contains the city and county and municipal borough of Nottingham, the municipal boroughs of Retford or East Retford, Mansfield, Newark and Worksop, and ten urban districts. For parliamentary purposes the county is divided into five divisions (Bassetlaw, Broxtowe, Newark, Rushcliffe and Mansfield), each returning one member; and Nottingham returns one member for each of its four divisions. There is one court of quarter sessions, and there are seven petty sessional divisions. The shire, which contains six wapentakes, is in the diocese of Southwell.

See *Victoria County History, Nottinghamshire;* R. Thoroton, *The Antiquities of Nottinghamshire* (Lond., 1677; republished with additions by J. Thoresby, 3 vols., London, 1797); Thomas Bailey, *Annals of Nottinghamshire* (4 vols., 1852–56); J. P. Briscoe, *Old Nottinghamshire* (1881); J. Ward, *Descriptive Catalogue of Books relating to Nottinghamshire* (Nottingham, 1892).

**NOÜMENON,** a philosophical term put into currency by Kant and not much used except in definite reference to his doctrine. In the Kantian system the term "noümena" means things in-themselves as opposed to "phenomena" or things as they appear to us. According to Kant the human mind is such that it can never penetrate by its speculative powers to things-in-themselves, but can only know phenomena. Thus we have the odd position that noümena, or the contents of the intelligible world, are just the things to which thought can never penetrate. The term,

however, is a relic of an early period of Kant's mental development. In his fully mature or critical position he held that the noümenal was inaccessible to the speculative reason, and yet that we are not altogether excluded from it, since the practical reason, *i.e.*, our capacity for acting as moral agents, assures us of the existence of a noümenal world wherein freedom, God and immortality have a real place.

The relation of noümena to phenomena in the Kantian system is a most difficult one; and, in view of the fact that the acutest intellects in Europe have been engaged vainly for more than a century in reconciling the various passages on the subject, the safest conclusion is that they are irreconcilable. The course adopted by Kant's immediate successors in German idealism was to reject the whole conception of noümena, for the reason that what is essentially unknowable has no existence for our intelligence. Kant, however, protested strongly against this development when it was propounded by Fichte, and held that he had precluded it by his "refutation of idealism": he stood unshakably to the belief in an absolutely real world behind phenomena.

Kant's position may be illogical as he himself stated it, but it is the expression of a sound principle: we must connect it with his general tendency to recognize the dynamic side of things. He saw, what so many of his successors failed to see, that the world as we know it is an expression of power; and he could not imagine whence the power could come if not from a world beyond phenomena. (*See* KANT; PHENOMENON.)

**NOVA.** A nova may be defined as a variable star which brightens up for a short time to a luminosity far exceeding that of its normal condition, and does so only once over a long interval of time. The facts observed are (1) a very rapid brightening (frequently many thousandfold in two or three days) followed by a slower fluctuating fall in brightness; (2) a steady sequence of changes in the star's spectrum, which in the beginning consists of lines, due to ionized atoms of such elements as calcium, iron and titanium, and finishes with those due to ionized atoms of oxygen, nitrogen and helium; (3) the rapid expansion of a disc round a central bright nucleus, with evidence of complex internal motions.

The first nova which counts in modern astronomy was that of Tycho Brahe, *N Cassiopeiae,* 1572, the first nova definitely allotted not to the solar system but to the stellar universe by measure of its distance. This nova was brighter than Jupiter or Venus, was easily visible at midday, and remained a naked-eye object for 16 months. *N Coronae Borealis,* 1866, was the first nova to be examined through the spectroscope, and its spectrum was found by Sir William Huggins to consist of bright hydrogen lines on a continuous spectrum which also showed many absorption lines. Ten years later Cornu noticed that the bright line spectrum of *N Cygni,* 1876, was very like that of the chromosphere, the layer of the sun's atmosphere which flashes into view just as the disc of the sun passes behind the moon at a total eclipse. This was amply confirmed in the case of later novae, the next point to be noticed being that this spectrum is in general, at discovery, a dark line spectrum; the dark lines are always displaced markedly to the violet, suggesting that the gases which give rise to them are moving rapidly towards the observer.

The majority of novae appear either in the Milky Way, *i.e.*, with galactic latitudes less than 20°, or else in spiral nebulae. In the Milky Way they are concentrated in the direction of the star clouds of *Sagittarius,* in galactic longitude, 320° to 340°, and judging from analogy with the 86 novae discovered mainly by Hubble in the *Andromeda* nebula, this means that the conditions are most favourable for the production of novae in the central regions of the Milky Way and of the spiral nebulae. Many novae settle down again as faint variable stars of about their initial magnitude, showing very little sign if any of the upheaval through which they have passed. The range of magnitude involved in their outbursts may be from 9 to 14 magnitudes, the rate of rise just before maximum varying from 7·6 to $0.^{m}2$ *per diem,* the rate of fall, *per diem,* being from 10 to 50 times as slow. The brightness at maximum is probably about −5·0 absolute magnitude, though values have been found ranging from 0·0 to −15·4 absolute magnitude. In general it may be said that the more violent the outburst, the greater the contrast between the rates of rise and fall, and the more rapidly the star runs through its spectral changes.

To explain the startlingly high velocities of the out-rushing gases, reaching at times the value of 3,000km. sec. or $\frac{1}{100}$ the velocity of light, E. A. Milne has advanced the theory that a sudden brightening of a stellar nucleus, with the accompanying increased pressure of radiation, involves the blowing out of the gases of the outer atmosphere of the star with accelerations which might easily lead to limiting velocities of the values found in novae. Atoms just balanced under gravity and radiation pressure are driven outwards by the increase in the radiation pressure; they then absorb light of a shorter wave-length coming from the star and are no longer screened by the intervening layer of atoms which absorb light of the wave-length which has been mainly involved in supporting them before the outburst. A stream or shell of atoms thus driven out gives the dark lines displaced to the violet which are seen by the distant observer. It is possible to explain in terms of Milne's theory many of the miscellaneous complications observed in the multiple dark lines with their varying shifts, but, as special assumptions have to be made for each complication, it is wiser at this stage of our knowledge not to strain the one hypothesis but to wait the ripe time for further simplifications.

It remains to be asked what leads to the sudden brightening of a faint star, which results in the production of the aforementioned phenomena. There are two main lines of explanation available. Newton was one of many enquirers who have looked outside the star for the source of the necessary energy and have postulated collision or the inflow of matter as the exciting cause. Laplace held the view that a great surface conflagration of a star was all that was involved and this view has been held in varying form by many others. The breakdown of equilibrium in a cooling star through chemical combination at low temperature, through radioactive forces, or through unstable pulsations, have all been suggested, as have also tidal eruptions through the close passage of a second star or companion. The latter theory is the bridge to the view that we have a collision between a star and a planet or comet, or even a collision between two stars. The frequency of the phenomenon makes an explanation in terms of the collision of two stars difficult to accept, and Seeliger's view, that what we behold in a nova's outburst is the result of a star (or a binary star) entering into a nebula, seems on the whole the best solution of the problem so far proposed. E. W. Brown has worked out the effect to be observed when a star enters a nebula, and his picture closely resembles what the camera shows at the present time for the region round *N Persei,* 1901—a spherical expanding shell and a fan-like appendage on one side of the star. In the case of this star there was evidence of nebulosity round the star at the time of outburst. It seems then not unlikely that some of the novae are to be explained in terms of Seeliger's hypothesis of an encounter of a star with dark nebulosity. Differences between the behaviour of various novae may well argue against a common cause for the initial brightening of all novae. It is, perhaps, fairest to return an open verdict on the cause for the nova's original brightening, though we can now follow with reasonable certainty the main effects which follow the great outburst of radiation.

See *Handbuch der Astrophysik, Bd. VI.* (1927). (F. J. M. S.)

**NOVALICHES, MANUEL PAVIA Y LACY,** 1ST MARQUIS DE (1814–1896), Spanish marshal, was born at Granada on July 6, 1814. In 1833 lieutenant in the guards of Queen Isabella II., he became general of division during the Carlist war (1833–40). Senator in 1845, war minister in 1847, and marquis in 1848, he went out to Manila in 1852 as captain-general of the Philippine Islands, crushed a formidable insurrection in 1854 and carried out many useful reforms. He commanded the reserves in the Peninsula during the Moroccan war, twice refused the war portfolio offered him by O'Donnell and Narvaez, and when the revolution broke out in September 1868 accepted the command of Queen Isabella's troops. He was defeated by Marshal Serrano at the bridge of Alcolea on September 28, 1868, and was so badly wounded in the face that he remained disfigured for

life. He kept apart during the revolution. The Restoration made him senator, and King Alfonso gave him the Golden Fleece. He died in Madrid on Oct. 22, 1896.

**NOVALIS,** pseudonym of Friedrich Leopold, Freiherr von Hardenberg (1772–1801), German poet and novelist, one of the pioneers of the Romantic movement, was born on May 2, 1772, on his father's estate at Oberwiederstedt in Prussian Saxony. He studied philosophy at Jena, and law at Leipzig and Wittenberg. At Tennstedt, near Langensalza, he was betrothed to Sophie von Kühn. He became auditor to the salt works at Weissenfels where he heard (1797) of Sophie's death. He expressed his grief in the beautiful *Hymnen an die Nacht,* in which the religious poetry of the Romantics reaches its greatest height. He then entered the Mining Academy at Freiberg, in Saxony, to study under A. G. Werner, whom he immortalized as the "Master" in *Die Lehrlinge in Sais.* In the autumn of 1799 he read to the circle of young Romantic poets at Jena his *Geistliche Lieder.* In 1800 he was appointed local magistrate in Thuringia, and after a short illness he died at Weissenfels on March 25, 1801.

His all too short life did not permit him to blend his mystic and philosophical conceptions into a harmonious whole. His longest work was the unfinished romance, *Heinrich von Ofterdingen;* its hero's search for the mysterious blue flower is an allegory of the poet's life. More popular, however, are his shorter lyrics.

There are editions of the collected works of Novalis by E. Heilborn (3 vols., 1901), and by J. Minor (3 vols., 1907; rep., 1923). His *Briefwechsel* with the Schlegels was edited by J. M. Raich in 1880. *See* also E. Heilborn, *Friedrich von Hardenberg* (1901); T. Carlyle's essay on "Novalis"; Obenauer, *Novalis Gesammelte Studien* (1925); H. Hesse and Isenburg, *Novalis. Documente seines Lebens und Sterbens* (1925).

**NOVARA,** town and episcopal see, Piedmont, Italy, capital of Novara province, 31 mi. by rail W. of Milan, 538 ft. above sea-level. Pop. (1936) 52,269 (town), 62,570 (commune). Till 1839 circled by Spanish ramparts, Novara is now an open, modern town. The cathedral, except for the octagonal dome-roofed baptistery (10th century), was rebuilt (1863–65); the church of S. Gaudenzio, dedicated to Bishop Gaudentius (d. 417), who is buried under the high altar, rebuilt by Pellegrino Tibaldi about 1570, has a baroque campanile and a dome (1875–78) 396 ft. high. The city also contains handsome market buildings erected in 1817–1842, a large hospital dating from the 9th century and a court-house constructed in 1346. The town has also a museum of Roman antiquities. The principal industry is the carding and spinning of silk; there are also iron-works and foundries, cotton mills, rice-husking mills, organ factories, dye-works, printing and map-making works.

Novara, the ancient *Novaria,* lay on the road between Vercellae and Mediolanum. Its rectangular plan probably survives from Roman days. A dukedom of Novara was constituted by the Lombards, a countship by Charlemagne. In the 12th century it accepted the protection of Milan. In 1706 it was occupied by Savoy troops. At the Peace of Utrecht it passed to Austria with Milan; but was granted to Charles Emmanuel in 1735. Under the French it was the chief town of the department of Agogna. Restored to Savoy in 1814, it was in 1821 the scene of the defeat of the Piedmontese by the Austrians, and in 1849 of the more disastrous battle which led to the abdication of Charles Albert and an Austrian occupation of the city.

Novara was the scene of a battle on March 23, 1849, between the Austrians, 70,000 strong with 182 guns, under Radetsky and King Charles Albert, who led the Sardinian forces, 65,000 men with 140 guns. Chzarnowski, a Pole, virtually directed the army. Armistice, concluded Aug. 9, 1848, was to terminate March 20. Radetsky retreated from Milan on March 17, feigning to retire to Lodi-Cremona, but on reaching San Angiolo he made for Pavia, crossing the Ticino on March 20. Meanwhile Chzarnowski marched on Magenta without encountering the enemy, but here news reached him that the Austrians were at Pavia; thereupon he halted the army and turned it back to Vigevano. Radetsky had advanced so swiftly that Ramorino's Sardinian division south of the Po was cut off, the bridge at Mezzano Corte being destroyed, though it had orders to stand at Cava, threatening the hostile advance. Fighting took place at Mortara on March 21, the Sardinians falling back on Novara, where Chzarnowski decided to await Radetsky. A corps of Austrians approached Novara and engaged the whole Sardinian army on March 23. Seriously outnumbered until reinforcements arrived, the Austrians fought with great tenacity and before the end of the day had driven the Sardinians back in confusion. Charles Albert abdicated that night.

**NOVA SCOTIA,** a province of the Dominion of Canada, lying between 43° 25′ and 47° N. and 59° 40′ and 66° 25′ W., and composed of the peninsula proper and the adjoining island of Cape Breton (*q.v.*). The extreme length from southwest to northeast is 376 mi. (N.S. 268, C.B. 108); breadth 60 to 100 mi.; area 21,068 sq.mi. The isthmus of Chignecto, 11½ mi. wide, connects it with the province of New Brunswick.

**Geology and Physical Features.**—Nova Scotia may be described as an ancient mountain land almost completely worn down. The original folds apparently ran either east or northeast and were complicated by intrusive granite in the country southwest of Halifax. The fact that some Carboniferous beds, at any rate, transgress upon the worn folds, indicates that the folding is either Carboniferous or earlier in date. The general disposition of the folds seems to be indicated in the coast-line and in the lines of higher land, which, however, rarely reach above the 1,000 ft. level, save in the Cobequid mountains, which rise to a few feet above this figure. They occupy the neck between New Brunswick and Nova Scotia, and represent the axis of a fold. The Chignecto bay to the northwest, and the Minas basin and Cobequid bay to the south, indicate by their directions the divergence of the old worn folds of Nova Scotia on the one hand, and of St. John, New Brunswick, on the other. Around the southeast of the Bay of Fundy are horizontal Triassic deposits including volcanic elements, which give rise to a precipitous coast from Brier island to Cape Split. The western railway of Nova Scotia runs on low ground between this structural feature and the main mountain fold-axis farther southeast. This feature is broken at Digby Gut, and a portion of the lowland within it is submerged as the long Annapolis basin (called the garden of Nova Scotia).

One of the last geological changes has been a land-sinking, which has given rise to the remarkable succession of cliff-fringed rias, with islands offset along the Atlantic coast, Halifax harbour being the most famous of these. The north shore is, as a rule, low, and Pictou has its chief harbour.

Cape Breton island is essentially a continuation across the narrow strait of Canso. The granitic southwest is rugged and barren, with many small lakes and peat bogs. The coasts of the province are famous for their tides. Though they rarely exceed 8 ft. at Halifax, they are said to average 42·3 ft. in the Bay of Fundy, and 53 ft. at the top of the funnel in Cobequid bay.

**Climate.**—The maritime influences are more marked in this province than in New Brunswick (*q.v.*). The average rainfall is between 40 and 45 in., except along the southern coast-line, where it is nearly 10 in. greater. The winter snowfall is slight.

**Area and Population.**—The area of the province is 21,068 sq.mi. of which 20,743 are land and 325 water. The population (census of 1941) numbers 577,962. At the census after confederation (1871) it stood at 387,800, an increase in 70 years of only 49%. The great majority of the people, over 75%, are of British race, either direct or through American loyalists. The Acadian French, including nearly 7,000 in Cape Breton island, constitute about 11%.

**Government and Public Finance.**—The government of Nova Scotia is based on the (imperial) British North America Act of 1867 and its amendments, together with all pre-confederation institutions, including the Common Law, except as altered or abolished by confederation itself or later imperial statutes. The act provided representation in the senate (12 members 1867–72; 10, 1873–1940) and a membership in the house of commons at Ottawa adjusted according to population after each census, 12 in elections of 1940, and distributes federal and provincial powers. The administration of Nova Scotia consists of a lieutenant-governor, appointed and paid by the dominion, and by custom a resident of the province; a prime minister and cabinet on the rec-

ognized constitutional model and a non-political civil service: the judges are appointed by the dominion. There is a legislative assembly sitting at the capital, Halifax, 30 members elected for five years unless sooner dissolved. Municipal government in Nova Scotia, as in all the maritime provinces, is less developed than in central Canada. In 1940 there were in Nova Scotia 24 rural municipalities of which 12 are counties and 12 represent 6 divided counties. With these are two incorporated cities, Halifax (70,488) and Sydney (28,305) and 43 incorporated towns. The provincial revenue of Nova Scotia was $525,000 in 1871 and $16,443,000 in 1940, an increase from $1.35 per capita to $28.45.

**Education.**—Primary public education is compulsory, free of charge and non-denominational. Ordinary day schools of this character had in 1940 an enrolment of 117,168 pupils (average attendance 93,350) as against 2,719 in denominational and private schools and 740 in "business colleges." The number of teachers in public schools (1940) was 3,429 of whom 2,119 received salaries from $325 to $725 a year. The universities of the province include King's college, Anglican, established at Windsor, Nova Scotia in 1790 but after 1923 amalgamated with Dalhousie university for all subjects except divinity; Dalhousie university, Halifax, established in 1818; St. François Xavier, Antigonish, Roman Catholic (1866) and Acadia university, Wolfville, Baptist (1839). The college and university enrolment of 1940 showed 22,666 students in regular university courses.

**Commerce and Manufactures.**—Nova Scotia is naturally a sea-going province, and till about 1881 had the largest tonnage, in proportion to population, in the world. Halifax is still one of the chief winter ports of the dominion, and Sydney is also a favourite port of call for steamers in need of "bunker" coal. The water power provided by the rivers supports many manufactures. Several sugar refineries exist.

The fisheries of Nova Scotia are the next most important in Canada, after those of British Columbia. Lobsters, cod and mackerel, herring and haddock, constitute the bulk of the catch. Many boats are also fitted out in Lunenburg, Digby, Yarmouth and other ports for the Grand Banks of Newfoundland. A large number are employed in the lobster canneries and other kindred industries. Trout and salmon abound in the lakes and streams.

The fully classified returns just before the outbreak of war in 1939 showed the manufactures of Nova Scotia as having 13,131 employees, of whom 2,252 were in the iron and steel industry, 1,944 in fish processing, 1,781 in sawmills.

**Lumber.**—Lumbering was long the chief industry of the province, and is still very important, though the forest left uncut is only some 12,000 sq.mi. The network of small lakes and rivers enables the logs to be brought to the mills with great ease, and little rough timber is now exported. The chief trees include spruce, fir, pine, birch, oak and maple. The manufacture of wood-pulp for paper is also carried on.

Returns made before the war in 1939 showed the lumber production of Nova Scotia to be 152,721M.ft.b.m.

**Minerals.**—Bituminous coal is mined in various parts of Cape Breton (*q.v.*) and in the counties of Cumberland and Pictou. The seams dip at a low angle, and are of great thickness, especially in Pictou county. The known coal fields cover some 1,000 sq.mi. Other important centres are Springhill, Acadia Mines, Stellarton and Glace Bay (C.B.). It is shipped as far west as Montreal, and to the New England states. The by-product industries are very important. Iron is largely produced, chiefly in the vicinity of the Cumberland and Pictou coal fields. The deposits include magnetite, red haematite, specular, limonite and carbonate ores. Blast furnaces are in operation, especially at New Glasgow, Sydney and North Sydney, though most of the ore used at Sydney is imported from Newfoundland. The quarries of easily worked limestone, the product of which is used as a "flux" in the blast furnaces, add to the value of the iron deposits. Gold occurs in workable quantities in the quartz all along the Atlantic coast. Large deposits of gypsum occur, especially at Windsor, in Hants county. Manganese and copper are also worked on a small scale.

Classified statistics of mineral production for 1940 showed a total value of $33,318,587: gold, fine oz., 22,219; coal, 7,848,921 tons, valued at $28,766,195; gypsum, 1,278,204 tons, valued at $1,302,347.

**Agriculture.**—The attention paid to lumbering, fishing and shipping, and the subsequent emigration westwards have lessened the importance of this industry. Mixed farming is, however, largely carried on, and dairy farming has been greatly extended. Nova Scotia is specially famous for its fruits, the export of apples being the main feature. The centre of this industry is the valley of the Annapolis. At the head of the Bay of Fundy and on Minas basin the low-lying meadows produce splendid crops of hay and good pasture, while the cool climate and moisture make the region well suited for dairy farming and stock raising.

Statistics show the total agricultural land of Nova Scotia, actual and available, as 12,640 sq.mi. or 60·9% of the land area of the province. Of this area 2,810 sq.mi. were represented in 1943 by farm lands and pasture; 6,910 sq.mi. as still needing clearing, and the rest unoccupied grass and brush land.

**Communications.**—The geography of Nova Scotia and the great number of harbours make communication by sea a principal feature. The Canadian National railway (succeeding the government Intercolonial) connects with Halifax *via* Moncton and Truro with a branch to Sydney. The Canadian Pacific connects from St. John, N.B., *via* steamer ferry to Digby and to Halifax and also westward to Yarmouth. The total railway mileage in 1943 was 1,420. The province had 14,959 mi. of motor roads. The Trans-Canada air mail and passenger service was extended from Montreal to Moncton, N.B., in 1940 and in the same year from Moncton to Halifax. Telegraph and telephone connections extend throughout the province with Atlantic cables at Canso and Sydney.

**History.**—Nova Scotia may well have been the Markland of early Norse and Icelandic voyages, and Cape Breton was visited by the Cabots in 1497–98, but not till 1604 was any attempt at permanent colonization made by Europeans. In that year an expedition was headed by a Frenchman, Pierre du Guast, Sieur de Monts (1560–*c.* 1630), who had received from Henry IV full powers to explore and take possession of all lands in North America lying between the 40th and 46th parallels of north latitude. De Monts and his friend de Poutrincourt (d. 1615), endeavoured to form settlements at Port Royal (now Annapolis), St. Croix (in New Brunswick) and elsewhere, but quarrels broke out with the Jesuits, and in 1613 the English colonists of Virginia invaded the settlement and expelled the greater part of the inhabitants. In 1621 Sir William Alexander obtained from James I a grant of the whole peninsula, which was named in the patent, Nova Scotia, instead of Acadia, the old name given to the colony by the French. During the reign of Charles I the still existing order of baronets of Nova Scotia was instituted, and their patents ratified in parliament. The Treaty of St. Germain-en-Laye (1632) confirmed France in the possession of Acadia, Cape Breton and New France; but fierce feuds broke out among the French settlers, and in 1654 a force sent out by Cromwell took possession of the country, but by the Treaty of Breda (1667) it was restored to France by Charles II. Continual fighting went on between the French and the British colonists of New England, the Indians taking part, usually on the side of the French; in 1710 the province was finally captured by Great Britain and ceded to her in 1713 by the Treaty of Utrecht, under the name of "Acadia or Nova Scotia," the French remaining masters of Cape Breton. In 1749 Halifax was founded as a counterpoise to Louisbourg in Cape Breton, and over 4,000 colonists sent out.

Shortly after the foundation of Halifax occurred that expulsion of the Acadians in 1755 which remains, not in magnitude but in significance, one of the great episodes of American history, celebrated afterwards in Longfellow's *Evangeline*. Some 3,000 Acadians were removed from their settlements on Minas Basin and elsewhere, and transferred, with no compensation for property or livestock, to various American colonies. Those who found their way back later on made new homes mostly in New Brunswick. The plea of the British government was that these Acadians had since the Treaty of Utrecht a status rendered impossible by

recurrent war with France.

In 1758 the province of Nova Scotia was accorded an elective representative assembly in view of a decision of the British law officers that this was an inherent privilege of British settlers overseas. The precedent has remained of great importance. During the American Revolutionary War a large number of Negroes were set free by British armed forces and transported as free men to Nova Scotia. These, with freed Negroes from Jamaica, originated the Negro population of today. In 1769 Prince Edward island (formerly Isle St. Jean) was made a separate government. An influx of American Loyalists led in 1784 to the erection of New Brunswick into a separate colony.

During the wars of the American and French revolutions Halifax grew apace. Between 1784 and 1828, a large Scottish emigration, chiefly from the Highlands, had settled in the counties around Pictou, and the lumbering industry rose to great proportions. Agriculture was neglected, but in 1818 the letters of "Agricola" (John Young, 1773–1837) gave it an impetus.

After peace in 1815, the middle 19th century witnessed a great economic advance in Nova Scotia due to the fisheries, the timber trade and the building of wooden ships. Nova Scotia shipbuilding seemed (1846) to be conquering the world, with 2,583 vessels as against 605 for Canada, representing one third as much tonnage as that of France. But political life lagged behind owing to the peculiar privileges of a small official class and the Anglican Church. Hence a movement for reform by responsible government, as in Upper Canada, led by Joseph Howe, whose "twelve resolutions" of 1836 became the platform of reform. Refused for years, responsible government (1848) came painlessly as a result of its institution in Canada. The political struggle was interwoven with an agitation for free secular education (1864) and for reorganizing Dalhousie university on a secular basis. Dr. Charles Tupper (Sir Charles, 1873) of Amherst, Conservative, and "Joe" Howe, Liberal, were the great protagonists of the province at this period. Tupper's influence carried confederation (1867) but only by a legislative, not a popular, vote. The province was rent by the subsequent agitation for repeal, weakened by Howe's defection (1869) (to enter the dominion cabinet) but never lost from Nova Scotia politics. In the middle '80s it took the form of secession into a maritime union, sponsored by W. S. Fielding as the platform of election in 1886 and carried by a legislative vote of 2 to 1. The imperial government joined the dominion in getting "better terms" for the maritime provinces, but opposed secession.

Nova Scotia had prospered greatly between 1855 and confederation as the result of British trade and the reciprocity treaty (1854) with the United States. The abrogation of the reciprocity in 1866 and the embrace of the Canadian tariff on manufactures after 1867 were followed by a change of fortune never alleviated. Politics in the 20th century have largely turned on this unsatisfactory economic status in spite of the changes effected by the steel and coal industries, by local manufactures and by the construction of the railway systems and the development of Halifax (along with St. John, N.B.) as Canadian winter ports. In the period between World Wars I and II, attention continued to be turned on economic relations with central Canada, the subject of various investigations and reports. Two royal commissions (Duncan commission, 1926; Jones commission, 1934) investigated and reported in favour of better "terms" for the province.

BIBLIOGRAPHY.—*Canadian Census; Canada Year Book* (annual); *Canada and Its Provinces,* 23 vols., 1912; T. C. Haliburton, *Nova Scotia* (1829); Beckles Willson, *Nova Scotia* (1912). (S. LEA.)

**NOVATIANUS,** Roman presbyter, and one of the earliest antipopes, founder of the sect of the Novatiani or Novatians, was born about the beginning of the 3rd century. On the authority of Philostorgius (*H.E.* viii. 15) he has been called a native of Phrygia. He was ordained at Rome by Fabian, or perhaps by an earlier bishop; and during the Decian persecution he maintained the view which excluded from ecclesiastical communion all those (lapsi) who after baptism had sacrificed to idols—a view which had frequently found expression, and had caused the schism of Hippolytus. Bishop Fabian suffered martyrdom in January 250, and, when Cornelius was elected his successor in March or April 251, Novatian objected on account of his known laxity on the above-mentioned point of discipline, and allowed himself to be consecrated bishop by the minority who shared his views. He and his followers were excommunicated by the synod held at Rome in October of the same year. He is said by Socrates (*H.E.* iv. 28) to have suffered martyrdom under Valerian. Novatian has been confused with Novatus, a Carthaginian presbyter, who held similar views.

Novatian was the first Roman Christian who wrote to any considerable extent in Latin. Of his numerous writings three are extant: (1) a letter written in the name of the Roman clergy to Cyprian in 250; (2) a treatise in thirty-one chapters, *De trinitate;* (3) a letter written at the request of the Roman laity, *De cibis judaicis.* They are well-arranged compositions, written in an elegant and vigorous style. The best editions are by Welchman (Oxford, 1724) and by Jackson (London, 1728); they are translated in vol. ii. of Cyprian's works in the *Ante-Nicene Theol. Libr.* (Edinburgh, 1869). The Novatian controversy can be advantageously studied in the *Epistles* of Cyprian.

**NOVATION,** a legal term derived from the Roman law, in which *novatio* was of three kinds—substitution of a new debtor, of a new creditor, or a new contract. In English law the term (though it occurs as early as Bracton) is scarcely naturalized; substitution of a new debtor or creditor being generally called an assignment. A new contract either tacitly or expressly operates as a release from the original contract. Where the substituted contract is one of a higher nature, as where a contract under seal supersedes a simple contract, it is called a merger. The extinction of the previous contract is held to be sufficient consideration. The particular points on which novation turns are whether the new firm or company has assumed the liability of the old, and whether the creditor has consented to accept the liability of the new debtors and discharge the old. The question is one of fact in each case. (*See* especially the Life Assurance Companies' Act, 1872, s. 7, where the word, "novations" occurs in the marginal note to the section, and so has quasi-statutory sanction.) Scots law seems to be more stringent than English law in the application of the doctrine of novation, and to need stronger evidence of the creditor's consent to the transfer of liability. In American law, as in English, the term is something of a novelty. In Louisiana, and generally in systems much influenced by Roman law, novation forms a more specific department of the law of contract (*q.v.*).

**NOVAYA ZEMLYA.** An Arctic land off the coast of European Russia, to which it belongs, consists of two large islands separated by a narrow winding channel 56 mi. long, the Matochkin Shar. It lies between 70° 31′ and 77° N., and between 51° 35′ and 69° 2′ E. and forms an elongated crescent, being nearly 600 mi. long with a width of 30 to 90 mi., and an area of about 30,000 sq.mi. It separates the Barents sea on the west from the Kara sea on the east. With Vaigach island 30 mi. to the south, and the mainland, Novaya Zemlya forms a continuation of the Pai-Khoi hills, a branch of the Ural folds.

The greatest heights occur in the neck of the south islands where near Matochkin Shar are altitudes of about 4,000 ft. In the middle part of the south island there are few elevations over 1,400 ft., but in the south the summits rise to over 2,000 ft. The north island seldom rises to greater altitudes than 3,000 ft.

**Geology.**—A central zone of upper Cambrian and Devonian rocks extends along the islands. These quartzites, conglomerates and dolomites are flanked by carboniferous shales and limestones. The minerals of value are some lignite and a little copper ore.

**Climate.**—Novaya Zemlya is colder than Spitsbergen (which lies more to the north) as in some degree it shares in the continental conditions of northern Russia and Siberia. The middle and northern parts of the west coast are not so cold as the east. Temperatures at Karmakul are 2·3° F. (Feb.) and 43·2° (July). Snow is universal from October to May.

**Flora and Fauna.**—Vegetation is solely tundra and decreases from south to north. It is most luxuriant in Gooseland on the southwest. There are no trees or bushes. The flowering plants number 187.

In the ice-free areas there are foxes, lemmings, bears, reindeer and an occasional wolf. Insects are numerous near the coast. Countless birds come from the south for the breeding season, and at certain parts of the seacoast the rocks are covered with

millions of guillemots, while great flocks of ducks of various sorts, geese and swans swarm every summer on the valleys and lakes of the south. Whales, walruses and various seals are frequently seen. The goltzy occurs in the rivers.

The numbers of sea mammals and birds attracted Russian hunters, and even in the 16th century they had extended their huts (stanovishtcha) to the extreme north of the island. Many of them wintered for years on Novaya Zemlya. Owing to the ice in the White sea Russian hunters found Novaya Zemlya less easy of access than did the Norwegians. But about 1877 systematic attempts at settlement were begun by the Russian Government, several families of Samoyedes being established at stations on the west coast of the south island, including Karmakul on Moller bay, Pomorskaya bay and Byeloshya bay. There is a Russian observatory on Matochkin Shar.

**History.**—Novaya Zemlya was probably known to Novgorod hunters in the 11th century and to Norse hunters a century earlier. In 1553 Sir Hugh Willoughby may have sighted Gooseland. In 1556 Stephen Borough reached the south extremity of the Novaya Zemlya, being the first western European to do so. Willem Barents touched the island (1594) at Sukhoi Nos (73° 46′) and followed the coast north to the Orange islands and south to the Kostin Shar. In 1596, after his discovery of Spitsbergen, Barents wintered at Ice haven in 76° 12′ N. (*see* ARCTIC REGIONS). Rumours of silver ore led the Russian Government to send out expeditions. In 1760 Savva Loshkin cruised along the east coast, spent two winters there, and in the next year returned along the west coast, thus accomplishing the first circumnavigation; but the records of his voyage have been lost. In 1768 Lieut. Rozmyslov explored Matochkin Shar, where he spent the winter. The first scientific information about the island is due to the expeditions (1821–24) of Lütke (1797–1882) after whom part of the north island is named Lütkeland. Nearly all the west coast as far as Cape Nassau, as well as Matochkin Shar, was mapped, and valuable scientific information obtained. In 1832 and 1835 Lieut. Pakhtusov mapped the east coast as far as 74° 24′. The work of Karl von Baer in 1837 was untrustworthy. In 1870 the Norwegian, Capt. L. E. H. Johannesen, accomplished the second circumnavigation of Novaya Zemlya and in 1871 E. Carlsen found Barents's winter hut. In 1878 M. Grinevetskiy crossed the south island. Among later expeditions may be mentioned those of C. Nossilov (1887–92), T. N. Chernychev (1895), who made a crossing of the S. island, H. J. Pearson (1895 and 1897), A. A. Borisov (1899 and 1900) O. Ekstam (1900 and 1903), W. Russanov (1908), who crossed the south of the island, Pavlov and Weise (1912) of the Sedov expedition, who crossed the north island (*see* ARCTIC), as did O. Holtedahl (1921). P. V. Vittenburg explored the south island in 1925.

BIBLIOGRAPHY.—Most work is in Russian. *See* H. J. Pearson, *Beyond Petsora Eastward,* with botanical and geological appendices by H. W. Feilden (London, 1899); J. Spörer, *Nowaja Semlja* (Gotha, 1867); A. P. Engelhardt, *A Russian Province of the North* (Archangel, of which the author was governor) translated by H. Cooke (London, 1899); and O. Holtedahl, *Report of the Scientific Results of the Norwegian Expedition to Novaya Zemlya, 1921* (Oslo, 1924).

(R. N. R. B.)

**NOVEL,** the name given in literature to a sustained story which is not historically true, but might very easily be so. The novel has been made the vehicle for satire, for instruction, for political or religious exhortation, for technical information; but these are side issues. Its plain and direct purpose is to amuse by a succession of scenes painted from nature, and by a thread of emotional narrative. It was not until the 18th century that it began to be a prominent factor in literary life, and not until the 19th that it took a place in it which was absolutely predominant.

It was Voltaire, in his *Pyrrhonisme de l'histoire,* who set the fashion of calling the *Cyropaedeia* a novel, but it is probable that Xenophon had a purpose that was didactic and historical rather than imaginative. The vogue of the novel really began in Alexandrian times, when social life was so far settled in tradition that the pleasure of reflecting on reality had definitely set in. In the 2nd century B.C. a certain Aristides wrote, in six books, the *Milesiaka,* which was probably the beginning of the modern novel. These Tales of Miletus, the town in which Aristides lived, are lost, but from existing imitations of them in Greek and Latin we can gather that they consisted of humorous and sarcastic episodes of contemporary life. There seems to be good evidence that the bulk of these novelettes, and of the tales which followed them, dealt mainly with the adventures of lovers. In the 2nd century A.D. Lucian preserved for us invaluable pictures of the life in which he moved: his *Lucius or the Ass* and his *True History* are fantastic and extraordinary fictions in which the nature of the novel is not infrequently approached. But a Syrian Christian, Heliodorus, bishop of Tricca in the 4th century, may claim to have come much closer to it in his *Aethiopica,* which has the unique merit of being a perfectly pure love story, in which the marvellous is not absolutely banished, but in which on the whole the solid structure of experience is preserved. In the 6th century, as is supposed, a Greek who is called Longus, but of whose life nothing is known, wrote the voluptuous pastoral story of *Daphnis and Chloë,* which is far superior to all other remnants of Greek fiction which have come down to us, and is the only one of them which can strictly be called a novel. In Latin literature, the *Golden Ass* of Apuleius is manifestly a translation of a lost Greek book, to which Lucian also was indebted. If the *Satyricon* of Petronius was not an isolated phenomenon—and it is highly improbable that this was the case—then the Romans of the Neronian epoch understood to the full the secret of how to produce in prose a satirical, not to say cynical, study of manners in fiction. The *Satyricon* is not less skilfully managed than such later novels as *Gil Blas* or *Peregrine Pickle,* and it is of the same class. From the extent of the principal episode which has been preserved, it is supposed that this novel was not a short tale of intrigue, but was a sustained record, drawn up with careful and lengthy observation of manners, for the single purpose of entertainment. Unfortunately this extraordinary work remains not merely solitary in its class, but itself a fragment. In early Christian times, such books as *The Shepherd of Hermas,* and the productions of Palladius and of Synesius, testified to a certain appetite for prose fiction.

**Italy.**—It is from northern Italy that the novel of modern Europe (both the literary type and the name) derives. An early collection of tales, called *Il Novellino* or *Cento novelle antiche* (although only 66 of the 100 survive), was composed at the end of the 13th century, and started this class of literature in Europe. These anonymous stories are of extraordinary diversity, chivalrous, mythological, moral and scandalous. The mediaeval view of women and priests and peasants is found in its full development, and there is something of the realistic reflection of customs which was to flourish later in a whole class of fiction. The earliest Italian novelist whose name is connected with his writings is Francesco da Barberino (1264–1348), whose *Documenti d'Amor* was first printed in 1640. He was followed by Giovanni Boccaccio, who wrote his *Filocopo* about 1339 and the *Decameron* some nine years later. Of his disciples the most eminent was Franco Sacchetti (1335–1400), a Florentine. Sacchetti's *Trecente novelle,* which remained in ms. until the 18th century (1724), are ironical and realistic studies of the life around him in Tuscany. To Giovanni Fiorentino is attributed a collection of 50 tales, called *Il Pecorone,* printed first in 1558, but written in 1378. A great name in the evolution of European fiction is that of Tomaso Guardato, called Masuccio (1415?–1477?); he was a native of Salerno, and was the first of the south Italian novelists. Masuccio imitated no one; his conceptions and his observations are wholly his own. His *Novellino,* printed at Naples in 1476, is divided into five books, each containing ten stories. These deal satirically with the three favourite subjects of the age—namely, jealous husbands, unfaithful wives and debauched priests. He was followed in this, as well as in his vivacity, by Antonio Cornazzano (1431?–1500?), an inhabitant of Piacenza, who wrote Italian with much greater purity than Masuccio, but less vigour. His stories were frequently reprinted, under the title of *Proverbii.* Of the novels of Giovanni Brevio (1480?–1562?) only five have been preserved, but these are of unusual merit. We then reach Matteo Bandello (1480–1561), long the most famous of all the Italian

novelists, whose *Novelle,* first issued in 1554, were eagerly read in all parts of Europe; they are 214 in number. After Bandello the decline of the Italian *novella* is evident. Francesco Maria Molza (1489–1544), whose stories appeared in 1547, was a rival to Bandello, and has been preferred to him by several modern critics. The *Ragionamenti d'Amor* (1548) of Agnolo Firenzuola (1493–1545) was the work of a poet writing in richly embroidered prose. After Firenzuola the great school of Italian story-tellers declined. There was no more novel writing of any importance in Italy until the close of the 18th century, when an admiring study of German literature produced the romances of Alessandro Verri (1741–1816) and Ugo Foscolo (1778–1827). The first Italian novelist of merit in recent times, however, is Alessandro Manzoni (1785–1873), whose *I Promessi Sposi* (1825) enjoyed an unbounded popularity. Manzoni had imitators, but no rivals. In the fourth quarter of the 19th century Italy produced some brilliant and original novelists, in particular Giovanni Verga (1840–1922), Matilda Serao (1856–1927) and Gabriele d'Annunzio (1864–1938).

**France.**—It was not until about 1450 that the anonymous *Quinze joies du mariage* showed the French to be influenced by the Italian discovery of the novelette of manners. The author of this extraordinary work was perhaps Antoine de la Sale who seems certainly to have written the whole of the *Cent nouvelles nouvelles,* imitated from Boccaccio and Sacchetti. This bud of realistic fiction, however, was immediately nipped by the romances of chivalry, of Spanish extraction, which were only destroyed by the vogue of *Don Quixote.* The translation of Montalvo's celebrated *Amadis de Gaula* enjoyed at this time an extraordinary popularity.

The habit of telling tales freely in prose was not, however, formed in France until after 1500. Bonaventure Despériers (d. 1544) was the author of the *Cymbalum mundi* and of *Nouvelles récréations,* mordant satires and gay stories. Probably to this age also belongs the semi-fabulous Béroalde de Verville, who is supposed to be the author of a collection of facetious anecdotes and conversations, *Le Moyen de Parvenir.* These and other experiments in fiction lead us up to Rabelais, whose magnificent genius adopted as its mode of address the chain of burlesque prose narratives which we possess in *Gargantua* and *Pantagruel,* but his influence on the novel is insignificant. It was half a century later that, in the romantic pastoral of *Astrée,* published in 1610, France may be said to have achieved her first attempt at a novel. This famous book was written by Honoré d'Urfé; in spite of its absurdities it is full of talent, and succeeds, for the first time in the history of French narrative, in depicting individual character. D'Urfé was followed, with less originality, by Marin Le Roy de Gomberville (1600–74), who was the author of a Mexican romance, *Polexandre,* and by Gombauld (1570?–1666), the author of *Endymion* (1624). These were fictions of interminable adventures, broken by an infinite number of episodes; they seem tedious enough to us nowadays, but with their refinement of language, and their elevation of sentiment, they fascinated readers like Mme. de Sévigné. To Gomberville, who has been called the Alexandre Dumas of the 17th century, succeeded Mlle. de Scudéry (1607–1701), who preserved the romantic framework of the novel, but filled it up with modern and familiar figures disguised under ancient names. But in the meantime, the elephantine heroic romances were ridiculed by Charles Sorel in his *Francion* (1622) and *Le Berger extravagant* (1628). Later examples of a realistic reaction against the pompous beauty of Gomberville and Scudéry were the *Roman comique* (1651) of Scarron and *Le Roman bourgeois* (1666) of Furetière.

All these, however, were mere preparations. The earliest novelist of France is Marguerite de la Vergne, comtesse de La Fayette (1634–93), and the earliest genuine French novels were her *Princesse de Montpensier* (1662), and her far more important *Princesse de Clèves* (1678). Mme. de La Fayette was the first writer of prose narrative in Europe who portrayed, as closely to nature as she could, the actual manner and conversations of well-bred people. To show that she was capable of writing in the old style, she published, with the help of Segrais, in 1670, a *Zayde,* which is in the Spanish manner affected by Mlle. de Scudéry. It was long before the peculiar originality of the *Princesse de Clèves* was appreciated. Meanwhile La Fontaine, in 1669, published a fine romance of *Psyché,* partly in verse, and Fénelon, in 1699, his celebrated *Télémaque.* The influence of La Bruyère on the novelists, although he wrote no novels, must not be overlooked. But the *Princesse de Clèves* remained the solitary novel of moral analysis when its author died and the 17th century closed. The successes of Lesage seemed to be wholly reactionary. His realistic novels, *Gil Blas* and *Le Diable boiteux,* depended upon their comic force, their picaresque vivacity, rather than upon the sober study of average human character. But Marivaux (1688–1763) took up the psychological novel again, and produced in *Marianne* (1731) and *Le Paysan parvenu* (1735) analytical stories of Parisian manners and character which were wholly modern in form. If *Marianne* was deliberate, the exquisite *Manon Lescaut* (1731), by the Abbé Prévost d'Exiles (1697–1763), was almost an accident; but, between them, these simultaneous works started the French novel of the analysis of emotion. The brilliant stories of Voltaire, which began with *Zadig* and included *Candide,* hardly belonged to this category; they are rather satires and diversions, in which class must also be placed the fashionable boudoir novels of Crébillon *fils,* La Morlière and others. But the English taste, exemplified mainly by Richardson, Sterne and Fielding, prevailed, and its effect was seen again in the imperfect novels of Diderot and Rousseau. The *Nouvelle Héloïse* and the *Émile* of the latter are not skilfully constructed as stories, but they mark the starting-point of the novel which aims at familiarizing the public mind with great ideas in an attractively romantic form.

The moral purpose is equally evident in the famous *Paul et Virginie* of Bernardin de St. Pierre. It was less didactically present in Mme. de Staël's *Delphine* (1802) and *Corinne* (1807), where the misinterpreted woman of genius, so often depicted since, is first introduced to French novel-readers. It was not, however, until about 1830 that the novel began to be one of the main channels of imaginative writing in France, and the development of this kind of fiction was one of the main features of the romantic revival. Stendhal showed that, without any of the charms of style, and relying exclusively upon minute psychological observation, the record of a human life could be made enthrallingly interesting. Alexandre Dumas, under the direct influence of Sir Walter Scott, allowed his tropic imagination to revel and riot in brilliant chains of adventure. The imaginative novel was admirably conceived by George Sand. But it was Balzac who filled canvas after canvas with the astounding intensity of life itself, and who insisted with irresistible force that the function of the novel is to draw a consistent and unprejudiced picture of humanity under the strain of a succession of probable passions. This has been clearly comprehended by a host of later French novelists, whose record cannot be traced here, to be the function of the novel, as Mme. de La Fayette invented it, as Marivaux and Prévost developed it, and as George Sand and Balzac finally laid down its laws and settled its borders. Certain dates, however, must be recorded in the briefest record of the evolution of the French novel, and 1856 is one of these; in that year Gustave Flaubert published *Madame Bovary,* a work in which the rival realistic and romantic tendencies are combined with a mastery that had not been approached and has not since been equalled. Another is 1871, when Zola began to roll out the enormous canvas of *Les Rougon-Macquart.* Yet another is 1880, when *Boule de suif* first revealed in Maupassant a novelist whose creations were not merely amusing and striking, but absolutely convincing and logical.

**England.**—If we take no heed of translations of Latin stories, such as those from the *Gesta Romanorum,* we may say that the beginning of prose fiction in England is *Le Morte d'Arthur,* of Sir Thomas Malory, finished in or about 1470, and printed by Caxton in 1485. The great merits of this writer were that he got rid of the mediaeval burden of allegory, essayed an interpretation of the human heart, and invented a lucid and vigorous style of narrative. But his book became, as Prof. W. Raleigh has said, "the feeder of poetry rather than of prose," and it gave no inkling of the methods of the modern novel. The same may be said of such versions of the Charlemagne, Amadis and Palmeria cycles of romances as *Huon of Bordeaux,* published by Lord Berners, perhaps in 1535, and innumerable others. It was the *novella* of Italy from which the English novel first faintly started. Between 1560 and 1580 versions of the Italian novelists became exceedingly popular in England. Paynter in introducing the tales of Bandello and Straparola struck the true novelist's note by offering them not as works of morality or edification, but "instead of a merry companion to shorten the tedious toil of weary ways." The appreciation of these Italian stories led to the composition of the *Euphues* of Lyly (1579), a book of great interest and merit, which has been called "the first original prose novel written in English." This is somewhat to exaggerate, since *Euphues* is rather a work of elegant philosophy than a narrative. Lyly had many imitators,

Munday, Greene, Dickenson, Barnabe Rich, Lodge, Nash and others, who formed a school of prose fiction which was not without a certain romantic beauty, but possessed as little narrative vigour as possible. To compare a story written by Sacchetti in 1385 with one written by Greene in 1585 is to perceive that not merely had no progress been made towards the modern novel, but that a great deal of ground had been lost. The absence of the comic element in Elizabethan romances is very marked. M. Jusserand has claimed a peculiar merit in this and other respects for the *Jack Wilton* of Nash (1594), which, as he points out, is the earliest English example of picaresque literature. During the reign of the heroic romances in France, their vogue violently affected the English book-market. The huge stories of Calprenède (especially *Cassandre*) and Gomberville were translated and imitated to the exclusion of every other species of prose fiction, between 1645 and 1670. The long-winded books of Mlle. de Scudéry, especially *The Great Cyrus,* were read so universally in England as to leave their stamp on the national manners. Of original English romances written in competition with the French masterpieces of chivalry, the *Parthenissa* of Lord Orrery (1654) is the best known. The first definite stand against these Gallicized romances was made by two dramatists, Aphra Behn and William Congreve. Congreve's *Incognita* (1692) is remarkable for its light raillery and humour, and perhaps deserves as well as any 17th century composition to be called the earliest novel in English. The stories of Mrs. Behn have the merit of a romantic simplicity in narrative, but they are dull. It was Daniel Defoe who introduced a minute and rude system of realistic observation which exactitude he combined with a survival of the old picaresque method, the result being those entertaining works *Colonel Jack* (1722) and *Roxana* (1724). He came to positive success in the immortal narrative of *Robinson Crusoe.*

**The 18th Century.**—Not even yet had the English novel been invented. It came into the world in 1740 from the unconscious hands of Samuel Richardson (1689–1761), who had hit upon the notion that morality might be helped and young persons of inexperience protected by the preparation of a series of letters exchanged between imaginary persons. The result was *Pamela: or Virtue Rewarded.* Henry Fielding's *Joseph Andrews* (1742), which started as a mere burlesque of *Pamela,* proceeded upon admirably original lines of its own, in a study of the humours and manners of contemporary country life. Fielding rejected the epistolary artifice of Richardson, and told his story in a straightforward narrative, broken indeed by arguments and ejaculations which bound the new novel to the old essay of the *Spectator* type. The creative force of Fielding filled the pages of this book with a crowd of vividly presented characters, and this marked a step in advance. In 1748 appeared the *Roderick Random* of Smollett, and here we have neither the sculptural manner of Richardson nor the busy world of Fielding's realism, but a comic impression founded on an artful employment and emphasis and exaggeration. The next move was made by Fielding, who in 1749 published his *Tom Jones.* Starting with the pungent horror of hypocrisy ever before him, Fielding constructs a fragment of the world in which men and women are seen without exaggeration, plying their daily trades under the eye of an impartial observer who can penetrate to their secret motives. This was a great advance, and a still greater one was the sustained skill with which the author conducted the plot, the interwoven series of the actions of his characters. It may almost be said that until the publication of *Tom Jones* no novel with a real plot had been conceived in English. The rivalry of the great novelists of this time was of signal help to them, and there can be no question that the astounding richness of *Tom Jones* stirred Smollett to the exercise of increased energy in *Peregrine Pickle* (1751), a coarse and savage book, illuminated by brilliant flashes of humour. A better, because a tenderer and truer study of life was *Amelia,* which Fielding published in the same year; yet most readers have found this novel a little languid after *Tom Jones.* Now Richardson, who had long been silent, reasserted his mastery of epistolary analysis in the huge *History of Sir Charles Grandison* (1753), in which, as its admirers claimed, "all the recesses of the human heart are explored and its whole texture unfolded."

New forms, and also new subjects, were to present themselves to the imagination of capable British novelists, but the starting-point of every experiment was to be discovered in the ripest work of Richardson, Fielding and Smollett. Their influence was manifest in the writings of the second school of English novelists, in whom, however, several interesting varieties of subject and treatment were discovered. The *Tristram Shandy* (1759–66) of Sterne, is the most masterly example in English of a humour which goes direct to pathos for its most "sentimental" effects, and of the kind of loosely strung, reflective fiction which is hardly a narrative at all. Neither *Tristram Shandy* nor *A Sentimental Journey* (1768) can properly be included among novels. In *Rasselas* (1759) Dr. Johnson showed that the new kind of writing could be used to give entertainment to a sermon, and in this he was to have a multitude of followers. In *Chrysal* (1760) Charles Johnstone (d. 1800) showed that the picaresque romance could still exist, tinctured by the newly found art of the novelist. In *The Castle of Otranto* (1764) Horace Walpole adapted the methods of the novelist to a pseudo-historical theme of horror and romance, and prophesied of Walter Scott. In *The Vicar of Wakefield* (1766) Oliver Goldsmith was indebted to most of his immediate predecessors, but fused their qualities in an amalgam of gentle wit and delicate sweetness and conversational brevity which has made his one loosely constructed novel a foremost classic of our literature. Thus, in the one quarter of a century which divides *Pamela* from *The Vicar of Wakefield,* English novel-writing was born, grew into full maturity, and adopted its adult and final forms. During the remainder of the 18th century, little or nothing was done to extend the range of prose fiction in England, but one or two of those departments of novel-writing which had already been invented were developed and adapted to changing taste. In particular, the rapid increase of reticence and refinement in conversation made such a novel in letters as Smollett's *Humphrey Clinker* (1771) repulsively coarse to women of delicacy, who were charmed on the other hand with the *Evelina* of Frances Burney (1778). These two typical books are composed on the same plan, yet essentially a whole age lies between the former and the latter. What has been called "the novel of the tea-table" now came into existence, and the 18th century was about to close in mediocrity, when its credit was partially saved by a development of Horace Walpole's romance of terror in the vigorous and sensational narratives of Ann Radcliffe (1764–1823), whose *Mysteries of Udolpho* appeared in 1794. The same year saw the publication of *Caleb Williams,* in which William Godwin (1756–1836) evolved a tragic theory of politics.

**The 19th Century.**—The two schools here indicated, and they may be roughly defined as the school of the Tea-Table and the school of the Skeleton-in-the-Cupboard, did not, however, betray their real significance until the second decade of the 19th century, when they developed into the novel of psychological satire and the romance of historical imagination. Two writers, the greatest who had yet attempted to address English readers through prose fiction, almost simultaneously came forward as the protagonists in these two spheres of work. Jane Austen published *Sense and Sensibility* in 1811, Walter Scott *Waverley* in 1814. These were epoch-making dates; in each case a new era opened for the countless readers of novels. The first-named writer, all exactitude, conscience and literary art, worked away at her "little bit (two inches wide) of ivory"; the other, with bold and flowing brush, covered vast spaces with his stimulating and noble compositions. It is, however, to be noted that the isolation in which we now regard these great writers—a *solitude à deux* only broken in measure by the presence of Miss Maria Edgeworth—is an optical illusion due to the veils of distance. The bookshops from 1810 to 1820 and onwards were thronged and glutted with novels, many of them infinitely more successful, so far as sales were concerned, than the most popular of Miss Austen's works. The novels of Miss Austen were written between 1796 and 1816, although published from 1811 to 1818; those of Sir Walter Scott date from 1814 (*Waverley*) to 1829 (*Anne of Geierstein*).

The next artist in prose fiction whose force of invention was sufficient to start the novel on wholly fresh tracks was born 40 years later than Scott. This was Charles Dickens, whose *Pickwick Papers* (1836) marks another epoch in novel writing. His career of prodigal production ceased abruptly in 1870, by which time it had long been obvious that he was the pioneer of a great and diverse school of novelists, all born within the second decade of the century. Of these Thackeray was not really made obvious until *Vanity Fair* (1849), nor Charlotte Brontë till *Jane Eyre* (1847), nor Mrs. Gaskell till *Mary Barton* (1848), nor George Eliot till *Adam Bede* (1859). The most noticeable point on which the five illustrious novelists of the Early Victorian age resembled one another and differed from all their predecessors, was the sociological or even humanitarian character of their writings. All of them had projects of moral or social reform close at heart, all desired to mend the existing scheme of things. (E. G.)

## AMERICA

In America during the greater part of colonial life before the Revolution there was no fiction written because there was no fiction-reading public. After the middle of the 18th century novels began to find their way into the hands of the curiosity-seekers and adventurers in literature. By 1800 a change had come. Naturally among the English colonies English models were followed in fiction quite as closely as they already had been in architecture, music, poetry and the drama. Three authors wrote of a Richardsonian world as sentimentally as their master: William Hill Brown in *The Power of Sympathy* (1789), Susanna Haswell Rowson in *Charlotte* (1794), later *Charlotte Temple,* and Hannah Webster Foster in *The Coquette* (1797). Gilbert Imlay in *The Emigrants* (1793) superimposed the formula for Frances Burney's stories of the English town on a shifting American scene from the seaboard over the Alleghenies to the western valley of the Ohio river. Hugh Henry Brackenridge between 1792 and 1805 published the successive parts of *Modern Chivalry,* and wrote them avowedly after the fashions of Hume, Swift and Fielding. Royall Tyler smacked rather more of Smollett in *The Algerine Captive* (1797).

The reading of William Godwin's *Caleb Williams* (1794) led Charles Brockden Brown (1771–1810) to attempt the treatment of a social thesis in the "Gothic" manner. *Arthur Mervyn* (1799–1800), especially in the first half, pursued Godwin's theme of an innocent youth branded as an outlaw by the malignance of a guilty patron. In both *Arthur Mervyn* and *Ormond,* another English predecessor, Defoe, with his *Journal of the Plague Year* (1722), is paralleled in Brown's

lurid circumstantial memories of the yellow-fever epidemics in Philadelphia, 1793, and New York city five years later. In his most completely gothicized story, and his most powerful one, *Wieland* (1798), Brown dealt with a devastating pseudo-supernatural influence rationalized away as a feat of diabolical ventriloquism. In *Edgar Huntly* (1799), he turned to frontier adventure in anticipation of Cooper.

Twenty years later James Fenimore Cooper (1789–1851) discovered in his negligible domestic romance *Precaution* (1820) that he had a hitherto undiscovered gift. Stimulated by friendly critics to write of matters more nearly native to his experience, he followed with *The Spy* (1821), a tale of the Revolution, which was set in his own neighbourhood, with *The Pioneers* (1823), a story of the frontier on which he had grown up, and with *The Pilot* (1824), a sea-story for which his years in merchant shipping and the navy had equipped him. With these three tales, American in subject matter and point of view, natural and spirited in treatment and peopled with real characters acting against real backgrounds, the genuine American novel came into existence. In his nearly 30 years of authorship Cooper completed the Leatherstocking series of which *The Pioneers,* first to be written, is fourth to be read. The others in story progression are *The Deerslayer* (1841), *The Last of the Mohicans* (1826), *The Pathfinder* (1840) and *The Prairie* (1827), in which he showed how vainly he struggled to reconcile aristocratic prejudice with democratic theory.

By the time of Cooper's death in 1851 the output of novels, which largely paralleled his in their resort to the settlement, the frontier and the Revolutionary War, was considerable in size but inconsiderable in value. In New England John Neal, with *The Down-Easters* (1833), D. P. Thompson, with *The Green Mountain Boys* (1839), and Sylvester Judd, with *Margaret* (1845), took up the chronicle. J. P. Kennedy expounded Virginia in *Swallow Barn* (1832) and the Carolinas in *Horse-Shoe Robinson* (1835). And the inclination to follow the retreating frontier was marked by J. K. Paulding's *Westward Ho!* (1832), R. M. Bird's *Nick of the Woods* (1837), Mrs. C. M. S. Kirkland's *A New Home—Who'll Follow* (1839) as well as by most of the voluminous work of Wm. Gilmore Simms (1806–70). Just as Cooper was often referred to as the American Scott, Simms, with better reason, was frequently called the Southern Cooper. He complemented Cooper's success with the frontier by his own with the settlement and the Revolution. Of his seven novels of the war *The Partisan* (1835) is the sturdiest survivor, and of his many tales of the settlement, *Beauchampe* (1842) is perhaps pre-eminent.

In these years, however, Herman Melville (1819–91) began the work which culminated in the year of Cooper's death with *Moby Dick* (1851), one of the greatest novels of the century in the English language. Several years in early manhood spent in merchant shipping and whaling supplied him with his philosophic point of view and with most of his material. *Typee* (1846) and *Omoo* (1847) were the first literary fruits of his wanderings, a continuous narrative of South Sea adventure interlarded with drastic criticism of the invading whites. *Mardi* (1849), retaining all his zest for the sea, passed over to the realm of allegory from which Melville was never to return, in the tale of a world-wide quest for Unattainable Happiness, incarnate in the maiden, Yillah. And *White Jacket* (1850), the story of his return to Western life on an American warship, is characteristic of its author in its combination of cyclopaedic fact and elaborate allegory. *Moby Dick,* Melville's masterpiece, the pursuit of a hopeless conflict with fate waged by Captain Ahab, a Promethean whaler, is a story which moves with grim relentlessness to its tragic conclusion. With *Moby Dick,* Melville's major achievement was at an end, though the early successes cannot be fully understood without careful reading of *Pierre* (1852), *Israel Potter* (1855), *Piazza Tales* (1856), *The Confidence Man* (1857), his privately printed verse and the posthumous novel *Billy Budd* (1924).

America had as yet shown no bent for realism in fiction except in one or two distorted satires by Cooper. The turn to Nathaniel Hawthorne (1804–64) is a turn only to another type of romance. An unusually long period of solitary preparation, marked only by a few score short tales and sketches brought him to maturity and recognition at the age of 46 with *The Scarlet Letter* (1850). He is known as a novelist for *The Blithedale Romance* (1852), *The House of the Seven Gables* (1851) and *The Marble Faun* (1860); although in addition to the suppressed *Fanshawe* (1828), *Septimius Felton* (1872), *Dr. Grimshawe's Secret* (1882) and the uncompleted *Dolliver Romance* were all posthumously published. His romances proceed almost by formula, each dominated by a physical symbol, each told in terms of a small group of characters with a hyper-sensitive central figure, each developed mainly through analysis and interpretation of the changing moods of the markedly inactive actors, each garnished with many a meditative commentary on the text, each critical of the Puritan tradition which dominated the author's past and present and each inquisitive as to the mystery of life and the hidden sources of its visible phenomena.

The decade which was ushered in by *Moby Dick* was escorted to its end by a host of sentimental tales for girls and robust adventure stories for boys. Only one novel was taken seriously by adults, Mrs. H. B. Stowe's (1811–96) enormously successful propagandist tale, *Uncle Tom's Cabin* (1852). Mrs. Stowe felt no pride in it as a story, but as a popular document she composed it with great skill and through it she discovered the inherent ability which she vented not only in the second anti-slavery tale *Dred* (1856), but also in a succession of discriminating pictures of New England life, of which *The Minister's Wooing* (1859) and *Oldtown Folks* (1869) are worthy of remark. Her work marks the turn to a definite current of realism.

It is not without significance that the new tendency gained momentum most rapidly in the new West. With the close of the Civil War the movement began with a fresh depiction of the American scene, and swept in a great cyclonic curve from the Pacific coast past the shores of the Gulf of Mexico, up through the South-eastern States into New England, across to the Middle West and back into the Ohio valley, until every part of the country was represented by its descriptive story-tellers. The course of this newer provincial fiction is suggested by such book titles as Mark Twain's *Jumping Frog* (California, 1867); Bret Harte's *The Luck of Roaring Camp* (California, 1871); G. W. Cable's *Old Creole Days* (Louisiana, 1879); Joel Chandler Harris's *Uncle Remus: His Songs and Sayings* (Georgia, 1880); Charles Egbert Craddock's (Mary N. Murfree) *In the Tennessee Mountains* (1884); Thomas Nelson Page's *In Ole Virginia* (1887); Mary E. Wilkins' *A New England Nun* (1891); Hamlin Garland's *Main Traveled Roads* (1891); James Lane Allen's *Flute and Violin* (1891).

Mark Twain (Samuel Langhorne Clemens, 1835–1910) was an insistent anti-sentimentalist and anti-traditionalist, and free from any dominating literary influence. His *Innocents Abroad* (1869) was an account of what he saw in Europe in contrast with what the American pseudo-aesthete was supposed to see. His *Tom Sawyer* (1876) and *Huckleberry Finn* (1884) were written in honest contempt for the prevailing goody-goody boy story. *The Gilded Age* (1873), in collaboration with Charles Dudley Warner, was a relentless satire on the time, as was *The Man that Corrupted Hadleyburg* a quarter of a century later. During the latter part of his life Mark Twain wavered between a relative faith in democracy—*The Prince and the Pauper* (1882), *The Connecticut Yankee* (1889), *Joan of Arc* (1896)—and a positive despair in humankind—*What is Man?* (1906), *The Mysterious Stranger* (1916) and other posthumous works.

William Dean Howells (1837–1920) was the only American to rival Mark Twain in the long period when they were contemporaries and friends. Howells' career falls into two clearly marked periods before and after he had come under the acknowledged influence of Tolstoi. A trained observer in the school of journalism, he was content in the first period to focus his attention on the interplay of contrasting cultures, Western and Eastern, American and European, as in *A Foregone Conclusion* (1875), *The Lady of the Aroostook* (1879), *The Rise of Silas Lapham* (1884) and *Indian Summer* (1886). But when, through Tolstoi, he "began at last to discover [his] relations to the race," his novels, while retaining their earlier charm, carried on their shoulders the Pilgrim's pack of a social burden, as in *A Hazard of New Fortunes* (1889), *The Quality of Mercy* (1892), *The World of Chance* (1893), *A Traveler from Altruria* (1894) and many another. He was extremely prolific, though scrupulous in his art; and he exerted a wide influence over the oncoming generation.

Henry James (1843–1916) furnishes an inevitable parallel to Howells. Throughout his authorship he followed the path of the psychological realist from which Howells was diverted in mid-career. In this pursuit he penetrated to the inner shrines of sophisticated life: *The American* (1877) presents a robust compatriot cruelly wronged by an alien society. Later, American society had become alien to James. The writing of *Washington Square* (1881), a purely American narration, made him "feel acutely the want of the 'paraphernalia,'" of a matured society. *The Portrait of a Lady* (1881) he built "large, in fine embossed vaults and painted arches" which were for the most part located in Europe. *The Tragic Muse* (1890), one of his simplest works, portrays the security of conservative England threatened by an invasion from the Bohemia of art. From this point on James can hardly be claimed as American. And from this point too both his thinking processes and his style became so involved as to demand the loyal and painstaking attention of a highly eclectic body of readers.

In the 1880s, the decade in which Howells learned from his Russian master to "set life forever above art," the output of American fiction had become abundant and varied. The sentimental domestic story, the romance of adventure, the historical tale, the international novel, the provincial picture and the purpose novel all flourished. From them all only a few survive in memory, and these with such religious or ethical thesis as Lew Wallace's *Ben Hur* (1880), Helen Hunt Jackson's *Ramona* (1884), Margaret Deland's *John Ward, Preacher* (1888) and Edward Bellamy's *Looking Backward* (1888). Of the novelists who emerged at this time into a popularity not without literary basis the chief was Francis R. Stockton (1834–1902), a lord of whimsical misrule in his day, and F. Marion Crawford (1854–1909), prolific author of romances located in Europe and the Near East.

The current of romance, of course, did not cease to flow, but from 1890 to 1910 the most marked tendency in American fiction was toward the ethical realism of Tolstoi or the naturalism of Zola. With the outbreak of the brief war with Spain in 1898 an awakened national self-consciousness recognized or inspired such historical novels as Weir Mitchell's *Hugh Wynne, Free Quaker* (1897), Thomas Nelson Page's *Red Rock* (1898), Mary Johnston's *To Have and to Hold* (1900), Winston Churchill's *Richard Carvel* (1899) and Paul Leicester

Ford's *Janice Meredith* (1899). More important than this were the social novels reflective of Howells' later period written by Hamlin Garland, Brand Whitlock, Winston Churchill and Thomas Nelson Page, and still more important was the fresh naturalism of Stephen Crane (1871–1900) in *Maggie* (1896), *George's Mother* (1896) and the extraordinary expressionism of *The Red Badge of Courage* (1895) and *The Open Boat* (1898). With Frank Norris (1870–1902) the new century was greeted in another succession of naturalistic stories of which the two members, *The Octopus* (1901) and *The Pit* (1903), of the incompleted trilogy, *The Epic of the Wheat,* are the most important. (P. H. B.)

## OTHER COUNTRIES

**Spain.**—Prose narrative in Spain practically begins in the 15th century with chronicles and romances of chivalry, tempered occasionally and faintly by some knowledge of what had been attempted in Italy by Boccaccio. The Spanish version of *Amadis de Gaula,* in which the romance of knight errantry culminated, belongs to 1508; the lost original is supposed to have been Portuguese. This was the only book of its class which is saved from the burning in *Don Quixote;* it was followed by *Palmerin of England.* These interminable books and a hundred worse than they, occupied the leisure of 16th century readers of both sexes. Without approaching the form of novels, they prepared the ground for novel-reading. The exploration of America led to the composition of monstrous tales of the New World, which generally took the form of continuations of *Amadis.* A new thing was begun in 1554, when the anonymous picaresque romance of *Lazarillo de Tormes* started the story of fantastic modern adventure; this highly entertaining book has been called the 16th century *Pickwick,* and Fitzmaurice-Kelly remarks that it "fixed for ever the type of the comic prose epic." The pastoral romance, in the hands of Jorge de Montemayor (d. 1561), who wrote an insipid *Diana* which was popular for a while throughout Europe, took readers a step backward, away from the ultimate path of the novel. It is of interest to us, however, to note that it was in one of these "vain imaginings," in his pastoral romance of *Galatea,* that Cervantes approached the field of fiction in 1585. Few of his peculiar merits are to be found in this early work; he turned for the present to the composition of plays. It was not until 1604 that he returned to prose fiction by printing his immortal *Don Quixote,* which made an epoch in the history of the novel. This book was originally intended to ridicule the already fading passion for the romances of chivalry, but it proceeded much further than that, and there is hardly any branch of fiction which may not be traced back to the splendid initiation of some chapter of *Don Quixote.* In 1613 Cervantes published his 12 *Exemplary Novels;* these are not so well known as the great romance, and they owed not a little of their form to Italian sources, but they are very brilliant. One of the best anonymous Spanish stories of the period, *The Mock Aunt,* is a type of excellence in facetious narrative of the sarcastic class; it has been attributed to Cervantes himself. No other novelist of Spain has moulded the thought of Europe, but the heroic romance which occupied so much of the attention of France in the 17th century was invented by a little-known Spanish soldier, Pérez de Hita, who, about 1600, wrote fantastic stories about Granada and the Moors. The farcical romance of *Fray Gerundio de Campazas,* 1758, by J. F. de Isla (1703–18) competed in popularity with *Gil Blas.* Speaking broadly, however, Spain made no appreciable progress in novel-writing from the days of Cervantes to those of Walter Scott, when the *Waverley Novels* began to find such artless imitators as Martínez de la Rosa and Zorilla. But the first original novelist of Spain was Cecilia Böhl de Faber (Fernán Caballero) (1796–1877), whose *La Gaviota* (1848), a study of life in an Andalusian village, was the earliest Spanish novel, in the modern sense. She was followed by Valera (1824–1904), by Alarcón (1833–91), by Pereda (1834–1906), by Perez Galdós (1845–1920) and by Palacio Valdés (1853–1938), in whom the tendencies of recent European fiction have been competently illustrated without any striking contributions to originality.

**Germany.**—The cultivation of the novel in its proper sense began late in Germany. It is usual to consider that H. J. C. von Grimmelshausen (1625?–75) was the earliest German novelist; his very curious romance, *Abenteuerliche Simplicius Simplicissimus,* was printed at Mömpelgard in 1669. This is an account of the adventures of a simple-minded fellow during the Thirty Years' War, and is a chain of episodes, brilliantly recorded, but hardly a novel. Early in the 18th century, an extraordinary number of imitations of Defoe's great romance were published in Germany, and these are known to scholars as the *Robinsonaden.* Later on, Wieland imitated *Don Quixote,* but the earliest German novel which possesses original value is the celebrated work of Goethe, *The Sorrows of Young Werther* (1774). The still more celebrated *Wilhelm Meister* did not appear until 1796. A third novel, *Elective Affinities,* was published by Goethe in 1809. Meanwhile a very characteristic group of picturesque stories had been issued by Johann Paul Richter (Jean Paul) (1763–1825), destined to have a wide influence upon romantic literature throughout Europe. Purely romantic were the stories of Tieck, of Brentano, of Arnim, of Fouqué, of Kleist, of Immermann. The German novelists of this period wrote like poets, deprived of the discipline of verse. In later times novels of high merit have been written by Gustav Freytag, Wilibald Alexis (1798–1871), called the German Walter Scott, Laube, Fontane, Ebers, Jeremias Gotthelf, Berthold Auerbach, Spielhagen, Heyse and many others, but the 19th century produced no German novelist of commanding originality.

**Russia.**—In Russia alone, among the countries of central and eastern Europe, the novel has developed with a radical originality. Until the second quarter of the 19th century the prose fiction of Russia was confined to imitators of Sir Walter Scott, but about the year 1834 Gogol (1809–52) began to revolt against the historico-romantic school and to produce stories in which an almost savage realism was curiously blended with the Slavonic dreaminess and melancholy. Since then the Russian novel has consistently been the novel of resignation and pity, but wholly divorced from sentimentality. Gogol was succeeded by Gontcharov, Tourgéniev, Dostoievski, Pisemsky (1820–81) and Tolstoi, forming the most consistent and, doubtless, the most powerful school of novelists which Europe saw in the 19th century. The influence of these writers on the rest of the world was immense, and even in England, where it was least acutely felt, it was significant.

**Oriental.**—In a primitive form the novel has long been cultivated in Asia. It was introduced into China, but whence is unknown, in the 13th century, and Le Kuan-chung was the first Chinese novelist. The productions of this writer and of his followers are tales of bloody warfare, or record the adventures of travellers. The novel called *The Twice-Flowering Plum-Trees,* belonging to the 16th (or 17th) century, is a typical example of the moral Chinese novel, written with a virtuous purpose. Prof. Giles holds that the novel of China reached its highest point of development in *The Dream of the Red Chamber,* an anonymous story of the end of the 17th century; this is a panorama of Chinese social life, "worked out with a completeness worthy of Fielding." Prose stories began to be met with in the literature of Japan early in the 10th century. But the inventor of the Japanese novel was a woman of genius, Murasaki no Shikibu, whose *Genji Monogatari* has been compared to the writings of Richardson; it was finished in 1004 and may, therefore, be considered the oldest novel in the world. This book, which is one of the great classics of Japan, was widely imitated. After the classic period novel-writing was long neglected in Japan, but the humours of 17th century life were successfully translated into popular fiction by Saikaku (1641–93), and later by the collaborators Jisho and Kiseki. (E. G.)

BIBLIOGRAPHY.—M. Borroneo, *Catalogo de'novellieri italiani* (1805); J. C. Dunlop, *The History of Fiction* (1816); A. Rivadeneyra, *Biblioteca de autores españoles* (1846–80); V. Chauvin, *Les Romanciers grecs et latins* (1862); W. Forsyth, *Novels and Novelists of the 18th Century* (1871); E. Zola, *Le Roman expérimental* (1879), *Les Romanciers naturalistes* (1880); F. Brunetière, *Le Roman naturaliste* (1883); E. M. de Vogüe, *Le Roman russe* (1886); G. Pellissier, *Le Mouvement littéraire au XIXe siècle* (1889); W. Raleigh, *The English Novel* (1894); Sir E. Gosse, *A Century of French Romance* (1900–02); Em. Gebhart, *Conteurs du moyen âge* (1901); A. Bever and Ed. Sansot Orland, *Oeuvres galantes des conteurs italiens* (1903); G. Saintsbury, *The English Novel* (1913); E. A. Baker, *History of the English Novel* (1924–27); G. Duhamel, *Essai sur le roman* (1925); A. Chevalley, *Le roman anglais de notre temps;* Thomas Deloney, *Le roman de métiers au temps de Shakespeare* (1926); H. Massis, *Réflexions sur l'art du roman* (1927); E. Muir, *The Structure of the Novel* (1928); V. M. Ames, *Aesthetics of the Novel* (Chicago, 1928).

## MODERN DEVELOPMENTS

Towards the close of the 19th century, there arose as a reaction from the naturalistic novel, a school of neo-romantic psychologists, sceptically sentimental, and fond of lyrical "nuances." Types such as Oscar Wilde's *Dorian Grey* were popular, also the gentle, pallid, aristocratic, weary heroes of the Danish author, Hermann Bang. The erotic was the favourite theme, either sublimated, delicately portrayed in many beautiful shades or else traced in glowingly pathetic frescoes. Atmosphere, tact, a great knowledge of women, good form, scepticism and up-to-date-ness were the qualities valued in a novelist. Leading literary criticism asserted that Art has little to do with character and all that was written was appraised in accordance with a strongly underlined "Art for Art" principle.

**The New Novelists.**—Strange to say, only a few of the novelists who in the long run proved themselves great and lasting belonged to this tendency favoured by official literature. Independently of it, it may be mentioned, Romain Rolland wrote his vast life history of the musician Jean Christophe, and Anatole France his gentle, sceptical, wise novels. Rudyard Kipling composed his ballads and his great ballad-like Indian tales, and, following on Dostoievski and Tolstoi, Maxim Gorki appeared, melancholy and powerful, upon the European horizon. Independently also of this officially favoured tendency August Strindberg cried aloud his maniacal, embarrassing confessions; Hamsun, with biting lyrics, placed his quiet, queer characters in a grand landscape; Selma Lagerlöf wrote her wild, sweet novels; and Johannes V. Jensen transformed the doctrines of Darwin and his own views on America into literature.

Of American novelists after E. A. Poe and Mark Twain no more were sighted in the continent of Europe. A master of story writing of the rank of Stevenson was at best only known there through little read translations of *The Master of Ballantrae* and *Treasure Island.* Strindberg's novels, hardly accepted by a wider public, aroused in

the connoisseurs admiration and displeasure. Dostoievski and Tolstoi were looked upon by the Europe of their day as gifted lunatics in much the same way as was Shakespeare by the French of the 18th century. It was Paris that dominated. France—at least in fiction—played the part which Greece had played in the ancient world. French novels even of mediocre importance were everywhere translated and imitated. They ruled the entire East, Russia, the Balkans. Practically the whole of European society modelled itself, in all aesthetic questions, on the pattern portrayed in this type of novel. Only that which had withstood the criticisms of the Paris salons was considered as of real artistic merit. Each country sought to adapt the French mode to its own atmosphere. In Italy, d'Annunzio exaggerated the main feature of the French style, pathetically overcolouring it. In Hungary, the French style was highly seasoned, banalized and provincialized. Among German-speaking authors the Viennese especially showed great zeal in emulating the French example. They decreed, nearly without any contradiction, that love, comedy and death should be the themes of literature.

**Novels After the World War, 1914–18.**—With the war the position of the novel changed swiftly and fundamentally. At the front the boredom of the trenches, at home the want of other distractions, won for the novel new readers, who, accustomed to a hard existence, compelled to struggle with stark reality, found that literature was dealing with affairs of secondary importance and did not touch the real centre of life, at any rate, not of their lives. They had no use for the erotic futilities, for the artistic "drawing room" philosophy of life, for the psychology—subtle as it was superficial—so popular in literature. They demanded reality. If, up till now, the reader had been drawn to the novel by a longing for entertainment and suspense, now it was the films which responded to this longing in a more agreeable and intensive way.

All around were to be seen vast changes, social and political; in the common life of every day, almost every function had been enormously changed through technical progress; Russia and America now appeared as decisive factors on the horizon of the rest of the world. The reader now demanded of the novelist that he should weigh the merits of these problems; at any rate, that he should expose them and catalogue them clearly. The author now suddenly found himself confronted with a much more alert, more distrustful and more illuminated public.

**Changing Subject-Matter.**—The erotic, with its innumerable species, now moved away from the centre. No longer were the members of the ruling classes the only popular heroes of novels. Substance to the front; the artistic into the background! Even the old subject-matter was looked upon in a new light. Instead of portraying the setting of a period, the novel now shed light on its social and economic structure, on the sociological aspect instead of on the erotic. It gave a representation and analysis of facts instead of coloured, lyrical, sentimental impressions.

This revolution did not accomplish itself without an aesthetic struggle. The antithesis, ever popular—especially in Germany—between the descriptive writer ("Schriftsteller") and the creative poet ("Dichter") was emphasized afresh, defended and attacked with animosity. The question was discussed as to whether the novel was in principle a form of poetry or not. The decay of the epic in every form was proclaimed. Distinction was drawn between creations (of poetical fancy) and (mere) description. A German historian of literature proclaimed that the mission of German literature was the romantic, and that this rationalistic period was an empty hour for German poetry.

Intermediate tendencies were perceptible. Towards the end of the war of 1914–18 and immediately after it there broke out all over Europe a tendency to make the novel pathetic and prophetic. Even in fiction, writers liked to fling open their inmost hearts and to cry aloud with wild bluff gestures that society was badly organized but that Man was good. This tendency only lasted a short time. Shorter still lasted the symbolical tendency which flared up afresh in various literatures. In contrast to these passingly fashionable vacillations the main rationalistic tendency, which after the war of 1914–18 gained the upper hand in every literature, was all the more clearly distinguishable.

**The Poetical Novel.**—The purely poetical novel proceeding from the individual poetic vision which follows exclusively the author's need of self-expression, not aiming at the exposition of a great continuity of ideas, nor at a fixed sociological goal, in this quarter of a century, found great representatives. But their influence rarely extended beyond readers of their own mentality, or beyond the poetic perceptions of their own intellectual atmosphere. Germany counted a whole series of such novelists, of doubtless great talents, whose native limitations and restrictions, however, barred their way to international importance: Hermann Hesse, Jakob Schaffner, Emil Strauss, W. von Scholz, H. Stehr and Arnold Ulitz.

Scandinavians, Swiss and Dutch also produced the same kind of remarkable but limited novels. (Two noteworthy examples offered themselves by way of contrast, the English-writing Pole, J. Conrad, and the English-writing Swiss, John Knittel.) The great poet Knut Hamsun had unquestionably world-wide literary fame; but while, before the war, he found many imitators, his reputation became greater than his influence. Among the Anglo-Saxons of this class, Rudyard Kipling rose to international importance, while the great Thomas Hardy did not penetrate beyond the Anglo-Saxon world.

**Romance and Colour.**—The romantically artistic novel had, at the beginning of the century, to a great extent, replaced the naturalistic novel. Great was the delight in colour, in play of fantasy, in the sparkling, polished word. From Italy, d'Annunzio launched a pathetically high flown style. In Germany, Heinrich Mann triumphed with the strong colours and gestures of his fiction, finding numerous minor imitators; Eduard Stucken extended the wide, brilliant horizon of his books; and Alfred Döblin exaggerated this style, overcolouring it, turning it into a grotesque turmoil of gestures and actions. In Spain, Miguel De Unamuno; in France, André Gide; in England, Chesterton, clothed what they had to say in fantastically glittering forms.

The purely fantastical, purely Utopian novel provided documentary evidence of the rationalizing tendency of the times. At the beginning of the century Hanns Heinz Ewers strove after effect in his ghastly stories; Gustav Meyrink wrote his mystically magical novels. In France, Renard applied his extraordinary art of story telling to fantastic themes. But after the World War of 1914–18 the lawless roaming of imagination became more and more difficult; its direction was more and more decided by a biological and sociological point of view. The dream landscapes of the great vision of the Bohemian poet, Franz Kafka, were psychoanalytically traced out, and the Utopian novels of H. G. Wells were carefully founded upon the results of modern research.

**Films and Fiction.**—The films, with their manifold opportunities for creating suspense, with their immediate appeal to the senses, became a dangerous competitor to the purely fictional novel, written merely for the sake of telling a story. Some authors of the anecdotal novel took refuge in an artistically refined, at times pseudo-classical technique, as for instance Paul Ernst, or Bruno Frank, also Thomas Mann (in *Death in Venice,* in his short stories), and in England such writers as D. H. Lawrence. As this epoch had a whole series of authors of vigorous imagination and original delight in story telling an astonishingly high level was reached in this field. Writers such as M. Renard, Blasco Ibañez, Margaret Kennedy, Leo Perutz and Wilhelm Speyer and Franz Molnar wrote entertaining novels of a considerably higher quality than is to be found in the entertaining novels of a former period. Some of these stories were very pointed and not without ingenious jests; most of them penetrated into other fields, attaching themselves carefully to the historical or to the sociological. Or with worldly wise, cleverly interpreted imagination they paraphrased on actual life (Maurois, the life of Shelley in *Ariel,* and Maugham, the life of Gauguin in *The Moon and Sixpence*). A very fortunate combination of circumstances made *The Adventures of the Good Soldier, Schweik,* by Jaroslav Hasek, a sort of national epic of international reputation.

At the beginning of the 20th Century the society novel possessed important exponents, who found numerous imitators. Fritz Mauthner, Guy de Maupassant and young Bernard Shaw wrote their criticisms of society. These were justified at the time, as the conventions of society were still a problem. Later, when they were so no longer, criticism of society was at most a pretext for authors who wished to preserve the society novel as a portraiture of the fashionable world—Arlen, Dekobra, Morand, Colette and Pitigrilli. Even in Germany, where society in this special sense of the word has never existed, the society novel was attempted—Edschmidt and Speyer.

**Psychology and the Novelist.**—At the close of the 19th century the psychological novel was at its height. Taught by Dostoievski, leading authors in every literature sought more and more to shade the characters of their novels, to differentiate them more and more finely (Meredith, Wassermann, Henrik Pontoppidan and Theodore Dreiser). But while at the beginning of the 20th century it was the individual case, the glaring, sensational case that was the chief interest, the novelist later laid chief stress on portraying the individual going to mingle with the masses. The Russians of the school of Dostoievski; the followers of Chekhov, writers such as T. Shmeliov and their fellow-aspirants, were overshadowed by the sociologically inclined pupils of Tolstoi and Gorki. The books of the Viennese authors, such as Schnitzler and Stefan Zweig, and their languid knowledge of the human heart, with their esprit and their idle cautious psychology, were dislodged by the books of the Anglo-Saxons, Galsworthy, Bennett and Sinclair Lewis, in which the hero interests, not as an individual, but as a type. If psychology be admitted at all, then much colder and more unsentimental artistic shading was demanded by the younger school (somewhat after the style of Joseph Hergesheimer), or scientifically founded psychoanalysis, as, for instance, was attempted by James Joyce.

**Novels with a Purpose.**—The novel with a purpose, the novel with a thesis, triumphed. Their titles proclaim such themes as: "Not the Murderer, but the Murdered is Guilty," "All Roads Lead to Golgotha," "Thou Mayest Commit Adultery," "Man is Good." In Germany, Heinrich Mann emphasized with force the democratic, humanistic tendency in his great biting novels dealing with the Kaiser's period. (The development of the times showed itself typically in this author. He began with criticisms of society, then wrote highly coloured, romantically artistic books with a psychological strain, whose subject-matter consisted of tempestuous emotions, fierce land-

scapes and an intensely demoniacal heroine. Later, he wrote great sociological novels with a purpose.) Everywhere there appeared violent anti-war novels. Long before the war, Bertha von Suttner had the greatest success with her weak, well meant, pacifist novel, *Down with Arms.* Some of the anti-war novels, *Fire,* by Barbusse; *Three Soldiers,* by Dos Passos; *Sergeant Grischa,* by Arnold Zweig, although undisguised polemics, created a directly artistic effect. The didactic political tendency became strongly accentuated. Originating in Russia, there arose a mixture of fiction-writing and a reporting of facts. Moreover, the moment favoured bellicose emotions, and clear, undisguised attitudes. The gentle scepticism of Anatole France was too quietistic for these times. Strongly polemic themes predominated throughout the Utopian, society-criticizing novels of Wells. Upton Sinclair's novels, however, were solely and purely propaganda fiction, in which the rhetoric greatly outweighed the creative tendency. The novels of the Soviet writers (Gladkov's *Cement* and Kollontai's *Ways of Love*) were also unscrupulous propaganda. On the other hand, in the novels of the Americans, Jack London, Sinclair Lewis, Dos Passos and Theodore Dreiser, propaganda was subordinate to creative desire.

**The Historical Novel.**—The historical novel, as it was presented at the close of the 19th century, sprang from a delight in gaily coloured story telling and in the decorative. *Ben Hur,* by Wallace, and *Quo Vadis,* by Sienkiewicz, created enthusiasm in millions of readers. In Germany, Alfred Doeblin, in his books *The Three Leaps of Wan Lung* and *Wallenstein,* brought to perfection the artistically-coloured novel as based upon the works of Flaubert and of the Swiss author, C. F. Meyer. But it is just in the historical novel and its metamorphoses that the tendency of the times was most clearly to be traced. While, before the World War of 1914–18, the historical novel was popular due to its colour and its background, after the war it was the pragmatical that was sought for in it. It was popular because it strengthened in the reader the illusion of reality and imparted to him a conviction of documentary evidence and reliability. The Russian novels of D. Merezhovsky formed a connecting link between the earlier kind of historical novel and the modern one.

Two styles seem to be the peculiarity of the modern historical novel; the biographical, with a psychological strain (Maurois, Emil Ludwig and Werfel in his *Verdi*), and especially the new historical novel which does not restrict itself to portraying, in the form of a sensational anecdote, an individual drawn more or less graphically after the person of the author, but in which the characters are embedded in the environment of their period, in which is traced an outline of the structure of the times. The author of this new historical novel does not lay stress on the colour of a period, but on its substance. He does not care for what is curious and strange, does not seek to emphasize the romantic. He does not underline those qualities which mark the distance between those times and our own, but preserving historical reality, he underlines the very qualities which are common to our own time (Feuchtwanger's *Jew Süss* and *The Ugly Duchess*). In this way does he trace unchanging man through the everchanging periods of history and endeavours to transform history into politics.

**Sociological Fiction.**—Here one touches the field in which the modern novel flourishes best, the sociological. Since today the individual is linked more than ever before with the whole world through newspapers, better communications, brisker exchange of merchandise, films and wireless, the sociological interests of the reader have become broader, deeper and more varied.

This sociological novel develops the novel of environment of the 19th century, as it culminated in Zola, and changes it from within. For while that naturalistic novel constructed its setting from single events carefully put together so as to cause suspense, the modern sociological novel endeavours to comprehend in one glance the whole class which it portrays. It has learned much from the films, in particular the technique of building up a comprehensive picture from many small individual pictures. (Thus, for instance, Dos Passos, in his *Manhattan Transfer,* intentionally—after the manner of the films—rings the changes between a "close-up" of the individual and a general view of the crowd, showing the simultaneousness of many events in order to give a better view of the events as a whole.) In logical transition between the Zolaesque novel and the sociological novel of today stand novels such as Zangwill's *Children of the Ghetto, The Buddenbrooks,* by Thomas Mann, and Galsworthy's *Forsyte Saga.* The sociological novels of the times, the works of Jack London, Sinclair Lewis, Upton Sinclair, Dos Passos, the books of Gladkov and Kollontai, the prose epics of Bennett, Galsworthy and Wells take for their subject-matter not one arbitrary individual, but the whole society of today. It is for that reason that, notwithstanding the attractions of sport and wireless, they have won the entire world as their ardent readers, a somewhat superficial world, perhaps, but certainly a very enlightened one. Their works teach their readers to understand and to sympathize with the life of the citizen, and disclose the outlook of the proletariat. They impart a knowledge of those two opposite poles, Russia and America. And Russians and Anglo-Saxons have proved themselves masters of this form of novel, dislodging the French novel without a struggle. This new sociological fiction has converted the novel from a luxury for the idle rich into a necessity for busy workers. For it originates, not from the need for self-expression of a single arbitrary author, but from a universal need for self-expression. (L. F.; X.)

**The United States.**—With the death of Howells in 1920 Edith Wharton (1862–1937) was left as the connecting contributor to American fiction between his generation and the group who took the centre of the picture after the World War. One could begin to define later tendencies by saying that they reveal influences to which she was long or always impervious. She belonged to the privileged class into which James was born and Howells gravitated. To its code she gave the name of *The Custom of the Country* (1913). She reverted to it repeatedly, from her first notable success, *The House of Mirth* (1905), to her much later *The Age of Innocence* (1920); and in an exceptional excursion into rural life she applied a comparable code with grim effectiveness in *Ethan Frome* (1911). Mrs. Wharton, however, was essentially urban, as was her literary style. It was keen, brilliant, clever and attenuated, like the people it characterized. It was doubtless quite fair to them, though the 20th century reader can take them only as the author usually did, with a slight measure of compassionate amusement. They had the kind of phosphorescence that arises from decay. Howells turned away from them in mid-career to become a purpose-novelist. But Mrs. Wharton, remaining faithful to them, was still no less conscious than Howells of moral standards though she addressed herself to the proprieties while he was turning to problems of social justice.

Willa Cather (1876– ) marked in a single career the shift from an old Victorian sense of security, through irresolution, to a restored theological security. Her early stories up to *My Antonia* (1918) dealt with creative energies in the studio or on the frontier; with artists and pioneers struggling for self-fulfillment, and achieving it by grace of their own natures and the assistance of the author. After an interval of four years, a quartet of novels, of which *One of Ours* (1922) and *The Professor's House* (1925) are the best, deal with weaker personalities, native Americans subjected to American post-war life, baffled, frustrated, defeated by it. Finally, *Death Comes for the Archbishop* and *Shadows on the Rock* turn from the Anglo-Saxon, Protestant-American scene to the regions of Spanish-American and French colonial culture, and take refuge in the most enduring tradition in the modern Occident—the authority of the Church of Rome. It is a cycle with epic implications which happily are left as implications and not advanced as a thesis. It affirms the dramatic past, with its wealth of opportunity for action and for triumph. It denies the fruitfulness of the present, with its material pressures which have proved too strong for the individual. And it finds repose in a tranquil security, a life of unity and order, resting on authority and an established mode of living and believing.

Theodore Dreiser (1871–1945) led the way toward a realism for which America was unprepared when he began to publish. In 1900 his *Sister Carrie* was issued and promptly withdrawn, for though his public admired Tolstoi, Balzac and Zola at a distance, it preferred the refined company of English sentimental realists who recorded something about life, but not too much. Eleven years later *Jennie Gerhardt* was read and approved, as were *The Financier* (1912), *The Titan* (1914) and *The Genius* (1915). Wide acclaim was finally reached with *An American Tragedy* (1925), which was also dramatized and filmed.

Dreiser, starting with a conviction that life was ordained on just and orderly lines, was forced by the reading of Herbert Spencer to surrender his certainties and to set out on an uncharted course. He felt that life was rhythmic, but also that it was unknowable, unfathomable. He made, more or less explicitly, many admissions that he was not resigned to agnosticism, rejecting the existence of justice or morality as abstract standards, but never ceasing to grope for what he called "the equation inevitable." In the "painful kingdom of time and place" Dreiser did a work as massive and hardwrought as Rodin's. The failure of most of his characters "to round out life in a natural, normal, courageous, healthy way" was because he did not know a predominant number of such characters. Possibly it was the disorder of his world that was responsible for the clumsy maladroitness of his narrative structure and prose style. His literary offenses were as obvious as the harsh ugliness of the life he described and the painful sense of insecurity which it aroused in him.

Joseph Hergesheimer (1880– ) offered a key to his work in his book *From an Old House* (1925). He installed himself in a homestead that prolonged the quiet of an early American pastoral in the midst of a tumultuous present. It promoted the spirit of the patriot as this roots itself in love of the land, but depressed him with a sense of social disintegration in process. What he cherished from the past was not its religious beliefs, but the calmness, fidelity, hardness of body and resolution in mind and bearing, that belonged to the well-intrenched aristocrat. Admiring these virtues, he made them live in the novels which earned him his reputation: *Java Head* (1919), *The Three Black Pennys* (1917), *Linda Condon* (1919) and *Balisand* (1924). But as the years passed the hand of events exerted an increasingly disconcerting pressure on him. The old house became an anachronism and from a nearby club house the dance music seemed "a confusion of forms very like the age . . . the assault of a persuasive discontent." The phrases characterize such later novels as *Cytherea* (1922) and *Tampico* (1926). These later stories chronicle distinction of neither character, action nor manners. The author became victim of the social disintegration which he deplored.

James Branch Cabell (1879– ) in his discontent with the land of fact invented a realm of romantic chivalry to which he has recurrently set out from a modern land of gallantry where the ancient code has been abandoned though the manners have been in part retained. His approach to life is not so direct that it may be summed up either in woman-worship, which is chivalry in perfection, as in *Domnei* (1920) or in shirking, which is chivalry degenerate, as *Cords of Vanity* (1909). One tale marks the balancing of the two worlds—*The Cream of the Jest* (1917) in which Felix Kennaston, author, lives in Litchfield, Virginia, but by means of a magic charm, makes off nightly to a realm of dreams and idyllic adventure. Returning to daily life he maintains enough of the chivalric code to be true to his love, his Christian God and between the two incidentally to his own honour.

Cabell's avowed intention, much quoted, "to write perfectly about beautiful happenings" has yielded him an individual and often charming style, but has made him a laborious pleasure-hunter, too often pedantic in rhetoric and dispensable detail. If he had clung to his declared plan of withdrawing from authorship at the age of fifty, he would have closed a picturesque performance with a characteristic gesture; but few farewell tours, uninsured by old age, have ever proved to be bona fide.

During the decade of 1920 to 1930 national consciousness encouraged a notable output of books on the vanished frontier. Following Paxson's *History of the Frontier* (1924) and the literary studies by Rusk, Dondore, and Hazard of the three succeeding years, scores of works on the West appeared which were neither narrative, formal history nor explicit criticism. They were soon abundantly reflected in fiction. Hamlin Garland anticipated and stimulated them in his personal narrative *A Son of the Middle Border* (1917). Willa Cather was ahead of the movement with three novels already cited. Herbert Quick was early in the discussion of the native pioneer with *Vandemark's Folly* (1922) and its successors. Yet there was a scarcity of novels presenting the native pioneer in the first stages of frontier life.

More was written of actual contact with the soil by the emigrant pioneers. The most effective single representative of this type was O. E. Rölvaag (1876–1931), Norwegian immigrant. He had written several volumes in his native tongue when one of these was published in English in 1927 as *Giants in the Earth*. Within a year it ran to forty-four printings; it was followed by *Peder Victorious* two years later, and the trilogy was completed by *Their Fathers' God* (1931). An exceptional man, Rölvaag compressed great breadth and variety into his career. Not content with mastering two languages and blending two cultures, he rose from the life of the toiler to the life of the scholar and thence to the life of the artist. He was what Natty Bumppo Cooper or Antonia Shimerda Cather might have been. What he wrote about was in the warp of his emotional experience. He was the only kind of novelist who, writing about the Norwegian immigrant could vie with the Norwegian stay-at-home and surpass him; for he was the primitive subject of Bojer's *Emigrants* and his peer as a creative writer. The successive ordeals of the immigrant pioneer: first of withstanding physical defeat, then of social submergence without inner adjustment, then of adjustment to native stock and rival aliens, and finally of estrangement from his own offspring, these all are presented in the extended Rölvaag cycle.

In the interpretation of the Mississippi Valley post-frontier, Sinclair Lewis (1885– ) led the way in critical sagacity and in popular appeal. The Gopher Prairie of *Main Street* (1920) like all villages in Anglo-Saxondom that are neither rural nor urban, had lost the smell of the soil and had not "acquired the scent of patchouli." The central figure, Carol Kennicott, found dignity and greatness only in the awful expanse of the plains, some invisible barrier excluding these from the town, to which she finally succumbed. Gopher Prairie greatly magnified became the western city of Zenith, native town of *Babbitt* (1922). According to Lewis the difference is only a matter of size, the bigger community being harder for the average man to resist. The theme of these two novels becomes the theme of *Arrowsmith* (1925) and *Elmer Gantry* (1927): that the atmosphere of the Middle West is stifling to the scientist but ozone to the charlatan and demagogue. Only in *Dodsworth* (1929) did Lewis portray a man who is strong enough to succeed and also to withstand success. A complete product of frontier tradition, Dodsworth is Babbitt undefeated, Martin Arrowsmith with a stiffened backbone; for he is big enough to withstand the silly coerciveness of littler men, and to learn from the men who are bigger. In confessing to his inexperience and resolving to increase in wisdom as well as stature, Dodsworth keeps faithful the spirit of the frontier and holds out a promise for the future of America.

The doubt and irresolution so apparent among many who were in mid-career before the outbreak of the first World War, were the leading features or themes of many more who began writing in the war decade. They were ready to conclude that science was revealing man as a creature of heredity and circumstance, just when universal destruction beset them. The less hardy of the rising generation, brought up on benevolent assumptions that now seemed like mockeries, and with less than Job's endurance, were moved to curse God and live, because life was not as pleasant as they had been told; and in their despair they defied all the old hopes and all the old reticences.

Increasingly in the years between the close of war in Europe in 1918 and the opening of the conflict in 1939 fiction in America followed the trend of the times in abandoning the old ethical and social assumptions and the old criteria of good taste. Before the earlier date it was generally agreed that a given man in a given situation ought to behave in a given way. His character could be judged by his action. In the same period there was general consent as to what might and what might not be committed to print. By 1939 both standards had become more honoured in the breach than in the observing.

Thus Ernest Hemingway (1898– ) began, as he has continued, to harp on two strings: his world-weariness and his connoisseurship in the pleasures of the table and the technique of the bull-ring. Frederic Henry in *A Farewell to Arms* (1929), explains that during service at the front he was "embarrassed by the words sacred, glorious, and sacrifice and the expression in vain. . . . Abstract words like glory, honor, courage or hallow were obscene beside the concrete names of villages." This accounts for the reiteration of less savoury concrete details, for his insistence on vintages, the delights of the gourmet and the excesses of the carouser, and for his obsession with the bull-fight, through which he gains a vicarious enjoyment of gore and death while displaying technical familiarity with a sport unknown to Americans. There is no question as to Hemingway's narrative skill and no doubt that in his choice of subject he has so far lost contact with substantial life that there is little left in his work but the evidence of a nice but self-conscious technique.

William Faulkner (1897– ), another skilful writer, has gone farther than Hemingway in the same direction. He too was in the World War, was encouraged to write by Sherwood Anderson, was influenced by Gertrude Stein. He thus naturally combines ingenuity in structure and style with a tone of disillusionment expressed in terms of brutal naturalism. *Soldiers' Pay* (1926) and *Sartoris* (1929) do what Hemingway was to do in *A Farewell to Arms*. Faulkner's *As I Lay Dying* (1930) and *The Sound and the Fury* (1929) out-Herod Hemingway and reach the depths frequented by Robinson Jeffers. *Sanctuary* (1931) reaches deeper still because of the author's sardonic employment of his powers to split the ears of the groundlings. This tale of rape and lynching displays cynicism raised to a high power. But it is naturalism gone to seed, for it means nothing. In the hands of the greater naturalists brute fact is interpretable into something beyond itself. In the hands of Faulkner brute fact leads to little but folly and despair. Like many of the modern Jeremiahs, Faulkner differs from his Biblical prototype in not hearing when the Lord says "There is hope for thy latter end."

It was in his hope for the latter end that John Dos Passos (1896– ) was formerly distinguishable from the apostles of despair. Sinclair Lewis applauded his success in expressing the "roaring, thundering, incalculable, obscene, magnificent glory" of the great city; and the Marxists were for a while equally enthusiastic over his evident economic convictions. The qualities in *Manhattan Transfer* (1925) applauded by Lewis, were reachieved in the three volumes grouped as *USA*. Dos Passos had already pronounced his indictment on the ways of capitalism. In this trilogy he went on to answer questions as well as ask them and to suggest a new order to replace the old one. For a while the American Marxists pointed with pride to Dos Passos as their major prophet, their pre-eminent, if not sole, representative whose convictions did not overwhelm his art. But as time went on mutual dissatisfaction arose between Dos Passos and the Marxists and by the time of the appearance of *The Adventures of a Young Man* (1939) criticism of the novelist had displaced criticism of his novels, a clear evidence that he was more significant as propagandist than as artist.

The point is that contemporary fiction and drama are freeing themselves from the old conventions because they are moving in two directions: They are dealing more searchingly with what goes on in men's minds, and more frankly and explicitly with what goes on with their bodies. The consequence is that some tales become far more subtle as they have with James Joyce and the many writers he has influenced, some have become more brutally realistic as with Farrell, and some have become more subtle and more brutal as with alternating parts in the books of William Faulkner, Thomas Wolfe, and John Steinbeck.

Perhaps in this connection Wolfe is most significant of all, because as he tells in his *Story of a Novel*, he never really wrote novels at all, but simply amassed manuscript which took shape with the persistent help of a gifted editor, partly in three books that came out during his lifetime and partly in two more that were whipped into some semblance of form after his untimely death.

In these reorganized fragments as they now appear between bindings we can find magnificent lyric prose, long dives into the "stream of consciousness," front page writing, back-alley talk, old-fashioned narrative, in a great maelstrom of composition which makes up by sheer vitality for what it lacks in structure. The result is Thomas Wolfe of the chaotic 20th century, accepted by that century though the 19th century would have rejected him with a mixture of boredom and horror. A promise in all this was that Wolfe, had he survived, might sooner or later have become the master of his materials, a craftsman who could have brought his extraordinary powers under artistic control.

It is this control which marks the contrast to Thomas Wolfe of John Steinbeck (1902– ), who has developed slowly through an impressive series of books which are widely different in tone and theme though all are marked throughout by scrupulous artistry. His characters, combinations of primitive desire and mystical perception, are painted in primitive colours. His early novel *The Cup of Gold* (1929) is a historical romance, but Sir Henry Morgan the buccaneer and Ysobel the irresistible woman share interest with Merlin, man of visions and interpreter of common men. *To a God Unknown* (1933) is a frontier tale, but the four brothers around whom the story is woven are pioneers with a difference, a rake, a rude faun, a religious fanatic, and a poet-mystic, and three of the four have their secret avenues to the secrets of life. *Pastures of Heaven* (1932) like *The Long Valley* (1938) is a series of sketches against the same background. The gay *Tortilla Flat* (1935) serves by way of comic relief with its group of amoral *paisanos,* but they are evidently by the same hand. And so also are *Mice and Men* (1937) and his most popular work *Grapes of Wrath* (1939), which has been variously misunderstood by readers who did not know his other works. For *Grapes of Wrath* merely adds to Steinbeck's constant theme of Man and Nature the supplementary theme of Man and Industrialism. The moral indignation arises from a situation in which the simple tiller of the soil could be first dispossessed and then exploited, but its primary interest is still in the characters rather than in the special mishaps that befall them, and the leading characters, the "hero," his mother, and the delinquent preacher would be at home in any but the first of his books. The critics who hail *Grapes of Wrath* as a great propagandist novel or assail it as just one more in a seventy-year succession of social protests, overlook the fact that Steinbeck's powers as a teller of tales have long been well-defined and have been exercised in various ways.

Thus the main tendency in American fiction in the 1930s has been the turn toward realism and naturalism. The comfortable old assumptions about life have been challenged or abandoned. The brutal costs of modern progress have been brutally enumerated. Social protest and social revolution have been increasingly the themes of the more effective writers, while escape novels have been the best sellers. The American melting pot is a hot and parlous cauldron. (P. H. B.)

**NOVELDA,** a town of east Spain, in Alicante province, on the right bank of the river Vinalopó, and on the railway from Madrid to Alicante. Pop. (1940) 8,798 (mun., 10,349). The country is flat and fertile, producing much wine, dates, oranges, oil, saffron and aniseed. At Salinetas de Elda nearby are warm sulphur and saline baths.

**NOVELLO, VINCENT** (1781–1861), English musician, son of an Italian who married an English wife, was born in London on Sept. 6, 1781. He was a chorister at the Sardinian chapel in Duke Street, Lincoln's Inn Fields, where he learnt the organ; and from 1796 to 1822 he was successively organist of the Sardinian, Spanish (in Manchester Square) and Portuguese (in South Street, Grosvenor Square) chapels, and from 1840 to 1843 of St. Mary's chapel, Moorfields. He was an original member of the Philharmonic Society, of the Classical Harmonists and of the Choral Harmonists, officiating frequently as conductor. In 1849 he went to live at Nice, where he died on Aug. 9, 1861. He composed an immense quantity of sacred music, much of which is still deservedly popular; but his great work lay in the introduction to England of unknown compositions by the great masters. The Masses of Haydn and Mozart were absolutely unknown in England until he edited them, as were also the works of Palestrina, the treasures of the Fitzwilliam Museum, and innumerable great compositions now well known to everyone. His first work, a collection of *Sacred Music, as performed at the Royal Portuguese Chapel,* which appeared in 1811, marks the founding of the publishing house of Novello.

His son, JOSEPH ALFRED NOVELLO (1810–1896), who had started as a bass singer, became a regular music publisher in 1829. He really created the business, and has the credit of introducing cheap music, and departing from the method of publishing by subscription. From 1841 Henry Littleton assisted him, becoming a partner in 1861, when the firm became Novello & Co., and, on J. A. Novello's retirement in 1866, sole proprietor. Having incorporated the firm of Ewer & Co. in 1867, the title was changed to Novello, Ewer & Co., and still later back to Novello & Co., and on Henry Littleton's death in 1888, his two sons carried on the business.

**NOVEMBER,** the ninth month of the old Roman year [Lat. *novem,* nine], which began with March. By the Julian arrangement, according to which the year began with Jan. 1, November became the eleventh month and had 30 days assigned to it. Nov. 11 was held to mark the beginning of winter; it is now the day of solemn commemoration of the end of the World War. The Senate desired to rename the month in honour of Tiberius—his birthday occurring on the 16th, but the emperor declined, saying, "What will you do, Conscript Fathers, if you have *thirteen* Caesars?" The Anglo-Saxon names for November were *Windmonath,* "wind month" and Blodmonath "bloodmonth."

**NOVERRE, JEAN GEORGES** (1727–1810), French dancer and ballet master, was born in Paris on March 29, 1727. He composed his first ballet in 1747 for the Opéra Comique. After a year spent in Berlin, he mounted the ballets of Gluck and Piccini in Paris in 1749. He was in London (1755–57) and in Lyons (1758–60). From the publication of *Lettres sur la danse et les ballets* may be dated the revolution in the art of the ballet for which Noverre was responsible. (*See* BALLET.) He was next engaged by the duke of Württemberg, and afterwards by the empress Maria Theresa, until, in 1775, he was appointed, at the request of Queen Marie Antoinette, *maître des ballets* of the Paris Opera. This post he retained until the Revolution reduced him to poverty. He died at St. Germain on Nov. 19, 1810.

Noverre's friends included Voltaire, Frederick the Great and David Garrick (who called him "the Shakespeare of the dance"). The ballets of which he was most proud were his *La Toilette de Vénus, Les Jalousies du sérail, L'Amour corsaire* and *Le Jaloux sans rival.* Besides the letters, Noverre wrote *Observations sur la construction d'une nouvelle salle de l'Opéra* (1781); *Lettres sur Garrick écrites à Voltaire* (1801); and *Lettre à un artiste sur les fêtes publiques* (1801).

**NOVGOROD** (formerly known as *Velikiy-Novgorod,* Great Novgorod), a town of the Russian S.F.S.R., in the Leningrad region, in 58° 33′ N., 31° 20′ E., on the navigable Volkhov, 2 mi. below the point where it issues from Lake Ilmen. Pop. (1933) 38,000. The town has sawmills and manufactures boots and shoes, candles, bricks and tiles and has a brewery and a distillery.

The date at which the Slavs first erected forts in the marshy region of the Volkhov near Lake Ilmen is unknown. That situated on a low terrace close by Lake Ilmen was soon abandoned, and Novgorod or "New-town" (in contradistinction to the Scandinavian Aldegjeborg or Ladoga) was founded by Scandinavian searovers as Holmgård on another terrace which extended a mile lower on both banks of the river. The older fort (Gorodishche) existed in the 13th century. Even in the 9th century the new city on the Volkhov exercised a kind of supremacy over the other towns of the lake region, when its inhabitants in 862 invited the Varangians, under the leadership of Rurik, to the defence of the Russian towns of the north. Down to the end of the 10th century Novgorod to a certain extent depended on Kiev; yet in 997 its inhabitants obtained from their prince Yaroslav a charter which granted them self-government. For five centuries this charter was the bulwark of the independence of Novgorod. From the end of the 10th century the princes of Novgorod, chosen either from the sons of the great princes of Kiev (until 1136) or from some other branch of the family of Rurik, were always elected by the *vyeche;* but they were only its military defenders, and their delegates were merely assessors in the courts which levied taxes for the military force raised by the prince. The *vyeche* invariably expelled the princes as soon as they provoked discontent. Their election was often a subject of dispute between the wealthy and the poorer classes; and Novgorod, which was dependent for its corn supply upon the land of Suzdal, was sometimes compelled to accept a prince from the Suzdal branch instead of from that of Kiev. After 1270 the city often refused to have princes at all, and the elected mayor was the representative of the executive. Novgorod in its transactions with other cities took the name of "Sovereign Great Novgorod" (*Gospodin Velikiy Novgorod*). The supreme power was vested in the *vyeche.* The city, with a population of over 80,000, was divided into wards, each ward constituting a distinct commune. The wards were subdivided into streets, which corresponded to the occupations of their inhabitants, each being quite independent with regard to its own affairs.

Trade was carried on by corporations. By the Volkhov and the Neva, Novgorod—then known also as Naugart and Novwerden—had direct communication with the Hanseatic and Scandinavian cities, especially with Visby or Wisby on the island of Gotland. The Dnieper brought it into connection with the Bosporus, and

it was an intermediary in the trade of Constantinople with northern Europe. The Novgorod traders penetrated to the White Sea shores, hunted on Novaya Zemlya in the 11th century, colonized the basins of the northern Dvina, descended the Volga, and as early as the 14th century extended their trading expeditions beyond the Urals into Siberia. Two great colonies, Vyatka and Vologda, organized on the same republican principles as the metropolis, favoured the further colonization of north-east Russia.

It is said that the population of Novgorod in the 14th century reached 400,000, but the pestilences of 1467, 1508 and 1533 carried off no fewer than 134,000 persons. These figures seem to relate rather to the whole Ilmen region.

**Invasions of Novgorod.**—Novgorod's struggle against the Suzdal region (now the government of Vladimir) began in the 12th century. In the following century it had to contend with the Swedes and the Germans, who were animated not only by the desire of territorial acquisition, but also by the spirit of religious proselytism. Their advances were checked by battles at Ladoga and Pskov in 1240 and 1242 respectively. Protected by its marshes, Novgorod escaped the Mongol invasion of 1240–2, and repelled the attacks of the princes of Moscow by whom the Mongols were supported. It also resisted the attacks of Tver.

The first serious invasion, in 1332, was rolled back with the aid of the Lithuanians. But in 1456 the great prince of Moscow imposed a heavy tribute. Ivan III. of Moscow took possession of the colonies in the northern Dvina and the Perm regions, and began two bloody wars, during which Novgorod fought for its liberty under the leadership of Martha Boretskaya, the mayor. In 1475–1478 Ivan III. entered Novgorod, abolished its charters, and carried away 1,000 of the wealthier families, substituting for them families from Moscow; the old free city then recognized his sovereignty. A century later Ivan IV. (the Terrible) abolished the last vestiges of the independence of the city. Having learned that a party favourable to Lithuania had been organized in Novgorod, he took the field in 1570, and entered the city (much weakened by the recent pestilences) without opposition. His followers killed the heads of the monasteries, the wealthier of the merchants and clergy, and burned and pillaged the city and villages. No fewer than 15,000 were massacred at Novgorod alone (60,000 according to some authorities). A famine ensued, and the district of Novgorod fell into utter desolation. Thousands of families were transported to Moscow, Nijni-Novgorod, and other towns of the principality of Moscow.

In the beginning of the 17th century Novgorod was taken and held for seven years by the Swedes; and in the 18th century the founding of St. Petersburg (now Leningrad) finally destroyed its trade. Its position on the water highway from the Volga to St. Petersburg and on the trunk road from Moscow to the capital, still gave it some commercial importance; but even this was destroyed by the opening of the Vishera canal, connecting the Msta with the Volkhov below the city, and by the construction of the railway from St. Petersburg to Moscow, which did not reach Novgorod. Later a branch loop linked the town with the main line and its position improved.

**Antiquities.**—The town consists of a Kremlin (old fortress), and of the city, which stands on both banks of the river, connected by a handsome stone bridge. The Kremlin was much enlarged in 1044, and again in 1116. Its stone walls, originally palisades, were begun in 1302, and much extended in 1490. Its historical monuments include the cathedral of St. Sophia, built in 1045–1052 by architects from Constantinople to take the place of the original wooden structure (989), destroyed by fire in that year. Apart from minor changes the building remained unaltered until its restoration in 1893–1900. It contains highly-prized relics, including 12th century bronze doors, one brought reputedly from Sigtuna, the ancient capital of Sweden. Another ancient building in the Kremlin is the Yaroslav tower. Other remarkable monuments are the church of St. Nicholas (1135), the Znamenski cathedral (14th century), and churches of the 14th and 15th centuries. Within the town itself there are four monasteries and convents, two of them dating from the 11th century and two from the 12th century; and the large number in the immediate neighbourhood shows the great extent which the city formerly had. A monument to commemorate the 1,000th anniversary of the foundation of Russia (the calling in of the Varangians by Novgorod in 862) was erected in 1862. Another monument commemorates the repulse of the Napoleonic invasion of 1812.

**NOVI PAZAR** (ancient *Rashka*), the capital of the department of Novi Pazar, South Serbia, Yugoslavia, lies at the head of the fertile valley of the Upper Rashka, on the site of the ancient Serbian city of Rashka. Pop. (1931) 10,364, comprising Serbs, Albanians and some Greeks. Agriculture is the only industry. There are Roman baths in the vicinity, and in the old church of St. Peter and St. Paul, the metropolitan church of the bishopric of Rashka, Stephen Nemanya, founder of the Serbian empire, passed from the Roman to the Greek church in 1143. The town was taken by the Serbs and Montenegrins in the Balkan Wars (1912–13), and assigned to Serbia by the Treaty of Bucharest (1913). It was occupied by German troops in 1941.

**NOVI SAD** (German *Neusatz*), a town of the Voivodina, Yugoslavia. Pop. (1931) 63,985. It is the seat of a Greek Orthodox bishop, and is a prosperous town with wide, well-paved streets, public gardens, a cathedral, a hospital, schools, theatres and barracks. There is a daily market for household commodities, and for the artistic pottery and cotton goods manufactured in the town. Before the union of the province with Yugoslavia at the close of World War I Novi Sad was the literary and religious centre of the Serbians in Hungary, especially after the foundation in 1864 of the *Matica Srbska,* or Serbian Literary Society. The town was founded in the middle of the 18th century, and was almost totally destroyed during the revolution of 1848–49. In 1941 Hungarian troops occupied the town and it was reincorporated into Hungary.

**NOVOCAINE,** an artificial alkaloid, and the most satisfactory of the local anaesthetics introduced in recent years. The hydrochloride is employed in medicine ($C_{13}H_{21}O_2N_2Cl$) and it is a substitute for cocaine. It is very soluble in water and for subcutaneous injections is far superior to cocaine for several reasons: its solutions can be sterilized by boiling whereas cocaine would decompose; it has no irritant action and is of very low toxicity, whereas cocaine is both irritant and toxic. (*See* DRUG ADDICTION and COCAINE.)

**NOVOCHERKASSK,** a town of the Russian S.F.S.R., in the North Caucasian area, at the confluence of the Don and Aksai rivers, in 47° 28′ N., 40° 5′ E. Pop. (1939) 81,286. It manufactures cloth and machinery and is a collecting centre for corn, wine and timber exports.

Novocherkassk was founded in 1805, when the inhabitants of Old Cherkassk were compelled to leave the site because of the frequent inundations of the Don.

**NOVOMOSKOVSK,** a town of the Ukrainian S.S.R., 16 mi. N.E. of Dnepropetrovsk (Ekaterinoslav), in 48° 38′ N., 35° 16′ E. Pop. (1926 census) 10,564. It extends some distance along the right bank of the Samara river, a tributary of the Dnieper; its main industry is brick-making. The Zaporogian Cossacks occupied the site in the 17th century, when it was known as Samarchik. In 1687 Prince Golitsuin founded the Ust-Samara fort here, destroyed after the Treaty of Pruth (1711), but rebuilt in 1736. Near it is the Samarsko-Nikolayevskiy monastery.

**NOVOROSSIISK** (nŏv-ŏ-rŏss'ĭsk), Russian S.F.S.R. port on N.E. coast of the Black sea in 44° 42′ N., 37° 45′ E., in the North Caucasian area. Pop. (1939) 95,280. It has connections with the net of Russian railways, with Baku, and with Rostov-on-Don. It has large cement works, and its exports are mainly cement, naphtha, potash, leaf tobacco and champagne, its imports being machinery, coke and coal. Its grain export trade, formerly about 70%, is insignificant, naphtha and cement having largely replaced it. The bay, nearly 3 mi. wide at its entrance and 5 mi. deep from east to west, is exposed to the violent northeast wind (bora), sweeping down from the Caucasus. There is accommodation for 36 steamers. The town became Russian in 1829.

**NOVOSIBIRSK** (formerly Novo-Nikolayevsk), the chief town in the Siberian Area of the Russian S.F.S.R., in lat. 55° 6′ N., long. 83° 6′ E., situated on the navigable Ob river, where the

trans-Siberian railway crosses it on a 9 span bridge 30 ft. above high water level. The town was founded in 1896, but had in 1939 a population of 405,589. In 1915 a branch line was opened from Novosibirsk going through Barnaul, with a branch to Biisk, and on to Semipalatinsk, and a link with the railways of the central Asiatic Russian republics was completed in 1930. There is telegraphic communication with Mongolia. The town is a centre for distributing agricultural machinery. There are also grain elevators, one with a capacity of 16,070 tons, and several well set up flour mills. Butter trains, with ice trucks, start daily for the west, and frozen meat is also exported to Leningrad and Moscow. There are three electric sawmills in Novosibirsk dealing with the timber from this region. The town also exports the woodcock, hazelhen and quails. Other industries are brickmaking, iron-smelting, oil pressing, distilling, brewing, and leather preparation.

**NOWATA,** a city of north-eastern Oklahoma, U.S.A., in the valley of the Verdigris river; the county seat of Nowata county. It is served by the Missouri Pacific and electric railways. Pop. (1930) 3,531 and in 1940, 3,904. It is the trade centre of a farming, stock-raising, and oil-producing region. The city was founded in 1889, when the Missouri Pacific came through, and was incorporated in 1892. Since 1913 it has had a commission-manager form of government.

**NOWAWES,** a town of Germany, in the province of Brandenburg, 2 m. E. from Potsdam, on the Berlin-Potsdam railway. Pop. (1933), 29,229. The town was founded by Frederick the Great in 1754 and in 1907 the village of Neuendorf was incorporated with it. Its industries include the spinning and weaving of jute and silk and the manufacture of cloth, electrical apparatus, boots and locomotives.

**NOWELL, ALEXANDER** (1507?–1602), dean of St. Paul's, London, son of John Nowell of Read Hall, Whalley, Lancashire, was educated at Brasenose College, Oxford, where he is said to have shared rooms with John Foxe. He was elected fellow of Brasenose in 1526. He became master of Westminster school (1543), and prebendary of Westminster (1551). In Mary's reign he was deprived of his prebend, probably as being a married man, before May 1554, and sought refuge at Strasbourg and Frankfort, where he developed puritan and almost presbyterian views. He submitted, however, to the Elizabethan settlement of religion, and was rewarded with the archdeaconry of Middlesex, a canonry at Canterbury and in 1560 with the deanery of St. Paul's. His sermons occasionally created some stir, and on one occasion Elizabeth interrupted his sermon, telling him to stick to his text and cease slighting the crucifix. He held the deanery of St. Paul's for forty-two years, surviving until Feb. 13, 1602. Nowell is believed to have composed the Catechism inserted before the Order of Confirmation in the Prayer Book of 1549, which was supplemented in 1604 and is still in use. Early in Elizabeth's reign he wrote a larger catechism, to serve as a statement of Protestant principles; it was printed in 1570, and in the same year appeared his "middle" catechism, designed for the instruction of "simple curates."

*See* R. Churton, *Life of Alexander Nowell* (1809); G. Burnet, *History of the Reformation* (new ed., 1865); and R. W. Dixon, *History of the Church of England.* Also the *Works* of John Strype; the *Publications* of the Parker Society; the *Calendar of State Papers, Domestic;* and the *Dict. Nat. Biog.,* vol. lv.

**NOWGONG,** a town and district of British India, in the Assam Valley division of Assam province. The town (pop. [1941] 12,972) is situated on the Kalang river. The district of Nowgong has an area of 3,898 sq.mi. and a pop. (1941) of 710,800. It consists of a wide plain overgrown with jungle and canebrakes, intersected by numerous tributaries of the Brahmaputra and dotted with shallow marshes. The Mikir hills cover an area of about 65 mi. by 35 in the south of the district; the highest peak is about 3,500 ft. The slopes are very steep, and are covered with dense forest; reserved forests cover 500 sq.mi. The Kamakhya hills near the bank of the Brahmaputra are about 1,500 ft. high. On the summit of the highest peak is a celebrated temple of Kamakhya, the local goddess of love, where three annual festivals are held. The staple crop is rice. Tea cultivation and manufacture are carried on but the soil and climate are not so favourable as in upper Assam.

The section of the Assam-Bengal railway from Gauhati to the hills passes through part of the district, and a branch runs through it from Chaparmukh to Silghat steamer station. Lumding is a railway centre of some importance.

**NOWGONG,** a town of India, headquarters of the Bundelkhand agency, in the state of Chhatarpur, on the border of the British district of Jhansi. Pop. (1931) 6,459.

Here is situated the Kitchener college, an Indian army institution for the training of noncommissioned officers.

**NOWY SACZ** (NEU SANDEC), town, Poland, in the province of Cracow. Pop. (1931), 30,278. It grew to importance through the oriental trade in the 14th century and owed much to the patronage of Casimir the Great. It is near the Carpathians, in the beautiful valley of the Dunajec, in the country of the Gorale or Polish Highlanders. It has a church originally founded by the Franciscans in the 14th century. Germany took the town in 1939.

**NOYES, ALFRED** (1880– ), English poet, was born in Staffordshire on Sept. 16, 1880, and educated at Exeter college, Oxford. *The Loom of Years,* his first volume of poems, appeared in 1902, and his *Collected Poems* in 1910, 1920, and 1927. His *Forty Singing Seamen* (1907) and *Drake* (1908) struck the patriotic note of a poet of the sea. A volume of lectures given in America, *The Sea in English Poetry,* was published in 1913, and in 1914 he was elected to a professorship of modern English literature at Princeton university, which he resigned in 1923. His other publications include: *The Wine Press* (1914); *The Watchers of the Sky* (1912); *Aspects of Modern Poetry* (essays, 1924); *The Torch-bearers* (3 vols., 1922, 1925 and 1930; 1 vol., 1937); *Robin Hood* (poetic drama, 1927); *Ballads and Poems* (1928); *The Return of the Scarecrow* (novel, 1929); *The Opalescent Parrot* (essays, 1929); *Voltaire* (1936); *Orchard's Bay* (1939); and *The Last Man* (1940).

**NOYON,** a city of N. France, in the department of Oise, 67 mi. N.N.E. of Paris by the railway to Brussels. Pop. (1936) 5,869. Noyon is built at the foot and on the slopes of a hill.

Noyon, the ancient Noviomagus Veromanduorum, was Christianized by St. Quentin at the end of the 3rd century; and about 530 St. Medard, bishop of the district of Vermandois, transferred his see thither from St. Quentin. St. Eligius was bishop in the 7th century, Pippin the Short was crowned here in 752 and his infant son Carloman was then crowned king of Noyon, Charlemagne was crowned here in 768 and Hugh Capet elected in 987. Till the Revolution the bishopric was one of the ecclesiastical peerages of the kingdom. At the beginning of the 12th century Noyon obtained a communal charter through the favour of its bishops. Towards the middle of the 12th century the diocese of Tournai was split off. Noyon was ravaged by the English and the Burgundians during the Hundred Years' War. The city was captured by the Spaniards in 1552, and by the Leaguers, who were expelled in 1594 by Henry IV. John Calvin was born here in 1509.

Noyon was occupied by the German army in 1914 and was abandoned, bombarded and reduced to ruins 1917–18. Its beautiful transitional Romanesque Gothic cathedral was burned, and so was the old *hôtel-de-ville.* A good deal of the stone work of the cathedral survived the fire and was later restored. Again in June 1940 Noyon was occupied by the Germans. The town has good trade in livestock and grain and contains chemical and artificial manure works and iron foundries.

**NUBA, THE.** The Nuba may be regarded as the negro or negroid aborigines of Kordofan, although at the present day the northern half of this area is inhabited by Arabic-speaking tribes professing Islam, so that Dar Nuba, the country of the Nuba, occupies only the southern half of the administrative province, extending over 2½° to 10° N.

One of the most remarkable features of Dar Nuba is the multiplicity of languages spoken within its bounds. The inhabitants of hills only a few miles apart may speak languages mutually unintelligible, and even on the same *massif,* there may be two or three communities speaking different languages and coming little in contact with one another, though their customs and beliefs are fundamentally the same.

The inhabitants of the hills of southern Kordofan situated but little north of the Bahr-el-Ghazal have a series of languages with grammatical structure and vocabularies differing substantially from the Berberine dialects. The resemblances noted between the latter and those of Kordofan apply only to those spoken by a limited number of northern communities which have been subjected to foreign, *i.e.* Berberine, influence for a considerable period. Moreover, as Meinhof points out, such "Nubian" or "Hamitoid" languages extend scarcely a hundred miles south of El Obeid. Further south in the territory recognized by the Arabs as the true home of the Nuba (Dar Nuba corresponding on the administrative side roughly to the Jebel sub-province) two groups of languages must be recognized. One includes a number of "Sudan" languages, the other a series of tongues, called by Meinhof "pre-Hamitic," which, in some respects, resemble Bantu and Fulani and which Struck now terms "Bantoid." These latter languages, first noted in 1910, differ from the Berberine dialects, in which grammatical changes in both nouns and verbs are produced by suffixes, in that in the Bantoid languages these are brought about by initial change.

Struck, who has also studied the Nuba physical material available from the standpoint of its distribution among the linguistic groups considers that each is to be distinguished physically, and although the small number of individuals measured belonging to the Nubian and Sudanic groups renders some of Struck's conclusions premature it is probably true to say that the Bantoid group, with an average stature of 68in. and a cephalic index of 76·5, is rather longer headed and narrower nosed than the Sudanic who are themselves rounder-headed than the Nubian-speaking group from whom they do not substantially differ in breadth of nose or face.

**Mode of Life.**—The Nuba are for the most part agriculturists, the regulation of public life in each community being ultimately in the hands of the rainmaker. There is no clan organization among the southern Nuba and no restrictions upon marriage other than those imposed by blood relationship. No bride-price is paid, and either party can break the marriage at pleasure; property passes in the female line. This applies especially to the southern communities speaking Bantoid languages; further north, where a bride-price is paid, matters are less simple. Neither circumcision nor infibulation is practised, but the women of Jebel Talodi and the hills round it perforate the lower lip, in which they wear a quartz ornament. On many hills, especially where the lip ornament is worn, the lower incisors are removed in both sexes.

**Darfur.**—The non-Arab races of Darfur belong ethnically to, or originated from (many are now mixed) the hill stock, spoken of in Kordofan as Nuba (*supra*). In the north are the Bedayat, a nomad people related to Zaghawa; to the north of these are the Kura'an, who have been identified with the ancient Garamantes. The Zaghawa to the south are mentioned by Mas'udi, while Ibn Khaldun speaks of them as living further east, and at the present day there is a colony of them at Jebel Kagmar in Kordofan. These folk, although Mohammedans, have not yet given themselves Arab pedigrees; they retain their belief in rainmakers and are noted as potters. The people of Jebel Midob about 400m. west of Khartoum, described by MacMichael, differ but little from the Nuba of Kordofan; they are perhaps the least unknown of the pagan tribes of Darfur. The Tungur and Dargu are other ancient peoples of Darfur, the latter living by cultivation and breeding cattle in the fertile areas to the west of Dara. None of these peoples are as important as the Fur, from whom the country takes its name. Their stronghold is or was the considerable range known as Jebel Marra, whence they descended probably in the 17th century. Now nominally Mohammedans they still worship stones or trees to the extent that certain spots associated with rocks or trees are regarded as holy and are the scenes of sacrifice. (C. G. S.)

**NUBAR PASHA** (1825–1899), Egyptian statesman, was born at Smyrna in January 1825, the son of an Armenian merchant named Moghreditch, who had married a relative of Boghos Bey, an influential minister of Mehemet Ali. He was educated at Vevey and by the Jesuits at Toulouse. After some eighteen months' training as secretary to Boghos, who was then minister of both commerce and foreign affairs, he was made second secretary to Mehemet Ali. In 1845 he became first secretary to Ibrahim Pasha, the heir apparent, and accompanied him on a special mission to Europe. Abbas Pasha, who succeeded Ibrahim in 1848, maintained Nubar in the same capacity, and sent him in 1850 to London as his representative to resist the pretensions of the sultan, who was seeking to evade the conditions of the treaty under which Egypt was secured to the family of Mehemet Ali. Here he was so completely successful that he was made a bey; in 1853 he was sent to Vienna on a similar mission, and remained there until the death of Abbas in July 1854. The new viceroy, Said, at once dismissed him from office, but two years afterwards appointed him his chief secretary, and later gave him charge of the important transport service through Egypt to India. Here Nubar was mainly instrumental in the completion of railway communication between Cairo and Suez. After a second time falling a victim to Said's caprice and being dismissed, he was again sent to Vienna, and returned as principal secretary to Said, a position he held till Said's death in January 1863.

On the accession of Ismail Pasha, Nubar Bey was in the prime of life. He was already on friendly terms with Ismail; he even claimed to have saved his life—at all events, it was a coincidence that the two had together refused to travel by the train the accident to which caused the death (on May 14, 1858) of the prince Ahmed, who would otherwise have succeeded Said. Ismail charged him with a mission to Constantinople, to notify his accession, and to smooth the way for various projects, notably the completion of the Suez Canal, the change in title to that of khedive and the change in the order of succession. The sultan, believing as little as every one else that the canal was anything more than a dream, gave his consent at a price the moderation of which he must afterwards have regretted. The gratified Ismail created Nubar a pasha, and the sultan himself, persuaded to visit Cairo, confirmed the title so rarely accorded to a Christian. Nubar was sent to Paris to complete the arrangements, and to settle the differences between Egypt and the Canal Company.

On his return Nubar created the department of public works; but in 1866 he was made minister of foreign affairs, and at once went on a special mission to Constantinople, where he obtained the sultan's consent to the adoption by Ismail of the title of Khedive and the change in the law of succession. Nubar now had a harder task to undertake than ever before. The antiquated system of "capitulations" which had existed in the Ottoman empire since the 15th century had grown in Egypt to be a practical creation of seventeen *imperia in imperio*. (*See* EGYPT: *History.*) That in spite of the jealousies of all the powers, in spite of the opposition of the Porte, he should have succeeded in replacing the seventeen consular courts by mixed international courts with a uniform code, puts him in the first rank of statesmen of his period.

The extravagant administration of Ismail, for which perhaps Nubar can hardly be held wholly responsible, had brought Egypt to the verge of bankruptcy, and Ismail's disregard of the judgments of the Court at last compelled Great Britain and France to interfere. Under pressure, Ismail, who began to regret the establishment of the International Courts, assented to a mixed ministry under Nubar, with Rivers Wilson as minister of finance and de Blignières as minister of public works. Nubar, finding himself supported by both Great Britain and France, tried to reduce Ismail to the position of a constitutional monarch, but he lost the support of Great Britain and France, and was dismissed. (*See* ISMAIL.) Nubar remained out of office until 1884, when he was induced to become premier as the instrument of British policy, but he presently found himself in disagreement with Lord Cromer, and was dismissed by the khedive Tewfik in 1888.

Riaz Pasha, who succeeded him, was, with one interval of eight months, prime minister until April 1894, when Nubar returned to office. By that time Cromer had more completely grasped the reins of administration as well as of government, and Nubar had realized more clearly the rôle which an Egyptian minister was called on to play: Lord Cromer was the real ruler of Egypt, and

the death of Tewfik in 1890 had necessitated a more open exercise of British authority. In 1895 Nubar completed his fifty years of service, and retired. He died in Paris in January 1899.

**NUBIA,** a region of north-east Africa, bounded by Egypt, the Red sea and the Libyan desert, and extending south indefinitely to about Khartoum. It includes the Nile valley from Aswan near the first cataract to the confluence of the White and Blue Niles, stretching for about 560 m. between 16° and 24° N. Nubia, however, has no strictly defined limits, and is little more than a geographical expression. It is first associated historically, with the Nobatae, a negro people removed by Diocletian from Kharga oasis to the Nile valley above Egypt, whence the Blemmyes had been driven eastwards. From Nūba, the Arabic form of the name of this people, comes the modern Nubia.

The country consists mainly of sandy desert and rugged and arid steppes and plateaux through which flows the Nile. In this section of the river there occurs a continuous series of slight falls and rapids, and between Khartoum and Philae it makes a great S shaped bend, the region west of the Nile within the lower bend being the Bayuda Desert, and that east of the Nile the Nubian Desert, which districts roughly correspond to the conventional divisions of Upper and Lower Nubia respectively. Most of Nubia is within the almost rainless zone. An auriferous district lies between the Nile and the Red Sea, in 22° N. Politically the whole of Nubia is now included either in Egypt or the Anglo-Egyptian Sudan and has no administrative existence.

The life and agriculture of Egypt and the Sudan depend upon the Nile, which, for a great part of its course, flows through Nubia. To make irrigation possible for Egypt, a dam was built at Aswan, and barrages at Esna, Asyut and Zifta.

Until 1919 the Nile waters were utilized solely by Egypt, but in that year the Sudan government commenced a scheme to irrigate part of the Great Gezira plain by an enormous dam across the Blue Nile at Sennar, above Makwar, which was completed in 1925, when irrigation commenced.

In 1937–38 the Gezira irrigation scheme irrigated 206,653 ac. on which 149,149 short tons of seed cotton were harvested. The total area under cotton in the Sudan, including the irrigation from the river Gash, amounted to 426,818 ac., which produced 200,450 short tons. A barrage was erected at Jabal Awliya (Jebel Aulia) about 35 mi. south of Khartoum on the White Nile and was completed in 1937. The reservoir holds 1,620,000 ac. ft.

Proposals have also been put forward to build a dam at the foot of Lake Albert in Uganda. A barrage at Nagh Hammadi in Egypt was completed in 1930. To regulate and increase the water in the Blue Nile the construction of a barrage at Lake Tana in Abyssinia has been suggested.

The whole irrigation problem of the Nile involves difficult economic and political considerations between Egypt, Sudan and Abyssinia, in view of the fact that the waters of the Nile are of vital importance for Egypt.

Nubia is relatively well provided with communications. All navigable parts of the Nile are served by government steamers which also connect the different railroad systems. The railway from Alexandria terminates at Aswan. At Wadi Halfa the Nubian railroad begins which runs via Berber and Khartoum to Sennar. Branch lines go from north of Abu Hamed to Merowi, from Sennar crossing the White Nile at Kosti to El Obeid, and from Berber eastward to the Red sea at Port Sudan and Suakin. This latter branch is connected with Sennar by a line from Haiza junction southward to Kassala and thence to Sennar.

(X.)

## ARCHAEOLOGY

The archaeology of Nubia begins with a rare palaeolithic (Acheulian) implement of white quartz from Faras below the Second Cataract. Prehistoric settlements of the copper age spreading from Upper Egypt reached Dakkeh in the early period and held an isolated post at the Second Cataract in the later period. About the time of the 1st dynasty the two cataracts and all the intervening valley were occupied by small communities with the same culture as their Egyptian neighbours, but with two distinctive features in the grave deposits—the best pottery is soft but very thin with brilliant black polish inside, the outside yellow brown variegated with red haematite, and the palettes are of local quartz instead of slate. This culture seems to have soon disappeared. The Pharaohs of the 5th and 6th dynasty sent exploring and trading parties through Nubia and drew contingents for their armies from the Wawat, Aam, Meza and other tribes; but except some fortresses and an advanced trading post at Kerma beyond the Third Cataract they have left little trace. After the fall of the Old Kingdom a native civilization (known as the C-group) sprang up and long flourished between the first two cataracts. No dwellings of these nomad pastoral people have been recognized; they buried their dead in pits beneath orderly circular heaps of stones in the desert at some distance from the river. They used much leather, their black or red polished bowls are decorated with elaborate strap-work or plaited patterns, sometimes intensified by filling with white or with red, yellow and green earths; they made also the "prehistoric" sort of haematitic polished black-mouthed and other kinds of ware. Wawat of the valley and Meza (Beja, Blemmyes of the eastern desert?) alone were then the mercenary soldier tribes. The mother of Amenemhe I., founder of the 12th dynasty, was a Nubian and it is likely that these C-group people were on excellent terms with Egypt throughout that dynasty, whereas beyond the Second Cataract "Cush" appears as the object of conquest, and a series of elaborate fortresses was built all through the cataract region, each with its temple, up to Kerma, the residence of a wealthy Egyptian governor, who imported Egyptian statuary and manufactures and skilled workmen, and developed native-coloured industries in pottery, glazed-ware, etc. The Egyptian governors, and the native kings who succeeded them after the fall of the 12th dynasty, were interred in huge tumuli with multitudes of slaves and retainers buried alive in native fashion. The dead were laid on beds with their daggers, spears and knives; ostrich feathers and figures cut out of sheets of mica adorned the persons of the chiefs; exquisite haematitic pottery abounds, highly polished with grey and orange line between the black top and the red. Kerma was a great city in the midst of a barbarous and benighted kingdom of Cush (very different from the uniform wide-spread C-group), and only isolated burials of the same character generally associated with Egyptians, are found throughout Lower Nubia and Egypt.

Amasis I., his brother and founder of the 18th dynasty, began or added to the temple of Buhon, near Halfa, and in the next reign the Cushite kingdom was crushed out of existence. The first viceroy of the whole region was appointed by Thutmosi I. and entitled "king's son," a title which was afterwards changed to "king's son of Cush" or perhaps "son of the king of Cush," and the southern outpost of the empire was established by Thutmosi III. at Napata. Every king of the 18th dynasty built one or more temples in Nubia or had a shrine cut for him in the rock by his viceroy, and some kings built many temples. The most splendid was that of Soleb dedicated to himself and Ammon by Amenhotep III., who also built a lesser one at Sedēnga to the divinity of his queen, Taia; its name Ha-taia survives to this day in the place-name Adai. The series continued under Seti I. and Rameses II. in the 19th dynasty. The latter is everywhere between the first two cataracts. His new temples and shrines include the two great temples at Abu Simbel to himself and Queen Neferteri, also Ger Husên, Beit el-Weli, Wadi Sabu'a, Dirr, Ibrim, Faras, Aksha; and like Seti I. he was active in far off Napata. After Rameses II. only modest stelae or graffiti are found; even these cease at the end of the 20th dynasty. By the time that Thutmosi III. established his empire, Nubia had no independent vigour left, and even the C-group people had faded away to nothing. The antiquities of Nubia under the New Kingdom, both large and small, are entirely Egyptian. They include at Anibe tombs built with pyramidal roofs like those of Deir el-Medineh. The land between the First and Second Cataracts, *i.e.,* apparently the region named Wawat, was divided into districts like the nomes of Egypt with separate rulers. The first was centred at Dakkeh (Baki), the second at Anibeh (Maam), and the third opposite Halfa (Buhon), the capital in each case apparently at the southern end of its

district. Each was presided over by a Horus-divinity, representing the power of Pharaoh and dating back to the 12th dynasty, when strong fortresses existed at each of these places. There were also smaller districts subject to Hathor-goddesses, Bīgeh to Hathor of Senemt, and Faras to Hathor of Ibshek, whereas in the old Kingdom we hear only of a god Dedun of aromatic Nubia. In the shrines built further south in the New Kingdom the gods of the empire naturally take the lead—Amen-rē‘ of Thebes, Harmachis of Heliopolis and Ptah of Memphis.

The chiefs of Libyan mercenaries in Egyptian pay founded princely families at the southern outpost at Napata. The earliest of the Ethiopian-Libyan princes was buried at Kurrū with his flint-tipped arrows. A few generations later, about 725 B.C., Pankhy, after extending his power over Upper Egypt, triumphed completely over Tefnakhte of Sais. With artisans brought from Egypt Pankhy added to and adorned the temple of Ammon at Napata. The conquest of Egypt by Shabako followed and the throne of the Pharaohs was occupied for about 50 years by Ethiopians. Under the first two, Shabako and Shebitku, building proceeded in Egypt, but in Nubia their only monuments are pyramids in the ancestral burial place at Kurrū. The third Pharaoh, Tirhaqa, built more than one temple at Napata and the first and by far the largest pyramid of a new group at Nūri; at Sanam opposite Napata he built a temple and the extensive cemetery has many relics of his reign. Even in Lower Nubia, at Buhon and at Ibrīm, Tirhaqa's name occurs on temple-constructions and isolated graves have been found of his time. When his nephew, Tandamane, retired from Egypt before Psammetichus I. the line of Ethiopian kings continued to reign at Napata, with a palace also at Meroe, and were buried at Nūri. But their borrowed Egyptian culture fell lower and lower. Their sculptures and inscriptions, their glazed amulets and ushabti became ever more barbarous; mummification was abandoned and crouched burial, hand-made pottery (some of it reminiscent of prehistoric black-mouthed ware) became the rule. The pyramids lost their enduring form and sacrificed solidity to height. In Lower Nubia the only records of this time are graffiti of the Greek and Syrian mercenaries of Psammetichus II. (594–589 B.C.) on the colossus of Abusimbel, which must fall in the reign of Aspalta according to Reisner's chronology. The Persians are said to have invaded Ethiopia under Cambyses in 522, but they left no mark, and Ethiopians served in the army of Xerxes. According to Dr. Reisner, Meroe became the chief capital of the Ethiopians about 300 B.C.

At length, towards the end of the 3rd century, Ergamenes, a contemporary of Philadelphus who broke the political power of the priests at Napata, and certainly built his pyramid at Meroe, seems to have joined with Philopator (Ptolemy IV.) in adding to the temple of Isis at Philae and founding a new shrine of Thoth at Dakkeh; Azakheramani, succeeding him, built a shrine at Debod and gave aid to the rebel native kings of Thebes, Harmakhis and Ankhmakhis, until they were suppressed by Epiphanes (Ptolemy V.). The Triacontaschoenus between the first two cataracts was now claimed by the Ptolemies, but nothing was done there after Euergetes II., and his activity was probably confined to the Dodecaschoenus, the southern end of which at Dakkeh commanded the route to the gold mines of the Wadi Allāgi. The natives of Nubia, subject to Meroe, were beginning to acquire wealth and culture and had pushed up, chiefly on the west bank, to the frontier of the Dodecaschoenus.

### UNDER AUGUSTUS

After the conquest of Egypt by Augustus the first prefect appointed or agreed to a native ruler for the Triacontaschoenus, but while the next prefect was engaged in Arabia, an army under the command of the Meroitic crown-prince, Akinirar, in the reign of Teriteqas and Amenirenas-Candace, attacked and captured Philae, Syene and Elephantine, and established itself at Dakkeh (Pselcis). Petronius, however, the third prefect, quickly captured their headquarters, almost annihilating the Meroitic army, and following up the Nile, reached Napata and destroyed it. After a Roman garrison had held Ibrīm for several months Augustus decided to limit the possessions of the empire above Syene to the Dodecaschoenus, and soon temple-building began again in this Roman territory all along the west bank, the east bank being more open to attack from the Blemmyes of the desert. The punitive expedition of Petronius had been disastrous for the Meroites from Napata northward, and two centurions who spied out Ethiopia for Nero found nothing but scattered villages and a very impoverished people. Prosperity returned, and in the reign of Natakamani and his queen Amanitēre Candace a temple was built at Amāra between the Second and Third Cataract; the Napata temple was restored and important buildings were erected in the far south at Nāga and Ben-nāga and Meroe itself, towards the end of the 1st century A.D. The Faras cemetery, a type of many others, now becomes full of graves with decorated wheel-made pottery in abundance, vessels of bronze and glass, bead necklaces and trinkets, indicating a large and prosperous community. Many of the objects were imported; much is childish or in bad taste, but some of the local pottery is handsome in shape and decoration and much, such as the well-preserved barbotine cups, is of archaeological interest. The traditional hand-made wares (except black topped red ware) also recur. A century later the pottery is all wheel-made but less varied and interesting though still quite characteristic. Dating from A.D. 252 is a very long inscription in demotic writing at Philae recording a religious mission sent to the temple by King Teqreramani, whose monuments are amongst the latest found at Meroe. During all this time the Dodecaschoenus remained outside the Meroitic rule, and its antiquities are of Late Roman style and totally distinct from the Meroitic series on the other side of the border line. Soon after this date the Meroitic culture in Lower Nubia was destroyed by the Blemmyes of the eastern desert who from time to time laid waste Upper Egypt. About A.D. 285 Diocletian withdrew the garrisons from the Dodecaschoenus and invited the Nobatae from the western desert to settle there, subsidising them as a protection against the Blemmyes. The remnants of Meroitic civilization in the south were wiped out early in the 4th century by Aeizanes the powerful king of Axum. The Blemmyes were now established in the valley of the Dodecaschoenus and as far up the Nile as Ibrīm and their king reigned at Talmis (Kalabsheh). In the middle of the next century the Nobatae united with the Blemmyes in fresh outrages on Egypt; they were compelled by Florus in 452 to keep the peace for a hundred years but were allowed to visit the temple of Philae and borrow the statue of Isis for consultation in their own country. About the end of that century Silco, king of the Nobatae, conquered the Blemmyes from Ibrim to the First Cataract. We next discern at least five peoples in Nubia; the Nobatae in the valley between the two cataracts with capital probably Pachoras; the Blemmyes in the eastern desert; the Makurians (perhaps the old Magabari) south of the Nobatae, with capital perhaps at Dongola; and the kingdom of 'Alwa (Alodia) with capital 'Alwa or Sōba on the Blue Nile near Khartoum. In A.D. 543 the pagan temple of Philae was definitely closed and the statues then taken to Constantinople. A Christian missionary, Julian, of the Monophysite creed, with Theodore the bishop of Philae, began the conversion of the Nobatae, and after an interval of 18 years the conversion was consolidated by Longinus, another Monophysite, from 569 onwards. At about that time, under a king Eirpanome, the temple of Debōd was converted into a church. In 580 Bishop Longinus accepted the invitation of the king of 'Alwa and was escorted by the friendly Blemmyes through the deserts to the Blue Nile; 'Alwa at once became Christian, although the intervening Makuria remained stoutly pagan for a time.

Little is known of the history of Christian Nubia. For a century Lower Nubia probably enjoyed peace and prosperity, Makuria and Nobatia uniting in one Christian kingdom ruled from Dongola. In 652 a Muslim army from Egypt under 'Abd-allah-ibn Sa'ad captured Dongola, and required all the inhabitants of the kingdom to pay tribute to Egypt. Arabic historians often refer to the dealings of Egypt with Nubia, and the names of many kings are known from literary sources or from monuments, some of them being native as the above Eirpanome and Kudanbes (A.D. 1320), others biblical, as David, Abram, others again Christian-Greek as Basil, Mercurius.

The churches in Nubia were singularly small, when not simply adaptations of heathen temples or parts of them, or of tomb-grottoes. The more pretentious were built with carved stone columns and lintels, the walls of stone up to the level of the windows and above that of crude brick; others were entirely of crude brick, for which material in the more rainy districts of the south burnt brick was substituted. Many bear the marks of Muslim ruin and progressively inferior repair, with inappropriate re-use of the carved stones. There were two principal types, basilican and domed. The apse was single with altar in front and a sacristy on either side; the nave was with aisles, the ambo on the north side of the nave, a chamber at the north-west corner and a stairway to the roof at the south-west corner. Painted figures of Christ, saints and angels, and scenes from the Old and New Testaments covered a large part of the walls. Little now remains of them, much having been ruined in the last hundred years, not only by the natives, but by archaeologists clearing away without record all Christian work from the temples. Pottery was, as always in Nubia, the best product of the arts, the most attractive sort being shallow cups of fine thin ware coated with a thick white slip and painted in various designs in sepia.

BIBLIOGRAPHY.—G. A. Reisner and C. M. Firth, *Archaeological Survey of Nubia, Memoirs* (Cairo, 1910–15); L. Borchardt, *Altägyptische Festungen an der Zweiten Nilschwelle* (Leipzig, 1923); G. A. Reisner, "Kerma," *Harvard African Studies,* vol. v. (Cambridge, Mass., 1923); "The Meroitic Kingdom of Ethiopia" and many other articles in *The Journal of Egyptian Archaeology,* vol. ix. etc. (London, 1923); J. Lesquier, *L'Armée Romaine d'Égypte d'Auguste à Dioclétien,* pp. 458–490 (Cairo, 1918); G. Roeder, "Die Christliche Zeit Nubiens und des Sudans," in *Zeitschrift für Kirchengeschichte,* xxxiii. pp. 364–398 (Gotha, 1913); G. S. Mileham, *Churches in Lower Nubia* (Philadelphia, 1910); Somers Clarke, *Christian Antiquities in the Nile Valley* (Oxford, 1912); F. Ll. Griffith, "Oxford Excavations in Nubia," in *Annals of Archaeology and Anthropology,* vols. viii.–xv. (1921–28). (F. Ll. G.)

**NUBIAN LANGUAGE AND WRITING.** Nubian is the name given to the language of the Barabra or Nubians in the Nile valley, between Merawi, a few miles below the ancient Napata, and the First Cataract at Aswān. It has here two principal dialects, the Mahass-Fadīja being spoken in the central portion, from a little south of the Third Cataract, and the Dongola-Kenzi at either end of the region; the speech of these Barabra is now pervaded with Arabic words. Moreover, in the hills of Kordofān, dialects of Nubian are spoken by many small communities amongst other languages only remotely akin, and are found westward as far as eastern Darfūr. Nubian is without gender, agglutinative and mainly monosyllabic. Nubian roots are traceable in Ethiopian geographical names handed down by classical authors; but perhaps the chief interest of the language is its use in the writings of the Nubian Church. Probably to fortify their independence against Muslim encroachment, the Nubians adapted the Greek alphabet, with necessary additions from the Coptic and perhaps the Meroitic alphabets, to the purpose of writing their own language. The rare examples of Nubian writing that have been discovered, besides graffiti and two legal documents, comprise portions of a lectionary, homilies and edifying narratives, obviously translated from Greek and not from Coptic. The earliest dates from the end of the 8th century, the latest from the beginning of the 14th.

*See* H. N. Almquist, *Nubische Studien im Sudān 1877–78* (ed. Zetterstéen), Uppsala, 1911 (Bibl.); F. Ll. Griffith, *The Nubian Texts of the Christian Period,* Berlin, 1913; H. Junker and W. Czermak, *Kordofān Texte im Dialekt von Gebel Dair,* Vienna, 1913.
(F. Ll. G.)

**NUBIANS:** *see* BARABRA.

**ÑUBLE,** a province of central Chile, bounded N. by Maule and Linares, E. by Argentina, S. by Concepción and Bío-Bío and W. by Concepción and the Pacific ocean. Area, 5,485 sq.mi., according to the redefinition of the limits of the province in the '30s; pop. (1940 census) 243,185. The province lies partly in the great central valley of Chile, noted for its fine climate and fertility, partly on the western slopes of the Andes and partly in the coast ranges. The Itata river, which forms a part of the south-western boundary, and its principal tributary, the Ñuble, form the drainage system of the province. Agriculture, including viticulture, and grazing are the principal industries. The state railway from Santiago to the southern provinces passes through Ñuble, from north-northeast to south-southwest, and sends off a branch from Búlnes west to Tomé on the Bay of Concepción. The capital is Chillán, pop. (1940) 39,909; other important towns are San Carlos and Búlnes. The hot baths of Chillán (Termas de Chillán), in the eastern part of the province on the slope of the volcano of that name, are popular in Chile.

**NUCERIA,** an ancient city, Magna Graecia, on the west coast of Italy near the modern Nocera Tirinese. It was a small city in an important strategic position between two rivers, the valley of one of which affords a route to the valley of the Crathis, but had no harbour.

**NUCLEUS,** in biology the term first introduced by Miescher (1871), employed to describe a structure found in the cells of which the tissues of animals and plants are composed. In general it is a viscous spherical body containing a structure known as the *plasmosome* (or *nucleolus*) and a tangle of material *chromatin* characterised by a special affinity for basic dyes. The importance of the latter is set forth in the article on CYTOLOGY (*q.v.*). Discrete nuclear structures can be found in many micro-organisms, but cannot be identified with certainty, as yet, in the living substance of bacteria and *Cyanophyceae* (blue-green algae).
(L. T. H.)

**NUCLEUS.** Modern physical research has led to the theory that an atom of any given element, far from being the minute, impenetrable solid entity which it was supposed to be before the discovery of the electron, is a very open structure. It consists of a small, relatively compact particle at the centre, carrying a net positive charge, which is surrounded by a number of electrons sufficient to make the atom, as a whole, neutral. This central particle, in which practically the whole mass of the atom is concentrated, is exceedingly small, even compared to the atom. It is about a million-millionth of a centimetre in diameter, while the atom itself is a few hundred millionths of a centimetre across. These figures must not be taken to do more than give a rough estimate of the kind of sizes in question, for not only is it difficult to define precisely the size of a particle without a sharp boundary, such as an atom or its parts, but also the size is known to vary somewhat from atom to atom. The minute central particle is called the nucleus of the atom, the term having been first suggested by Rutherford in 1912 (*Philosophical Magazine,* xxiv, 461), to whom the nuclear theory owes its origin.

The nuclear theory of the atom is discussed under ATOM, where, however, attention is directed mainly to the widely-spaced electrons which surround the nucleus, the nucleus itself being considered merely as supplying a central attractive force which governs the number and behaviour of these electrons. In this article the properties of the nucleus itself will be treated in more detail.

**Nuclear Properties.**—The nucleus being at the centre of the atom, and surrounded by a strong electric field, is inaccessible to ordinary laboratory agencies, such as heat, strong electric or magnetic fields, mechanical pressure, and so on. Chemical combination affects only the outer regions of the atom, and has no influence on the nucleus itself. Nuclear properties are therefore atomic properties, rather than molecular properties: that is, they persist unchanged as properties of the atom, no matter how it may be combined. Such a property is mass, which has been experimentally shown, to a very high degree of accuracy, to be unchanged by chemical reactions. Another property of the nucleus is its net positive charge, which determines how many electrons an atom can possess in its neutral state, and so determines its chemical properties, since a given number of electrons controlled by a given central charge take up a definite disposition. To these mass and charge properties of the nucleus we attribute the existence of isotopes (*q.v.*), since, as we shall see, a given nuclear charge is not invariably associated with the same nuclear mass. The radioactive properties, which no laboratory agent can produce or modify, hurry up, or slow down, are also of an atomic nature. There is strong evidence that the radioactive processes which give rise to the discharge of $\alpha$-, $\beta$-, and $\gamma$-rays arise in the

nucleus: radioactivity is a nuclear process. It is, in fact, mainly from the radioactive side that our knowledge of nuclear structure, scanty though it may be, has come.

The experiments, mainly carried out by Aston, which have established firmly the existence of isotopes, reveal the net charge and mass of the nucleus, but tell us little of any mechanism which may exist within the nucleus. We may therefore say that the study of isotopes reveals the static properties of the nucleus. On the other hand radioactive processes arise in energy changes which are taking place within the nucleus. Their study reveals the dynamical aspect of the nucleus.

**Origin of the Theory of the Nucleus.**—Rutherford was led to enunciate the nuclear theory of the atom as a result of a study of the scattering of $\alpha$-particles by matter. The $\alpha$-particles are atoms of helium, carrying a positive charge $2e$ (where $e$ is the magnitude of the electronic charge), which are shot off spontaneously by certain radioactive bodies. (*See* RADIOACTIVITY.) The $\alpha$-rays from a given radioactive element are homogeneous in velocity (except for a few longer range particles present in certain cases), and thus provide a very valuable instrument for investigation. Those from Radium C, for instance, which have been chiefly, though not exclusively, used for the scattering experiments, are discharged with a velocity of about $1{\cdot}922\times10^9$ cm./sec., and an energy of $1{\cdot}224\times10^{-5}$ ergs. Swift $\alpha$-particles can be detected by their action on a phosphorescent screen. If a surface be covered with phosphorescent zinc sulphide, which is the substance usually employed, and the soft glow produced in the sulphide by the near presence of a radioactive substance be examined with a low power microscope, it is found that the light is not uniform, but made up of evanescent specks of light, which are referred to as scintillations. These scintillations are due to the impact of $\alpha$-rays on the screen. (*See* RADIOACTIVITY.) With suitable precautions every $\alpha$-particle can be made to produce a scintillation so long as its energy has not been too much diminished by passage through matter before the impact. A phosphorescent screen placed at right-angles to the path of a pencil of $\alpha$-rays gives us, then, a method of ascertaining how many $\alpha$-particles fall in a given time within a given small area, that is, proceed in a given direction, and it is by the scintillation method that the scattering of $\alpha$-particles has been investigated. A narrow beam of $\alpha$-rays of homogeneous velocity, say from a source of Radium C, produces a sharp spot on the screen. If a very thin metal foil be introduced in the path of the beam the spot loses its sharp outline and becomes diffuse, and a study of the scintillations makes it possible to say what fraction of the particles has been deflected through a given angle by the passage through the foil.

Studying the scattering in this way Geiger and Marsden found that the distribution of the scattered particles in the neighbourhood of the original beam was such as to accord with the view that each particle had suffered a large number of encounters, each encounter producing a small deflection in a random direction. In other words, the scattering through small angles obeys a law which can be calculated from the theory of probability, applied to calculate the final effect of many scatterings in chance directions. In addition to these $\alpha$-particles scattered through small angles there are a few scattered through large angles, and among these there are even some that have been so far deflected from their original direction that they issue from the foil on the same side as they went in, being thus, in a sense, "reflected." It might at first be supposed that a large number of small deflections conspire to produce such a very large deflection, but, from the probability considerations that give the distribution for small angle scattering, the number of particles to be anticipated at any given large angle can be calculated, and turns out to be far less than the number of large angle scatterings actually observed. In other words, there are far too many particles scattered through large angles for it to be possible to explain them on the basis of a multiple scattering through small angles in random directions. It was from this apparently insignificant quantitative observation that the nuclear theory sprang.

In 1911 Rutherford pointed out that large angle scatterings of the $\alpha$-particle, in the number actually observed, could only be explained as the result of single encounters with very intense centres of force. To provide those centres of force he assumed that each atom contained a central positive charge, with which the mass of the atom was associated, the remainder of the atom being made up of rings of electrons, maintained in a stable position by rotation. The central charge (or nucleus, as it was called later) was assumed to occupy a very small space, the diameter being taken as of the order $10^{-12}$ cm. in Rutherford's original paper. It becomes clear that in this case very few of the $\alpha$-particles passing through a thin foil, which may be some thousands of atoms thick, will approach near the nucleus: rather they will pass near outlying electrons in several atoms, experiencing a small deflection at each near passage. This accounts for the distribution of the particles deflected through small angles. An occasional $\alpha$-particle, however, will pass close to the nucleus, and will then experience, owing to the intense field of force caused by the big positive charge, a deflection which will be the larger the closer the approach. We thus distinguish between two different processes, multiple scattering, which denotes repeated small deflections in the majority of the particles which traverse the foil, and single scattering, which denotes the occasional very large deflection due to passage close to the nucleus. With foils such as are used in the experiment the chance of a given $\alpha$-particle experiencing more than one close approach to a nucleus, and hence more than one large deflection, is negligibly small.

This theory of single scattering survives severe quantitative tests. With the help of the simple theory of the dynamics of a particle, as applied in elementary considerations of planetary motion, the behaviour of a particle projected towards another particle repelling it with an inverse-square law of force can be easily worked out. Let the mass of the nucleus be so large that it may be considered infinite, and let its charge be $Ze$, where $e$ is the magnitude of the electronic charge: let the mass, charge and velocity of the $\alpha$-particle be $M$, $E$ and $v$. Then it can be shown that

$$p=\frac{ZeE}{Mv^2}\cot\tfrac{1}{2}\varphi$$

where $p$ is the length of the perpendicular from the centre of the nucleus onto the original direction of motion, and $\varphi$ is the angle through which the particle is deviated. (Fig. 1.) This gives a relation which can clearly be used to find the chance of a given large angle of deviation, since the probability of a given $p$ can be found immediately if we know the number of nuclei (*i.e.*, of atoms) per unit area of foil. If $n$ be the number of atoms per unit volume, $t$ the thickness of the scattering foil, the chance $q$ of a particle having an original direction such that $p$ lies between $p_1$ and $p_2$ is

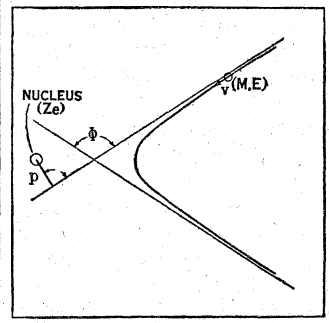



FIG. 1.—TO ILLUSTRATE THE THEORY OF SINGLE SCATTERING OF PARTICLES BY A HEAVY NUCLEUS

$$q=\pi(p_1^2-p_2^2)\,nt$$

so that the fraction of the incident particles deviated at an angle between $\varphi_1$ and $\varphi_2$ is

$$q=\pi\frac{Z^2e^2E^2}{M^2v^4}\,nt\,(\cot^2\tfrac{1}{2}\varphi_1-\cot^2\tfrac{1}{2}\varphi_2).$$

Since it is usual to arrange the little phosphorescent screen so as to be normal to the particular direction of scattering which is being investigated the equation is usually transformed so as to give the number **A** of particles turned through a given angle $\varphi$ which fall per unit of area on such a screen placed at distance $r$ from the point where the original beam hits the foil. This is

$$\mathbf{A}=\frac{QntZ^2e^2E^2\operatorname{cosec}^4\tfrac{1}{2}\varphi}{4r^2M^2v^4} \qquad (1)$$

when $Q$ is the number of particles in the original beam.

Now this formula can be checked experimentally:

(1) By measuring the number of particles turned through dif-

ferent large angles, to investigate the proportionality to cosec $4\frac{1}{2}\varphi$.

(2) By investigating the connection between the number scattered at a given fixed angle $\varphi$ and the velocity: the number should be inversely as the fourth power of the velocity.

(3) By varying the thickness of the foil, and measuring the variation of the number of particles scattered at a given fixed angle, which should be proportional to the thickness.

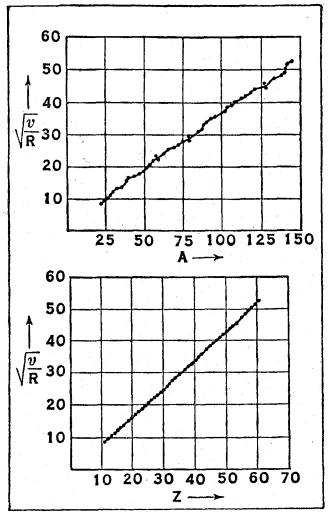
In these points the formula was satisfactorily confirmed. The proportionality to thickness is particularly important. Quite apart from the formula, it is easy to see that the theory of single scattering gives this result, since the number of nuclei behind a given surface area of foil is proportional to the thickness, and the chance that the close approach needed for large angle scattering shall take place with more than one nucleus is negligibly small with the thicknesses of foil which are practicable. On the other hand any theory of multiple scattering gives a proportionality to the square root of the thickness of foil.

To help the reader to form an idea of the chance of a single scattering through a large angle, and of the unlikelihood that a single particle shall make two encounters of the type which lead to such scattering, the following picture may be offered. One of the thicker gold foils used in the scattering experiments, actually some few hundred-thousandths of an inch thick, may be considered to be magnified until it is a mile thick. The centres of the individual gold atoms will then be about a yard apart. The $\alpha$-particle on the same scale will be represented by a tiny grain of dust, something less than a thousandth of an inch across. To be deflected through 45° this grain, in its passage through the mile-thick foil, must pass within four thousandths of an inch of one of the yard-separated centres. For larger angles of scattering an even closer approach is necessary.

The large angle scattering of $\alpha$-particles thus afforded, at the hands of Rutherford, certain evidence as to the nuclear structure of the atom. The great advantage of the $\alpha$-particle as a probe to investigate the fields of force which make up atomic structure is, firstly, that a single radioactive element gives a beam of homogeneous velocity, and, secondly, that single particles can be detected. A great deal of work has been done on the scattering of $\beta$-particles, from which a degree of confirmation of these views as to the mechanism of single scattering and multiple scattering can be derived. The intermediate case, where the number of deflections suffered by a particle is neither one, nor very large, also comes into account with $\beta$-particles with a certain thickness of foil and a certain angle of scattering. The problem of $\beta$-ray scattering, while of considerable interest, has not, however, on the whole, given us any fresh information on the nucleus, and therefore only receives passing reference here. It should not, however, be forgotten that, as a result of experiments on the absorption by matter of electrons of different speeds, including $\beta$-rays, Lenard, as long ago as 1903, put forward the view that the impenetrable part of the atom was very small. This impenetrable part, however, he considered to be located in a large number of small electrical doublets, which he called dynamids, each dynamid being, as a whole, electrically neutral. While this view has perforce been abandoned it is of great historical importance.

**The Charge and Mass of the Nucleus.**—If the elements be arranged in order of atomic weight, and then numbered successively, starting with hydrogen as 1, helium as 2, and so on, the number pertaining to a given element is known as the atomic number, a number often denoted by $Z$, which symbol is used throughout this article. The charge on the nucleus is then $Z$ times the magnitude of the electronic charge $e$. That this is so was first suggested by van den Broek in 1913, and confirmation of his hypothesis was speedily furnished by the experiments of Moseley. Moseley used the method of crystal reflection, which had just been discovered by W. H. and W. L. Bragg (*see* under article X-RAYS), to measure the wave length of the characteristic X-rays given out by different elements subjected to suitable electronic bombardments, and found that the X-ray spectrum of every element conformed to a single type, consisting of a group of a few lines of shorter wave length and another group of a few lines of longer wave length. These groups corresponded to the so-called $K$ and $L$ radiations discovered by Barkla from the difference of their penetrating power, and were accordingly called the $K$ and the $L$ series.

The $K$ and $L$ radiations are characteristic of the atom, not of the molecule: they are not affected by the state of chemical combination in which the atom may be held (except for certain small secondary effects, discussed under X-rays, *Röntgen*). Moseley found that the wave length of a given line in the X-ray spectrum decreased from element to element, taken in order of increasing atomic weight, and also that the frequency of such a line followed a simple law. This law, known as Moseley's Law is that, if corresponding lines be selected in the spectra of the various elements, then the square root of the frequency increases by a constant amount from element to successive element. Now while the atomic number, as defined, increases by 1 from element to element, the atomic weight increases by irregular steps. The law is exhibited in fig. 2, where $\sqrt{\nu/R}$ is plotted above against atomic weight, below against atomic number: it is obvious that regularity exists in the latter case only. Here $\nu$ is the frequency of the selected line, in the case of fig. 2 the so-called K$\alpha$ line, and $R$ is the constant, of fundamental importance for the theory of line spectra, known as Rydberg's constant. (*See* SPECTROSCOPY.) These results clearly show that there is some fundamental feature of the atom which is proportional to the atomic number, but has no reference to the atomic weight. A comparison of the simple formulae found by Moseley for the relationship between the frequency of the X-ray lines and the atomic number $Z$, which can be written




FROM E. N. DA C. ANDRADE, "STRUCTURE OF THE ATOM" (G. BELL & SONS)

FIG. 2.—THE SQUARE ROOT OF THE FREQUENCY OF AN X-RAY SPECTRAL LINE PLOTTED (ABOVE) AGAINST ATOMIC WEIGHT, AND (BELOW) AGAINST ATOMIC NUMBER, SHOWING THAT A SINGLE RELATION EXISTS IN THE LATTER CASE ONLY

$$\frac{\nu}{R}=(Z-1)^2\left(\frac{1}{1^2}-\frac{1}{2^2}\right) \text{ for the } K\alpha \text{ line}$$

and

$$\frac{\nu}{R}=(Z-7.4)^2\left(\frac{1}{2^2}-\frac{1}{3^2}\right) \text{ for the } L\alpha \text{ line}$$

with the general formula, deduced by Bohr, for a series in the line spectrum of a hydrogen-like atom (*see* ATOM), namely

$$\frac{\nu}{R}=Z^2\left(\frac{1}{n'^2}-\frac{1}{n^2}\right)$$

where $Ze$ is the nuclear charge, shows that Moseley's $Z$, multiplied by $e$, must also be the nuclear charge. The constants subtracted from $Z$ in Moseley's formula represent, speaking roughly, a shielding effect of the inner electrons. (*See* X-RAYS.) Thus Moseley's work, as represented by fig. 2, proves that the net positive charge on the nucleus is given by the atomic number, which thus has a fundamental significance for the nuclear theory of the atom. Moseley's linear relation is shown by more recent experiment not to be exact, but the departure, which is in the sense of a slightly more rapid increase of $\sqrt{\nu}$ with increasing $Z$, does not affect in any way this deduction, the curve remaining smooth, and the deviation from linearity being attributable to secondary effects.

The magnitude of the nuclear charge can be deduced directly from experiment by applying the formula (1) for single scattering, whose verification has already been discussed. **A** can be experimentally determined, by counting the scintillations due to particles scattered through a given large angle; $n$ is known from the atomic weight and the density; the thickness $t$ of the foil can be easily

measured; $e$, $E$, $M$, $v$ are all known; and $r$ and $\varphi$ merely express details of the experimental disposition. The only unknown in the equation is therefore $Z$. Rutherford in his original paper merely made a rough estimate, from which he conjectured that Z was about half the atomic weight, which is, in fact, a fair approximation. In 1920 Chadwick carried out the scattering experiments in a modified form, with greater accuracy, and obtained for platinum, silver, and copper values of $Z$ which were respectively 77·4, 46·3, and 29·3. The atomic numbers of the elements in question are 78, 47, and 29 respectively, so that the hypothesis that the number of electronic charges, of positive sign, in the nucleus is equal to the atomic number has been confirmed by the scattering experiments for elements of widely different atomic number.

The nuclear theory of the atom has been confirmed by another method of studying single scattering. The Wilson cloud chamber (*q v.*) gives us a method of rendering visible the path of an $\alpha$-particle, by means of a condensation of minute droplets of water on the ions produced by its passage. A study of photographs of these so-called ray tracks shows that some of the tracks end in forks, both prongs of the fork making an angle with the original direction of the $\alpha$-ray. The one prong is due to the $\alpha$-particle itself, turned through a large angle by collision with a nucleus of a gas atom, the other prong is due to the struck nucleus, which likewise produces ionisation, and consequent condensation, along its path. A single photograph will not enable us to measure accurately the angle which the forked tracks make with one another and with the original ray, since the plane containing the three paths makes an unknown angle with the direction from which the photograph is taken. If, however, two photographs are taken of a single ray track, from mutually perpendicular directions, it is a simple matter of geometry to find these angles. Now, on the assumption that the collision of $\alpha$-particles obeys the ordinary laws of mechanics for the collision of perfectly elastic bodies (conservation of energy and momentum) it is easy to calculate a theoretical value for the angles involved in the collision, but such a calculation involves the ratio of the mass of the struck particle to that of the striking particle Comparison of the theoretical and experimental values enables us to find a value for this ratio. Blackett, from a study of the passage of $\alpha$-particles through oxygen, obtained in this way for the mass of the oxygen nucleus 16·72, which is in good enough agreement with the chemically known value 16. Examples of his photographs are given in the article WILSON CLOUD CHAMBER. Calculation shows that if the masses of striking and struck particles are equal, a case that can be realized experimentally by letting $\alpha$-particles pass through helium, the two branches of the fork should always be at right angles to one another, no matter what angle the $\alpha$-particle itself be turned through. This result has also been confirmed experimentally, the actual value found being, for instance, 89° 27′ in one case. Since all the calculations are based upon the assumption that the whole mass of the atom is concentrated in a minute nucleus these ray track experiments give a brilliant confirmation of this feature of the theory.

**The Size and Field of Force of the Nucleus.**—In the case of an entity like the nucleus, whose existence is revealed to us by experiments on the deflection of particles, no definite boundary is defined by the conditions, and we must discuss what we mean by its size before we can attempt to form an estimate of it. Let us first consider what we mean by size in the case of other entities. In the case of an ordinary body, such as a metal wire, we can measure the thickness either by visual methods, such as the use of a reading microscope, depending upon the fact that there is an abrupt change of optical properties at the surface of a metal (revealing itself, for instance, by a reflection of the light taking place at a definite plane) or by mechanical methods, such as a micrometer screw. The reading of the micrometer depends to a slight extent upon how hard we screw it up, or the recorded size of the wire depends upon the force we exert. In other words, what we are really measuring is the place at which the resistance to the jaws changes abruptly, the force being negligibly small just outside the surface, and increasing rapidly but continuously as we force the jaws together. In the case of the dimensions of an atom, as measured by methods depending on the kinetic theory of gases, the diameter of the atom is taken as the distance between the centres of two atoms at the moment of closest approach. This depends markedly upon the relative speed of the two atoms, decreasing as the speed increases, that is, as the temperature of the gas is raised. The size of the atom usually accepted is that given by the distance of closest approach in a gas at ordinary temperatures, but some other methods, such as the distance of closest approach of atoms in a crystal of known structure, may also be used, and give somewhat different values.

We note the condition of arbitrariness in statements of atomic size: an atom has no sharp boundaries. Similarly, some convention must be adopted in speaking of the size of the nucleus of the atom. Either we can make an attempt to estimate the distance between the centres of the nucleus of an atom and of the $\alpha$-particle at the moment of closest approach, the $\alpha$-particle having a given velocity, or we can investigate the distance from the centre at which the inverse-square law of repulsion breaks down. Whether this distance be called the size of the nucleus is a matter of definition, and in any case it becomes necessary to state within what degree of accuracy we require the inverse-square law to be obeyed outside the boundary so specified. As with the atom, what we call the size is, within limits, a convention.

The investigations of the scattering of $\alpha$-particles, to which extensive reference has already been made, shows that with gold, for instance, the inverse-square law holds in cases where the angle of scattering is anything between 5° and 150°, since the formula (1) is based upon the assumption of an inverse-square law, and it represents experimental fact within this range of angle. For an actual head-on collision, the distance $b$ of closest approach of centres is given by

$$\tfrac{1}{2}Mv^2=\frac{ZeE}{b}$$

from which $b$ can be calculated, and for an angle of scattering of 150° the distance of closest approach is only slightly greater. This gives $3\times10^{-12}$ cm. as an upper limit for the radius of the gold nucleus. A study of the photographs of the forked ray tracks also enables us to estimate limits within which the inverse-square law holds, and leads to the conclusion that it is still valid for a distance $7\times10^{-12}$ cm. between centres of nucleus and $\alpha$-particle in the case of argon and $3\times10^{-12}$ cm. in that of air. The dimensions of the helium nucleus are probably smaller than those of the heavier nucleus, so that the general results of these estimates is $3\times10^{-12}$ cm. as the order of nuclear radius, as compared to $2\times10^{-8}$ cm. as the order of atomic radius. It may be added that the approach for the smaller angles at which the scattering law holds indicates that the inverse-square law is still valid at distances as great as $\cdot36\times10^{-10}$ cm. for gold, $5\times10^{-10}$ cm. for air and $10^{-9}$ cms. for argon, or a space surrounding the nucleus of the order $10^{-10}$ cm. in radius is free from any marked concentration of electrons.

Rutherford studied experimentally the impact of $\alpha$-particles on hydrogen nuclei, as further described when the disruption of the nucleus is considered. He came to the conclusion that, while for very slow $\alpha$-particles the number of hydrogen nuclei (to which the name protons, suggested by Rutherford, is often applied) knocked forward at different angles agrees with that calculated on the assumption of an inverse-square law of repulsion between the striking and the struck nuclei, with fast $\alpha$-particles the number thrown directly forward is much larger than is to be anticipated on this basis, a fact which he explained by supposing that at very close approach of $\alpha$-particles and hydrogen nucleus the $\alpha$-particle (helium nucleus) behaves as if flattened into a plate-like form, the plane of the plate being normal to the path of the nucleus, or, since the collision in such cases of very close approach is practically "head-on," to the line joining the centres of the two nuclei. This would clearly give a preferential projection of the struck nucleus in the line of motion of the $\alpha$-particle. Chadwick and Bieler experimented on the direction in which hydrogen nuclei were thrown forward by $\alpha$-particles, by letting $\alpha$-particles pass through a thin film of paraffin wax: the fact that the hydrogen atoms are here combined with carbon atoms has no effect on the

behaviour of the nuclei, the forces of chemical binding being negligible compared to those involved in these collisions. Applying Rutherford's line of argument to these experiments, they came to the conclusion that an $\alpha$-particle behaves in these collisions like an oblate spheroid of semi-axes $8\times10^{-13}$ and $4\times10^{-13}$ cm., the proton being treated as a point charge, on account of its presumably very simple structure.

To investigate in detail the departure of the field of force surrounding a nucleus from the inverse-square law it is clearly necessary to force the $\alpha$-particle which acts as our probe as close to the nucleus as possible. The energy of the $\alpha$-particle cannot be made to exceed that offered by the natural radioactive sources, so that two courses are open:

(1) to investigate the scattering by light elements, where the nuclear charge is low, and so the nuclear field comparatively weak;

(2) to work with very large angles of scattering, which correspond to intimate approach.

Rutherford and Chadwick therefore examined the scattering by foils of aluminium and magnesium, choosing fixed large angles, namely 135° and 90°. They used $\alpha$-particles of different energy, obtained from Radium C by the interposition of absorbing screens of various thickness, to vary the distance of approach. They found that the inverse-square law was followed with both these elements for distances of approach greater than $1{\cdot}5\times10^{-12}$ cm., but that the ratio of the number actually scattered to the number calculated on the inverse-square law rapidly decreased for closer approach, then attained a minimum and increased again. The minimum was found at $7\times10^{-13}$ cm. for magnesium ($Z=12$) and for a slightly greater distance of approach in the case of aluminium ($Z=13$). The closest distance of approach measured was $6\times10^{-13}$ cms. With gold and silver ($Z=79$ and $Z=47$), where the nuclear field is strong, the inverse-square law was obeyed up to the closest distance of approach obtainable, about $3\times10^{-12}$ cm. and $2\times10^{-12}$ cms. respectively. If we may treat in these experiments the $\alpha$-particle as a point-charge these results can be interpreted to mean that, with the aluminium and magnesium nuclei at any rate, the repulsive force exerted by the nucleus decreases for distances between $15\times10^{-13}$ and $7\times10^{-13}$ cm., but increases again for closer distances, the inverse-square formula being taken as a standard of comparison. A physical explanation can be given by supposing that the outer parts of the nucleus consist of a layer of positive charge, within which is a layer of negative charge; when the $\alpha$-particle penetrates the positive layer the effective nuclear charge is diminished, but when it goes further and penetrates the negative layer, the effective nuclear charge increases again. This conception receives further reference when the radioactive nuclei are discussed.

These experiments confirm and extend earlier results found with aluminium and magnesium, which indicated that the inverse-square law held to within one per cent or so for distances greater than $3\times10^{-12}$ cm. Speaking generally, then, we may say that the radius of nuclei, apparently not very different for different elements, is of the order $2\times10^{-12}$ cm., in the sense that at this distance there is a rapid change in the law of force, while it is possible to force a proton to within a distance of $4\times10^{-13}$ cm. from the centre of an $\alpha$-particle.

Very interesting results were obtained by Rutherford and Chadwick in their experiments of 1927 on the scattering of $\alpha$-particles by helium. The difficulty presented by the fact that a gas like helium cannot be obtained in a thin plate was surmounted by the use of diaphragms, which isolated an incident and a scattered pencil of rays in such a way that all particles reaching the phosphorescent screen must have come from a small annulus of the gas. The experiments were complicated by the fact that both scattered particles and struck nuclei are of the same nature, but skilful interpretation of the results allowed definite conclusions to be drawn. It was deduced that, for central collision, departure from the inverse-square law occurs at distances of about $3{\cdot}5\times10^{-13}$ cm. between the centres, while for glancing collisions (small angles of scattering) the departure occurs at about $14\times10^{-13}$ cm. This indicates a plate-like form for the $\alpha$-particles, confirming the conclusions reached by Chadwick and Bieler from an exhaustive study of the collision of the $\alpha$-particles with hydrogen nuclei.

It does not appear that these results are to be attributed to the departure from the classical laws of mechanics embodied in the new wave-mechanics (*see* QUANTUM MECHANICS), but rather that they are best explained on ordinary mechanical principles applied to a field of force departing from the inverse-square. Rutherford has suggested tentatively that the departures have their physical origin in a definite magnetic moment associated with the helium nucleus, which produces a magnetic force becoming prominent at distances of the order of $4\times10^{-13}$ cm. The turning couple due to two such magnetic moments would explain the orientation of the particles during collision. Of course a magnetic moment must be assumed for the proton itself, the moment of the helium nucleus being a resultant of the moments of its components. The introduction of a consideration of magnetic forces, so long neglected in the internal physics of the atom, seems likely to prove fruitful in the future.

We are faced with the paradox that, while the nucleus must, as we shall see, contain electrons (in the case of a heavy element like gold a great many electrons) yet the size of the nucleus is not much larger than that of the electron, for which the diameter is generally given as $4\times10^{-13}$ cm. The size of the electron, however, is far less directly determined than that of the nucleus. The estimate just quoted is based upon the assumption that the mass is entirely electro-magnetic, and is that which is produced by a distribution of the electronic charge throughout the volume of a small sphere. The electromagnetic mass of such a sphere, moving at slow speeds, is

$$m=\frac{4e^2}{5a}$$

where $e$ is the charge in electromagnetic units, and $a$ is the radius. If instead we assume that the charge is spread over the surface of the sphere we have

$$m=\frac{2e^2}{3a}.$$

Where so little is known it does not matter which formula we adopt. The assumption of such a formula is our only way of obtaining an estimate of the size of the electron, for there is no way at present known of investigating the field of force round an electron, which is the only really significant thing. The paradox of the approximate equality of electronic and nuclear size is therefore really explained by the fact that little significance can be attached to the value given for the radius of the electron, and we may further say that, whatever the radius of a free electron, the radius of an electron in close combination with other electrons and protons may be quite different.

**The Structure of the Nucleus.**—The constitution of the nucleus has been the subject of much speculation. The positive charge is ultimately due to the presence in the nucleus of protons, whose mass is that of the hydrogen atom and whose positive charge is 1 in terms of the electronic charge. If these were the only constituents the atomic number of any nucleus should be equal to its mass in terms of hydrogen as 1, but it is well-known that the atomic number—the *net* positive charge—is always markedly less than this, being usually less than half of the atomic weight. This indicates that the nucleus itself must contain a number of electrons, whose presence diminishes the positive charge, but leaves the mass practically unaltered. The expulsion of $\beta$-particles of very high energy might be taken to indicate the presence of such electrons in the nuclei of radioactive elements, but the occurrence of the $\beta$-particles by itself would not be convincing, as they might, without further experiments, be supposed to come from the outer parts of the atom, being ejected by a secondary action of nuclear $\gamma$-rays. However, it is found that strong $\beta$-radiators are transformed to elements whose chemical behaviour indicates a place in the periodic table corresponding to an increase of atomic number by unity, that is, to a gain of one unit of positive charge by the nucleus. This is equivalent to the loss of one electron by the nucleus, so the behaviour of radioactive ele-

ments affords strong evidence for the presence of electrons in the nucleus.

The occurrence of elements of different chemical properties, but the same mass, the so-called isobares (*see* ISOTOPES), also indicates a difference of nuclear charge with no difference of nuclear mass, which can be best explained as the effect of a difference in number of electrons in the nucleus. For the addition of an electron to the nucleus will diminish $Z$ by 1, but not appreciably change the mass. The existence of isotopes (*q.v.*) is also easily explained upon the hypothesis that the nucleus is ultimately built up of protons and electrons. Isotopes are elements which have the same chemical properties, that is, the same $Z$, but different masses. If, to a given nucleus we add $n$ protons and $n$ electrons we do not change the charge, but increase the mass by $n$ units.

It being established that the nucleus consists of protons and electrons, the question arises as to whether any special combinations exist as sub-groups within the nucleus. The expulsion of $\alpha$-particles by radioactive nuclei suggests that, inside heavy nuclei at any rate, we have particles composed of four protons and two electrons, existing as particularly stable units. The stability of the $\alpha$-particle is further discussed in the last section of this article. Meitner has further invoked the existence of particles composed of four protons and four electrons to explain certain peculiarities of the transformations of the radioactive families. (*See* RADIOACTIVITY.) Two of the electrons are assumed to be less firmly attached than the other two, so that the combination is really a neutralised $\alpha$-particle. When one electron leaves such a neutralised $\alpha$-particle, the rest is assumed to become unstable, so that a sequence of changes is to be expected, in which two $\beta$-ray emissions and one $\alpha$-ray emission are associated in some order or other. In the general run of the radioactive transformations this does, in fact, occur, as, for example, where Thorium emits an $\alpha$-particle, changing to Mesothorium I, followed by two $\beta$-ray changes, or where Uranium Y is transformed with a $\beta$-emission, to be followed by an $\alpha$ and a $\beta$ change. The branching of the radioactive series (such as follows, for example, the transformation of Radium B), where a $\beta$ emission is followed either by a $\beta$ and an $\alpha$ change, or alternatively by an $\alpha$ and a $\beta$ change (*see* RADIOACTIVITY) is also explicable on Meitner's hypothesis.

The hypothesis that the nucleus of radioactive atoms contains $\alpha$-particles, each neutralised by two tightly bound electrons, was also used by Rutherford to explain the origin of the $\alpha$-rays. The $\alpha$-particle, with its double positive charge will be strongly repelled if it once be released from whatever forces may be supposed to bind it in the nucleus. We can calculate the energy with which the particle will leave the atom, supposing it to be all gained by virtue of the work done on it by the nuclear field or force, if we know the distance from the centre of the nucleus at which it starts. Thus the charge on the rest of the nucleus being $Z'e$, while $2e$ is the charge on the $\alpha$-particle, this energy is

$$\frac{2Z'e^2}{r}$$

which, taking the slowest $\alpha$-particle, that from Uranium I, with energy $4{\cdot}07\times10^6$ electron-volts, gives the value $6{\cdot}3\times10^{-12}$ cm. for $r$, and any assumption that the $\alpha$-particle possesses an initial velocity would lead to an increased value of $r$. Scattering experiments, however, show that the inverse-square law holds for distances as small as $3\times10^{-12}$ cm., which could not be the case if there were particles with two positive charges in the region of the nucleus indicated by the above estimate. If, however, the $\alpha$-particles at distances $6\times10^{-12}$ cm. from the centre of the nucleus normally exist in a neutralised state they will have no effect on the scattering, and the two estimates can be reconciled. The electrons which neutralise the $\alpha$-particles cannot, of course, exist in the kind of outer orbits which they occupy for the neutral helium atom, for there would be no room for them, but must be held in some much more intimate manner. Rutherford's supposition is that the neutral $\alpha$-satellite, as we may call it, is attracted to the central bulk of the nucleus by the polarisation forces set up in it by the nuclear field, and that, controlled by these forces, the satellite executes a quantum orbit, something like that of an electron in the outer parts of the atom. (*See* ATOM.) When the satellite loses, by some unknown mechanism, its two electrons, it is repelled, gaining its final velocity of expulsion in its passage to confines where the nuclear field is negligible. The electrons are retained by the nucleus, and ultimately discharged in $\beta$-ray

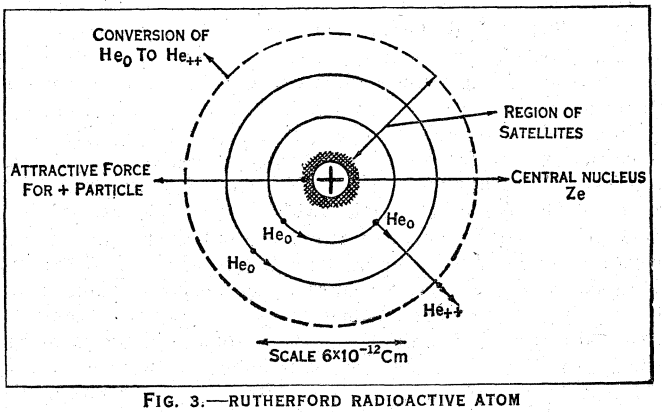



FIG. 3.—RUTHERFORD RADIOACTIVE ATOM

charges. A sketch to illustrate this conception of the radioactive nucleus is given in fig. 3.

The general arguments give us information as to the kind of particles which may be expected to exist within nuclei, at any rate within very heavy nuclei.

A line of argument as to the structure of the radioactive nuclei has been put forward by C. D. Ellis. He has made extensive measurements on the energies of the $\beta$-rays liberated from heavy metals by the action of $\gamma$-rays from a radioactive substance. (*See* PHOTOELECTRICITY.) These electrons may be freed from the $K$ or the $L$ levels of the atom (*see* X-RAYS, NATURE OF; ATOM) and the study of the X-ray spectra enables us to find the work required to take an electron from any one of these levels to the surface. A comparison of the spectra of the $\beta$-rays excited by the same $\gamma$-rays in different metals enables us to attribute the origin of certain observed $\beta$-rays to certain levels; if we correct the observed energy by adding the work of release, we obtain the same energy for a given $\beta$-ray, no matter from which element it has come, or, otherwise expressed, a $\beta$-ray spectrum is found which is independent of the element and expresses the energy initially communicated to the $\beta$-particle by the incident $\gamma$-ray. The quantum theory leads us to believe that the $\beta$-particle in these circumstances takes the whole of the energy of the $\gamma$-ray which releases it. These observations of the secondary $\beta$-ray spectrum therefore serve to reveal the wave length of the incident $\gamma$-rays, since the relation between wave length and energy is given by the simple quantum relation.

$$\text{energy} = E = h\nu = h\frac{c}{\lambda}.$$

Ellis has thus measured $\gamma$-rays of much greater energy, or short wave-length, than those measured by Rutherford and Andrade. Considering the complete $\gamma$-ray spectrum of an element, say Radium B, he has found that the different $\gamma$-ray energies can be accounted for by assuming a small number of energy levels in the nucleus, quantum transitions between suitably selected pairs of which give the frequency of the $\gamma$-rays in the same way as quantum transition between the levels of energy in the outer parts of the atom give rise to spectral lines. (*See* QUANTUM MECHANICS.)

We have, then, this evidence for energy levels within the radioactive nuclei, but we do not know to what mechanism these energy levels are to be attributed. It has been supposed that they could be best explained by electron orbits within the nucleus, corresponding to the quantised electron orbits in the outer parts of the atom so much invoked in the explanation of optical line spectra, but Kuhn has criticised this view, and suggested that it is more satisfactory to attribute the energy levels to the suitably quantised movements of massive positive particles.

This part of the subject is in its infancy, and we can say little with any degree of certainty. There is good evidence for a structure of protons and electrons; for a subdivision of the nucleus into energy levels, originating in circulating particles; for the existence of $\alpha$-particles, and of $\alpha$-particles neutralised by two electrons, as components of the radioactive nuclei. Beyond this speculation has an untrammelled range.

**The Disruption of the Nucleus.**—The nuclei of radioactive atoms, which are all heavy and correspondingly complex, are unstable and disrupt spontaneously, giving out either an $\alpha$- or a $\beta$-particle, with a corresponding change in the chemical nature of the atom. The ejection of an $\alpha$-particle decreases the mass by 4 units and the atomic number by 2 units: the ejection of a $\beta$-particle makes practically no difference in the mass, but increases the atomic number by 1 unit. (*See* RADIOACTIVITY, ISOTOPES.) The lighter elements (with the possible exception of potassium and rubidium) are all stable, and, even after the discovery of radioactivity and the later theory of the nuclear atom, were supposed to be proof against any agencies available in the laboratory. It was known that the outer electrons could be removed by irradiation, or by the impact of particles of sufficient energy, but as long as the nucleus is intact the atom will repair itself by taking up electrons again at the first opportunity. The atom can be *permanently* changed in kind only by adding or subtracting particles from the nucleus, and the expression "breaking the atom" is generally used in popular parlance to indicate such a tampering with the nucleus.

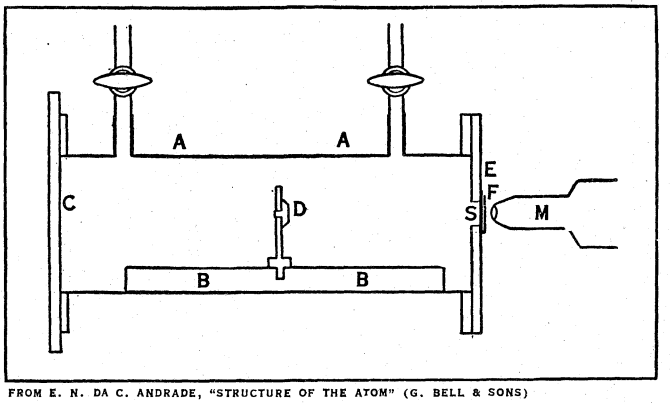
Sometime later, Rutherford showed that we have in the swift $\alpha$-particle a localization of energy intense enough to effect a disruption of the nucleus. The experiments were of great importance not only as advancing knowledge of the constitution of the nucleus, but also as the first in which a change in the chemical nature of an atom has been deliberately provoked. (*See* TRANSMUTATION OF ELEMENTS.)

As a preliminary to the description of Rutherford's method it may be well to consider the impact of an $\alpha$-particle on a very light nucleus. Whereas in the case of heavy nuclei (the nucleus of a gold or of a silver atom, say) we can neglect the motion of the struck nucleus, in the case of a hydrogen nucleus we must devote special attention to the motion produced by the collision. It is easy to show that the velocity $u$ of the struck nucleus will depend upon the masses $M$ and $m$ of the $\alpha$-particle and struck nucleus respectively, and upon the angle $\theta$ which the path of the nucleus makes with the original path of the $\alpha$-particle, whose velocity is $v$. If there is no loss of energy in the collision it is given by the expression:

$$u = 2v\frac{M}{M+m}\cos\theta \qquad (2)$$

which becomes 1·6 v $\cos\theta$ when the struck nucleus is a proton ($M=4$, $m=1$). It can further be shown that the range of a proton in a given gas is nearly the same as (actually a little less than) that of an $\alpha$-particle of the same initial velocity, the effect of the reduced mass and of the reduced charge nearly annulling one another in this respect. It is an established result that the range of an $\alpha$-particle is proportional to the cube of its velocity, whence for a direct impact ($\theta=0$) the range of a struck proton is about $(1{\cdot}6)^3=4{\cdot}1$ times the range of the $\alpha$-particle itself in the same gas. With an $\alpha$-particle from Radium C, whose range in hydrogen is 31 cm., the range of the proton which it strikes centrally should be 117 cm. in hydrogen. This result makes it possible to distinguish easily between struck protons and $\alpha$-particles themselves, since the greater range of the former allows them to be detected much further from the source than the latter. It is only the full collisions that lead to so large a range: protons struck at glancing angles have, by equation (2), smaller velocities, and hence smaller ranges. A connection between range and angle can be calculated for equation (2), and this distribution is actually confirmed for slow $\alpha$-particles. It is a significant observation, however, that for swift $\alpha$-particles passing through hydrogen far more protons are thrown directly forward than the formula indicates. It was this consideration that first led Rutherford to assume the plate-like form of the $\alpha$-particle in close collision, to which reference has been made.

The great range of the light proton struck by the heavier $\alpha$-particle is the key to Rutherford's first experiments on the disruption of the nucleus. The apparatus used is represented in fig. 4. The brass disc D bears a deposit of radium C, which is the source of the $\alpha$-particles. This is contained in a brass box




FROM E. N. DA C. ANDRADE, "STRUCTURE OF THE ATOM" (G. BELL & SONS)

FIG. 4.—TO ILLUSTRATE RUTHERFORD'S SUGGESTION AS TO THE CONSTITUTION OF A RADIOACTIVE NUCLEUS

AA which can be exhausted or filled with any gas. An opening S in one end is closed by a thin metal foil, which, as far as its power of stopping $\alpha$-particles is concerned, is equivalent to about 5 cm. of air. The particles which pass through this foil, and any other foils which may be placed between S and F, produce scintillations on the phosphorescent zinc sulphide screen F. These scintillations are observed with the microscope M. With this apparatus filled with dry hydrogen various results on the range of the struck protons were obtained, of which mention has already been made.

Long-range protons were also obtained from hydrogen compounds, such as paraffin wax in thin films. The particles were identified as protons not only by their range, but also by deflection in an electric and magnetic field. More recently Stetter has also shown that the ratio $e/m$ for the particles knocked out of paraffin wax has the value pertaining to a proton, by using as a source a very thin tube of wax containing radium emanation, and employing an apparatus built on the lines of Aston's mass spectrograph. (*See* POSITIVE RAYS, ISOTOPES.) The mean of his determinations agrees within 1% with the value to be expected.

When the apparatus of fig. 4 was filled with air, or pure nitrogen (for the effect was soon traced to this gas) particles were observed whose range in air was not less than 28 cm., which is about four times that of the $\alpha$-particles themselves, or just what we should expect the range of a struck hydrogen nucleus to be. The particles are not due to hydrogen contaminations, such as films of grease, for their number is proportional to the pressure of the nitrogen. Further, when oxygen or oxygen compounds, such as carbon dioxide, are substituted for the nitrogen, nothing but an occasional long-range particle is detected. A large number of control experiments were made, as a result of which it was definitely established that the passage of the $\alpha$-particles through nitrogen produces particles whose long range gives very strong reason to believe that they must be protons. Rutherford proved that this really was the nature of the particles by deflecting them in a magnetic field.

The only possible source of the long range protons, whose existence was established by these experiments, is the nucleus of the nitrogen atom. We are forced to the belief that the $\alpha$-particle, when it hits a nitrogen nucleus fair and square, is able to detach from it one of the protons which go to make up its structure, and hurl it in the forward direction. The extreme forward range was later found to be not 28 cm., but 40 cm., which makes the proof of the nuclear origin of the proton even more definite, energy being derived from the nucleus itself. More precise information as to the direction in which the expelled proton proceeds was furnished by subsequent experiments of Rutherford and Chadwick.

Rutherford and Chadwick investigated the passage of $\alpha$-particles through various light elements, with the object of finding out if protons are expelled from their nuclei. (With heavy nuclei this is not to be expected, as the high nuclear charge exerts so large a repulsive force on the $\alpha$-particle that the close approach necessary to detach a proton cannot occur.) Films of solid compounds of the various metals were placed in the path of the $\alpha$-particles, and a search made for long-range particles. Such particles were detected with the elements boron, fluorine, neon, sodium, magnesium, aluminium, silicon, phosphorus, sulphur, chlorine, argon, and potassium, as well as the original nitrogen, careful controls in each case establishing that the particles were actually protons, and that their source was the element named. The results obtained with these elements indicate the generalisation that the nuclei of atoms of odd atomic number are more easily broken, at any rate by $\alpha$-particles, than those of even atomic number, since with the latter the protons, if present at all, are of comparatively short range.

It was found that, whereas, using hydrogen, the free protons are always thrown in the forward direction—a large proportion directly forward—with the other elements the expelled protons proceed in all directions, although the range of the forward ones always exceeds that of the particles proceeding in the backward direction. This indicates that in the mechanism of release of the proton from the nucleus the nuclear forces play a large part: the proton is not just knocked out of a passive nucleus by the passage of the $\alpha$-particle, as an apple might be knocked from a bough by a tennis racket, but rather the close passage of the $\alpha$-particle releases some trigger action, the particle being expelled at the expense of nuclear energy. Rutherford and Chadwick suggested a mechanism in which the expelled proton is assumed to be revolving as a satellite before the expulsion initiated by the $\alpha$-particle, and the difference of forward and backward velocity is expressed in terms of the path of the struck satellite within the nuclear system before expulsion. Against this Pettersson has put forward what he calls an explosion hypothesis, which supposes that the $\alpha$-particle starts a disturbance by which the proton is shot out in a random direction with a definite velocity *relative to the nucleus,* which is itself thrown forward. The experimental evidence is insufficient to enable very much to be urged in favour of either hypothesis.

Particular interest attaches to the case of aluminium. The protons expelled in the forward direction from this element have a range of 90 cm. in air, as contrasted with a range of 7 cm. for the $\alpha$-particles themselves, or 29 cm. for a free proton thrown straight forward by impact of an $\alpha$-particle. The energy of the long-range proton from aluminium is considerably in excess of that of the $\alpha$-particle which produces it, involving an actual gain of energy as the result of the collision, independent of the fate of the $\alpha$-particle. There has in this case been a considerable release of nuclear energy—considerable in relation to amounts of energy involved in the motions of the particles. The actual excess of energy of expelled proton over energy of incident $\alpha$-particle is, however, only of the order of $5\times10^{-6}$ ergs, so that it would require some ten million million impacts to produce a gain of one calorie. As successful impacts are very rare, the gain of energy is not a matter of immediate practical use.

The fact that the protons are expelled at right angles to the path of the incident $\alpha$-particles, and also in a retrograde direction, has proved of great service in the investigation of elements for expelled protons. One great difficulty of these experiments is to distinguish between protons due to hydrogen contaminations (either occluded gas or solid or liquid hydrogen compound) and protons originating in complex nuclei. Now whereas the long-range protons from hydrogen contamination are all thrown in a forward direction, those from complex nuclei, released by a trigger action of the passing $\alpha$-particle, are, on the whole, discharged in much the same numbers in all directions. If, therefore, observations are made at right angles to the path of the incident $\alpha$-particle, or in a direction making an acute angle (on the side near the source) with the path, the protons observed will be those that originate in the complex nuclei. This method was used by Rutherford and Chadwick, and also by Kirsch and Pettersson. As a result Rutherford and Chadwick gave the elements already named as those which show nuclear disintegration under the bombardment of $\alpha$-particles. They never found evidence of nuclear disintegration with carbon or beryllium. Kirsch and Pettersson, however, have found protons of 3 cm. range with carbon, and also protons with beryllium, copper, and nickel, using the retrograde method for these elements, and later added to the list ten elements between titanium and iodine. In fact, these workers and their school seem to have seen far more scintillations than other workers, for even in the case of aluminium the number of protons which they give is five times as many as those observed by Rutherford and Chadwick under similar conditions. The discrepancies have not yet been explained. It may be taken as certain that with the elements in Rutherford and Chadwick's list nuclear disintegration can be produced by the bombardment with $\alpha$-particles, but for other elements final decision must be reserved.

Decisive confirmation of the disruption of the nitrogen nucleus by an $\alpha$-particle has been supplied by photographs of ray tracks taken with the Wilson Cloud Chamber (*q.v.*). By this method Blackett has taken a very large number of pictures of the passage of $\alpha$-particles through nitrogen, each picture showing, from two different directions, a bundle of many ray tracks. Altogether 23,000 photographs were taken, showing some 270,000 tracks of $\alpha$-particles of range 8 and 6 cm. and 145,000 tracks of range 5 cm. from a source of Thorium B+C. As a result 8 tracks were obtained showing the expulsion of a proton, the path of the proton being visible as a long thin beaded track, quite different in appearance from the tracks of an $\alpha$-particle or struck nucleus. (*See* Plate I., fig. 6, WILSON CLOUD CHAMBER.) The proportion of $\alpha$-particles producing disintegration agrees well with Rutherford and Chadwick's estimate from scintillations. Among the eight disruptions recorded one shows a proton ejected backwards, a further confirmation of the scintillation results.

A striking feature of these photographs is that, in the disruption cases, there is no track corresponding to the $\alpha$-particle *after* collision. This indicates that the $\alpha$-particle enters into the nucleus and remains there, forming a nucleus of mass $14-1+4=17$, and of nuclear charge $7-1+2=8$. This would be an isotope of oxygen, whose existence has not been detected by the ray spectrograph. (*See* ISOTOPES.) However, ray-track photographs of Harkins and Ryan, and of Akiyama, taken in air, show, in the case of disintegration, a track of the $\alpha$-particle after the disrupting collision, indicating that the $\alpha$-particle does not always stick in the nucleus. The reason for this difference of behaviour is not yet explained.

**Stability of Nucleus. Atomic Energy.**—The evidence which has been considered clearly shows that the nuclei of all atoms are ultimately built up of electrons and protons in intimate combination. It is clear that combinations containing more than a certain number of these component parts are not stable, for the very heavy nuclei pertain to radioactive atoms, and break up spontaneously. However, of the radioactive nuclei the heaviest are not the most unstable, for Uranium I. and Uranium II., both of atomic number 92, and of atomic weight 238·2 and 234·2 respectively, have very large half-value periods (*see* RADIOACTIVITY), that is, break down very infrequently, while Actinium C′ and Radium C′, both of atomic number 84, and of atomic weight 210 and 214 respectively, are extraordinarily unstable. The explanation of the relative instability of the radioactive nuclei in terms of their structure or composition is still to seek. Fajans, however, has enunciated a rule that all nuclei of atomic mass $4n$, where $n$ is a whole number, and of odd nuclear charge, are very unstable. The only radioactive nuclei which fall in this class are those of Thorium C″, Thorium C, and Mesothorium II., which are all $\beta$-radiators of comparatively short life. Nuclei of the general composition specified are not found among the other elements, so that the rule, which is purely empirical, does seem to have a general application.

Evidence of relative stability among the nuclei of non-radioactive elements has been sought by Harkins in the comparative

abundance in which different kinds of atoms occur in nature, the assumption being that elements of rare occurrence are comparatively unstable. The commonest elements, both in meteorites. which may be regarded as samples from extra-terrestrial sources, and in the earth, as far as we can judge from geological evidence, are oxygen, silicon, magnesium, and iron, all comparatively light elements of even atomic number. Taking the figures as a whole, elements of even atomic number are much commoner than elements of odd atomic number. Further consideration of the conjunction of atomic weights and atomic numbers in individual elements leads to the conclusions that the number of nuclear electrons is generally even, or nuclear electrons tend to occur in pairs. There are a fair number of empirical rules of this nature, which enunciate generalities, but no laws of universal application. This aspect of the subject still awaits a co-ordinating theory.

The $\alpha$-particle itself is a particularly stable entity, consisting of four protons and two electrons: the two electrons which it picks up when it becomes a neutral helium atom do not, of course, form any part of the nucleus, but are, relatively speaking, very distant and very loosely held. Evidence of the stability is obtained by consideration of the peculiar fact that, while the mass of the two electrons is negligible, the mass of the helium nucleus is not exactly equal to that of four protons, for the atomic weight of helium in terms of oxygen as 16, is 4·00, while the atomic weight of hydrogen is 1·0077. We might expect the atomic weight of helium to be 4·0308: the difference between this number and the actual number 4·00 is called the *mass defect.*

The explanation of the mass defect is to be sought in the electromagnetic nature of mass. If an electric charge be concentrated in a very small space it requires a force to produce an acceleration of its movement, or, in other words, it possesses inertia. The smaller the volume into which it is crowded, the greater the inertia. Making, for the sake of precision, the very simple, and somewhat improbable, assumption that elementary charges behave as small charged spheres, the electron must have a diameter of $3{\cdot}8\times10^{-13}$ cm., the proton a diameter of $2\times10^{-16}$ cm. to give the required masses. Even without this assumption we may say, quite generally, that the electromagnetic mass depends not only on the charge but on the capacity of the system. If we bring two small charged spheres of opposite sign close together the capacity of the system is not the sum of that of its parts, considered separately, so that the electromagnetic mass of the two together is less than the sum of the two separately. In general, whenever we pack protons close together with electrons we might anticipate a diminution of mass due to this close packing. The fact that the mass of a nucleus is always less than the mass to be anticipated, by simple addition, from the number of protons it contains is said to be due to the "packing effect." (*See* Isotopes, *Packing Fraction.*)

Quite apart from any mechanism, such as that just considered, we can get an estimate of the stability of the helium nucleus from the mass defect, by taking into account Einstein's relation between mass and energy. (*See* Relativity.) This relation is

$$m=E/c^2$$

where $m$ is the mass, $E$ the energy, $c$ the velocity of light, which is $3\times10^{10}$ cm./sec. If a system loses mass it loses energy to an amount represented by this formula. For the helium nucleus the energy per gram molecule, *i.e.*, per 4 grams of the gas, is

$$E=\cdot0308\times9\times10^{20}=\cdot28\times10^{20}\text{ ergs}=7\times10^{11}\text{ gram calories.}$$

In the language of the chemist a helium nucleus is an endothermic compound giving out $1{\cdot}75\times10^{11}$ gram calories per gram when it is formed from four protons and two electrons and similarly requiring this amount of energy to dissociate it back into its component parts. The energy per atom works out to be $4{\cdot}6\times10^{-5}$ ergs, which is nearly three times the kinetic energy of the swift $\alpha$-particle, of range 8·6 cm. of air, from Thorium C′. As the swift $\alpha$-particle represents the greatest localisation of energy at our disposal we may confidently say that the helium nucleus is likely to withstand any agent which we may bring to bear upon it without disrupting.

The enormous energy which, as these calculations show, would be released if we could make hydrogen nuclei combine with electrons to form helium nuclei offers a starting point for daring speculation as to the possibilities of atomic energy, that is, nuclear energy, as a source of power. It may be noted that this is energy which would result from building atoms, not from breaking atoms. The disruption of the aluminium nucleus, with its release of energy, or the spontaneous disruption of the radioactive atoms may be taken as examples of the breaking of atoms with release of energy. If 4 grams, that is one-seventh of an ounce, of helium could be built up from hydrogen we should anticipate a release of nuclear energy equivalent to about a million horse power for an hour. It does not follow that this energy would be released in a form which we know how to handle profitably—it might appear as a very penetrating radiation which would pass through all our screens set to catch it. Speculation has a free range. It has been suggested that a small rate of formation of helium from hydrogen may be responsible for the maintenance of the sun's heat.

The packing effect with heavier nuclei, as represented by the departure of the atomic weights, in terms of oxygen as 16, from whole numbers is a very important study which is being investigated by Aston with a sensitive mass spectrograph. (*See* Isotopes.) His results can be interpreted as supporting the view that the light elements of odd atomic number all have a loosely packed outer structure which has no counterpart in the more stable nuclei. The whole question of the structure of the nucleus, the detailed nature and arrangement of its parts, is still obscure. It is beset with great difficulties, in view of which the progress that is recorded in this article, which deals almost entirely with the work that has been done since 1910, is very encouraging. If at that date the investigation of the composition and structure of a particle some $10^{-12}$ cms. across had been suggested as a study for the immediate future, few would have taken the matter seriously. (*See* also Transmutation of Elements.)

Bibliography.—E. N. da C. Andrade, *The Structure of the Atom,* 1927 (contains numerous references to work up to end of 1926); H. Pettersson and G. Kirsch, *Atomzertrümmerung,* 1926; E. Rutherford, "Structure of the Radioactive Atom and Origin of the $\alpha$-Rays," *Philosophical Magazine,* 4, 580, 1927; E. Rutherford and J. Chadwick, "The Scattering of $\alpha$-Particles by Helium," *Philosophical Magazine* 4, 605, 1927. *See* also bibliography to Radioactivity, Isotopes, Transmutation of Elements. (E. N. da C. A.)

**NUER:** *see* Nilotes.

**NUEVA SAN SALVADOR** (Santa Tecla), the capital of the department of La Libertad, Salvador; on a branch railway from San Salvador (10 mi. N.). Pop. (1940) 23,276. The town was founded in 1854 and intended to replace the capital, San Salvador, which was ruined by an earthquake in that year but soon afterwards rebuilt. Nueva San Salvador is an attractive town with a large and growing trade.

**NUEVO LEÓN,** a northern State of Mexico. Pop. (1940) 541,147; area 25,130 sq. miles. Nuevo León lies partly upon the great Mexican plateau and partly upon its eastern slopes, the Sierra Madre Oriental crossing the State northwest to southeast. A branch of the Sierra Madre extends northward from the vicinity of Salinas, but its elevations are low. The average elevation of the Sierra Madre within the State is slightly under 5,500 feet. The general character of the surface is mountainous, though the western and southwestern sections are level. In the north the general elevation is lower, the surface sandy and covered with cactus and mesquite growth. The eastern slopes are well clothed with vegetation, but the lower valleys are subtropical in character and are largely devoted to sugar production. The higher elevations have a dry, temperate, healthful climate. There are many rivers and streams, notably the Salado and Pesqueria.

Agriculture is the principal industry, the chief products being sugar, barley, Indian corn and wheat. Rum is a by-product of the sugar industry, and "mescal" is distilled from the agave. The gathering and preparation of "ixtle" fibres from the agave and yucca form another important industry, the fibre being sent to Tampico for export. Considerable progress has been made in manufacturing industries, and there are a large number of sugar-mills, cotton factories, woollen mills, important smelting works

and iron and steel works. The State is well served with railways. Monterrey (*q.v.*) is the capital (pop. 1940, 185,833). Other towns are: Linares, or San Felipe (9,918) 112 mi. by rail S.E. of the capital in a rich agricultural region; Montemorelos (5,579); Lampazos (2,820), 96 mi. by rail N.W. of the capital; Cadereyta, Jiménez, García, Santiago and Doctor Arroyo.

**NUISANCE,** that which gives offence or causes annoyance, trouble or injury. In English law nuisance is either public or private. A public or common nuisance is defined by Sir J. F. Stephen as "an act not warranted by law, or an omission to discharge a legal duty, which act or omission obstructs or causes inconvenience or damage to the public in the exercise of rights common to all His Majesty's subjects" (*Digest of the Criminal Law*). A private nuisance is an act or omission which causes inconvenience or damage to a private person. There must be some sensible diminution of these rights affecting the value or convenience of the property. "The real question in all the cases is the question of fact, whether the annoyance is such as materially to interfere with the ordinary comfort of human existence" (Lord Romilly in *Crump* v. *Lambert,* 1867, L.R. 3 Eq. 409). A private nuisance, differing in this respect from a public nuisance, may be legalized by uninterrupted use for 20 years. (*See* ANNOY.) The remedy for a public nuisance is by information, indictment, summary procedure or abatement. An information lies in cases of great public importance, such as the obstruction of a navigable river by piers. In some matters the law allows the party to take the remedy into his own hands and to "abate" the nuisance. Thus, if a gate be placed across a highway, any person lawfully using the highway may remove the obstruction, provided that no breach of the peace is caused thereby. The remedy for a private nuisance is by injunction, action for damages or abatement. An action lies in every case for a private nuisance; it also lies where the nuisance is public, provided that the plaintiff can prove that he has sustained some special injury. In such a case the civil is in addition to the criminal remedy. In Scotland there is no practical distinction between public and private nuisances, the remedy against either being interdict or damages. The law as to what constitutes a nuisance is substantially the same as in England.

There is a list of statutory nuisances in the Public Health (Scotland) Act 1867, and amending acts. The American law on the subject is practically the same as the English law.

**NUKHA,** a town of Russia in the Azerbaijan S.S.R. in 41° 11′ N., 47° 8′ E., on a winding road linking Baku with Tiflis, and on the Nakhichevan river. Pop. (1933) 26,300. It is occupied in the breeding of silkworms and has five silk spinning factories. Hajji Chelyabi, the founder of the khanate of Sheki, chose the town as his residence in the 18th century and it remained the capital of the khanate until 1819, when it finally became Russian.

**NULLIFICATION,** the process of making null or of no effect (Lat. *nullus,* none). In United States history the term is applied to the process by which a state either (*a*) in fact suspended, or (*b*) claimed a constitutional right of suspending, the operation of a federal law within its own territory. The doctrine of nullification as a constitutional theory was probably never held by a majority of the states or of the American people at any one time, though before 1860 most of the states asserted or practised it. The belief in nullification was based on the theory that the union of the states was a voluntary one, each member retaining its sovereignty, though for purposes of convenience delegating certain powers of government to an agent—the federal government. The powers of this agent were strictly limited by the Constitution, and should it transcend these powers the states must interpose to protect their rights. This view held that the Supreme Court created by the Constitution was not a proper tribunal to decide causes arising beyond the Constitution or relating to the nature of the Union, but that its jurisdiction was limited to cases arising under the Constitution. If the Federal Government usurped a right belonging to the state, the latter, being a sovereignty, must judge for itself.

As later perfected by John C. Calhoun (*q.v.*), the theory of nullification required a practice as follows. A state aggrieved by a law of the Federal congress might, in constituent convention, suspend the operation of the objectionable law, and report its action to the other states. If three-fourths of them should decide that the law in question was not unconstitutional, then in effect it became ratified (*see* United States Constitution, art. v.). The dissatisfied state must then submit or draw out of the Union by secession (*see* SECESSION, and CONFEDERATE STATES).

The earliest assertions of the doctrine of nullification are found in the Kentucky and Virginia resolutions of 1798–99, written respectively by Thomas Jefferson and James Madison in protest against the Alien and Sedition Acts of Congress. Nullification was first practised in 1809 by Pennsylvania, the governor ordering out the state troops to resist the execution of a decree of a Federal court. In the New England states, 1809–15, the United States laws relating to embargo, non-intercourse and army enlistments were nullified by state action. From 1825–29 the state of Georgia forcibly prevented the execution of Federal laws and court decrees relating to the Indians within her borders and in Alabama, 1832–35, there was a similar nullification. The only example of nullification in which theory and practice coincided was the nullification in 1832 by South Carolina of the Federal tariff laws. In this the state acted upon the theory outlined above which was perfected by Calhoun. In the last decade before the Civil War 14 of the Northern states in the so-called "Personal Liberty laws" nullified the Federal statutes relating to slaves and slavery by making it a crime for their citizens to obey these laws. Since the Reconstruction the Southern states have in practice effected a nullification of the Fourteenth and Fifteenth amendments to the Constitution providing for negro suffrage.

*See* John C. Calhoun, *Works,* vols. i. and vi. (1853–55); D. F. Houston, *Critical Study of Nullification in South Carolina* (1897); C. W. Loring, *Nullification and Secession* (1893); E. P. Powell, *Nullification and Secession in the United States* (1897); and U. B. Phillips, *Georgia and States Rights* (Washington, 1902); D. W. Howe, *Political History of Secession to the Beginning of the American Civil War* (1914); C. S. Boucher, *The Nullification Controversy in South Carolina* (Chicago, 1916); P. M. Hamer, *The Secession Movement in South Carolina, 1847–52* (Allentown, Pa., 1918); L. T. Lowery, "Northern Opinion of Approaching Secession," *Smith College Studies in History,* vol. 3 (Northampton, Mass., 1918); and E. S. Corwin, *John Marshall and the Constitution* (New Haven, Conn., 1919).

(W. L. F.)

**NULLITY OF MARRIAGE,** a judicial declaration that a marriage was null and void *ab initio* (from the beginning). In the 12th century the Roman law doctrine of nullity of marriage was developed in order to deal with hard cases under the principle of the indissolubility of marriage laid down by the Church of Rome, whose canons at that date governed the matrimonial law for the whole of Christendom. Nullity could be sued for on the grounds of affinity, into which the law of adoption entered very largely, or a previous unconsummated marriage, which latter was a ground for nullity in England as late as 1750. There were, and continue to be in Roman Catholic countries, various other grounds for nullity, but the grounds of nullity in England are at present limited to the following: (1) Where the parties are not by reason of age (14 for a male and 12 for a female), mental capacity, or otherwise capable of contracting marriage; (2) where the parties are within the prohibited degrees of affinity or relationship; (3) where one of the parties is already married; (4) where one of the parties does not freely consent to marry the other or does not understand the nature of the contract or ceremony; (5) where certain forms have not been observed; (6) where the form of marriage is essentially polygamous. Forms of marriage which offend against these rules are void *ab initio.* If at the time of the marriage one of the parties is and continues to be incapable of consummating the marriage by reason of some incurable physical defect, or of some incurable mental disability on the part of the man preventing him from consummating the marriage, or on the part of the woman resulting in her refusal of marital rights, the marriage may be annulled on the petition of the other party. A person may claim as a ground of nullity that he or she was insane at the time of the marriage. For the prohibited degrees of affinity *see* MARRIAGE.

The Royal Commission on Divorce which reported in 1913

recommended the following additional grounds of nullity of marriage: (1) When the other party, though of sufficient understanding to consent to a marriage, is at the time of the marriage either of unsound mind in other respects, or in a state of incipient mental unsoundness which becomes definite within six months after marriage, and the first party is at the time of the marriage ignorant of the defect, provided that (*a*) the suit is instituted within a year of the celebration of the marriage; (*b*) there has been no marital intercourse after discovery of the defect; (2) where the other party at the time of the marriage is subject to epilepsy or to recurrent insanity, and such fact is concealed by such party or his or her parents or either of them, or by anyone who has control over such party and is aware of the intended marriage, and the first party remains ignorant of the fact at the time of the marriage, subject to the same limitations for petitioning as in (1) above; (3) where one of the parties at the time of the marriage is suffering from a venereal disease in a communicable form, and the fact is not disclosed to the other party; (4) where a woman is pregnant by some other man at the time of the marriage and the husband is ignorant of the fact; (5) where there has been wilful refusal, without reasonable cause to allow intercourse, and where in fact there has been no intercourse owing to such refusal. (*See* also DIVORCE.)

*See* W. Rayden, *Practice and Law in the Divorce Division* (2nd. ed., by C. Mortimer, 1926); Sir L. Dibdin, *Reformatio Legum Ecclesiasticarum,* vol. iii. (1912); Report of the Royal Commission on Divorce and Matrimonial Causes (1913). (W. LA.)

**United States.**—Three different situations relating to the nullity of marriage must be distinguished. A marriage may in the first place be totally void. No suit is necessary for its annulment and third parties can set up the fact of its invalidity. This, for example, is generally true of a bigamous marriage. Secondly, a marriage may be voidable at the election of one of the parties. No judicial decree is in theory necessary, though it is customary to secure a judicial declaration of nullity. Non-age of a party generally permits him thus to avoid the marriage, rendering it invalid *ab initio,* but until avoided by the act of the party it is valid, and third parties have no rights to contest its validity. Thirdly, as in the cases of marriage within the prohibited degrees of affinity, a suit to annul the marriage may be essential and such suit must be brought within the lifetime of one of the parties. The decree of annulment also relates back to the time of the marriage. The chief tendencies manifested by the many statutes in this field, apart from specifying the grounds for annulment, relate to: preserving the legitimacy of children born prior to the decree of annulment; making all annulments dependent upon judicial action and, in some instances, permitting the court in its discretion to deny or withhold relief; limiting the right to sue for annulment to a short space of time after discovery of the cause for annulment; permitting courts to award alimony upon decreeing annulment; allowing the injured party to a subsisting marriage to bring suit for its annulment; permitting courts in their discretion to hold trials for annulment in camera.

The grounds for annulment commonly recognized are: bigamy, impotency, non-age, marriage within the prohibited degrees of affinity, non-compliance with an essential statutory formality, mental incapacity existing at the time of the marriage. Among grounds that are recognized in some States by legislation, though not generally recognized, are: fraud, duress or mistake in the granting of consent to marriage, wilful refusal of a party to consummate the marriage by sexual intercourse, venereal disease or other serious illness existing at the time of the marriage and unknown to the other party, pregnancy due to some third party at the time of marriage and unknown to the other party. The causes for annulment are now generally specified by statute and these vary from State to State. Wide legislative activity in this field is due to the fact that in the United States no courts succeeded to the jurisdiction of the English ecclesiastical courts. Consequently no action for annulment on grounds entertained by the English ecclesiastical courts could be maintained in the absence of statute though equity courts would entertain such actions on grounds other than the canonical disabilities. Under such a theory the intervention of the legislature became necessary and in short time legislation expanded to bring the entire field within its control. (J. M. LA.)

**NUMANTIA,** an ancient hill fortress in northern Spain, in the province of Soria (Old Castile), overhanging the village of Garray, near the town of Soria, on the upper Douro. Here, on a small isolated high plateau in the middle of the valley, was the stronghold which played the principal part in a famous struggle between the conquering Romans and the native Spaniards during the years 154–133 B.C. Numantia was especially concerned in the latter part of this war from 144 onwards. It was several times unsuccessfully besieged. Once the Roman general Hostilius Mancinus with his whole army was compelled to surrender (137). Finally, Scipio Aemilianus, Rome's first and only general in that age, with some 60,000 men drew round the town 6 m. of continuous entrenchments with seven camps at intervals. After 15 months (134–133) he reduced by hunger the 6,000–8,000 Numantine soldiers, much as Caesar afterwards reduced Alesia in Gaul. The result was regarded as a glorious victory, and in Roman literature the fall of Numantia was placed beside the fall of Carthage. The site was, under the Roman Empire, occupied by a Roman town called Numantia, and the *Itinerary* tells of a Roman road which ran past it. It is to-day a "Monumento Nacional" of Spain, and has yielded remarkable discoveries to the skilful excavations of Dr. Schulten (1905–1910), who has traced the Celtiberian town, the lines of Scipio and several other Roman camps dating from the Numantine Wars. (F. J. H.)

**NUMA POMPILIUS,** second legendary king of Rome (715–672 B.C.), was a Sabine, a native of Cures, and his wife was the daughter of Titus Tatius, the Sabine colleague of Romulus. He was elected by the Roman people at the close of a year's interregnum, during which the sovereignty had been exercised by the members of the senate in rotation. Nearly all the early religious institutions of Rome were attributed to him. He set up the worship of Terminus (the god of landmarks), appointed the festival of Fides (Faith), built the temple of Janus, reorganized the calendar and fixed days of business and holiday. He instituted the flamens (sacred priests) of Jupiter, Mars and Quirinus; the virgins of Vesta, to keep the sacred fire burning on the hearth of the city; the Salii, to guard the shield that fell from heaven; the pontifices and augurs, to arrange the rites and interpret the will of the gods; he also divided the handicraftsmen into nine gilds. He derived his inspiration from his wife, the nymph Egeria, whom he used to meet by night in her sacred grove. After a long and peaceful reign, during which the gates of Janus were closed, Numa died and was succeeded by the warlike Tullus Hostilius. Livy (xl. 29) tells a curious story of two stone chests, bearing inscriptions in Greek and Latin, which were found at the foot of the Janiculum (181 B.C.), one purporting to contain the body of Numa and the other his books. The first when opened was found to be empty, but the second contained fourteen books relating to philosophy and pontifical law, which were publicly burned as tending to undermine the established religion.

No single legislator can really be considered responsible for all the institutions ascribed to Numa; they are essentially Italian, and older than Rome itself. Even Roman tradition itself wavers; *e.g.,* the *fetiales* are variously attributed to Tullus Hostilius and Ancus Marcius. The supposed law-books, which were to all appearance new when discovered, were clearly forgeries.

*See* Livy i. 18–21; Plutarch, *Numa;* Dion. Halic. ii. 58–76; Cicero, *De republica,* ii. 13–15. For criticism: Schwegler, *Römische Geschichte,* bk. xi.; Sir G. Cornewall Lewis, *Credibility of early Roman History,* ch. xi.; W. Ihne, *Hist. of Rome,* i.; E. Pais, *Storia di Roma,* i. (1898), where Numa is identified with Titus Tatius and made out to be a river god; J. B. Carter, *The Religion of Numa* (1906); O. Gilbert, *Geschichte und Topographie der Stadt Rom im Altertum* (1883–1885); and ROME: *Ancient History.*

**NUMBER,** an abstract term for the integers 1, 2, 3, . . . as well as for the various mathematical generalizations of the integers, such as fractions and irrational quantities. It is also used as a concrete term. The practice of specifying the multiplicity of classes of objects by means of marks (integers) is found at an early stage in all civilizations, and has led to various systems of

numeration (*see* NUMERALS and ARITHMETIC). The ordinary decimal system is now in general use. While the particular system of numeration to be adopted is a matter of no theoretic importance, nevertheless, to insure the free development of the concept of number, some symbol for zero must be introduced, as well as symbols for addition, subtraction, multiplication and division. Over two thousand years ago the Greek philosopher Pythagoras (*q.v.*) foresaw the fundamental rôle of number and gave it a central place in his philosophy. The actual progress made however in the development of the concept of number is not to be found in the many philosophical speculations on the subject, but rather in the technical researches of mathematicians. In what follows our purpose will be to outline the essential ideas involved in this development.

## INTEGERS

The simplest and most fundamental type of number is that of the integers. This type may be analyzed in the following manner. Consider two classes of objects $A$ and $B$, each of which has only a finite number of constituent elements. Suppose that the elements of $A$ and of $B$ can be put in "one-to-one correspondence." In other words suppose that the elements of $A$ can be paired with the elements of $B$ just as the fingers of one hand can be paired with those of the other. Suppose, furthermore, that the elements of $A$ and of a third class $C$ can be put in one-to-one correspondence in the same way. It is then evident that the elements of $B$ and of $C$ can also be put in one-to-one correspondence. Thus the various classes $B, C, \ldots$ in one-to-one correspondence with $A$ are also in one-to-one correspondence with one another.

An integer may be defined as a mark associated with such a collection of classes $A, B, C \ldots$ ; *e.g.*, the integer 5 is the mark associated with the class of fingers on a hand and with all other classes in one-to-one correspondence with this particular class. It is reasonable to believe that even before the dawn of primitive civilization the first step in the use of the integer must have been taken in some such way as the following. A herdsman might set one stone aside for each animal in the herd. By use of the pile of stones he would be able to determine at any time whether or not his herd was complete. Later a series of scratches might serve as a simplified mark, and it is easy to see how the long continued use of such methods would lead to complete systems of numeration.

In basing the notion of the integer upon that of one-to-one correspondence, the classes were assumed to have only a finite number of constituent elements. Since the notion of a finite number of elements is thus involved at the outset, our analysis might seem to involve circular reasoning. This is not really the case since the notion of one-to-one correspondence of itself furnishes a method of distinguishing between finite and infinite classes. We may *define* an "infinite" class as one which can be put in one-to-one correspondence with a part of itself. For example, the class of integers 1, 2, 3, . . . will be infinite according to this definition since it may be put in one-to-one correspondence with the class of even integers 2, 4, 6, . . . ; we need only make an integer $n$ of the first class correspond to its double $2n$ of the second class:

$$1, 2, 3, 4, \cdots$$
$$2, 4, 6, 8, \cdots.$$

Likewise we may *define* a "finite" class as one which cannot be put in one-to-one correspondence with a part of itself.

**Operations with the Integers.**—If $a$ and $b$ are the integers for two classes $A$ and $B$ having no elements in common, and if these classes be combined to form a new class $S$, the integer $s$ for $S$ is determinable from the integers $a$ and $b$. Indeed the underlying notion of correspondence shows that if $A'$ and $B'$ are any two other classes having no elements in common, whose integers are also $a$ and $b$, then the integer for the combined class $S'$ formed from $A'$ and $B'$ will be the same integer $s$ as before. To make this fact clear, we need only observe that when $A$ and $B$ are put in one-to-one correspondence with $A'$ and $B'$ respectively, $S$ is put coincidently in one-to-one correspondence with $S'$. The integer $s$ is called the "sum of $a$ and $b$"; in the language of algebraic symbolism we write $s=a+b$. The operation of determining $s$ when $a$ and $b$ are given is called *addition*. Thus the operation of addition corresponds to the fundamental logical process of combination of two classes.

Similarly there may be $a$ classes, each of which contains the same number $b$ of elements, while no two of these classes have an element in common. If these classes be combined to form a new class composed of all these elements, its integer $p$ is determinable from $a$ and $b$, as follows in a similar manner. The integer $p$ is called the "product of $a$ and $b$": $p=a\times b$, and the corresponding operation is called *multiplication*. Thus the operation of multiplication corresponds to the combination of a number of distinct classes, themselves in one-to-one correspondence with each other.

The two operations of addition and multiplication are usually considered to be the two fundamental operations. The inverse operations of subtraction and division may be defined by means of the respective equations

$$(a-b)+b=a, \quad \left(\frac{a}{b}\right)\times b=a.$$

Consequently the symbol $a-b$ will represent an integer if and only if $b$ is smaller than $a$ (*i.e.*, some class $B$ can be put in one-to-one correspondence with a part of some class $A$). Likewise $a/b$ will represent an integer if and only if $a$ contains $b$ as a factor. The successive integers may be defined in terms of addition as follows:

$$1+1=2,\ 2+1=3,\ 3+1=4, \cdots.$$

Here 1 is to be regarded as the integer for any unit class. The definition of multiplication makes it clear that multiplication of any integer by 1 does not affect the integer.

**The Five Fundamental Laws of Operation.**—The notion of the integer, as based upon the one-to-one correspondence of classes, shows immediately that certain simple laws must hold. For instance since the class $C$, obtained by the combination of two classes $A$ and $B$, is the same whichever class is mentioned first, we infer that the sum of two integers is independent of the order in which they are taken. This law has been termed the *commutative law of addition* (*see* COMMUTATIVE LAWS), and is the first of the five fundamental laws written below in algebraic form:

(i) $a+b=b+a$,

(ii) $(a+b)+c=a+(b+c)$,

(iii) $a\times b=b\times a$,

(iv) $(a\times b)\times c,=a\times(b\times c)$,

(v) $a\times(b+c)=(a\times b)+(a\times c)$.

The second *associative law of addition* (*see* ASSOCIATIVE LAWS) declares that if a third integer be added to the sum of a first and second integer, then the sum obtained is the same as if the sum of the second and third integers were added to the first; either process will give the sum of all three integers. In fact if the combination of two classes $A$ and $B$ is followed by a combination of the resulting class with a third class $C$, the combination of $A$, $B$, and $C$ is obtained, just as when $A$ is combined with the combination of $B$ and $C$. Consequently the first two laws embody the principle that when integers are added, the final sum obtained is the same, no matter in what arrangement the operations of addition are performed.

The third and fourth laws embody an entirely analogous principle in connection with multiplication; viz., that when integers are multiplied, the final product obtained is the same, no matter in what arrangement the operations of multiplication are performed. However the reason for this principle is not quite so immediate. It may be formulated as follows: First consider two distinct classes $A$ and $B$ with $a$ and $b$ elements respectively. A class may be formed whose elements are all possible pairs of elements, one from $A$ and the other from $B$. For each element of $A$ there will be $b$ elements of $B$ which may be associated with it. Consequently by the definition of multiplication there will be $a\times b$ pairs in all, or equally $b\times a$ of course. Thus we obtain the

third *commutative law of multiplication.* The same justification may be presented in a simple graphical form. A rectangular array of $a \times b$ dots may be regarded either as $a$ rows of $b$ dots each or as $b$ rows of $a$ dots each.

Secondly, consider three distinct classes $A$, $B$ and $C$ with $a$, $b$, and $c$ elements. A class may be formed whose elements are all possible triples of elements, one from $A$, one from $B$, and one from $C$. Evidently the class of triples so obtained may also be formed by taking the class of pairs from $A$ and $B$ mentioned above, and associating any such pair with any element of $C$ to form a triple. Likewise the same class of triples may be constructed by taking the class of pairs from $B$ and $C$ and associating any such pair with any element of $A$. In this way the fourth *associative law of multiplication* is justified. This justification may also be given graphical form by use of an array of $a \times b \times c$ dots in space arranged in the form of a rectangular parallelepiped.

The fifth *distributive law of multiplication* (*see* DISTRIBUTIVE LAW) may be seen to hold as follows. The class of pairs of elements taken one from the class $A$ and the other from the combination of $B$ and $C$ is evidently merely the combination of the class of pairs taken from $A$ and from $B$, with the class of pairs taken from $A$ and $C$. This, too, admits of graphical justification, since an array of $a \times (b+c)$ dots is evidently made up of an array of $a \times b$ dots and an array of $a \times c$ dots.

These five general laws contain all of the principles necessary for the manipulation of the integers, provided that we take for granted the special law, $a \times 1 = a$. In particular we can deduce the usual addition and multiplication tables for the integers by the aid of these laws; as an illustration we find

$$2+2=2+(1+1)=(2+1)+1=3+1=4,$$
$$2 \times 2=2 \times (1+1)=(2 \times 1)+(2 \times 1)=2+2=4.$$

## THE REAL NUMBER SYSTEM

**Positive or Ordinary Numbers.**—The concept of quantity expressed in terms of a suitable unit of measure is of almost the same intuitive nature as the concept of the integer. This is particularly true of geometric quantities such as lengths, areas and volumes. In the case in which the given quantity contains the unit an exact number of times, it is clear that the quantity may be designated by means of the corresponding integer. For similar reasons a fraction $\frac{m}{n}$ ($m$ and $n$ being integers) may be taken to represent the $n$th part of $m$ units.

Fractions were employed as early as 1700 B.C. by the ancient Egyptians, but the concept of ordinary number was first adequately presented by Euclid. In the tenth book of his *Elements* he considered geometric magnitudes, and distinguished between commensurable and incommensurable quantities. For instance he established that the hypotenuse of an isosceles right triangle is incommensurable with the other two equal sides. In other words the number $\sqrt{2}$, representing the hypotenuse in terms of one of the equal sides taken as unit, is an *irrational* number, not expressible as a fraction $\frac{m}{n}$. How then shall such irrational numbers be represented by means of marks? This must be accomplished with the aid of a sequence of fractions which approach the irrational number as a *limit*. For instance when $\sqrt{2}$ is represented in the form of an infinite decimal: $\sqrt{2}=1.4142\ldots$, this amounts to a specification of $\sqrt{2}$ by means of the sequence of fractions

$$1, \frac{14}{10}, \frac{141}{100}, \frac{1414}{1000}, \frac{14142}{10000}, \ldots.$$

The fundamental operation of addition of two such numbers may be interpreted geometrically, and in this way it is intuitively evident that the first two general laws must continue to hold.

**Zero and Negative Numbers.**—The real number system includes not only the positive or ordinary numbers, but zero and the so-called negative numbers, and is the system of most theoretical importance in the actual application of number to scientific questions. It might be shown how in various fields such a further extension is very natural; for instance in dealing with temperature we must select an initial or zero point of the scale and must differentiate between temperatures above and below this point. Instead of doing so we propose to indicate how more purely mathematical considerations suggest this further extension. Similar considerations also suggest the extension already made from the integers to the fractions, but this extension can be based so directly upon experience as to make the statement of the purely mathematical considerations seem superfluous. The mathematical considerations entering are the following:

For the free manipulation of numbers the use of the inverse operations is an indispensable adjunct. We may deduce the general laws for such operations from the five fundamental laws. One illustration of this must suffice. The usual algebraic rule for the addition of two fractions with a common denominator is embodied in the formula

$$\frac{a}{d}+\frac{b}{d}=\frac{a+b}{d}.$$

To establish this law we may write $\frac{a}{d}=x, \frac{b}{d}=y$, whence we find $xd=a$, $yd=b$, in virtue of the definition of division. By addition we infer that

$$xd+yd=(x+y) \times d=a+b,$$

whence follows $x+y=\frac{a+b}{d}$, which it was desired to prove.

In this free manipulation of quantities with the aid of these inverse operations, such symbols arise as $1-1$, $1-2$, which do not represent ordinary numbers. Yet it is soon found that if formally correct manipulations are made regardless of the meaning of the symbols, the correct result is always obtained. This situation suggests inevitably that such symbols in reality represent a valid kind of number.

Let us assume that this is the case and consider the conclusions which follow. For brevity let us write $a-a=0$. This definition will be legitimate since we can establish formally that the equality

$$a-a=b-b$$

holds whatever $a$ and $b$ may be. The two further special laws $a \times 0=0$, $a+0=a$ are obeyed by this symbol 0, and are of the same nature as the special law $a \times 1=a$ already mentioned.

Next write for the sake of brevity

$$0-a=-a$$

in case $a$ is a positive number. Such a quantity may be called *negative.* With this extension of the number system to include 0 and the negative quantities, all symbols are found to be formally reducible to the same type, provided that division by 0 is excluded. Consequently the extension of the ordinary numbers by the introduction of zero and the negative numbers follows from the free formal use of the laws of operation. Furthermore the rules for dealing with such numbers are obtained in the same way; for example the conclusion that the product of $-a$ and $-b$ is $ab$ follows in this way.

Up to this point the method of approach has been heuristic rather than logical. It is now a simple matter to explain the method by which the real numbers can be satisfactorily defined in terms of ordinary numbers. We propose to consider ordinary numbers, the number 0, and ordinary numbers with a $-$ symbol prefixed. The first type of mark will be referred to as a positive number and the last type as a negative number. The number 0 will be regarded as a member of either type; *i.e.*, $-0=0$ by convention. The rules of combination of these marks under the operations $\oplus$ and $\otimes$ (which are not to be confused with the operations $+$ and $\times$) will be defined in the following manner: If $a$ and $b$ are positive $a \oplus b$ is the positively taken sum; if either $a$ or $b$ is negative $a \oplus b$ is their difference considered as positive if the positive term is numerically greater, and negative in the contrary case; if both $a$ and $b$ are negative, $a \oplus b$ is their ordinary sum taken as negative. Likewise if $a$ and $b$ are both positive or both negative $a \otimes b$ is the positively taken product; and if one

is positive and the other negative, $a \otimes b$ is the negatively taken product. Finally we define $a \oplus o$ and $o \oplus a$ to be $a$ in all cases, and $a \otimes o$ and $o \otimes a$ to be $o$ in all cases.

It may then be verified, upon the basis of the properties of ordinary numbers, that the *extended real number system* satisfies the general and special laws of operation in all cases whatsoever; for example it may be verified that the commutative law of addition holds always. Furthermore it is readily verified that the inverse operations (except division by o) can be performed. These inverse operations will of course obey the usual formal laws which can be deduced from the five general laws for the direct operations. Hence we are fully justified in regarding the real number system so obtained as a complete generalization of the ordinary number system.

## THE COMPLEX NUMBER SYSTEM

As soon as equations of the second and higher degree are considered, a further and (in some ways) final extension of the number system is suggested. In fact the general formula for the solution of an equation of the second degree involves the extraction of the square root of a quantity which may be negative. But no real quantity has a negative square. Hence we are again led to meaningless symbols. However the symbol for the solution can be reduced formally to $a+bi$ where $i$ stands for $\sqrt{-1}$ so that $i^2=-1$. Here $bi$ is an abbreviation for $b \times i$.

The question then arises as to whether these symbols can be regarded as an appropriate generalization of the real numbers. If we write

$$(a+bi)+(c+di)=(a+b)+(c+d)i,$$

$$(a+bi)\times(c+di)=ac+(ad+bc)i+bdi^2=(ac-bd)+(ad+bc)i,$$

we define thereby the operations of addition and multiplication of these complex or imaginary numbers. It may then be verified that the usual formal laws will be satisfied in all cases. Consequently the further extension of the number system must be regarded as legitimate.

The above treatment may be clarified as follows. Let us begin by defining a complex number as a pair of associated real numbers $(a, b)$. The definitions of addition $\oplus$ and multiplication $\otimes$ may be written

$$(a, b) \oplus (c, d) = (a+c, b+d)$$

$$(a, b) \otimes (c, d) = (ac-bd, ad+bc).$$

Furthermore as a means of abbreviation we may write $(a, o)=\underline{a}$ and call these pairs $\underline{a}$ the real numbers of the extended system; in particular we have $(o, o)=\underline{o}$, $(1, o)=\underline{1}$. Likewise we write $i=(o, 1)$, and find from the definition of multiplication

$$i^2=i \otimes i=(-1, o)=-\underline{1}.$$

We are now in a position to deduce

$$(a, b)=(a, o) \oplus (o, b)=(a, o) \oplus (b, o) \otimes i=a \oplus (b \otimes i),$$

which is essentially the form of expression $a+bi$ with which we started.

When this complex number system is adopted the solution of all algebraic equations of any degree may be accomplished, even when the coefficients are themselves complex numbers. Thus from an algebraic standpoint no further generalization is called for. The so-called Argand diagram represents complex numbers by means of the points of a plane, and makes it evident graphically that these numbers satisfy the general and special laws. (*See* COMPLEX NUMBERS.)

## BASIS OF THE NUMBER SYSTEM

**The Integers as Basis.**—We are now in a position to indicate in what sense the integers alone may be regarded as basis for these extensions. Our first step is to define a fraction as a pair of associated integers $\frac{p}{q}$, and to define addition and multiplication of fractions by the usual algebraic formulae. It is then readily verified on the basis of the properties of the integers that such fractions obey the five general laws. We regard two fractions $\frac{p}{q}$ and $\frac{p'}{q'}$ as "equal" if $pq'=qp'$. Furthermore we write $\frac{a}{1}=a$, and find that the first special law also holds. We may next introduce the inverse operations and obtain the usual corresponding laws from the five fundamental laws.

**The System of Postulates.**—In the course of the preceding development certain general and special laws were found to be characteristic of various types of number systems. It is of decided interest to investigate the question as to whether these laws are sufficient to characterize such systems. This can be accomplished by means of the postulational method. Here certain postulates are formulated in terms of certain elements and operations, and it is then proved that the elements and operations are essentially the numbers and the operations of addition and multiplication.

A natural set of postulates with which to begin is the following. The set of elements and $+$, $\times$ obey the fundamental laws $I-V$; there are two special elements o, 1 which obey the special laws. The equations

$$a+x=b, \quad a \times x=b$$

have a unique solution $x$ for all values of $a$ and $b$, except for $a=o$ in the second case.

These postulates however do not suffice. In fact they hold for the set of positive and negative fractions, for the real number system, and for the complex number system. They also hold for certain modular number systems referred to later in which there are only a finite number of elements; the simplest such system contains only three marks o, 1, 2 with addition and multiplication defined by the following tables:

| + | o | 1 | 2 |
|---|---|---|---|
| o | o | 1 | 2 |
| 1 | 1 | 2 | o |
| 2 | 2 | o | 1 |

| × | o | 1 | 2 |
|---|---|---|---|
| o | o | o | o |
| 1 | o | 1 | 2 |
| 2 | o | 2 | 1 |

The complete treatment of the ordinary number system which Huntington has given introduces the further relation $<$ (less than).

The advantage of such a postulational analysis is that we are led to see what are the essentially independent properties of an assigned number system. By the modification or removal of one or more of the postulates other types of number are obtained; *e.g.*, if to the above set we add the postulate that there are three distinct elements, it may be proved immediately that the modular system specified is obtained.

## SYMBOLIC LOGIC AND THE INTEGER

Symbolic logic attempts to reduce the so-called logical processes of thought to explicit objective form in such wise that logical reasoning may be comparable in its mechanical precision and objective quality with a game such as chess. Here the paper on which the symbolic propositions are written corresponds to the chessboard, and the symbols correspond to the chessmen. There is given an initial set of "true" propositions which corresponds to the initial position of the chessmen with which we start.

Now this logical game and its rules, as ordinarily conceived, do not have any reference to number or even to the integers. It would of course be possible to insert at the outset a given set of true propositions (*i.e.*, postulates) sufficient to characterize the set of integers. It would then be possible in accordance with the strictly prescribed logical processes to define the fractions. In developing the ordinary number system, it would be necessary to deal with an infinite ordered sequence of fractions.

Our method of approach to the ordinary integers was itself of a logical character, since it defined the integers in terms of the notion of one-to-one correspondence of classes, which is a purely logical one. Thus the fundamental and interesting question is suggested: in a symbolic logic not containing initial propositions which state the existence of the integers, might it not be possible to define the integers in purely logical terms? The kind of definition that has been considered by Frege, Russell and Whitehead

may be stated as follows in ordinary language: an integer is the class of all classes in one-to-one correspondence with some specified finite class. The one-to-one correspondence between two classes is a relation $R$ between the elements of the classes which may be expressed in the form: for each element $x$ of the first class there exists one and only one element $y$ of the second class such that $x\ R\ y$; likewise for each $y$ of the second class there exists one and only one $x$ of the first class such that $x\ R\ y$.

The attempt to devise a satisfactory system of symbolic logic is beset with many difficulties. In particular it must be able to deal with certain paradoxes which have been encountered in the theory of infinite classes. A theory of types of proposition has been devised by Whitehead and Russell with this purpose in view. At the present time there is no general agreement among mathematicians as to the proper foundation of symbolic logic; but on the basis of the work of Whitehead and Russell it seems clear that if symbolic logic can be given a definite form, it will prove to be possible to define the positive integers in purely logical terms.

## FURTHER GENERALIZATIONS

**Modular and Hypercomplex Numbers.**—There are many generalizations and modifications of number besides those referred to above. In particular there are the modular and Galois number fields in which there are only a finite number of marks (numbers) and in which all the usual formal laws are satisfied (*see* NUMBERS, THEORY OF). There are also various hypercomplex number systems such as quaternions (*see* QUATERNIONS) in which there are more than the two "fundamental units" such as 1 and $i$ of the ordinary complex number system. In these hypercomplex number systems, however, the commutative law of multiplication does not hold.

**Transfinite Numbers.**—The above-mentioned directions of generalization are technical in character. Of a much more fundamental nature is the extension of the notion of the integer as the mark of a finite class so as to apply to infinite classes. These *transfinite numbers,* discovered by G. Cantor, have attracted much interest and have led to certain paradoxes to which we cannot do more than allude. An infinite class has the property that it can be put into one-to-one correspondence with part of itself. This was illustrated above by means of the infinite sequence (*see* NUMBER SEQUENCES) of integers 1, 2, 3, . . . ; but from any infinite class we may remove such an infinite sequence.

Consider now a collection of classes which can be put in one-to-one correspondence with one another. These can be regarded as associated with a mark which is an ordinary integer if the classes contain a finite number of elements, and which is called a *transfinite cardinal,* if there are infinitely many elements in each class. The simplest such mark $\omega$ is that attached to the class of positive integers; $\omega$ is the mark characteristic of enumerable classes, *i.e.,* of classes which may be put in one-to-one correspondence with the infinite sequence of integers 1, 2, 3. . . . The class of all fractions $\frac{m}{n}$ has also this transfinite cardinal $\omega$, for these fractions may be ordered according to the size of the sum of numerator and denominator:

$$\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{2}{3}, \frac{3}{2}, \cdots.$$

A first conjecture might be that all infinite classes have the transfinite cardinal $\omega$. The following simple reasoning shows, however, that the class of all ordinary numbers between 0 and 1 has a greater transfinite cardinal than $\omega$.

Suppose it possible that the class of these numbers has the transfinite cardinal $\omega$. This would signify that all of these numbers could be written in a sequence $S$ just as the integers 1, 2, 3, . . . can be written. First let us imagine the numbers of this sequence to be written in decimal form. Now certain rational numbers admit of double representation, as is evident from the fact that 0·879999 . . . =0·880000. . . . Let us agree, in all such cases, to use the mode of representation by 9's, so that every number shall have a unique decimal representation. We may now construct another number less than 1 as follows: Let the first figure after the decimal point be chosen apart from 0 and the first figure of the first number of $S$; the second figure be chosen apart from 0 and the second figure of the second number of $S$, and so on. There will then be defined a number in decimal form which is obviously distinct from all the numbers of $S$. Hence the hypothesis that the sequence contains all of the numbers between 0 and 1 is incorrect. The conclusion may be stated in the form: The continuum of numbers between 0 and 1 is not enumerable. By an extension of this method it is possible to define greater and greater transfinite numbers.

In the consideration of the transfinite cardinals various paradoxes arise unless some definite logical theory such as the theory of types of Russell and Whitehead is carefully adhered to. Moreover the precise structure of these transfinite numbers is not known except in the case of the least such number $\omega$; thus it is not known whether or not the transfinite cardinal of the continuum is the first exceeding $\omega$ or not.

**Cardinal and Ordinal Numbers.**—In the account of number given above no reference has been made to the usual elementary distinction between the cardinal and ordinal integers. Up to the time of the discovery of transfinite number this distinction possessed merely elementary pedagogical significance, and the mathematical treatment of number dealt exclusively with the cardinal integers. With the invention of the transfinite numbers, however, it appeared immediately that this distinction, although mathematically barren in the case of ordinary integers, lead to two distinct types of number when applied to infinite classes, namely to the transfinite cardinals and to the transfinite ordinals.

The distinction between cardinal and ordinal number may be expressed as follows in the case of finite classes. In the case of the cardinal type of integer we have a mark characteristic of the class without reference to any order of its elements; in the case of the ordinal type of integer the class is ordered and its elements are supposed to be counted in this order, the mark 1 being attached to the first element, the mark 2 to the second, and so on, to the end of the sequence. This gives an ordinal number for each element. Of course if the last element has the mark $n$, the cardinal number of the class is also $n$. Thus the two kinds of integer are very intimately related.

When we deal with infinite classes and attempt to extend the notion of ordinal number, it is necessary first of all to define what is meant by an ordered infinite class. First we have an infinite sequence 1, 2, 3, · · · as before. To continue with the ordinal numeration we call the next mark $\omega$; after it the successive marks are denoted by $\omega+1$, $\omega+2$, · · · , although this is merely by convention. Immediately after this sequence appears the next ordinal, denoted by $\omega\cdot 2$, followed by $\omega\cdot 2+1$, $\omega\cdot 2+2$, · · · , then $\omega\cdot 3$, $\omega\cdot 3+1$, · · · . Evidently this process of ordinal numeration is now part of a more extensive sequential process which may be written symbolically

$$\begin{aligned}
&1, 2, \cdots\\
&\omega, \omega+1, \omega+2, \cdots\\
&\omega\cdot 2, \omega\cdot 2+1, \omega\cdot 2+2, \cdots\\
&\qquad\cdots\\
&\omega^2, \omega^2+1, \omega^2+2, \cdots\\
&\omega^2+\omega, \omega^2+\omega+1, \omega^2+\omega+2, \cdots.
\end{aligned}$$

Thus a series of order types of increasing complexity is formed, and the process may be continued indefinitely. These give the sequence of transfinite ordinals, appropriate to the numeration of well-ordered infinite classes. A class is said to be "well-ordered" if the elements are not only ordered but are such that every element or ordered sequence of elements has an immediately following element.

The marks for the transfinite ordinals are not the same as for the cardinals. Thus it is immediately evident that the set of transfinite ordinals up to $\omega^2$ are enumerable; *i.e.,* they have the transfinite cardinal $\omega$. It is not as yet known whether or not every class, *e.g.,* the continuum of numbers between 0 and 1, can be well-ordered or not.

The theory of the transfinite cardinal and ordinal numbers, and their interrelations is of great philosophical as well as mathematical interest. The subject requires much further development. In particular the underlying basis of symbolic logic has not been agreed upon.

BIBLIOGRAPHY.—General treatment of number: L. L. Conant, *The Number Concept* (New York and London, 1836); H. B. Fine, *The Number System of Algebra* (Boston, 1903); G. H. Hardy, *A Course of Pure Mathematics* (Cambridge, 1914), ch. i., iii.; B. Russell, *Introduction to Mathematical Philosophy* (New York, 1919).

General discussion of transfinite number: G. Cantor, *Contributions to the Founding of the Theory of Transfinite Numbers* (tr., Chicago and London, 1915); E. V. Huntington, *The Continuum and Other Types of Serial Order* (Cambridge, Mass., 1917); E. W. Hobson, *Theory of Functions of a Real Variable,* ch. i.–iv. (Cambridge, 1927).

(G. D. BI.)

**NUMBERS** is the fourth book of the Pentateuch, as the five books of the Law, or of Moses, have come to be called. The three previous books carried on the story of Israel's history from the creation, through the captivity in Egypt and the escape therefrom, down to the sojourn at Sinai. Numbers traces out the march from Sinai, the wanderings in the wilderness and the final arrival on the steppes of Moab within sight of the Promised Land. Like the other books of the Pentateuch, it consists of earlier (JE) and later (P) sources; *see* BIBLE: *Old Testament.* But, although the sources come from different ages and from writers of different schools of thought, yet if its significance is properly to be apprehended, it is necessary to remember that for more than 2,000 years it has been a complete whole.

The book falls naturally into three sections which follow a chronological sequence; (1) Chaps. i.–x. 10 (P) Israel's sojourn at Sinai, the census and the promulgation of various laws by Moses. (2) Chaps. x. 11–xxii. 1 (JE and P), incidents which occurred during the wanderings between Sinai and the arrival at the steppes of Moab. These incidents seem to have been chosen mainly for the purpose of casting light on the religious history and character of the people and also to explain the meaning of various place-names (*cf.* Taberah and Kibroth hattaavah, xi. 3, 34). They also attempt to give an account of the origin of some religious objects of worship (*e.g.,* the brazen serpent, xxi. 4–11). (3) Chaps. xxii. 2–xxxvi. (mainly P) the sojourn on the steppes of Moab, the incident of Balaam, the second census and the giving of additional laws, together with various other incidents.

The middle section contains important passages from J and E: the twelve spies, the rebellion of Korah, and Balaam's mission to Balak (no signs of P). J, E, and P can be readily separated in chaps xi. and xii. To E belongs the passage describing the outpouring of the Spirit on Eldad and Medad and the remarkable prayer of Moses in xi. 29, "Would God that all Yahweh's people were prophets that Yahweh would put his Spirit upon them," *cf.* the idea that Christians are "priests unto God" (Rev. i. 6). As usual the J and E elements possess such a vivid character as to render them familiar to ordinary readers; contrast P's legislative and statistical style, and his diffuseness (which reaches a climax in ch. vii.). The most illuminating example of the difference between JE and P is found in the passage that occurs after the first long section of P describing the order of march of the several tribes and the position of the ark in the very centre of the host, both when encamped and on the march. In x. 30 Moses entreats Hobab, the son of Reuel his father-in-law, to come with the Israelites to be "eyes" unto them; and in x. 33 it is stated that the ark went *before* them to seek out a resting-place for them. It is clear that these statements directly contradict P's elaborate scheme, according to which the people march mechanically, tribe by tribe, with the ark in the very centre of the square, and guided by the pillar of cloud by day and the pillar of fire by night. Moses, instead of simply following the pillar of cloud, requests Hobab to determine the line of march and select the sites for encampment. No clearer proof could be desired of the nature of early methods of compilation than that the detailed account in ch. i.–x. 28 should be immediately followed by two short paragraphs in palpable contradiction of the whole plan of camp and march so elaborately worked out in the preceding narrative.

Of very great interest is the account of Korah's revolt in ch. xvi. which is composed of J, E, and P in a most intricate manner. Literary analysis has unravelled three stages of development: (*a*) two *Reubenites,* Dothan and Abiram, rebel against the *civil* authority of Moses; (*b*) Korah the Levite, with 250 *Israelites,* rebels against the *religious* authority of Moses and Aaron, and (*c*) Korah at the head of 250 *Levites* protests against the priestly privileges of Aaron (for details *see* the commentaries). The analysis (which is generally accepted) is of extreme value for the difficult study of the history of the Levites (*q.v.*).

Another very important narrative is that of Balaam (*q.v.*). It includes a number of poetical quotations which help to determine its date and also indicate the value of poetry in its bearing on history. Also in xxi. 14 we have a poetical quotation from a lost volume of early poetry entitled "The Book of the Wars of Yahweh." Deborah's song was probably originally in this book; and when we compare its statement as to Israel's full fighting strength, viz., 40,000 men, with the statements in the prose of Numbers as to 600,000 men and more, we at once realize how much closer to actual facts we are brought by early poetry than by the later prose of writers like P. Perhaps it is in chap. xxxi. that we have the clearest proof of P's non-historical character. There we are told that 12,000 Israelites, without losing a single man, slew every male Midianite, children included, and every Midianite woman that had known a man, and took so much booty that there had to be special legislation as to how it should be divided. But if this were actual fact, how could the Midianites have ever reappeared in history? And yet in Gideon's time they were strong enough to oppress Israel.

*See* Commentaries of G. B. Gray, *Internat. Crit. Com.,* L. E. Binns *Westm. Comm.,* McNeile *Camb. Bible,* A. R. S. Kennedy *Century Bible.*

(J. A. P.; L. E. B.)

**NUMBERS, THEORY OF.** The theory of numbers deals primarily with positive and negative whole numbers, called integers. For example, to take the simplest kind of proposition, if $n$ is any integer, $n(n+1)$ is divisible by 2, $n(n+1)(n+2)$ is divisible by 3, etc. Many apparently very simple theorems concerning integers require for their actual proof various branches of mathematics. Frequently a proof employs the theory of algebraic numbers (such as $2+5\sqrt{3}$), which is one of the advanced parts of the theory of numbers.

## MAIN PROPERTIES OF DIVISIBILITY

**Theorems of Fermat and Euler. Primitive Roots.**—A positive integer, like 7, is called a *prime* if it has no factor except itself and 1. But $6=2\times3$ is composite. Two integers, like 8 and $-15$, are called *relatively prime* if they have no common factor $>1$.

In 1640 Fermat stated that, if $p$ is any prime and if $n$ is any integer not divisible by $p$, then $n^{p-1}-1$ is divisible by $p$. For example, $3^4-1=80$ is divisible by 5. The generalization by Euler in 1760 states that if $m$ is any positive integer, prime or composite, and if $n$ is relatively prime to $m$, then $n^{\phi(m)}-1$ is divisible by $m$. Here $\phi(m)$ denotes the number of positive integers not exceeding $m$ which are relatively prime to $m$. For example, these are 1, 5, 7, and 11 when $m=12$, so that $\phi(12)=4$, and $5^4-1=624$ is divisible by 12.

Euler's theorem shows that the linear equation $nx\pm my=c$, in which $n$ and $m$ are relatively prime, has the integral solution $x=cn^k$, $y=\mp cq$, where $k=\phi(m)-1$ and $q$ is the quotient of $n^{\phi(m)}-1$ by $m$.

A *primitive root* $n$ of $m$ is such that $\phi(m)$ is the least positive exponent $e$ for which $n^e-1$ is divisible by $m$. For example, 2 is a primitive root of 5, since $2^4-1$ is divisible by 5, while no one of $2-1$, $2^2-1$, $2^3-1$ is divisible by 5. Again, 5 and 7 are primitive roots of 9. There exist primitive roots of $m$ if and only if $m$ is 2, 4, $p^k$, or $2p^k$, where $p$ is an odd prime.

**Quadratic Residues. Law of Reciprocity.**—When the squares $1^2$, $2^2$, $3^2$ are divided by 7, the positive remainders $<7$ are 1, 4, 2, which are called *least quadratic residues* of 7. Evidently the squares of $4=7-3$, $5=7-2$, $6=7-1$ have the same remainders as the squares of 3, 2, 1. Likewise, $8^2$, $9^2$, $\cdots$ have the same remainders as $1^2$, $2^2$, $\cdots$. Finally, the square of a multiple of 7 has the remainder zero, which is not counted as a

quadratic residue. Hence when all squares relatively prime to 7 are divided by 7, the only remainders $<7$ are 1, 2, 4, which are therefore the only least quadratic residues of 7. The remaining positive integers 3, 5, 6 less than 7 are called the *least quadratic non-residues* of 7. Then if $t$ is any integer, $3+7t$, $5+7t$, and $6+7t$ are called non-residues of 7; while $1+7t$, $2+7t$, and $4+7t$ are called residues of 7. Clearly the product of any two residues or of two non-residues is a residue, while the product of a residue by a non-residue is a non-residue.

The generalization from 7 to any $m$ is immediate. If an integer $r$ is relatively prime to $m$ and if $r$ differs from some square by a multiple of $m$, then $r$ is a *quadratic residue* of $m$. But if $n$ is relatively prime to $m$ and if there is no integer $x$ such that $x^2-n$ is divisible by $m$, then $n$ is a *quadratic non-residue* of $m$. If $m=15$, we need only test the squares of 1, 2, 4, 7; their remainders 1 and 4 are the only least quadratic residues of 15. The remaining positive integers $<15$ and relatively prime to 15 are 2, 7, 8, 11, 13, 14 and give all the least non-residues of 15.

If $p$ is a prime $>2$, and if $s$ is any integer not divisible by $p$, *Legendre's symbol* $(s/p)$ is defined to have one of just two values, viz., $+1$ when $s$ is a quadratic residue of $p$, and $-1$ when $s$ is a non-residue. The earlier results give $(2/7)=+1$, $(3/7)=-1$. By use of the formulas

$$(s/p)(t/p)=(st/p),\quad (-1/p)=(-1)^{(p-1)/2},\quad (2/p)=(-1)^{(p^2-1)/8},$$

the computation of any symbol $(s/p)$ is evidently reduced to that of $(l/p)$ where $l$ is an odd prime $\neq p$. In case $l>p$, we have $l=ap+r$, where $0<r<p$. Since $l$ and $r$ are either both quadratic residues or both non-residues of $p$, $(l/p)=(r/p)$. Hence the computation always reduces to that of $(q/p)$, where $q$ and $p$ are distinct odd primes and $q<p$. We now make use of the reciprocity law:

$$(q/p)\ (p/q)=(-1)^e,\quad e=\frac{p-1}{2}\cdot\frac{q-1}{2}.$$

Hence $(q/p)$ will be known as soon as $(p/q)$ has been found. Since $p>q$, our former method applies to $(p/q)$. All these principles are illustrated in the following example:

$$(-22/73)=(-1/73)(2/73)(11/73),\ (-1/73)=+1,\ (2/73)=+1,$$
$$(11/73)=(73/11)=(7/11)=-(11/7)=-(4/7)=-1.$$

Here it was necessary to know that 73, 11, and 7 are all primes. The removal of the restriction to primes would obviously save much work. Partly for this reason, but mainly on account of its importance in many investigations, we shall discuss *Jacobi's symbol.*

Let $P$ be a positive odd integer. If $P=1$, we take

$$(s/P)=(s/1)=+1.$$

But if $P=p_1\,p_2\cdots p_r$, where $p_1, p_2\cdots$ are odd primes, not necessarily distinct, we define Jacobi's symbol to be

$$(s/P)=(s/p_1)\ (s/p_2)\cdots(s/p_r).$$

In case an even number of these factors is $-1$, the symbol $(s/P)$ is $+1$ and yet $s$ is a non-residue of $P$. While therefore Jacobi's symbol does not admit of the same interpretation as Legendre's, yet all the above formulas hold true, including the reciprocity law, provided $p$ and $q$ are now any relatively prime positive odd integers. If for $n=-P$ we define $(s/n)$ to be $(s/P)$, we see that the reciprocity law holds also when just one of $p$ and $q$ is negative.

## CLASSES OF FUNCTIONS. REPRESENTATION OF INTEGERS BY FUNCTIONS

**Equivalent Functions and Equations.**—The problem to find all solutions of $x^2+y^2=41$ in integers is equivalent to that for $X^2+4XY+5Y^2=41$, which is derived from the first equation by the substitution $x=X+2Y$, $y=Y$. The discussion is not more difficult if we start with any substitution

$$x=aX+bY,\qquad y=cX+dY, \tag{1}$$

in which the coefficients $a$, $b$, $c$, $d$ are integers whose *determinant* (*see* DETERMINANT) $ad-bc$ is $+1$. Solving equations (1) for $X$ and $Y$, we get

$$X=dx-by,\qquad Y=-cx+ay.$$

Hence to any pair of integers $x$ and $y$ corresponds a single pair of integers $X$ and $Y$, and conversely by (1). Let the substitution (1) replace the function $f(x, y)$ by $F(X, Y)$. Then if $g$ is any given integer, the integral solutions of $f=g$ are put into one-to-one correspondence with those of $F=g$ by the substitution (1), so that the problem to find all solutions of $f=g$ in integers is evidently equivalent to that for $F=g$. We therefore need only treat one of the infinitely many equivalent equations.

These two functions $f$ and $F$ are called *equivalent.* Let $F(X, Y)$ become $G(u, v)$ when we apply the new substitution

$$X=qu+rv,\qquad Y=su+tv, \tag{2}$$

with integral coefficients whose determinant $qt-rs$ is $+1$. If we eliminate $X$ and $Y$ between the four equations (1) and (2), we evidently obtain equations of the form

$$x=Au+Bv,\qquad y=Cu+Dv. \tag{3}$$

The coefficients are seen to be integers whose determinant is unity. This substitution (3) is called the product of the substitutions (1) and (2) taken in that order. Since (1) replaces $f$ by $F$, and (2) replaces $F$ by $G$, evidently (3) replaces $f$ by $G$. This proves that if $f$ and $G$ are both equivalent to $F$, they are equivalent to each other. Hence all the functions which are equivalent to a given one $f$ form a *class* of functions any two of which are equivalent. It is easy to extend this discussion for two variables $x$ and $y$ to any number of variables.

When $f(x, y, \cdots)=g$ has integral solutions, $g$ is said to be *represented* by $f$. In case $x, y, \cdots$ have no common factor $>1$, $g$ is *properly represented* by $f$. For example, $2^2+3^2+4^2=29$, whence 29 is properly represented by $x^2+y^2+z^2$.

**Positive Binary Quadratic Forms.**—The function

$$f=ax^2+bxy+cy^2$$

is called a binary quadratic form and is denoted by $(a, b, c)$. Its *discriminant* is $b^2-4ac$. Two equivalent forms have the same discriminant.

Let $A$ be properly represented by $f$, whence $f=A$ for relatively prime integers $x=r$, $y=s$. As shown above, there exist two integers $t$ and $u$ such that $rt-su=1$. The substitution

$$x=rX+uY,\quad y=sX+tY,$$

whose determinant is unity, replaces $f$ by an equivalent form in which the coefficient of $X^2$ is $A$.

Let $a>0$ and let the discriminant of $f$ be a negative number $-\Delta$. Then

$$4af=(2ax+by)^2+\Delta y^2$$

shows that $f$ is positive for all real numbers $x$ and $y$ not both zero. Hence $f$ is called a *positive form* (*see* ALGEBRAIC FORMS). Let $A$ be the least positive integer which is represented by this $f$. If $f=A$ when $x=r$, $y=s$, and if $r$ and $s$ have a common factor $d>1$, then $f=A/d^2$ when $x=r/d$, $y=s/d$, which contradicts the definition of $A$ as least. Thus $A$ is properly represented by $f$. As shown above, $f$ is equivalent to some form $g=(A, \beta, \gamma)$ with $A$ as first coefficient. The substitution $x=X+nY$, $y=Y$ replaces $g$ by $F=(A, B, C)$, where $B=\beta+2nA$. Evidently the integer $n$ may be chosen so that $-A<B\leqq A$. Since $C$ is represented by $F$, $C$ is not less than the minimum $A$. In case $C=A$, the substitution $x=-Y$, $y=X$, whose determinant is unity, replaces $F$ by $(A, -B, A)$. This proves that every positive form is equivalent to a *reduced form* $(A, B, C)$ in which

$$A<B\leqq A,\quad C\geqq A,\ \text{with } B\geqq 0 \text{ if } C=A. \tag{4}$$

Then $$4A^2\leqq 4AC=\Delta+B^2\leqq\Delta+A^2,\ 3A^2\leqq\Delta.$$

Hence if $\Delta$ is given, there is a limited number of positive integral values of $A$. The same is now true for $B$ by (4). Each pair of integers $A$ and $B$ determines at most one integer $C$ for which $4AC=\Delta+B^2$. Hence there is only a finite number of positive

reduced forms having a given discriminant.

*Example 1.* To find the reduced forms whose discriminant is $-4$. Since $3A^2 \leqq 4$, the positive integer $A$ is 1. By (4), $B=0$ or 1. Then $4C=4+B^2$ gives $B=0$, $C=1$. Hence $x^2+y^2$ is the single reduced form.

*Example 2.* Let the discriminant be $-12$. Then $A=1$ or 2. If $A=1$, we get $F=x^2+3y^2$ as in Ex. 1. If $A=2$, $8C=12+B^2$ shows that $B$ is even and $\neq 0$. Then (4) gives $B=2$. The resulting reduced form (2, 2, 2) represents only even integers and hence is not equivalent to $F$.

The last example illustrates the theorem that no two reduced forms having the same negative discriminant are equivalent. This implies that the number of classes of positive binary quadratic forms having a given negative discriminant is exactly the number of reduced forms.

The importance of these ideas will become clear by considering the theorem that every prime $p$ of the form $4n+1$ is sum of two squares. This fact was recognized by Girard in 1625. Euler was the first to publish proofs (1749, 1773, 1783). In 1854 Hermite gave the following immediate proof: Since $(-1/p)=+1$, $-1$ is a quadratic residue of $p$. In other words, there exist integers $t$ and $q$ such that $t^2+1=pq$. Hence the discriminant of

$$f=pX^2+2tXY+qY^2$$

is $-4$. By Example 1, $f$ is equivalent to the single reduced form $x^2+y^2$ of discriminant $-4$. This means that there is a substitution (1) which replaces $x^2+y^2$ by $f$. Equating the coefficients of $X^2$, we get $p=a^2+c^2$.

Euler noted that if we multiply $(a\pm bi)$ $(c+di)$ by its conjugate imaginary, we obtain the identity

$$(a^2+b^2)(c^2+d^2)=(ac\mp bd)^2+(ad\pm bc)^2 \qquad (5)$$

known by Diophantus (*c.* 275; *see* DIOPHANTINE EQUATIONS). It now follows that an integer is a sum of two squares if and only if its quotient by the largest square dividing it is a product of primes all of the form $4n+1$, or the double of such a product.

If $p=a^2+b^2$ and $q=c^2+d^2$ are distinct primes of the form $4n+1$, the two numbers whose squares appear in the second member of (5) cannot have a common factor $f>1$, since $f^2$ does not divide the first member $pq$. For all combinations of signs, $(\pm a, \pm b)$ and $(\pm b, \pm a)$ give the 8 representations of $p$ by $x^2+y^2$, and all 8 are proper. Hence there are 16 proper representations of $pq$ as a sum of two squares. But if $p=q$, we may take $c=a$, $d=b$. For the lower signs, the final number in (5) is zero, and the resulting representation $p^2+0$ of $p^2$ is not proper. This illustrates and makes plausible the important theorem that a product of powers of $k$ distinct primes each of the form $4n+1$ has exactly $2^{k+2}$ proper representations by $x^2+y^2$.

The number of all representations of a positive odd integer $m$ by $x^2+y^2$ is the quadruple of the excess of the number of divisors of the form $4n+1$ of $m$ over the number of divisors of the form $4n+3$ of $m$.

Hermite's method is not restricted to $x^2+y^2$. If $p$ is a prime of either of the forms $8n+1$ or $8n+3$, then $(-2/p)=+1$, and $t^2+2=pq$ is solvable for integers $t$, $q$. Then $f$ is equivalent to the single reduced form (1, 0, 2) of discriminant $-8$. Hence $p$ is represented by $x^2+2y^2$. Again, if $p=3n+1$ is a prime,

$$(-3/p)=(p/3)=+1,$$

and $t^2+3=pq$ is solvable; hence $p$ is represented by $x^2+3y^2$. The method applies directly when no two reduced forms have the same *divisor, i.e.*, the greatest common divisor of the three coefficients of a form.

But the two reduced forms (1, 0, 5) and (2, 2, 3) of discriminant $-20$ have the same divisor 1. The primes $p$ of the forms $20n+1$, 3, 7, 9 are the only ones distinct from 2 and 5 for which $(-5/p)=+1$. Hence any product $m$ of powers of primes of these four types is represented by one of the reduced forms $g=x^2+5y^2$, $h=2x^2+2xy+3y^2$. To decide which one, note that $g=m$ gives $(m/5)=+1$, while $h=m$ gives

$$2m=(2x+y)^2+5y^2, \quad (2m/5)=1, \quad (m/5)=(2/5)=-1.$$

Hence the representation is by $g$ if $m=5k\pm 1$, but by $h$ if $m=5k\pm 3$.

**Positive Ternary Quadratic Forms.**—If we write

$$F=ax^2+by^2+cz^2+2ryz+2sxz+2txy, \qquad (1)$$

$$d=\begin{vmatrix} a & t & s \\ t & b & r \\ s & r & c \end{vmatrix} \qquad \begin{aligned} L&=ab-t^2, \\ M&=ar-ts, \\ N&=ac-s^2, \end{aligned}$$

then $d$ is called the *determinant* of the ternary form $F$. For real values of the coefficients and variables, $F$ is called a *positive form* if every value of $F$ is $\geqq 0$ and if $F=0$ only when $x=y=z=0$. We have

$$aF-(ax+ty+sz)^2=f=Ly^2+2Myz+Nz^2, \qquad (2)$$

$$Lf=(Ly+Mz)^2+adz^2, \qquad LN-M^2=ad. \qquad (3)$$

Hence if $a$, $L$, and $d$ are all positive, $F$ is a positive form. The converse is easily proved.

Let $\phi$ be any positive ternary quadratic form of determinant $d$ with integral coefficients (those of cross products being even as in $F$). Let $a$ be the least positive integer which is represented by $\phi$. The main theorem states that $\phi$ is equivalent to a form (1) such that (2) is a reduced binary form of discriminant $-4ad$, and such that $-a<2s\leqq a$, $-a<2t\leqq a$. Since $F$ and hence also $\phi$ represents $b$, we have $a\leqq b$. Thus

$$a^2\leqq ab=L+t^2\leqq L+\tfrac{1}{4}a^2, \quad 3a^2\leqq 4L.$$

Our earlier work on reduced binary forms $f$ gives $3L^2\leqq 4ad$. Hence

$$a\leqq \tfrac{4}{3}\sqrt[3]{d}. \qquad (4)$$

Thus when $d$ is given, there is only a finite number of sets of integers $a$, $s$, $t$ satisfying our inequalities. We saw that there is only a finite number of reduced binary forms $f$ of given discriminant $-4ad$. Hence there is only a finite number of classes of positive ternary quadratic forms of given determinant.

Let $a=1$. Then $s=t=0$, and (2) becomes $F-x^2=f$. The substitution which merely changes the signs of $x$ and $y$ is of determinant 1 and merely changes the sign of $M$. Hence we may take $M\geqq 0$.

Let $d=1$ or 3. Then $a=1$ by (4). Applying also the conclusions found in Examples 1 and 2 under binary quadratic forms, we have the following theorem: Every positive ternary quadratic form of determinant 1 is equivalent to $x^2+y^2+z^2$; every one of determinant 3 is equivalent to $P=x^2+y^2+3z^2$ or

$$Q=x^2+2y^2+2yz+2z^2.$$

We are now in a position to discuss one of the most useful theorems in the theory of numbers: If $a$ is any positive integer not of the form $4^k(8n+7)$, then $a$ is a sum of three squares having no common factor $>1$. Complicated proofs were first given by Legendre in 1798 and by Gauss in 1801. The simplest proof is that by Dirichlet in 1850. It employs a positive form (1) whose determinant $d$ is unity. Take $s=1$, $t=0$. Then $d=a\Delta-b$, where $\Delta$ denotes $bc-r^2$. Let $a$ be double an odd integer. There are infinitely many primes in any arithmetical progression whose first term and common difference are relatively prime. Hence we can choose a positive integer $l$ so that $b=4al+a-1$ is a prime. Take $\Delta=4l+1$. Then $(-\Delta/b)=+1$. Hence there is an integer $r$ such that $(r^2+\Delta)/b$ is an integer $c$. The resulting positive form (1) of determinant unity must be equivalent to $X^2+Y^2+Z^2$ by our previous theorem. Hence $X=\alpha x+\cdots$, $Y=\beta x+\cdots$, $Z=\gamma x+\cdots$ have integral coefficients whose determinant is unity. Hence $a=\alpha^2+\beta^2+\gamma^2$, where $\alpha$, $\beta$, $\gamma$ are integers with no common factor $>1$. The proof is similar for the remaining numbers $a$.

We saw that all positive ternary forms of determinant 3 are equivalent to $P$ or $Q$. To show that $P$ represents every positive integer $a$ not divisible by 3, Dirichlet used (1) with $s=1$, $t=0$ and $b-5$ a multiple of 8. It is easily verified that $Q-5$ is never divisible by 8. Since (1) is of determinant 1 and represents $b$, while $Q$ does not represent $b$, (1) must be equivalent to $P$. But he did not prove that $P$ represents every positive integer $9n+3$.

Its proof requires a serious modification of his method and was given, along with a complete study of various new ternary forms, in several papers published in America in 1927. The complete theorem for $P=x^2+y^2+3z^2$ is that a positive integer can be represented by $P$ if and only if it is not of the form $9^k(9n+6)$.

The forms $P$ and $x^2+y^2+z^2$ are called *regular* since all the positive integers not represented by one of them coincide with all the positive integers in certain arithmetical progressions. The form $g=x^2+y^2+10z^2$ is regular with respect to even integers since it represents no number $4^k(16n+6)$, but represents all the remaining even integers. However, $g$ is irregular with respect to odd integers. It was proved in 1927 that if $k$ is any one of the odd integers 3, 7, 21, 31, 33, 43, 67, 79, 87, 133, 217, $\cdots$ not represented by $g$, then every arithmetical progression which contains $k$ will contain integers represented by $g$. Only a few forms are regular.

**Positive Quaternary Quadratic Forms.**—One of the most remarkable theorems is that every positive integer $p$ is a sum of four squares. Diophantus seems to have recognized this fact. In 1659 Fermat stated that he possessed a proof by descent from $p$ to smaller numbers, and a short proof of this kind was published in 1924. Euler tried for 40 years to find a proof. The first proof published was that by Lagrange in 1772. The next year Euler gave a much simpler proof which is still quoted in text-books.

Every $p$ is represented by each of $x^2+y^2+z^2+su^2$ $(s=1, \cdots, 7)$. Except when $p=4^k(8n+7)$, we may take $u=0$ and apply the earlier result that $p$ is a sum of three squares. We shall next prove that $8n+7$ is represented, whence $2^kx, \cdots, 2^ku$ give a representation of $4^k(8n+7)$. We have only to exhibit a value of $u$ for which $8n+7-su^2$ is positive and not of the form $4^k(8m+7)$ and hence is a sum of three squares. For $s=1$, 2, 4, 5, or 6, take $u=1$. For $s=3$, take $u=1$ or 2 according as $n=0$ or $n>0$. For $s=7$, take $u=1$ if $n=0$, 1, or 2; but take $u=2$ if $n\geqq 3$.

The same proof applies to $x^2+2y^2+2z^2+su^2$. A similar proof shows that every $p$ is represented by each of

$$\begin{aligned}
&x^2+y^2+2z^2+lu^2 \quad (l=2, \cdots, 14),\\
&x^2+y^2+3z^2+mu^2 \quad (m=3, 4, 5, 6),\\
&x^2+2y^2+3z^2+nu^2 \quad (n=3, \cdots, 10),\\
&x^2+2y^2+4z^2+qu^2 \quad (q=4, \cdots, 14),\\
&x^2+2y^2+5z^2+ru^2 \quad (r=6, \cdots, 10).
\end{aligned}$$

Besides these 54 forms there is no new form of the type $ax^2+by^2+cz^2+du^2$ which represents every $p$ when $a$, $b$, $c$, $d$ are positive integers. This is easily verified by using the values 1, 2, 3, 5, 6, 7, 10, 14, 15 of $p$.

Recently the problem has been completely solved for forms $q$ involving also products like $xy$. The main point in the solution is a simple application of the principles which have been developed above in detail. It will be explained for the important typical case $q=u^2+\tau$ where $\tau$ is a positive ternary quadratic form. Let $m$ be the least positive integer represented by $\tau$. Unless $m$ is 1 or 2, $q$ would not represent 2. Let $m=1$ and let $d$ denote the determinant of $2\tau$. The main theorem quoted under ternary forms shows that $2\tau$ (whose minimum is $a=2$) is equivalent to a form $2T=F$ such that $4T-X^2$ is the reduced binary form $f$ in (2), where $X=2x+ty+sz$, $t=0$ or 1, $s=0$ or 1. By hypothesis, $q=u^2+T$ represents all positive integers. Hence $Q=4q=4u^2+X^2+f$ represents all positive multiples of 4. The positive minimum of the reduced $f$ is $L$. If $L>12$, $Q=12$ requires that $f=0$. But $12=4u^2+X^2$ is impossible in integers. Hence $L\leqq 12$. Since the coefficients of $y^2$ in $X^2+f$ and $4T$ are equal, $t^2+L$ is a multiple of 4. Hence the only possible values of $L$ are 4, 8, 12, 3, 7, 11. In these respective cases the least positive multiple of 4 not represented by $4u^2+X^2+Ly^2$ (or $Q$ with $z=0$) is found to be $l=28$, 56, 24, 24, 84, 88, respectively. Since $Q$ shall represent $l$, we have $f\leqq l$ for certain integers $y$ and $z$ such that $z\neq 0$. Then (3) evidently implies that $2d\leqq Ll$. Hence there is a limited number of values of $d$, and therefore of reduced forms $f$ of discriminant $-8d$. This proves that the number of forms $T$ is finite.

In addition to the above 54 forms involving only squares, there are exactly 299 further forms $u^2+T$ which represent all positive integers. If we multiply them by 4, 8, 12, 28, or 44, we may complete the squares and obtain forms involving only squares. The following are samples of the resulting equivalent theorems: If $r=4m-1$ or $4m-2$, $m=1, \cdots, 7$, then $x^2+y^2+z^2+rw^2$ represents all positive multiples of 4. If $k=1, \cdots, 6$, and $s=0$ or 1, then $x^2+3y^2+3z^2+4(3k-s)w^2$ represents all positive multiples of 12. If $3\leqq k\leqq 22$, $s=0$ or 1, $0\leqq M\leqq 5$, with $M+s$ even, then $x^2+11y^2+11z^2+(44k-Ls-M^2)w^2$ represents all positive multiples of 44.

The number of representations of any positive integer $N$ as a sum of four squares is $8s$ or $24s$, according as $N$ is odd or even, where $s$ is the sum of the positive odd divisors of $N$. If $N$ is odd, the number of representations of $4N$ as a sum of four odd squares is $16s$.

Let $w$ be odd and $S$ be the sum of its divisors not divisible by 3. The number of representations of $2^rw$ by $x^2+y^2+3z^2+3u^2$ is $4(2^{r+1}-3)S$ if $r>0$, but is $4S$ if $r=0$.

Analogous theorems have been found for many forms whose four coefficients are all products of powers of 2 and 3, or when each coefficient is 1 or 5. Also the number of proper representations was found.

**Waring's Problem.**—Without proof, Waring stated in 1770 that every positive integer is a sum of 9 integral cubes $\geqq 0$, a sum of 19 biquadrates, etc. In 1859 Liouville employed an identity equivalent to

$$6(x_1^2+x_2^2+x_3^2+x_4^2)^2=\Sigma(x_i+x_j)^4+\Sigma(x_i-x_j)^4, \qquad (1)$$

summed for $i, j=1, \cdots, 4$; $i<j$. Since every integer $n\geqq 0$ is a sum of four squares, this proves that $6n^2$ is a sum of 12 biquadrates. Every integer $p\geqq 0$ is of the form $6q+r$, where $r$ is one of $0, 1, \cdots, 5$ and is evidently a sum of five biquadrates 0 or 1. Since $q=n_1^2+\cdots+n_4^2$, $6q$ is a sum of $4\times 12$ biquadrates. Hence every $p$ is a sum of 53 biquadrates.

Later writers gradually reduced this limit 53 to 37. The latest result is that every $p$ is a sum of 17 biquadrates and 10 doubles of biquadrates.

That every $p$ is a sum of nine integral cubes $\geqq 0$ was first proved by Wieferich in 1909; a gap in his proof was first filled by Kempner in 1912. A simpler proof was given by Dickson in 1927, who proved also that, if $t\leqq 23$, every $p$ is represented by $tx^3+C_8$, where $C_8$ is a sum of 8 integral cubes $\geqq 0$, and $x\geqq 0$; also by $kx^3+2y^3+C_7$ if $k\leqq 34$, $k\neq 10, 15, 20, 25, 30$; also by $lx^3+3y^3+C_7$ if $l\leqq 9$, $l\neq 5$; and for $p<40{,}000$ by $x^3+y^3+2z^3+2w^3+3v^3$.

In 1909 Hilbert proved that every $p$ is a sum of $N_k$ positive or zero $k$th powers. The long proof gives no clue as to the value of the finite number $N_k$. By means of a fivefold integral, he proved the existence of an identity, of type (1), which expresses $M(x_1^2+x_2^2+x_3^2+x_4^2)^k$ as a sum of $2k$th powers of linear functions of $x_1, x_2, x_3, x_4$ with integral coefficients. Here $M$ is a positive integer depending on $k$. Later writers established this identity by algebraic methods.

In 1913 Baer gave $N_5=58$ and $N_6=478$, which are less than earlier limits. Wieferich gave $N_7=3{,}806$. Writing $(1_r, 8_s)$ for a sum of $r$ sixth powers and the products of $s$ sixth powers by 8, Dickson proved that every $p$ is represented by each of the forms

$$(1_{115}, 8_{108}), \quad (1_{178}, 8_{99}), \quad (1_{10}, 2_{90}, 3_{72}, 4_{18}).$$

Identities of Hilbert's type leading to explicit finite values of $N_k$ were given by A. Hurwitz for $k=8$, by I. Schur for $k=10$, and by Kempner for $k=12$ and 14.

By intricate analytic investigations, Hardy and Littlewood recently obtained remarkable results. First they gave a new proof that $N_k$ is finite. Next, they proved that, for all sufficiently large numbers, $N_k\leqq(k-2)2^{k-1}+5$ (9 cubes, 21 biquadrates, 53 fifth powers, etc.). Finally, when $k\geqq 4$ they obtained in 1925 a limit involving logarithms which gives the best results to date: Every sufficiently large integer $p$ is a sum of 19 biquadrates, 41 fifth powers, 87 sixth powers, 193 seventh powers, 425 eighth powers, 949 ninth powers, or 2,113 tenth powers. No determination was made for the limit beyond which $p$ must

lie, but it would be excessively large. Landau simplified this theory in his 1927 text.

In 1909 Landau proved that all sufficiently large integers $p$ are sums of 8 cubes. That this holds if $p \geqq 23\times 10^{14}$ was proved by Baer by technical results in the analytic theory of primes. For $l=1, \cdots, 5$, Dickson proved that $lx^3+C_7$ represents all sufficiently large integers.

**Sums of Values of a Polynomial.**—In 1636 Fermat stated that every positive integer $p$ is a sum of $m+2$ *polygonal numbers* $\frac{1}{2}m(x^2-x)+x$ of order $m+2$. For $m=1$, the latter is a triangular number $\frac{1}{2}x(x+1)$ and is the number of shot arranged in a triangle with $x$ shot in the base. That every $p$ is a sum of three triangular numbers is equivalent to the fact that $8p+3$ is a sum of three odd squares $(2x+1)^2$. For $m=2$, the theorem states that every $p$ is a sum of four squares. Cauchy gave the first proof in 1815, and showed that all but four of the polygonal numbers may be chosen from the special ones 0 and 1. He employed the following lemma: If $a$ and $b$ are positive odd integers and if $b$ lies between $\sqrt{(3a-2)}-1$ and $\sqrt{4a}$, there exist four integers $t, u, v, w$, each $\geqq 0$, such that

$$a=t^2+u^2+v^2+w^2, \quad b=t+u+v+w.$$

When $a$ and $b$ are even, this holds if also $a-b^2/4$ is a sum of three squares.

In 1921 Kampke considered any polynomial $P(x)$ with rational coefficients whose values are integers $\geqq 0$ for every integer $x\geqq 0$, and proved that every integer $p\geqq 0$ is a sum of $s$ such values of $P(x)$ and $e$ numbers 0 or 1, where $s$ and $e$ are finite integers depending on $P(x)$, but not on $p$. This existence proof gives no clue to the values of $s$ and $e$. He also generalized Cauchy's lemma from 2 to $n$ simultaneous equations

$$l_k={x_1}^k+\cdots+{x_N}^k \quad (k=1, \cdots, n),$$

where $l_2, \cdots, l_n$ lie between specified limits, and $N$ is to be chosen.

The complete solution for quadratic functions was given by Dickson in 1928. Consider $f(x)=\frac{1}{2}m(x^2-x)+tx+c$, where $m$, $t$, $c$ are integers and $m>0$, $t>0$, $c\geqq 0$. A quadratic function takes integral values $\geqq 0$ for every integer $x\geqq 0$ if and only if it is either $f(x)$ or $f(x-k)$ with $k\geqq 1$, $m\geqq t$. Since $c$ is the least such value of $f(x-k)$, $sc$ is the least sum of $s$ values. The problem is to find the least integer $e_s$ such that every integer $\geqq sc$ is a sum of $s$ values of $f(x-k)$ for integers $x\geqq 0$ and $e_s$ numbers 0 or 1. We may take $c=0$ without loss of generality. First, let $s\geqq 5$. If $k=0$, then $E_s=e_s+1$ is $t$ or $m-(s-3)t$, according as $m<(s-2)t$ or not. If $k>0$ and $m\geqq 2t$, then $E_s$ is $t$ or $m-(s+1)t$, according as $m<(s+2)t$ or not. When $m<2t$, write $q$ for $m-t$. If $k\geqq 2$, $E_s$ is $q$ or $t-3q$, according as $t\leqq(s+1)q$ or not. When $k=1$, $E_5=q$ if $t\leqq 3q$, $E_5=t-2q$ if $t\geqq 3q$. But if $k=1$, $s\geqq 6$, $E_s=q$ or $t-(s-2)q$, according as $t\leqq(s-1)q$ or not. We now know the minimum $L$ for all $s\geqq 5$ of the number $s+e_s$ of summands. Whenever $4+e_4$ is less than $L$, it is exactly $L-1$. The minimum of all $s+e_s$ for $s\geqq 1$ is $L$ or $L-1$ except when $k=0$, $m\leqq t$, and then is $L-2$.

Every integer $p\geqq 0$ has been recently proved to be a sum of ten pyramidal numbers $\frac{1}{6}(x^3-x)$ for integers $x\geqq 0$; also a sum of nine if $p$ is sufficiently large.

If in the formula for polygonal numbers we employ negative as well as positive integral values of $x$, we obtain the generalized polygonal numbers. Every positive integer is a sum of $N$ generalized polygonal numbers of order $k$, where $N=3$ for $k=3$, 5 or 6; $N=4$ for $k=4$, 7 or 8; $N=k-4$ for $k>8$.

Consider the positive binary quadratic forms $q$ and the integers $s$ such that every positive integer $p$ is a sum of $s$ values of $q$. The case $p=1$ requires that $q$ shall represent 1. Hence we may take $q=x^2+axy+by^2$, $a=0$ or 1. Then each $p$ is a sum of four values of $q$ with $y=0$. Thus the cases $s=2$ and $s=3$ alone are interesting. Whether $a$ is 0 or 1, every $p$ is a sum of two values of $q$ if and only if $b=1$, 2, or 3, and a sum of three values of $q$ if and only if $b=1, \cdots, 7$.

## ALGEBRAIC NUMBERS

**Failure of Expected Laws.**—The roots of an equation $ax^n+bx^{n-1}+\cdots=0$ having integral coefficients are called algebraic numbers. If $a=1$, the roots are *integral algebraic numbers*; examples are $\sqrt{5}$, $\sqrt[3]{5}$. Prior to a lengthy controversy in 1847, it was regarded as self-evident that the laws of divisibility which hold for whole numbers continue to hold also for integral algebraic numbers. Fundamental for mathematics was the recognition of the falsity of this intuition and the invention of "ideals" serving to restore those laws of divisibility.

A typical example is the set $S$ of all quadratic integers $a+b\theta$, where $\theta=\sqrt{-5}$, while $a$ and $b$ are whole numbers. By an indecomposable number $n$ of this set $S$ we mean one having no factor in $S$ other than $n$, $-n$, 1, $-1$. If $2+\theta=(x+y\theta)(z+w\theta)$, where $x, y, z, w$ are whole numbers, we multiply by the like equation having $-\theta$ in place of $\theta$, and get $9=(x^2+5y^2)(z^2+5w^2)$. But $x^2+5y^2=3$ is evidently impossible in whole numbers. Hence we may take $x^2+5y^2=1$, whence $x+y\theta=\pm 1$. The same discussion applies also if we replace $2+\theta$ by $2-\theta$ or 3. Hence $9=3\cdot 3$ and $9=(2+\theta)(2-\theta)$ give two factorizations of 9 into indecomposable numbers of $S$. The law of unique factorization of whole numbers into primes therefore fails for numbers of $S$. Since the indecomposable number 3 divides the product 9 of $2+\theta$ and $2-\theta$ without dividing either of them, we have a second failure in $S$ of laws of ordinary primes. A third more astonishing failure in $S$ of the laws of arithmetic is the absence in $S$ of a greatest common divisor of 9 and $t=3-6\theta$; their only common divisors are $\pm 1$, $\pm 3$ and $\pm(2-\theta)$, no one of which is divisible by the remaining five.

**Ideals.**—These laws are restored by the introduction of ideals, first defined intangibly in special cases by Kummer in 1847, and later in complete generality and clearness by Dedekind. To any number $\mu$ of our set $S$ corresponds uniquely the totality $\rho\mu$ of its multiples, where $\rho$ ranges over all numbers of $S$. This totality is called the *principal ideal* $(\mu)$ and evidently has the following two properties: (a) The sum and difference of any two numbers of an ideal are themselves numbers of the ideal. (b) Every product of a number of an ideal by a number of $S$ is a number of the ideal. Any set of numbers of $S$ is called an *ideal* if it has these two properties and is not composed exclusively of the number zero.

When $x$ and $y$ range independently over all whole numbers, the totality $x\xi+y\eta$ is denoted by $[\xi, \eta]$. It evidently has property (a). To show that $\beta=[3, 1+\theta]$ is an ideal, it remains to verify that it has property (b). This will follow if we show that $3\rho$ and $(1+\theta)\rho$ belong to $\beta$ for every $\rho$ in $S$. But $\rho=a+b\theta$, where $a$ and $b$ are whole numbers, and

$$3\rho=3(a-b)+3b(1+\theta), \quad (1+\theta)\rho=-6b+(a+b)(1+\theta)$$

are numbers in $\beta$. Since we may replace $\theta$ by $-\theta$ in this proof, we conclude that also $\alpha=[3, 1-\theta]$ is an ideal.

If $L$ ranges over the numbers of an ideal $\lambda$ and if $M$ ranges over those of an ideal $\mu$, then the set composed of the products $LM$ and all their sums and differences is seen to have properties (a) and (b) and hence is an ideal, called the product of $\lambda$ and $\mu$, and denoted by either $\lambda\mu$ or $\mu\lambda$. In particular,

$$\alpha\beta=[9, 3+3\theta, 3-3\theta, 1-\theta^2=6]=[3, 3\theta]=(3).$$

Similarly, $\beta^2=(2-\theta)$ and hence $\alpha^2=(2+\theta)$.

To remove the above difficulties concerning numbers 9, 3, $\cdots$, $t=3-6\theta$ of $S$, we pass to the uniquely corresponding principal ideals (9), (3), $\cdots$, $(t)$. Now

$$(9)=(3)\ (3)=\alpha^2\beta^2=(2+\theta)\cdot(2-\theta),$$

and we have the single factorization $(9)=\alpha^2\beta^2$ instead of the former two factorizations of 9. Finally, $\gamma=[7, 3+\theta]$ is an ideal such that $\beta\gamma=(1-2\theta)$, so that (9) and $(t)=(3)\beta\gamma=\alpha\beta^2\gamma$ have the greatest common ideal divisor $\alpha\beta^2$.

If an ideal is different from the principal ideal (1) and if it is divisible by no ideal other than itself and (1), it is called a *prime ideal*. It is readily proved that every ideal which is not a prime can be expressed in one and but one way as a product of (a finite number of) prime ideals. Hence the laws of factorization in

arithmetic hold for our ideals. Since $\alpha$, $\beta$, $\gamma$ are prime ideals, the above three difficulties have been completely removed.

**Classes of Ideals.**—Two ideals $\rho$ and $\sigma$ are called equivalent if there exist principal ideals $(r)$ and $(s)$ such that $\rho(r)=\sigma(s)$. If also $\rho$ is equivalent to $\tau$, with $\rho(q)=\tau(t)$, then $\sigma$ is equivalent to $\tau$ since $\sigma(sq)=\rho(r)(q)=\tau(tr)$. Hence all ideals equivalent to a given one are equivalent to each other and are said to form a *class* of ideals.

Evidently any two principal ideals are equivalent. If $\sigma$ is equivalent to the principal ideal $(1)$, so that $\sigma(s)=(r)$, the number $r$ of the product $\sigma(s)$ is in $(s)$, whence $r$ is divisible by $s$ and $\sigma=(r/s)$. Hence the principal class contains all the principal ideals and no others.

For the above set $S$ determined by $\theta=\sqrt{-5}$, we readily specify the classes of ideals. If $(\alpha)$ is any principal ideal, we have $\alpha=m(x+y\theta)$, where $x$ and $y$ are relatively prime integers. We can choose integers $r$ and $s$ such that

$$\begin{vmatrix} x & -y \\ s & -r \end{vmatrix} = sy-rx=1.$$

Hence we can solve $x\alpha-y\alpha\theta=u$, $s\alpha-r\alpha\theta=v$, and express $\alpha$ and $\alpha\theta$ as linear functions of $u$ and $v$ with integral coefficients. This proves that $(\alpha)=[\alpha,\ \alpha\theta]$ is identical with $[u, v]$. But $u=ma$, $a=x^2+5y^2$, $v=m(b+\theta)$, $b=sx+5ry$. Also

$$b^2+5=b^2+5(sy-rx)^2=a(s^2+5r^2).$$

Hence all principal ideals are given by

$$[ma,\ m(b+\theta)],\quad (b^2+5)/a=\text{integer}, \qquad \text{(I.)}$$

in which $a$ is properly represented by $x^2+5y^2$.

Since 2 is not such a value of $a$, $\rho=[2,\ 1+\theta]$ is not a principal ideal. Hence the system $S$ was actually enlarged by the introduction of ideals. In some other systems $\Sigma$, every ideal is a principal ideal and then the laws of divisibility of whole numbers hold for $\Sigma$ since they hold for the essentially equivalent set of all ideals. This happens for systems $\Sigma$ of numbers involving $\sqrt{-k}$ when $k=1, 2, 3, 7, 11, 19, 43, 67, 163$, but for no further positive values $<1{,}500{,}000$ of $k$ lacking square factors, and holds for many negative values of $k$.

For $S$ all ideals equivalent to $\rho$ are readily shown to be of type (I.) where now $a$ is properly represented by $f=2x^2+2xy+3y^2$. Moreover, all ideals are given by (I.). Consider any such ideal and write $l$ for the final integer in (I.). Then $ax^2+2bxy+ly^2$ is of discriminant $4(b^2-al)=-20$ and hence is equivalent to one of the two reduced forms $x^2+5y^2$ or $f$ of discriminant $-20$. Thus $a$ is represented by one of them. Hence there are exactly two classes of ideals.

This example illustrates the identity of the problems to find the number of classes of binary quadratic forms of negative discriminant $d$ and the number of classes of ideals for the system of quadratic integers determined by $\sqrt{d}$. For a positive $d$, a similar result holds if in our criterion $\rho(r)=\sigma(s)$ for the equivalence of ideals $\rho$ and $\sigma$, we impose the restriction that the norm of $r/s$ is positive (narrow equivalence of ideals).

**Arithmetics of Algebras.**—We shall now discuss an important generalization of algebraic numbers. A quaternion $q=a+bi+cj+dk$ was called integral by Lipschitz in his *Untersuchungen über die Summen von Quadraten* (Bonn, 1886) if and only if $a, b, c, d$ are integers. This natural definition led to serious difficulties and has been discarded. More fortunate was A. Hurwitz in his important book, *Zahlentheorie der Quaternionen* (1919), who called $q$ *integral* not only when $a, b, c, d$ are integers, but also when all four are halves of odd integers. Two such integral quaternions have a greatest common right (or left) divisor. The resulting perfect arithmetic of quaternions leads to simple proofs, as well as interpretations, of the main facts about the number of representations of integers as sums of four squares. Du Pasquier applied Hurwitz's definition unchanged to many further linear algebras and found that they usually do not possess integral numbers.

The latter unfortunate conclusion is avoided by the new definition given by Dickson in his *Algebras and their Arithmetics* (Chicago, 1923), where general theorems were obtained for the first time. In his *Algebren und ihre Zahlentheorie* (Zürich, 1927), he gave the following simpler, but equivalent, definition: Let $A$ be any rational associative algebra containing 1. Consider a set $S$ of numbers in $A$ each satisfying an algebraic equation with integral coefficients and having 1 as leading coefficient, and such that the sum, difference and product of any two numbers of $S$ are all numbers of $S$. Let $S$ contain 1. Then if $S$ is not contained in a larger such set, its numbers are called the *integral numbers* of algebra $A$. In case $A$ is an algebraic field, our integral numbers become the classic integral algebraic numbers of $A$. Again, if $A$ is the algebra of quaternions, our integral numbers become the integral quaternions of Hurwitz (*see* QUATERNIONS).

The applications include a complete theory of the number of (all or only proper) representations by $x^2+y^2+tz^2+tu^2$ for $t=1, 3, -3$, or 7, and by various forms having cross-products; and the complete solution in integers $x, \cdots, u, \delta_1, \cdots, \delta_k$ of $Q=\delta_1\,\delta_2\cdots\delta_k$, where $Q$ is any one of the mentioned quadratic forms. For example, $q=a+bi+cj+dk$ is said to have the co-ordinates $a, b, c, d$ and norm $N(q)=a^2+b^2+c^2+d^2$. Then all integral solutions of $x^2+y^2+z^2+u^2=\delta_1\cdots\delta_k$ are derived from

$$x+yi+zj+wk=d_1\cdots d_k,\quad \delta_1=N(d_1),\ \cdots,\ \delta_k=N(d_k)$$

if we take $d_1, \cdots, d_k$ to be arbitrary quaternions with integral co-ordinates. If we take $k=2$ and express $w^2-v^2$ as a product $\delta_1\delta_2$ of two integers in all ways, we obtain all integral solutions of $x^2+y^2+z^2+u^2+v^2=w^2$ by means of quaternions.

Let $M$ be an $n$-rowed square matrix whose $n^2$ elements $x_{ij}$ are variables. Denote its determinant by $D$. Then all integral solutions $x_{ij}, \delta_1, \cdots, \delta_k$ of $D=\delta_1\,\delta_2\cdots\delta_k$ are derived from

$$M=d_1\,d_2\cdots d_k, \qquad \delta_1=|d_1|,\ \cdots,\ \delta_k=|d_k|$$

if we take $d_1, \cdots, d_k$ to be $n$-rowed matrices whose elements are arbitrary integers. For $n=k=2$, this yields all integral solutions of $x^2+y^2+z^2=u^2+v^2+w^2$. Instead of integers we may employ integral algebraic numbers.

## MISCELLANEOUS TOPICS

**Perfect Numbers.**—A number is called perfect if it is equal to the sum of its divisors smaller than itself. For example, $6=1+2+3$ is the first perfect number. No odd perfect number is known, but it has not been proved that none exist. It is easily proved that every even perfect number is of the form $2^{p-1}(2^p-1)$. Euclid (*Elem.*, ix. 36) proved that the latter is a perfect number if $2^p-1$ is a prime. Without justification, Mersenne stated in 1644 that the first 11 values of $p$ for which $2^p-1$ is a prime are 2, 3, 5, 7, 13, 17, 19, 31, 67, 127, 257. It is now known that 67 should be omitted, and 61, 89, 107 included; while the only cases in doubt are 137, 139, 149, 157, 167, 193, 199, 227, 229, 241, 257.

**Galois Imaginaries.**—Under the topic quadratic residues, we found that there is no integer $x$ such that $x^2-3$ is divisible by 7. Nevertheless, in 1830 Galois invented imaginaries $x$ having this property. Their use was later justified by employing the 49 residues $ax+b$ ($a, b=0, 1, \cdots, 6$) obtained from all polynomials in $x$ with integral coefficients by suppressing polynomial multiples of both $x^2-3$ and 7. The theory is given completely in Dickson's *Linear Groups* (Leipzig, 1901). An account in French occurs in Serret's *Algèbre*.

**Modular Invariants.**—For example, consider

$$l=\begin{vmatrix} x^{p^2} & y^{p^2} & z^{p^2} \\ x^p & y^p & z^p \\ x & y & z \end{vmatrix}, \qquad L=\begin{vmatrix} X^{p^2} & Y^{p^2} & Z^{p^2} \\ X^p & Y^p & Z^p \\ X & Y & Z \end{vmatrix},$$

where $p$ is a prime. If $x, y, z$ are linear functions of $X, Y, Z$ with integral coefficients whose determinant is $d$, then $l-dL$ is divisible by $p$. We therefore call $l$ a *modular invariant*. But $l$ has the factor $x$. It follows that $l$ differs by a multiple of $p$ from the product of all linear functions of $x, y, z$ whose coefficients are chosen from $0, 1, \cdots, p-1$ such that the first coefficient $>0$ is 1. These facts hold also when $l$ is replaced by the like deter-

minant of order $n$. For $n=2$, the last theorem implies Fermat's theorem.

All algebraic invariants (*see* ALGEBRAIC FORMS) with integral coefficients are modular invariants; but the converse is not true. The simplest theory of modular invariants is based on the modular classes of forms. For an exposition with bibliography, *see* Dickson's *Invariants in the Theory of Numbers* (American Mathematical Society Colloquium Lectures, 1914).

**Distribution of Primes.**—The number of primes is infinite (Euclid, *Elem.*, ix. 20). Any arithmetical progression $mx+n$ contains an infinitude of primes if $m$ and $n$ are relatively prime. The first proof is due to Dirichlet (1837), who extended the theorem to numbers $a+bi$ such that $a$ and $b$ are integers. He proved that $q=ax^2+2bxy+cy^2$ represents infinitely many primes if $a$, $2b$, $c$ have no common factor. Also an infinitude are represented simultaneously by $f$ and $mx+n$ provided the two can represent the same number and $m$ and $n$ are relatively prime.

For any $\epsilon>0$ and any relatively prime integers $m$ and $n$, the number of primes $mx+n$ which lie between $z$ and $(1+\epsilon)z$ increases to infinity with $z$. Take $\epsilon=1$. Hence if the integer $y$ exceeds a certain limit (6, in fact), there exists at least one prime $p$ such that $\frac{1}{2}y<p\leqq y-2$; this is known as Bertrand's postulate (1845).

In 1742 Goldbach conjectured that every positive even integer is a sum of two primes. This has been verified to 10,000, but not yet proved. Subject to assumptions about the roots of Dirichlet's function $L$, Hardy and Littlewood recently proved that all sufficiently large odd integers $e$ are sums of three odd primes; also if $N$ of the first $m$ even positive integers are not sums of two odd primes, $N/m$ approaches zero as $m$ increases indefinitely.

Tchebychef proved in 1852 that, if $x$ is sufficiently large, the number $\pi(x)$ of primes $\leqq x$ is between $0{\cdot}92129Q$ and $1{\cdot}10555Q$, where $Q = x/\log x$. By use of Riemann's function $\zeta(s)=\Sigma n^{-s}$, Hadamard and de la Vallée-Poussin proved independently in 1896 that the sum of the natural logarithms of all primes $\leqq x$ is equal to $x$ asymptotically. This implies the important result that $\pi(x)$ is asymptotic to $Q$. If we integrate $du/\log u$ first from 0 to $1-\delta$ and second from $1+\delta$ to $x$, add the results, and take the limit of the sum for $\delta=0$, we get the integral logarithm of $x$, denoted by $Li(x)$.

It is asymptotic to $Q$ and hence to $\pi(x)$. But $Li(x)$ represents $\pi(x)$ more exactly than does $Q$ or $Q+x/\log x$, etc.

All these subjects are treated exhaustively in Landau's *Handbuch der Lehre von der Verteilung der Primzahlen* (1909).

**Partitions.**—There are just two partitions $1+5$ and $2+4$ of 6 into two parts chosen from $1, 2, 3, \cdots$ without repetition; there is the third partition $3+3$ if repetition is allowed. If we exhibit the partition $2+4$ as $\left\{\begin{smallmatrix}1&1\\1&1&1&1\end{smallmatrix}\right\}$ and then sum the columns instead of the lines, we get the partition $2+2+1+1$. If we repeat the process on the latter, we return to $4+2$. This proves that the number of partitions of $n$ into $m$ parts is equal to the number of partitions of $n$ in which $m$ is the largest part. Taking $m=1, \cdots, k$, we conclude that the number of partitions of $n$ into not more than $k$ parts is equal to the number of partitions of $n$ with no part greater than $k$.

The number of partitions of $n$ into $m$ parts chosen without repetition from the distinct positive integers $c_1, c_2, \cdots, c_r$ is the coefficient of $x^n z^m$ in the expansion of the product $(1+x^{c_1}z) \cdots (1+x^{c_r}z)$. Next, the coefficient of $x^n z^m$ in the series giving the expansion of $(1-x^{c}z)^{-1} \cdots (1-x^{c_r}z)^{-1}$ is the number of partitions of $n$ into $m$ parts chosen from $c_1, \cdots, c_r$, repetitions allowed.

For $D=(1-x)(1-x^2)\cdots(1-x^m)$, the coefficient of $x^n$ in $1/D$ is the number $(n, m)$ of partitions of $n$ into parts $\leqq m$ not necessarily distinct. The relation $(n, m)=(n, m-1)+(n-m, m)$ serves to compute $(n, m)$.

There are important applications of Sylvester's theorem (1855) concerning the number $Q$ of partitions of $n$ into distinct positive integers $c_1, \cdots, c_r$ repetitions allowed, whence $Q$ is the number of sets of integral solutions $\geqq 0$ of $c_1x_1+\cdots+c_rx_r=n$. Then $Q=\Sigma W_q$, where $W_q$ is the coefficient of $1/t$ in the development in ascending powers of $t$ of

$$\Sigma \rho^{-n} e^{nt} \prod_{i=1}^{r} (1-\rho^{c_i} e^{-tc_i})^{-1},$$

in which the summation extends over the various primitive $q$th roots $\rho$ of unity. Thus $W_q=0$ unless $q$ divides some $c_i$.

**Binary Quadratic Forms.**—The form $f=(a, b, c)$ of positive discriminant $d$ is called reduced if the roots of $aw^2+bw+c=0$ are of opposite signs, if one root $\omega_1$ is numerically $<1$, and if the other root is numerically $>1$. Although every form is equivalent to a reduced form and the number of reduced forms of discriminant $d$ is finite, usually each reduced form is equivalent to several other reduced forms, and the number of the latter depends upon the periodicity of the continued fraction for $\omega_1$. There is also another reason why the theory is more complicated than that for negative discriminants (*see* the topic positive binary quadratic forms). When $d>0$, the number of linear transformations with integral coefficients which leave $f$ unaltered (called automorphs of $f$) is infinite, in fact one for each set of integral solutions $t$, $u$ of the Pellian equation

$$t^2-du^2=4\sigma^2, \qquad (1)$$

where $\sigma$ is the divisor of $f$. The difficult point is to prove the existence of solutions $T$, $U$ in least positive integers such that if $t, u$ be any further solution in positive integers then $t>T, u>U$. It is then easily proved that all sets $t$, $u$ of integral solutions are given by

$$\frac{t+u\sqrt{d}}{2\sigma} = \pm \left(\frac{T+U\sqrt{d}}{2\sigma}\right)^k \quad (k=0, \pm 1, \pm 2, \cdots).$$

Gauss and various later writers restricted attention to forms $f=(a, b, c)$ in which $b$ is even, $b=2B$. Its discriminant is the quadruple of the *determinant* $D=B^2-ac$ of $f$. In (1), $t$ is now even, $t=2\tau$, and we obtain the new Pellian equation $\tau^2-Du^2=\sigma^2$.

Many writers have obtained formulas for the number $h(D)$ of classes of forms $(a, 2B, c)$ of determinant $D$ and divisor $\sigma=1$. To give only samples, let $p$ be a prime of the form $4n+3$. Then

$$h(-p)=\Sigma\alpha-\Sigma\beta, \quad h(p)\log(T+U\sqrt{p})=\log\Pi\tan\frac{k\pi}{4p},$$

where $\Sigma\alpha$ is the sum of the quadratic residues $\leqq\frac{1}{2}(p-1)$ of $p$ and $\Sigma\beta$ is that of the non-residues, while $T$, $U$ give the solution of $T^2-pU^2=1$ in least positive integers, and $k$ takes those values from $1, 3, 5, \cdots, 4p-1$ of which $p$ is a non-residue.

Let $N$ be the number of proper representations of $m$ by $x^2+y^2+z^2$. Kronecker proved in 1860 by use of series for elliptic functions that $N=24\,F(m)-12\,G(m)$, where $G(m)$ is the number of classes of binary forms of determinant $-m$, while $F(m)$ is that of the forms in which at least one of $a$ and $c$ is odd. This is equivalent to a result due to Gauss (1801). Others found that

$$N=24\sum_{s=1}^{k}\left(\frac{s}{m}\right) \text{ if } m=4k+1, \quad N=8\sum_{s=1}^{2k+1}\left(\frac{s}{m}\right) \text{ if } m=4k+3,$$

where $(s/m)$ is Jacobi's symbol and is zero if $s$ and $m$ have a common factor. (*See* FORMS, ALGEBRAIC.)

**Positive Quadratic Forms in $k$ Variables.**—Let $N(n, k)$ denote the number of representations of $n$ as a sum of $k$ squares. Then $N(4r+1, 6)=12s$, $N(4r+3)=-20s$, with $s=\Sigma(d_1^2-d_3^2)$, where $d_1$ ranges over the divisors of type $4k+1$, and $d_3$ over the divisors $4k+3$. For $m$ odd, $N(m, 8)=16\Sigma d^3$, where $d$ ranges over all divisors of $m$, and $N(2^rm, 8)=\frac{16}{7}(8^{r+1}-15)\Sigma d^3$. While $N(4r+3, 10)=12\Sigma(d_3^4-d_1^4)$, the expressions for $N(n, 10)$ are complicated if $n\neq 4r+3$. For $m$ odd and $r>0$,

$$N(2^rm, 12)=\tfrac{2}{3}\tfrac{4}{1}(21+2^{5r+1}\cdot 5)\Sigma d^5.$$

The numbers $N(n, 5)$ and $N(n, 7)$ have been expressed as sums involving Jacobi's symbol $(s/n)$, and in various other ways.

In a series of 18 papers in his journal for 1858–65, Liouville stated without proof many formulae and applications to the present topic. For example, he employed any function $f(x, y)$

which remains unaltered by the change of the sign of $x$ or of $y$, and a given odd integer $M$, and a given positive integer $\alpha$. Then

$$2\Sigma[f(d'-2^\alpha d,\ \delta'+\delta)-f(d'+2^\alpha d,\ \delta'-\delta)]$$
$$=\Sigma[2f(D,2)+2f(D,4)+\cdots+2f(D,\Delta-1)-(D-1)f(D,0)],$$

where the second summation extends over all factorizations $M=D\Delta$ of $M$, and the first summation extends over all sets of odd integers $d'$, $\delta'$, $d$, $\delta$ for which $M=d'\delta'+2^\alpha d\delta$. Let $m'=d'\delta'$, $m=d\delta$, and let $\zeta_k(t)$ denote the sum of the $k^{th}$ powers of the divisors of $t$. When $f(x, y)$ is $y^2$, this gives

$$\tfrac{1}{2^4}[\zeta_3(M)-\zeta_1(M)]=\Sigma\zeta_1(m')\zeta_1(m),$$

which is therefore the number of decompositions of $4M$ into $s+2^\alpha\sigma$, where $s$ and $\sigma$ are sums of four odd squares. Next, the choice $(-1)^{\frac{1}{2}y}$ for $f(x, y)$ yields the number of decompositions of $2M$ into $s+2^\alpha\sigma$, where $s$ and $\sigma$ are now sums of two odd squares. He found also the number of representations by various forms involving six squares with coefficients chosen from 1, 2, 3, 4; arithmetical proofs were given by Humbert in 1921.

Uspenskij employed any function $F(x, y, z)=F(x, -y, -z)$ such that $F(-x, y, z)=-F(x, y, z)$. He proved that

$$2\Sigma F(\delta-2i,\ d+i,\ 2d+2i-\delta)-\Sigma F(d+\delta,\ i,\ d-\delta)=T,$$

where the summation extends over all integral solutions of $m=i^2+d\delta$, $d>0$, $\delta>0$. Here $T=0$ if $m$ is not a square, while if $m=s^2$,

$$T=2\Sigma F(2s-j,\ s,\ 2s-j)-\Sigma F(2s,\ s-j,\ 2s-2j),$$

summed for $j=1, \cdots, 2s-1$. In a memoir of 1916 in Russian, he used this formula to deduce the number of representations by $x^2+ay^2$ for $a=1, 2, 3$; $x^2+y^2+z^2+bu^2$ for $b=1, 2, 3, 4, 5, 12$; $x^2+y^2+cz^2+cu^2$ for $c=3, 4, 5$; $x^2+2y^2+3z^2+6u^2$; many quaternary forms whose coefficients are all powers of 2;

$$x^2+y^2+z^2+u^2+v^2+dw^2 \text{ for } d=1, 2, 3;$$
$$x^2+y^2+z^2+e(u^2+v^2+w^2) \text{ for } e=2, 3;$$
$$x^2+4y^2+2z^2+2u^2+2v^2+2w^2;$$
$$x^2+4(y^2+z^2+u^2+v^2+w^2).$$

In his papers of 1925 in French, he applied the same formula to find the number of representations as a sum 2, 4, 6, 8, 10 squares, and to deduce all known and certain new relations between the numbers of classes of positive binary quadratic forms of various determinants.

The number of representations as a sum of any even number of squares was found by elliptic functions by Boulyguine in 1914–15 and by elliptic modular functions by Mordell in 1920. The same year, Hardy applied his powerful analytic methods to sums of $k$ squares, $k\leqq 8$. In 1924 Kloosterman gave exact and asymptotic formulas for the number of representations as a sum of $r$ squares. In 1922 Siegel found an asymptotic expression for the number of representations as a sum of 5 or more squares of integers of a real quadratic field. *See* EQUATIONS; DETERMINANT; NUMBER; ALGEBRAIC FORMS.

BIBLIOGRAPHY.—H. J. S. Smith, *Report on the Theory of Numbers* (Brit. Ass. Rep., 1859–63, 1865, or Coll. Math. Papers, vol. i.); D. Hilbert, "Bericht über die Theorie der algebräischen Zahlkörper" (in *Jahresber. d. deutschen Math.-Vereinig.*, vol. iv., Berlin, 1897; French trans. in *Annales Fac. Sc. Toulouse,* ser. 3, vol. i., 1909, vol. ii., 1910, vol. iii., 1911). Hilbert's excellent report on algebraic numbers has been brought up to date by *Report of Committee on Algebraic Numbers* (National Research Council, Washington, 1923; continuation in preparation), and by H. Hasse, "Bericht über neuere Untersuchungen und Probleme aus der Theorie der algebräischen Zahlkörper" (in *Jahresber. d. deutschen Math.-Vereinig.*, vols. 35, 36, 1926–27). L. E. Dickson, *History of the Theory of Numbers* (Carnegie Institution, Washington, D.C., vol. i., 1919, vol. ii., 1920, vol. iii., 1923; vols. i., ii. are out of print) and "Fermat's Last Theorem and the Origin and Nature of the Theory of Algebraic Numbers" (in *Annals of Math.*, vol. xviii., 1917).

Text-books. Dirichlet-Dedekind, *Vorlesungen über Zahlentheorie* (4th ed., 1894); P. Bachmann, *Zahlentheorie* (Leipzig, 1894), *Die Arithmetik der Quadratischen Formen* (vol. i., 1898, vol. ii., 1923) and *Niedere Zahlentheorie* (vol. i., 1902, vol. ii., 1910); E. Landau, *Vorlesungen über Zahlentheorie* (Leipzig, 1927). Further texts in German: P. L. Tchebychef (1889), G. Wertheim (1887, 1902), H. Minkowski (1896), F. Klein (1896–97), K. Hensel (1913), R. Fueter (1917). E. Cahen, *Théorie des Nombres* (vol. i., 1914, vol. ii., 1924); G. B. Mathews, *Theory of Numbers* (1892, out of print); L. E. Dickson, *Theory of Numbers.*

Texts in German on algebraic numbers: H. Weber (1891), J. König (1903), P. Bachmann (1905), H. Minkowski (1907), J. Sommer (1907), K. Hensel (1908), E. Landau (1918), E. Hecke (1923).

(L. E. D.)

**NUMBER SEQUENCES.** A set of numbers is said to form an ordered set if, in addition to the definition of the elements in the set, there is also given a means by which relative rank may be assigned to any two numbers of the set so that of two such numbers $A$ and $B$ one may say either that $A$ precedes (is of lower rank than) $B$ or that $A$ follows (is of higher rank than) $B$. For example, the set 1, 2, 3, 4 is an ordered set. The order relation so defined is analogous to that of points on a directed line and hence the order itself may be characterized as linear. By a part of a sequence we mean an ordered subset of its elements such that every two elements in the subset have the same relative rank in it as they have in the whole set. Various types of ordered sets are known as *sequences.* Any ordered set containing only a finite number of elements is called a *finite sequence.* In this case the order may be defined by a law, as when we speak of the even positive integers less than 100 taken in order of magnitude; or it may be given by an exhibition of the objects in a given order, as when one writes the sequence 9, 7, 3, 6, 1, 8, 10. A *simply infinite sequence,* or a *simple sequence,* is an ordered set which contains no element of higher rank than all the others, while every part of it which contains an element of higher rank than all the other elements in that part is a finite sequence. Thus the positive integers in the order of their magnitude form a simply infinite sequence. But if they are taken in the order

$$1, 3, 5, 7, \ldots, 2, 4, 6, 8, \ldots,$$

they form not a simply infinite sequence but a combination of two such sequences. In a simply infinite sequence the elements are arranged in a countable order, that is, so that there is a first element, a second, a third, and so on. Thus a simply infinite sequence may be denoted by the symbols $u_1, u_2, u_3, \ldots, u_n, \ldots$, where it is understood that there is no last element in the sequence. The rational numbers between 0 and 1, taken in order of magnitude, afford an example of an ordered set which cannot be denoted by such a sequence of symbols; in fact, there is no element in this set which has a next following element in the set. This set may, however, be re-ordered so as to afford an example of a simple sequence. It is necessary that the order relation in an infinite sequence be prescribed by some norm or rule; it cannot be exhibited explicitly by a given arrangement as in the case of a finite sequence. In the course of the article other types of infinite sequences will appear.

The principle of mathematical induction may be given its most characteristic formulation with respect to simply infinite sequences. If in the case of a given simply infinite sequence it be true (1) that, if an element of the sequence possesses a given property $P$, the next following element also possesses the property $P$; (2) that the first element in the sequence possesses this property $P$; then it is true that every element in the sequence possesses the property $P$. For instance, if we wish to show that the numbers in the sequence 1, 1+3, 1+3+5, 1+3+5+7, . . . are the square numbers $1^2, 2^2, 3^2, 4^2, \ldots$ in order, we observe that the first term in the sequence has the required property and we prove that if one term has the property the next one also has it, and then we conclude to the truth of the general proposition by aid of the principle as formulated.

**Examples of Sequences.**—A finite or a simply infinite sequence of numbers is said to form an *arithmetic progression* if for every pair of consecutive elements $A$ and $B$ of the sequence ($A$ preceding $B$) the difference $B-A$ is one and the same fixed number $d$. If the first term is $a$, then the numbers of the sequence are

$$a,\ a+d,\ a+2d,\ a+3d, \ldots.$$

The $n$th term of the sequence and the sum of the first $n$ terms are respectively

$$a+(n-1)d \quad \text{and} \quad \tfrac{1}{2}n[2a+(n-1)d].$$

A sequence of numbers is said to form a *harmonic progression* if the reciprocals of its terms in order constitute an arithmetic pro-

gression. A finite or a simply infinite sequence of numbers is said to form a *geometric progression* if for every pair of consecutive elements $A$ and $B$ ($A$ preceding $B$) the quotient $B/A$ is one and the same fixed number $r$. If the first term is $a$ then the numbers of the sequence are

$$a,\ ar,\ ar^2,\ ar^3,\ \ldots.$$

The $n$th term and the sum of the first $n$ terms are respectively

$$ar^{n-1} \text{ and } \frac{a(1-r^n)}{1-r}.$$

**Simple Infinite Sequences.**—A simply infinite sequence $a_1, a_2, a_3, \ldots$ of numbers is said to be *convergent* and to form a *regular sequence* if for every positive number $\epsilon$, however small, there exists a positive integer $n$ such that the numerical value of $a_n-a_m$ is less than $\epsilon$ for every integer $m$ greater than $n$. Regular sequences play a fundamental rôle in the development of mathematical analysis. To begin with, they furnish one of the means by which the number system may be extended from the rational domain to the domain of real numbers, and thus serve to lay the foundations on which an adequate theory of functions may be built. If, having developed the system of rational numbers (*see* NUMBERS), we proceed to form simply infinite sequences of rational numbers, it will be found that some such sequences have rational numbers as limits (*see* LIMIT), and that all such sequences having rational numbers as limits are regular in accordance with the foregoing definition, the number $\epsilon$ in the definition being taken rational in this case. It becomes desirable to extend the number system so that every regular sequence of rational numbers shall have a limit in the extended number system. This is done by taking the regular sequence of rational numbers itself to represent a definite number defined by the sequence, in accordance with a method introduced by G. Cantor (*Math. Annalen*, vol. v., 1872, and vol. xxi., 1883).

Before presenting the method of Cantor it is convenient to note some properties of regular sequences of rational numbers. Let $\{a_n\}$ be a symbol to denote the sequence $a_1, a_2, a_3, \ldots$. If $\{a_n\}$ and $\{b_n\}$ are two regular sequences of rational numbers, then it may be shown that the sequences

$$\{a_n+b_n\},\ \{a_n-b_n\},\ \{a_n\,b_n\},\ \left\{\frac{a_n}{b_n}\right\}$$

are also regular sequences, with suitable restrictions in the last case—for instance, that all the elements of $\{b_n\}$ shall be greater than some given positive number. It is natural to take as the sum, difference, product, and quotient, of two sequences $\{a_n\}$ and $\{b_n\}$ the sequences

$$\{a_n+b_n\},\ \{a_n-b_n\},\ \{a_n\,b_n\},\ \left\{\frac{a_n}{b_n}\right\}$$

respectively. Then from the foregoing theorem it follows that the processes of addition, subtraction, multiplication and division may be carried out on regular sequences of rational numbers (with suitable restrictions in the case of division) and that the sequences which result from any finite number of applications of these operations are themselves regular sequences of rational numbers. Furthermore, it may be shown that the ordinary fundamental laws of algebra hold for operations with sequences, namely, the associative and commutative laws of addition and multiplication and the distributive law of multiplication (*qq.v.*) with respect to addition. (*See* ALGEBRA.)

Since these regular sequences of rational numbers combine according to the same formal laws as rational numbers themselves, it is natural to take regular sequences of rational numbers as themselves defining a new sort of number; and this is what Cantor does. The new numbers are called *real numbers*. A rational number $a$ may then be denoted by the sequence $a, a, a, \ldots$ each element of which is the rational number $a$. But this is not a unique representation of $a$. In fact, any sequence of rational numbers $a_1, a_2, a_3, \ldots$ having the rational limit $a$ may be used to denote the number $a$. In general, the real numbers $a$ and $b$ defined by two regular sequences $\{a_n\}$ and $\{b_n\}$, respectively, are said to be equal if for every positive rational number $\epsilon$ however small, a number $n$ exists such that the numerical value of $a_{n+m}-b_{n+m}$ is less than $\epsilon$ for every positive integer $m$. The real number represented by $\{a_n\}$ is said to be of higher rank than the real number represented by $\{b_n\}$ if a value of $n$ exists such that $a_{n+m}-b_{n+m}$ is numerically greater than some given positive number $\delta$ for all positive integers $m$. These definitions are sufficient to establish the relations of order among the real numbers.

The real numbers thus postulated satisfy the usual laws of algebra and possess an order relation analogous to that of rational numbers. In the domain of real numbers every regular sequence of rational numbers has a limit; namely, the real number defined by the sequence itself. The question naturally arises, whether every regular sequence of real numbers has a limit in the domain of real numbers. The answer is affirmative; that is, if definitions are introduced in connection with sequences of real numbers, in all respects analogous to those already given for sequences of rational numbers, then every regular sequence of real numbers has a limit in the domain of real numbers. Therefore regular sequences of real numbers lead to no further extension of the system of numbers. The fact that a regular sequence of real numbers always has a limit in the domain of real numbers renders the set of real numbers suitable to be the field of the real variable in a general theory of functions of real variables.

Any given simply infinite sequence $a_1, a_2, a_3, \ldots$ may be employed to define a new sequence $s_1, s_2, s_3, \ldots$ by writing

$$s_n=a_1+a_2+a_3+\ \ldots\ +a_n$$

The problems connected with the convergence of the sequence $\{s_n\}$ are then identical with the problems of the convergence of the infinite series

$$a_1+a_2+a_3+\ \ldots.$$

Therefore a part of the theory of limits (*see* LIMIT) and the whole of the general theory of simply infinite series (*see* SERIES) are aspects of the theory of simply infinite number sequences. In a similar way the definition of a definite integral as the limit of a sum presents the theory of integration as another one of the fundamental applications of the theory of simply infinite sequences.

**Other Types of Infinite Sequences.**—A simply infinite sequence is said to be of type $\omega$; the distinguishing qualities of these sequences lie in their possessing a first term, a term following any given term but no last term, while the terms preceding any given term constitute a finite sequence. The symbol $*\omega$ is used to denote what may be called a reversed simply infinite sequence. It has no first term but does have a last term, while every term but the last one is followed by a next term and all the terms following a given term constitute a finite sequence. A sequence of type $\omega$ is called an ascending sequence while one of type $*\omega$ is called a descending sequence. As the positive integers 1, 2, 3, . . . in order of magnitude form a typical ascending sequence so the negative integers in order of magnitude . . . , −, 3 −2, −1 form a typical descending sequence. The sequence

$$\ldots,\ -3,\ -2,\ -1,\ 0,\ 1,\ 2,\ 3,\ \ldots$$

of positive and negative numbers and 0, taken in order of magnitude, form a sequence of type $*\omega+\omega$, characterized by its possession of the following properties: there is no first term and no last term, there is a term next following any given term, and the elements following one and preceding another given element form a finite sequence.

In the development of the general theory of functions it has become necessary to consider many other types of sequences as well as order types of a more general character than those for which the term sequence is usually employed; on this account a general theory of sequences and order types has sprung up—usually developed both in treatises on functions of a real variable and in those on the theory of sets of points (*see* POINT SETS). A few of those usually called sequences may be briefly described. A sequence of type $\omega$ followed by another of type $\omega$ is said to form a sequence of type $\omega\cdot 2$. A typical instance is the following:

$$1,\ 3,\ 5,\ 7,\ \ldots,\ 2,\ 4,\ 6,\ 8,\ \ldots.$$

If $n$ such simple sequences are taken in a given order the resulting

sequence is said to be of type $\omega \cdot n$. A single sequence of type $\omega$ will then be noted by $\omega \cdot 1$. If any sequence of type $\omega \cdot n$ is followed by a finite sequence containing $m$ elements, the sequence so formed is said to be of type $\omega \cdot n + m$.

Let $S_1, S_2, S_3, \ldots$ denote a simply infinite sequence each element of which is itself a simply infinite sequence. The sequence thus formed is said to be of type $\omega^2$. This process of forming sequences of sequences may be continued; it has given rise to a certain class of so-called transfinite numbers. The theory of these transfinite numbers, and of the sequences which underlie them, has been extensively developed; and it has given rise to important analyses of the logical processes involved in defining them and reasoning about them, processes usually investigated in the theory of sets of points, since these sequences may be represented to the mind by means of sets of points on a line.

Let us illustrate the last remark by exhibiting a set of points of type $\omega^2$. First define any simply infinite sequence of non-overlapping intervals on a given line, as, for instance, the intervals from 0 to 1, from 1 to $1\frac{1}{2}$, from $1\frac{1}{2}$ to $1\frac{3}{4}$, and so on without end, each interval after the first having half the length of the preceding one. On each of the intervals a set of points forming a sequence of type $\omega$ is to be defined. We might, for instance, define the points on a given interval $I$ as follows. Let the first one be the midpoint $P_1$ of $I$, the second be the midpoint of the part of $I$ to the right of $P_1$ and in general let the $i$th one $P_i$ be the midpoint of the part of $I$ to the right of $P_{i-1}$. Then on $I$ we have a sequence $P_1, P_2, P_3, \ldots$ of points of type $\omega$. When this is done for each interval $I$ of the set of intervals and the resulting points are contemplated in their order from left to right on the line, we have a sequence of points of type $\omega^2$.

A typical arrangement of a sequence of type $\omega^2$ is the following:

$$a_{11}, a_{12}, a_{13}, \ldots,$$
$$a_{21}, a_{22}, a_{23}, \ldots,$$
$$a_{31}, a_{32}, a_{33}, \ldots,$$
$$\ldots\ldots\ldots,$$

the elements in each line forming a simply infinite sequence and the elements in any line preceding all the elements in each following line. Such a sequence is often called a *double sequence*. It is the type which underlies the general theory of double series. A fundamental problem concerning double sequences is that of the existence and equality of the limits

$$\lim_{m=\infty,\, n=\infty} a_{mn}, \quad \lim_{m=\infty} \lim_{n=\infty} a_{mn}, \quad \lim_{n=\infty} \lim_{m=\infty} a_{mn},$$

the last two denoting limits of limiting values while the first denotes the limit as $m$ and $n$ become infinite independently. If the first limit exists and is $a$ then each of the other limits exists and is $a$. But one or both of the latter limits may exist while the first does not, nor is it necessary that the two latter limits (when they exist) shall be equal.

That the same set of objects may be contemplated in sequences of various types may be indicated by observing that the elements in a double sequence, or sequence of type $\omega^2$, are capable of an arrangement into a sequence of type $\omega$. Thus, in the case of the foregoing array we may arrange the elements in the order of the finite diagonal sets and obtain the following sequence of type $\omega$:

$$a_{11}, a_{12}, a_{21}, a_{13}, a_{22}, a_{31}, a_{14}, a_{23}, \ldots.$$

**Recurrent Sequences of Integers.**—In the theory of ordinary integral numbers certain simply infinite sequences of integers have been found to play an important rôle (*Quart. Journ. Math.*, 48 [1920]: 342–372). These integers satisfy recurrence relations of the form

$$u_{n+\kappa} + \alpha_1 u_{n+\kappa-1} + \ldots + \alpha_\kappa u_n = 0, \quad n = 0, 1, 2, \ldots,$$

where $\alpha_1, \alpha_2, \ldots, \alpha_\kappa, u_0, u_1, \ldots, u_{\kappa-1}$ are given integers. If to take a simple case, the polynomial

$$\rho^\kappa + \alpha_1 \rho^{\kappa-1} + \ldots + \alpha_\kappa$$

is irreducible modulo $p$, where $p$ is a prime, then the sequence of residues $\{r_n\}$, where $u_n \equiv r_n \bmod p$ and $r_n$ is a number of the set $0, 1, 2, \ldots, p-1$, is periodic and (when certain exceptional cases are removed) the period is a factor of $p^\kappa - 1$. This theorem may be extended to the case of a general modulus $m$. In this connection several criteria have been obtained for recognizing certain large prime numbers as prime, the following being one of the simplest. A necessary and sufficient condition that $2^n - 1$ shall be a prime is that

$$(a + b\sqrt{-1})^{2^n} + (a - b\sqrt{-1})^{2^n}$$

shall be divisible by $2^n - 1$, where $a$ and $b$ are any integers such that $a^2 + b^2$ is a prime number of which $2^n - 1$ is a quadratic non-residue. By means of such theorems several large numbers have been shown to be prime, including the following:

$$2^{61} - 1, \quad 2^{89} - 1, \quad 2^{107} - 1, \quad 2^{127} - 1, \quad 5 \cdot 2^{75} + 1.$$

*See* E. W. Hobson, *Theory of Functions of a Real Variable*, vol. i. (3rd ed., 1927); and *Encyclopédie des Sciences Mathématiques*, tome i., vol. i. (R. D. Ca.)

**NUMENIUS,** a Greek philosopher, of Apamea in Syria, Neo-Pythagorean and forerunner of the Neo-Platonists, flourished during the latter half of the 2nd century A.D. His chief divergence from Plato is the distinction between the "first god" and the "demiurge." This is probably due to the influence of the Valentinian Gnostics and the Jewish-Alexandrian philosophers (especially Philo and his theory of the Logos). His works were valued by the Neoplatonists, and it is said Amelius wrote about 100 books of commentaries upon them. Fragments of his treatises on the points of divergence between the Academicians and Plato, on the Good (in which according to Origen, *Contra Celsum*, iv. 51, he makes allusion to Christ), and on the mystical sayings in Plato, are preserved in the *Praeparatio Evangelica* of Eusebius.

The fragments are collected in F. G. Mullach, *Frag. phil. Graec.* iii.; *see* also F. Thedinga, *De Numenio philosopho Platonico* (Bonn, 1875); Ritter and Preller, *Hist. Phil. Graecae* (ed. E. Wellmann, 1898), T. Whittaker, *The Neo-Platonists* (1901; 2nd ed. 1918) and Überweg, *Grundriss der Gesch. der Philosophie* Bd. I. (1926).

**NUMERALS.** Just as the first attempts at writing came long after the development of speech, so the first efforts at the graphical representation of numbers came long after people had learned to count. Judging by the habits of primitive tribes of the present as well as by the oldest trace that we have of written or sculptured records, the earliest numerals were simple notches in a stick, scratches on a stone, marks on a piece of pottery, or the like. Having no fixed units of measure, no coins, no commerce beyond the rudest barter, no system of taxation, and no needs beyond those of a savage, there was no necessity for written numerals until about the beginning of what we call historical times.

**Early Forms.**—The earliest numerals of which we have definite record were simply straight marks for the small numbers, with some special form for ten. These symbols appear in Egypt as early as the 1st dynasty (*c.* 3400 B.C.), and in Mesopotamia as early as *c.* 3000 B.C. These dates long precede the first known inscriptions containing numerals in India (*c.* 3rd century B.C.), in China (3rd century B.C.), and in Crete (*c.* 1200 B.C.).

Egyptian hieroglyphic, *c.* 3400 B.C. . . . .

Egyptian hieratic, *c.* 3400 B.C. . . . .

Cretan inscriptions, *c.* 1200 B.C. . . . . 

Sumerian and later, *c.* 3000 B.C. . . . .

Somewhat later it is not uncommon to find a group mark before 10 is reached. For example, four has a special symbol in certain Hindu types, as here shown:

Aśoka's time, 3rd century B.C. . . . . 

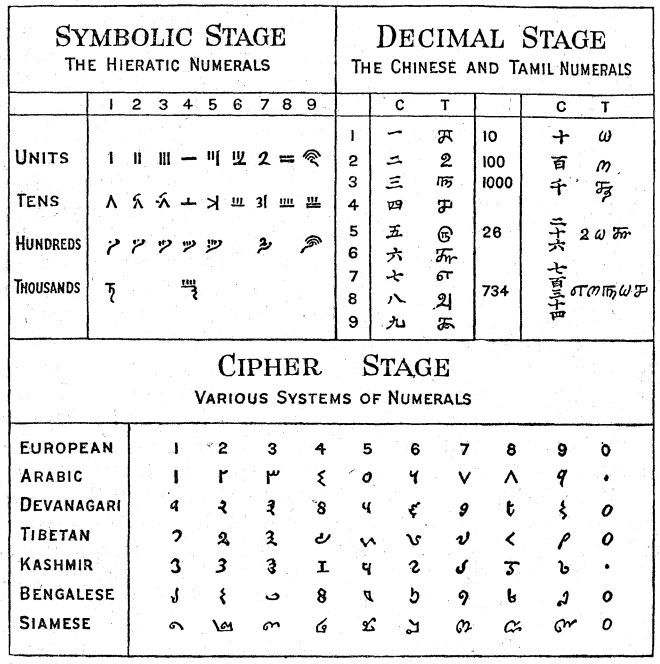
Nānā Ghāt, 2nd century B.C. . . . .

Śaka, *c.* 1st century B.C. . . . . 

Nasik, 1st or 2nd century . . . . . 

Kuṣana, *c.* 150 . . . . . 

**Early Hindu Symbols for 1 and 4.**—Even to-day a Chinese merchant may write one and four in the forms **I** and **X** respectively, instead of using the classical symbol. This use of a symbol for four may, in fact, have preceded the Western habit of taking




THE DEVELOPMENT OF NUMERALS THROUGH THE SYMBOLIC, DECIMAL AND CIPHER STAGES

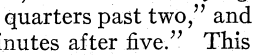
ten as the first group number, and the Etruscan and Roman use of **V** or **Λ** for five may have been a hand symbol in use before the **X** was taken for ten.

The vertical marks, **I**, **II**, **III**, etc., may possibly be representations of the fingers held as used in counting and computing, a linguistic trace of which is found in the word *digit*. The horizontal marks may be representations of computing rods as they lie on a table. The vertical symbols were preferred in Mesopotamia and the Mediterranean region, and the horizontal ones in the Far East, where 一, 二, and 三 were commonly used for one, two, and three, 二 and 三 being cursively written to give us our present 2 and 3.

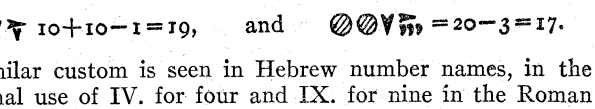
It therefore appears that the primitive numerals were **I**, **II**, **III**, **IIII**, and so on, as we find in Egypt and the Grecian lands, or 一, 二, 三, and probably so on as we usually find in the East, each going as far as the simple needs of people required. The idea of a group figure would naturally have occurred to merchants as soon as there developed a need for numbers beyond 10 or 12 (as was the case in Egypt and Babylon). Once the idea was suggested, probably influenced by the ten fingers, symbols were invented for smaller units, as in the case of those used for four and five as stated above. These naturally suggested special symbols for each of the numbers from one to ten or even farther, and the use of the additive principle to build up larger numbers, as in the Roman XXII. The idea of special symbols for larger groups, as for 20, 30, and so on, was a natural extension.

**Cuneiform Numerals.**—Around Babylon, clay was abundant; and in the damp clay tablets they impressed their symbols, then baking these tablets in the sun or in a kiln, thus forming historical documents that were practically as permanent as stone. Since the pressure of the stylus gave a wedge-shaped symbol, the writings are known as cuneiform (Lat. *cuneus*, a wedge, +*forma*, a shape) inscriptions.

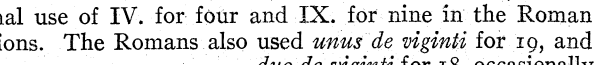
For our purposes some leading principles will suffice. The symbol for 1 served also for 60, 3,600, and in general for $1\times60^n$; similarly the symbol for 10 served for $10\times60^n$, the context telling what particular value was indicated. The symbols could be made either with the pointed or the circular end of the stylus, as follows:



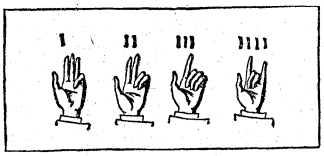

There was also a symbol for 100, but in general the scribe preferred to make use of the symbol for 60, thus:




Following the general custom of the race to use small numbers instead of large ones, the Babylonians employed a subtractive principle, as we do in saying "a quarter to three" instead of "three quarters past two," and "three minutes to six" instead of "57 minutes after five." This appears in such numerals as



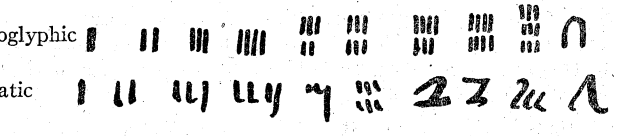

A similar custom is seen in Hebrew number names, in the occasional use of IV. for four and IX. for nine in the Roman inscriptions. The Romans also used *unus de viginti* for 19, and *duo de viginti* for 18, occasionally writing these numbers as XIX. (or IXX.) and IIXX., respectively. On the whole, however, the subtractive principle was little used in the numerals of the classical period.



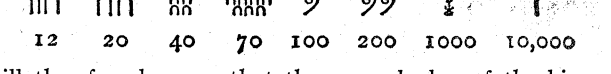
FROM SMITH, "HISTORY OF MATHEMATICS"

THIRTEENTH CENTURY FINGER SYMBOLISM
From the *Codex Alcobatiensis*, in the Biblioteca Nacional, Madrid

**Egyptian Hieroglyphics.**—The Egyptian numerals in hieroglyphic writing differed somewhat from those in the hieratic and demotic, but the last two were degenerate forms of the first, with certain additions. It will suffice to call attention to the principles of the first and second. In doing so, however, it should be observed that the Egyptians generally wrote from right to left, as in the Semitic script, but the hieroglyphics were occasionally written from left to right or (as also the Hieratic) from top to bottom. The numerals from 1 to 10 were as follows:

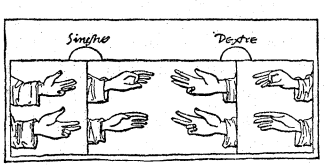



The hieroglyphic symbols for certain larger numbers were as follows:




It will therefore be seen that the general plan of the hieroglyphic notation was to have special symbols for powers of 10, and to repeat these as necessary. The Hieratic had special symbols for 5, 7, 8, and 9—a step towards the later Hindu system. The Hieroglyphic was similar in principle to the Etrusco-Roman, except that the latter introduced special numerals for 5, 50, and 500.

**Greek Numerals.**—The Greeks had two important systems of numerals, besides the primitive plan of repeating single strokes, as in **III IIII** for six. Their predecessors in culture—the Babylonians, Egyptians, and Phoenicians—had generally repeated the units up to nine, with a special symbol for ten, and so on. The early Greeks also repeated the units to nine, and probably had various symbols for ten. In Crete, whose early civilization was so much influenced by that of Phoenicia and Egypt, the symbol for ten was —, a circle was used for 100, and a rhombus for 1,000. Cyprus also used the horizontal bar for ten, but the precise forms




FROM SMITH, "HISTORY OF MATHEMATICS"

FIFTEENTH CENTURY FINGER SYMBOLISM
From *Sūma* of Pacioli, Venice, 1494

are not of so much significance as that the grouping by tens, with special symbols for certain powers of ten, was characteristic of the early systems of the Near East.

The Greeks, entering the field much later, and influenced as to their alphabet by the Phoenicians, based their first elaborate system chiefly on the initial letters of the numeral names. This was a natural thing for all early civilizations, since the custom of writing out the names for large numbers was at first quite general, and the use of an initial by way of abbreviation of a word is universal. These initial numerals, in modern characters, were

Π, *pi*, for ΠΕΝΤΕ (*pente*), five;
Δ, *delta*, for ΔΕΚΑ (*deka*), ten; often written like Ο;
Η, an old Attic breathing, like our *h*, later represented by a special symbol like ', for ΗΕΚΑΤΟΝ (*hekaton*), hundred;
Χ, chi, for ΧΙΛΙΟΙ (*chil'ioi*), thousand;
Μ, *mu*, for ΜΥΡΙΟΙ (*myr'ioi*, *mur'ioi*), ten thousand.

These numerals were frequently combined, thus:

**ΠΔ** or **ΠΔ**, *pente-deka*, for 5×10, or 50;

**ΠΗ**, *pente-hekaton*, for 5×100, or 500;

**ΠΜ**, *pente-murioi*, for 5×10,000 or 50,000.

This system appears in records of the 3rd century B.C. but was probably used much earlier. In the 2nd century of our era it was described by the grammarian Herodianus, and hence characters are often spoken of as Herodianic numerals. They are more properly called Attic numerals, being the ones always found in the Attic inscriptions.

As early as the 3rd century B.C. another system came into use, running parallel to the initial-letter one, being better adapted to the theory of numbers, and being more difficult of comprehension by the trading class. It consisted in assigning nine letters of the alphabet to the numbers 1–9, nine letters to the numbers 10, 20, 30,..., 90, and nine letters to the numbers 100, 200, 300, ..., 900. Since, however, there were only 24 letters in the Greek alphabet, three were added, namely the Phoenician *vau* (shaped like our letter **F**), *koph* or *qoph* (shaped somewhat like our letter **Q**, which indeed is derived from the same source, and represented below as **Ϙ**), and a character known in modern times as *sampi* (and then shaped somewhat like the Greek π, but tipped about 45° to the right and represented below as **ϡ**). An earlier form of this last symbol was **Ͳ**. The numerical values of the letters were therefore as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Units | Α | Β | Γ | Δ | Ε | [F] | Ζ | Η | Θ |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Tens | Ι | Κ | Λ | Μ | Ν | Ξ | Ο | Π | [Ϙ] |
| | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| Hundreds | Ρ | Σ | Τ | Υ | Φ | Χ | Ψ | Ω | [ϡ] |
| | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 |

The thousands were often indicated by placing a bar to the left of the numeral, thus:

/Α=1,000 /Β=2,000 /Ι=10,000 /Σ=200,000

The myriads (ΜΥΡΙΟΙ, *myrioi*, ten thousands) were represented by such symbols as

$\overset{\Upsilon}{\mathrm{M}}$ or $\overset{\Upsilon}{\mathrm{M}}$, for 10,000, $\overset{\Delta}{\mathrm{M}}$ for 4×10,000, or 40,000, etc.

Such numeral forms were not particularly difficult for computing purposes, once the operator was able automatically to recall the meaning of each. To be able to express 10,407 by ΜΤΖ would have seemed to a Greek considerably simpler than by our system. The capital letters were used by the Greeks, the small letters being a relatively modern invention.

**Hebrew Numerals.**—By the 2nd century B.C. at the latest, the Hebrews had established a system of alphabetic numerals similar to the one used by the Greeks. The alphabet being exhausted when the symbol for 400 was reached, the letters for 400 and 100 were combined by early writers to represent 500, and similarly up to 900. Later scholars used the final forms of the letters for 20, 40, 50, 80 and 90 (that is, the form of the letter that would be used at the end of a word) to represent 500, 600, ..., 900. The scheme then appeared as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Units | א | ב | ג | ד | ה | ו | ז | ח | ט |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Tens | י | כ | ל | מ | נ | ס | ע | פ | צ |
| | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| Hundreds | ק | ר | ש | ת | ך | ם | ן | ף | ץ |
| | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 |

**Roman Numerals.**—The direct influence of Rome for such a long period, the superiority of her numeral system over any other simple one that had been known in Europe before about the 10th century, and the compelling force of tradition explain the strong position that the system maintained for nearly 2,000 years in commerce, in scientific and theological literature, and in *belles lettres*. It had the great advantage that, for the mass of users, the memorizing of the values of only four letters was necessary—V, X, L, and C. Moreover, it was easier to see three in **III** than in 3, and to see nine in **VIIII** than in 9, and correspondingly easier to add numbers—the simplest of all the operations.

FROM SMITH, "HISTORY OF MATHEMATICS"
SIXTEENTH CENTURY FINGER SYMBOLISM
From the *Abacvs* of Johannes Aventinus, Nürnberg, 1522

As in all such matters, the origin of these numerals is obscure, although the changes in their forms since the 3rd century B.C. are well known. Of the various theories that of Mommsen (1850) has had the widest acceptance. This was that the use of **V** for 5 is due to the fact that it is a kind of hieroglyphic representing the open hand with its five fingers. Two of these gave the **X** for ten. Three of the other symbols, he asserted, were modifications of Greek letters not needed in the Etruscan and early Latin alphabet. These were *chi*, which appears in inscriptions not only as **X** but also in such forms as ⊥, ↓, and which later became the **L** that was arbitrarily chosen for 50; *theta*, Θ, which was selected for 100, being finally changed to C under the influence of the word *centum* (hundred); and *phi*, Φ, to which was assigned the value 1,000, and which finally took the forms (**I**), and **M**, the last being chosen because of the word *mille* (thousand). There is considerable epigraphical evidence in support of these contentions made by Mommsen. (*See* the bibliography for other theories.)

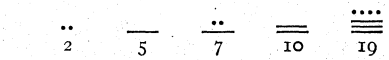
The oldest noteworthy inscription containing numerals representing very large numbers is on the *columna rostrata*, a monument erected in the Roman forum to commemorate the victory of 260 B.C. over the Carthaginians. In this a symbol for 100,000, which was an early form of (((**I**))), was repeated 23 times, making 2,300,000. This illustrates not only the early Roman use of repeated symbols, but also a custom which extended to modern times—that of using (**I**) for 1,000, ((**I**)) for 10,000, (((**I**))) for 100,000, and ((((**I**)))) for 1,000,000. The symbol (**I**) for 1,000 frequently appears in various other forms, including the cursive ∞. All these symbols persisted until long after printing became common. In the middle ages a bar (*vinculum*, *titulus*) was placed over a number to multiply it by 1,000, but this use is not found in the Roman inscriptions. When the bar appears in early manuscripts it was merely for the purpose of distinguishing numerals from nouns, as in the case IIVIR for *duumviri*. We also find in the middle ages such forms as **|X|** or **IX|** for ten hundred thousand and **|M|** for one thousand hundred thousand.

Of the later use of the numerals, a few of the special types are as follows:

(1) $\overline{c} \cdot \overline{\text{lxiiij}} \cdot \text{ccc} \cdot \text{l} \cdot \text{i}$, for 164,351, Adelard of Bath (*c.* 1120).
(2) II.DCCC.XIIII, for 2,814, Jordanus Nemorarius (*c.* 1125).
(3) MCICLVI, for 1,656, in San Marco, Venice.
(4) cIↃ.IↃ.Ic, for 1,599, Leyden ed. of Capella, 1599.
(5) IIIIxxet huit, for 88, a Paris treaty of 1388.
(6) four Cli.M, for 451,000, Baker's arithmetic (1568).
(7) vj.C for 600 and CCC.M for 300,000, Recorde (*c.* 1542).

The first represents the use of the vinculum; (2) represents the place value as it occasionally appears in Roman numerals; (3) illustrates the not infrequent use of ⊐ (like ⊃, originally half of (I), the symbol for 1,000); (4) illustrates the persistence of the old Roman form for 1,000 and 500, and the subtractive principle so rarely used by the Romans for a number like 99; (5) shows the use of *quatre vingt* for 80, commonly found in French manuscripts until the 17th century, and occasionally later, the numbers often being written like iiij$^{xx}$, vij$^{xx}$, and so on; (6) represents the coefficient method, "four C" meaning 400, a method often leading to forms like ijM or **IIM** for 2,000, as shown in (7).

**The Maya Use of Place Value.**—Evidence of some appreciation of place value is found in various systems of notation. For example, the cuneiform inscriptions contain frequent examples like 1tt1 (using 1 to represent the vertical wedge and *t* to represent the tens symbol), in which the first 1 stands for 60 and the last 1 for one, the number being 81. Similarly the later Roman forms occasionally contain cases like II · CX for 2,110, although these are not examples of the systematic use of place value as we understand it. In Yucatan, however, the highly developed Maya civilization used, for calendar purposes, a system of numerals based upon a scale which has elements of both 5 and 20, the horizontal bar (—) representing 5 and the dot (·) representing unity. The following are examples:



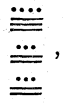

The Mayas also had a symbol for 0 in connection with which the place value clearly appears, as follows:

, 1 twenty and no units

, 15 twenties and no units

, 17×20 and no units (our 340)

The next number after 17×20+19 is 360, which then became a kind of super-radix, as follows:


, 19×360+13×20+13=7,113.

The Maya numerals seem to have been used for writing numbers rather than for calculation.

**Chinese Numerals.**—The Chinese have three general systems of numerals—the ancient national, the modern national, and the mercantile. These are respectively as follows:

一 二 三 四 五 六 七 八 九 十 百 千

一 二 三 四 五 六 七 八 九 〇 百 千

丨 ㇇ 川 乂 𠂇 一 二 三 文 十 百 千

The second differs from the first in that the place value is used, the circle ○ being used for our zero. The date 1937 is here shown in the two systems, the numbers being written downwards, as usual.

一九三七 千九百三十七

Modern Traditional

**Sanskrit and Arabic Numerals.**—By way of comparison of the modern Sanskrit and Arabic forms, the two are here shown:

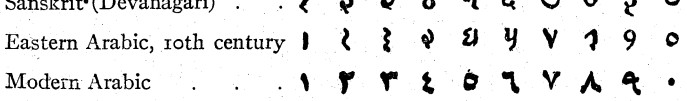
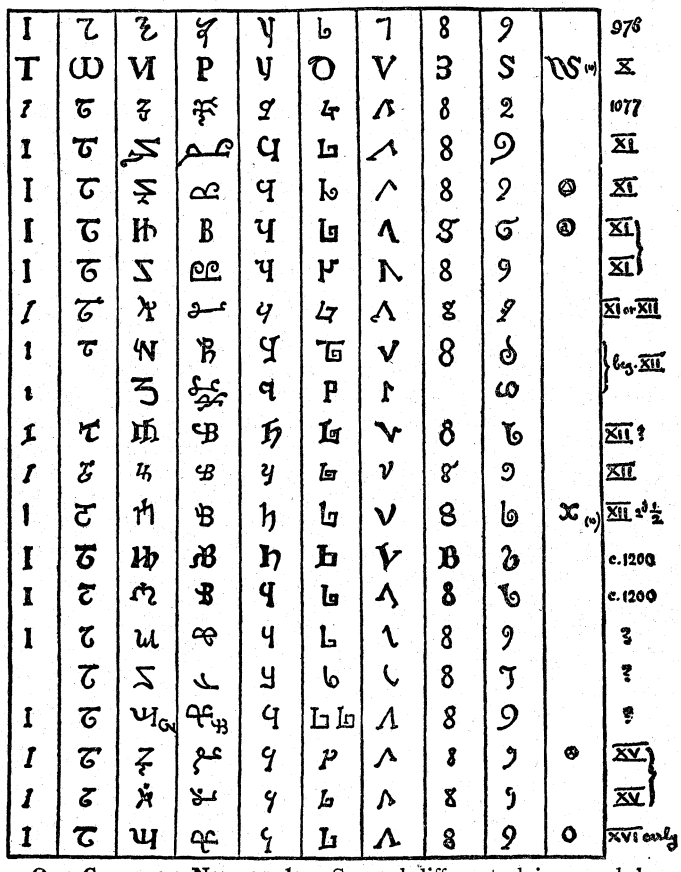



TABLE OF CHANGES OF THE HINDU-ARABIC NUMERALS IN EUROPE
From G. F. Hill's *The Development of Numerals in Europe*, Oxford, 1915
Reproduced by permission of the author and the Oxford University Press




**Our Common Numerals.**—Several different claims, each having a certain amount of justification, have been made with respect to the origin of our present numerals, commonly spoken of as Arabic but preferably as Hindu-Arabic. These include the assertion that the origin is to be found among the Arabs, the Persians, the Egyptians, and the Hindus. It is not improbable that the intercourse between traders served to carry such symbols from country to country, so that our numerals may be a conglomeration from different sources. The country, however, which first used, so far as we know, the largest number of our numeral forms is India. The 1, 4, and 6 are found in the Aśoka inscriptions (3rd century B.C.); the 2, 4, 6, 7, and 9 appear in the Nānā Ghāt inscriptions about a century later; and the 2, 3, 4, 5, 6, 7, and 9, in the Nasik caves of the 1st or 2nd century of our era—all in forms that have considerable resemblance to our own, our 2 and 3 being well-recognized cursive derivations from the ancient 二 and 三. None of these early Indian inscriptions gives any evidence of place value, or of a zero that would make our place value possible. Hindu literature gives some evidence that the zero may have been known before our era, but we have no actual inscription containing such a symbol before the 9th century.

The first definite external reference to the Hindu numerals is in a note by Severus Sebokht, a bishop who lived in Mesopotamia *c.* 650. Since he speaks of "nine signs," the zero seems not to have been known to him. By the close of the 8th century, however, some astronomical tables of India are said to have been translated into Arabic at Baghdad, and in any case the numerals became known to Arabic scholars about this time. About 825 al-Khowârizmî wrote a small book upon the subject, and this was translated into Latin by Adelard of Bath (*c.* 1120) under the title of *Liber Algorismi de numero Indorum*. There is some reason for believing that the numerals found their way into Europe even earlier than into Baghdad, but the earliest European

manuscript that is known to contain them was written in Spain in 976. The table on preceding page shows their subsequent development until the time of printing.

BIBLIOGRAPHY.—D. E. Smith, *History of Mathematics,* 2 vols. (Boston, 1923, 1925); vol. ii., pp. 36–79 (Numerous facsimiles of different systems; extensive bibliography); A. P. Pihan, *Exposé des signes de numération usités chez les peuples orientaux anciens et modernes* (Paris, 1860). (Numerous tables); G. Friedlein, *Die Zahlzeichen und das elementare Rechnen der Griechen und Römer* (Erlangen, 1869); M. N. Tod, "Three Greek Numeral Systems," *Journal of Hellenic Studies,* vol. xxxiii., p. 27, and "The Greek Numeral Notation," *Annual of the British School at Athens,* vol. xviii., p. 98 (The best modern discussions); D. E. Smith and L. C. Karpinski, *The Hindu-Arabic Numerals* (Boston, 1911). (Contains an extensive bibliography and numerous facsimiles.) (*See* also the article on FINGER NUMERALS.) (D. E. S.)

**NUMERAL SYSTEMS.** There is no language without some numerals; the notion of unity and plurality is expressed at least in the formation of "one" and "two," though "two" is often equal to "much," thus concluding a numeration that has just only started. It is doubtful whether even systemless numeration really exists, as it is mostly reported of peoples who are but vaguely known. The eastern languages of Australia, in spite of the occurrence of numerals for "three" and even "four," and in a less degree the western languages, Yuin-Kuri, Wiradhuri, Kamilaroi, and the southern central languages have been suspected of it. It remains doubtful whether Tasmania practised systemless or pair numeration. The Pygmies of the Andaman islands and Malacca form numerals for "one" and "two," yet sum up only with units, not with pairs. So with the Chiquito in South America.

**The Pair System.**—The pair system has numerals for "one" and "two" and forms the following numerals by addition to the "pair": $3=2+1$, $4=2+2$, $5=2+2+1$, etc. It is found in Australia among tribes ethnologically the oldest—the Kulin-Kurnai of the south-east, the Narrinyeri of the south; several of them count up to "ten" in this manner. A pure pair system still occurs in many Papuan languages of Torres straits and the adjacent coast of New Guinea. In Africa it is practised by the Bushmen. In South America it is found among the ethnologically oldest tribes—the Fuegian tribes: Yamana and Halakwulup, the Guayaki and Shipaya, and the Ges-Tapuya tribes.

The pair system starts from the parts of the human body that exist in pairs, like eyes, ears, hands, feet. The pair system is also found in various associations with later numeration systems. The formation of a dual with the personal pronoun (and substantive) can be traced back to those times.

**The Quaternary System.**—The quaternary system forms the numerals above "four" by composition: $5=4+1$, $7=4+3$, $8=4+4$ (or $2\times4$), $9=(2\times4)+1$, $16=4\times4$. In this consequent type, however, it is but seldom met, *e.g.,* in California with the Salina and traces of it with the Chumash. In California the four quarters of the sky play an important part in religion, mythology and custom.

**The Hexad System (Senary System).**—When further developed to a duodecimal system this is the most useful of all as it permits of more divisions without fractional numbers than any other system, and in later stages it has been repeatedly introduced especially for astronomy or in metrical or monetary systems. In primitive numeration it has a rather limited dispersion in north-west Africa, *e.g.,* in the Huka, the Bulanda, the Apko; traces of it are to be met with among the Bube on Fernando Po.

**The Quinary System.**—The quinary system in its pure form, where for instance $10=2$ hands, $25=5$ hands, is found only in Saraweka, a South American Arowak language. Everywhere else it is combined either with the decimal or the vigesimal system.

**The Vigesimal System.**—The vigesimal system takes 20 as a basis, so as to make $20\times20$ the numeral next in height, if the numeration goes as far as that. It may combine either with the quinary system forming a quinary vigesimal system or more rarely and only in younger forms with the decimal system, and then becomes a decimal vigesimal system. The quinary vigesimal system is frequently combined with the pair system, so that the numbers 3 and 4, often also 6, 7. 8, 9, and further 12 and 13, are formed according to the pair system.

These systems start with the fingers and the toes. Therefore "five" often means "hand," "ten" means "the two hands," 11 "one at the foot." 20 "both the feet (and hands)" or "the whole man."

The quinary vigesimal system is found sporadically in almost all the Australian linguistic groups; in nearly all the Papuan languages of the (north) east coast and exterior of New Guinea, in the oldest Melanesian languages of New Caledonia, the Loyalty islands, etc. In Asia-Europe it occurs in the border languages: Ainu, Chukchi, Koryak, in Burushaski (*q.v.*), and in the Himalaya group of the Tibeto-Burman languages.

The decimal vigesimal system is found in the Munda languages of India and in Tibeto-Chinese groups of the Himalayas, in Nicobarese, in the north (and south) Caucasian languages. With the Indo-European and the Semitic languages the dual form for 20 seems to point to a former vigesimal system. The Sumerian, too, shows traces of it. Basque practises a full (decimal) vigesimal system, so that forms like soixante-dix, quatre-vingt, quatre-vingt-dix in French are to be explained.

In Africa the vigesimal system occurs in upper Guinea, and its hinterland, from the Senegal to the Cross river, in a series of Bantu, Mande, Togo and Niger languages, and in some east Bantu languages, in the Hamitic Kunama (and Barea) and in the Bantu languages Konde and Sango.

In North America it is found in Eskimo and in the north-west in Bellacoola and Haida and several languages of California, together with Pawnee (Caddo). This system mostly as decimal vigesimal is dominant in Mexico, Central America, even in the languages of the high civilization of the Aztecs and Maya. In South America the vigesimal system is found both in the progressive civilization of the Chibchas and with a great many primitive tribes belonging to nearly every linguistic group save the Gez-Tapuya and the tribes south of the Gran Chaco.

The quinary vigesimal system, especially its older form combined with the pair system, appears to have originated in the culture cycle (*Kulturkreis,* culture area) of the totemistic-patriarchal progressive hunters; a culture type in which the human body in art (sculpture), clothing and adornment has gained greatest importance and is most cared for. According to that the vigesimal system, too, agrees up to 20 with the parts of the body.

In north-western Africa on the coast of upper Guinea a quadragesimal system has developed, derived from a vigesimal system. Its origin is due to commercial reasons, as the monetary standard in this region is a set of 40 cowries.

**The Decimal Systems.**—The decimal systems are superior to the vigesimal systems in taking as a basis a smaller numeric unity more easily applied, and render possible shorter forms of the numbers. Two forms are known, the quinary decimal system and the pure decimal system. In the quinary decimal system the numbers of the second pentad are formed by composition with "five" ($6=5+1$, $7=5+2$, etc.) or by the pair system (especially $6=3\times2$, $8=4\times2$) or by subtraction (especially $9=10-1$). It seems to have originated in the matriarchal soil-tilling culture. The great quantity of agricultural products which had to be counted, arranged, stored, and brought to market required to be frequently repeated and counted quickly, and thus led to this system. In the languages of this culture numeral unities have developed which spring from the special grouping of certain products: a dozen, a brace, score (three score), etc.

In Australia and in the Papuan languages it is found isolated and in rudimentary form; with the Melanesians it is fully displayed. In Asia it originally dominated the two great families of the Austroasiatic and the Tibeto-Chinese languages. Whether a quinary or a pure decimal system was the original numeration in the Ural-Altaic languages cannot be ascertained. In Africa the great majority of the languages show originally a quinary decimal system, especially the Bantu and the semi-Bantu languages and the majority of the Nilotic, Wule, Ngo-Nke and Manfu languages. So too, in North America; but neither in Mexico, Central America, nor in South America has the system spread widely.

With the pure decimal system there is no partition of the decad into two pentads and therefore the compound character of the numerals from five to ten is not met with. The whole system

becomes simpler and its forms are better fitted for general application. The pure decimal system seems to have originated in the culture-cycle of the nomadic herders, who, in counting their large flocks of horses, cows, camels, sheep, etc., needed to employ high numbers with more facility. From the aristocracies of the nomadic herders it has spread everywhere, and it is now found in all nations of high culture on the whole globe, except those of Mexico and Central America, where the number 20 was used in astronomy, and thus was safe from competition. (W. Sc.)

**NUMERATION:** *see* NUMERALS; ARITHMETIC.

**NUMIDIA,** the classical name of a territory in the northern part of Africa. When the Romans first came into conflict with Carthage in the 3rd century B.C., the name was applied to the whole country from the river Mulucha (now the Muluya), to the frontier of the Carthaginian territory. Numidians were divided into two great tribes, the Massyli on the east, and the Massaesyli on the west, the limit between the two being the river Ampsaga. At the time of the second Punic war, the eastern tribe was governed by Massinissa, who took the side of the Romans, while Syphax, king of the Massaesyli, led the Carthaginians. At the end of the war, the Romans confiscated the dominions of Syphax, and gave them to Massinissa, whose sway extended from the frontier of Mauretania to the boundary of the Carthaginian territory, also south and east to the Cyrenaica, so that the Numidian kingdom surrounded Carthage except towards the sea. Massinissa, who reached a great age, retained the whole of these dominions till his death in 148 B.C. and was succeeded in them by his son Micipsa, who died in 118. For the war with Rome which followed the death of Micipsa, *see* JUGURTHA.

After the death of Jugurtha, the western part of his dominions was added to those of Bocchus, king of Mauretania, while the remainder continued to be governed by native princes until the civil war between Caesar and Pompey, in which Juba I. was defeated by Caesar. Numidia in the more restricted sense became for a short time a Roman province under the title of Africa Nova, but after the battle of Actium it was restored to Juba II., who had acquired the favour of Augustus. In 25 B.C., Juba was transferred to the throne of Mauretania, including the whole western portion of the ancient Numidian monarchy as far as the river Ampsaga, while Africa Nova was rejoined to the province of Africa; together with Africa Vetus it was governed by a proconsul, and was the only senatorial province in which a legion was permanently stationed. In A.D. 37 the Emperor Gaius sent a legatus of his own to take over the command of the legion (*see* AFRICA, ROMAN). Under Septimius Severus (A.D. 193–211) Numidia was separated from Africa Vetus and governed by an imperial procurator (*procurator per Numidiam*); finally, under Diocletian, Numidia became one of the seven provinces of the diocese of Africa, being known as Numidia Cirtensis, and after Constantine as Numidia Constantina. During this period it reached a high degree of civilization, and was studded with numerous towns, the importance of which is attested by inscriptions and by the massive remains of public buildings. The invasion of the Vandals in A.D. 428 reduced it to a condition of decay; and the invasion of the Arabs in the 8th century again brought desolation on the land, which was aggravated by misgovernment till the conquest of Algeria by the French in 1833.

Chief towns of Numidia under the Romans were: in the north, Cirta, the capital, which still retains the name Constantine given by Constantine, and Hippo Regius, the see of St. Augustine; to the south, Theveste (Tebessa) and Lambaesis (Lambessa), connected by military roads with Cirta and Hippo respectively. Lambaesis was the seat of the legion III. Augusta, and the most important strategic centre.

For bibliography and account of Roman remains, *see* AFRICA, ROMAN.

**NUMIDINAE:** *see* GUINEA-FOWL.

**NUMISMATICS** (from the Latin *numisma*, a coin) is the study of coins and medals. Coins were first issued in east and west in the eighth century B.C., and since then their use has spread over the whole civilised world. Unlike many objects in every-day use, they have always been highly prized by their owners, and were therefore frequently hoarded. As is still the custom in the east, it was usual to bury treasure for safety, with the result that the contents of such ancient and mediaeval savings banks are frequently turned up by the spade to-day. Coins are themselves the most imperishable of antiquities. The result is that they still exist in vast numbers of forgotten generations out of all proportion to other remains of the culture with which they were contemporary. The study of coins may therefore be expected to yield a considerable amount of information about the past, although we must be careful not to exaggerate their importance. Coins give us some idea of the wealth and importance of ancient states and cities. A study of the find-spots of coins gives an idea of their circulation in ancient times, and it is sometimes possible to make deductions about the extent of the dominion of a particular state from this; chronological analyses of finds, by reasoning from known dates to pieces of which the dates are hitherto unknown, has often given valuable results. The argument from find-spots has to be used with care, as commercial reasons frequently explain the finding of coins far from their original mints. Thus, the frequent finds of Roman gold of the early empire in India do not show that the Romans ruled there, but corroborate Pliny's reference to the tremendous drain on Rome for gold to pay for Indian luxuries; to go to the other end of the world, the huge finds of Arab silver coins in Scandinavia were brought there to pay for furs for the wealthy Abbasids and Samanids. At all times certain currencies have acquired especial popularity and have wandered far; such were in ancient times the tetradrachms of Athens and the staters of Philip II.; in mediaeval times, the dinars of the early caliphs and the ducats of Venice, and in modern times the Mexican and Maria Theresa dollar and the English sovereign.

Commercial and economic history can thus learn much from coins; their depreciation reveals times of economic stress; the base Roman antoniniani of the third century tell their tale as readily as the inflated paper currency of Germany in 1919. The imitation of the Edward I. penny on the Continent shows how welcome a really good coin was in those days of base deniers.

Coins and medals have preserved a series of portraits which throw light on the characters of their issuers. Of particular value is the light thrown by coins on ancient religion and mythology.

As datable objects they are above all valuable as the grammar of art. Not only do they throw light on local forgotten schools and preserve representations of long-lost masterpieces, but it is from them that the chronology of ancient art has been fixed. A long series of coins of a Greek town, ranging from the archaic period to the decline of art, sets a standard of comparison which enables sculpture and other objects to be dated.

The principal metals in which coins are struck are electrum, gold, silver, copper and bronze.

Electrum is a natural mixture of gold and silver which was used for the earliest Greek coins struck in Asia Minor (Lydia) until Croesus replaced it by pure gold. Electrum was the metal of the great 5th century coinage of Cyzicus. An artificial electrum was used in the 5th and 4th centuries in Carthage and Sicily.

Gold was the great currency of Asia, of the later Lydian kings, of the Achaemenids, of the Kushans and most Indian dynasties till the 12th, and again in the 17th century. In Europe it is not found till the great coinages of Philip II., Alexander III. and Lysimachus of Macedon; in Europe we find it in the Roman and Byzantine empires and their successors till the 8th century; it was revived in the 12th century with the great commercial currencies of the Italian republics and from the middle of the 14th century became the standard of the northern countries of Europe also.

In the ancient world silver was the currency of early Greece and of Republican Rome, and of the 9th to the 14th century in Europe generally; it was the currency of the Parthians, and on the whole of the Sassanians, and of the Asiatic state of the middle ages.

Bronze or copper was the early currency of Rome and Northern Italy and of China till modern times; it first appears in Greece towards the end of the fifth century, and here as usual in its later numismatic history throughout the world was used only for small change.

Lead has only been occasionally used for coins; the only lead currencies of any note are that of the Andhras of ancient India and the modern coinages of the Malay States. Iron was occasionally used in the ancient world and during the World War in Germany. Nickel was used in Bactria, 3rd century B.C., and has been extensively used in modern currencies since the middle of the nineteenth century. The only pre-war aluminium coinage was that for British East Africa in 1908, but it was not a success. Aluminium and aluminium-bronze have recently been used for a number of the post-war currencies of modern Europe.

## GREEK COINS

A coin may be defined as a piece of precious metal stamped with some mark or type or inscription showing that it is issued by some authority which guarantees its weight and purity. Coins as we know them are not older than the 8th century B.C. Traces of more primitive currencies which preceded them survived into historic times. Passing over the stage of barter, when a superfluity of one necessity of life was exchanged by its owner for another necessity of which he was in want but could not so easily supply, we find that certain things, notably oxen and instruments of husbandry, early became standards of value and were used as mediums of exchange. Among the Romans for example we find fines exacted in cattle down to the end of the 5th century B.C. and the etymology of *pecunia* from *pecus* shows that coined money took the place of cattle. With the passing of a pastoral civilization and the transition to an agricultural community with its multiplicity of products a demand for some more convenient medium and for small change was felt. We have abundant evidence of the use of agricultural implements and household utensils as currency in the ancient world. In China for example the earliest coins of the 8th century B.C. are models of the spades and billhooks which preceded them, with the addition of a proper coin-inscription showing they were issued by authority. In prehistoric Europe we have in Gaul hoards of small bronze celts which seem to have been used for currency. The most certain survival of this coin in the Mediterranean world is the iron or bronze spit (*obeliskos*—whence the name *obol* for a small coin); hoards of these spits have actually been found in circumstances which show that they were currency; the most remarkable of these hoards of spits is that found in the Heraeum in Argos, dedicated by Pheidon himself—whether as specimens of demonetised currency or as standards set up in connection with Pheidon's reforms or simply dedicated specimens of the usual currency is disputed; similar bundles of spits in bronze and iron have been found in Etruria. In Homer we find basins, tripods and axes used as gifts and prizes in a way which shows that they were a recognised standard of wealth. With the invention of the scales these more or less clumsy currencies disappeared and we have the metal itself used; a definite weight takes the place of a particular shape. In all countries from the 10th to the 5th centuries B.C. we find hoards of broken bronze or silver, sometimes shapeless, sometimes cast in the form of bricks or plates; later it is regularly in the form of bars which could be broken and weighed. We have finds of silver of this kind from Assyria of the 8th century B.C. and from Egypt and South Italy of a little later. The Egyptian finds frequently contain Greek silver coins chopped in a way which shows they were considered only as bullion. In Italy in particular rude chunks of copper (*aes rude*) were regular currency from early times to the 3rd century B.C. as we know from literary references and from finds. Caesar tells us that the ancient Britons used iron bars of a definite weight and specimens still survive; excavations have also confirmed the accuracy of Plutarch's reference to the iron money of the Spartans.

The large oblong Roman bronze pieces with a type on either side form a kind of transition from metal bars to coins although they are not earlier than some Roman coins—in any case it is a short step from the use of metal by weight to its use in pieces of definite weights with a stamp of some kind guaranteeing it is what it professes to be, so that it can be paid without weighing; at this stage it becomes a coin; it is in this form that coinage first meets us in Greece and India.

**Period I. 750–480 B.C.**—Ancient tradition—Xenophanes in the 6th and Herodotus in the 5th century—ascribes the invention of coinage to the Lydians; the latter says they were the first to strike coins of gold and silver. This definite statement probably refers to a period after the beginnings of coinage when Croesus of Lydia struck coins of pure gold and pure silver. We have, however, evidence of an earlier coinage of Lydia and Ionia of electrum, a natural mixture of gold and silver, the "white" gold of the Greeks; these early pieces, as the finds at Ephesus show, belong to the 8th century B.C. (Pl. I.-1). They are little globules with a variety of stamps which suggests that they are private issues and not issues of a state authority; this early coinage is irregular in weight and quality and unsystematic in character and it is not till the issues of Croesus that we have in Asia Minor an undoubted coinage by a state authority. The types on his gold and silver coins are the same, the heads of lion and bull facing one another and reverse a double incuse square caused by the anvil in striking (Pl. I.-3).

In contrast to this early electrum coinage, irregular, alike in quality, types and shape, is the almost contemporary earliest coinage of Greece proper, even the oldest specimens of which, unlike the electrum, are at once recognisable as coins to the least trained eye. This is of silver and capable of definite attribution. The oldest are those of Aegina and if the not early but persistent ancient tradition which says that coinage was invented by Pheidon king of Argos is correct, these would be his coins. The type of Aegina is a turtle—an animal associated with Aphrodite—on the obverse, an incuse square on the reverse. That the coins of Aegina are the earliest is supported by the fact that the Aeginetic standard is the commonest on the earlier coins of the islands, the Peloponnese and Greece proper; it was later supplanted by the Euboic-Attic standard, the adoption of which by Solon for Athens led to its wide dissemination. By the end of the 6th century the practice of striking coins was well established in many centres. Corinth with its *pegasi* (Pl. I.-9)—from their type of a pegasus—struck staters on its own standard, a variant of the Attic and began to strike not long after Aegina; it is not improbable that Periander was the institutor of the Corinthian coinage which became one of the great commercial currencies of the Greek world. The date of origin of the coinage of Athens is still uncertain; the well known types of the head of Athena on the obverse and her attribute the owl on the reverse date from the middle 6th century and are the earliest coins with a type on both sides and the earliest to bear a human head (Pl. I.-8). The exact attribution to Athens of its Solonian and pre-Solonian coins is still disputed. By the institution the "owls," a type of coin, obv. deity and reverse an attribute of the deity, was developed which had a far-reaching effect on the development of coin-types; the head of the king on an English penny goes back to the head of Athena through the deified head of Alexander and the Britannia on the reverse similarly can be traced back to the owl. Other important towns like Thebes and trading centres like Corcyra began to issue coins about this time but a number of important towns seem to have still been content to use the currency of their neighbours. In the 6th century also we have the earliest coins of Africa in the issues of the Spartan colony of Cyrene with its badge the silphium plant, the cultivation of which was its great source of revenue. Coinage was also begun by the Greek colonies in South Italy and Sicily; these latter are of a characteristic fabric. Instead of the thick dumpy piece with a type on the obverse only and an incuse square on the reverse which are common to the cities and islands of Greece, we have broad thin pieces with the type struck on both sides, in relief on the obverse, incuse on the reverse (Pl. I.-5). We possess many coins of this type of Tarentum, Metapontum, Croton, Rhegium, Zankle (Messana), etc. By the time of the Persian Wars coinage was a familiar feature of everyday life in the cities of the Greek world. Traders and colonists had carried the art to Cyrene in North Africa from Sparta to south Italy from Corinth, and to Sicily from Athens and the Peloponnese. In Asia Minor also coinage spread southwards and had reached Cyprus but not yet Crete. The Phoenicians and Egyptians were already familiar with Greek coins but did not

attempt to copy the invention; in the north however the silver mints of Thrace and Macedon were beginning to be worked vigorously and not only the Greek cities but the barbarian tribes, also, who employed Greek legends on their coins, were actively striking.

The various coinages of this early period (down to 480 B.C.) have a number of features in common. One of the most remarkable to the modern eye is the absence of inscriptions; these are either non-existent or consist only of the initial letter or letters of the town issuing the coin. The device of the town was originally sufficient for local circulation but as coins began to go further afield it became necessary to add some indication of its name. The earliest coin legends are therefore very brief: a *koppa* for the initial of Corinth, a Φ (*phi*) for Phocaea, Σ Γ (*Su*) for Sybaris, AΘE for Athens, and so on. The earliest inscriptions of any length are still written from right to left. Long inscriptions like "I am the badge of Phanes" above a stag on an archaic coin of Ephesus or "the stamp of Gortyna" on an early coin of the Cretan mint of Gortyna are remarkable exceptions and important as showing the original nature of inscriptions and of the types themselves. They show that the genitive, which is the usual form of the name when written in full, although nominatives are not very rare, is explanatory of the type.

**Types.**—The types in the early period are mainly taken from the animal world; they include domestic—particularly the bull—wild animals, birds and insects (the bee at Ephesus); fabulous creatures are also common like the griffin at Abdera, the pegasus at Corinth, the Chimaera, etc.; the vegetable world is also represented, notably by the silphium plant at Cyrene. Representations of the human figure are rarer and later than other types to appear, but once the human head became established as a coin-type, its use spread rapidly and widely and with the disappearance of the incuse square and coming of the double typed coin a head began to be regularly used as one of the types. Complete human figures are rare and are represented either kneeling or standing, both very stiffly like the Poseidon at Poseidonia; the nymph and satyr or centaur common in Thrace (Pl. I.-7) hardly deserves the name of a group; elaborate compositions like the Hercules and Hesperides at Cyrene and the flight of Aeneas at Aeneia are quite unique.

With the coming of legends on coins it was no longer necessary that the main type should be the badge of the town, which is frequently relegated to the reverse or becomes merely a symbol or disappears altogether to give the artist a subject more worthy of his talents. Except in the doubtful case of the earliest electrum, coinage was always a matter for the ruling authority whether civic or regal and the earliest types are chosen to show who these are. That coinage was early recognised as too important a right for private ownership is seen from the traditions which associate all the great law-givers, Pheidon, Solon and Lycurgus, with the institution or improvement of coinage. The sanctity of the republic's right of coinage is seen in the coinage of cities ruled by tyrants, who never put their name or other indication of their existence on the coins, although they occasionally made alterations in the types, as when Peisistratos added the head of Athena to the Athenian coins or when Anaxilos of Rhegium introduced the mule-chariot type in memory of his Olympic victory.

The early types are generally chosen from simple motives. Many of them are a punning allusion to the name of the town like the lion at Leontini, the seal at Phocaea, the goat at Aegae or the quince at Melos, or the sickle-shaped harbour at Zancle. Sometimes it is chosen from the history of a town like the figure of the mythical founder Taras at Tarentum or the Minotaur and Labyrinth at Cnossos (Pl. I.-6). Types like the ear of corn at Metapontum allude to the fertility of the country about. Thrace and Macedon are notable for their huge silver octodrachms with the type of a local hero in a chariot drawn by two bulls. In Italy, Croton takes as its type the tripod of Apollo like its mother city Zacynthus. Poseidonia has a statue of Poseidon brandishing his trident. Naxos in Sicily, whose founders came from Naxos in the Aegean, has a head of Dionysos who was born in the Aegean island. Himera has a cock, a punning allusion to the name of their town for the cock proclaims the dawning of day (*hēmera*). Selinus has another punning type, the wild parsley leaf (*selinon*). Towards the end of the 6th century B.C., Syracuse introduces the celebrated type of the head of Arethusa, the nymph of a spring in Ortygia, which was in the next century to become the most famous of Greek coin-types. The reverse, a victorious chariot, became a popular one in other towns. The finest specimen of this type of late archaic style is the *Demareteion* (Pl. I.-14) commemorating the victory over Carthage in 480. The head of Arethusa on the obverse wears the laurel wreath of the victorious and beneath the chariot on the reverse is a lion, the emblem of conquered Africa. This type of obverse spread throughout Sicily; the main types of Sicilian towns in the 5th century are local nymphs and river gods. At Catania we have the river god Amenanos; Gela has a manheaded bull swimming, a personification of the river Gelas.

**Period II. 480–336 B.C.**—The finest period in Greek coinage begins after the Persian Wars and runs to the accession of Alexander the Great in 336 B.C. The first half of this period is transitional and is marked by a great advance in technical skill, an increased delicacy in the treatment of details and greater freedom of movement in the treatment of the human figure. In the last eighty years of this period the art of engraving coins reached the highest standard it has ever attained: the head of a divinity is now established as the obverse type and is usually represented in very high relief—many of the finest are shown facing; the engravers sign their coins which show that they were artists of note and not mere artificers: the names of great artists otherwise unknown have been thus preserved. The types are very varied and almost entirely based on local mythology, although latterly the fine bigae and quadrigae types became popular in allusion to Olympic victories. The type first introduced in Athens—obverse head of a deity and reverse badge of the city—grows increasingly popular and towards the end of the period is almost regular. Inscriptions become general although still frequently contracted. The period is marked by a geographical extension of coining and an increase in its quantity; with the decline of the Persian empire, the cities of Asia Minor, Phoenicia and Syria show an increasing activity; the opening of the mints of Emporiae in Spain and Messalia in Gaul bring the art of coinage to the other end of the known world. Towards the end of the period the rise of Macedon under Philip II. led to the closing of many mints in northern Greece, and his coinage foreshadows the great imperial coinages of Alexander the Great. The second half of the 5th century witnesses a great expansion of the monetary influence of Athens at the expense of her allies.

The coinage of the period is mainly silver; the Aeginetic standard gradually yields to the Attic: electrum disappears except at Lampsacus and Cyzicus and sporadically at Syracuse and Carthage. Gold is continued in the darics of the Persian kings in the east and in the fine series of Lampsacene staters (Pl. I.-10); with the decline of Persian power the Great King's monopoly of gold was usurped by various rulers in Cyprus and Caria. The late 5th and 4th century gold coinages of Syracuse, Tarentum and Cyrene are extensive. Towards the end of the period we have the institution of Philip II.'s gold stater, the first great gold coinage of the world. In the latter part of the 5th century the first copper coins were issued and soon drove out the infinitesimal small silver coins which had hitherto served as small change.

The greatest commercial currency of the 5th century was the silver coinage of Athens, as contemporary references and the huge finds still made all around the Mediterranean show. It was imitated in Central Asia and Arabia which shows the extent of its penetration. The Corinthian stater continued to be an important coinage although its circulation was more limited. The same is true of Cyzicene staters: these great currencies remain more conservative than their contemporaries which are not affected by the same commercial considerations; care is taken to avoid the slightest change, hence the long survival of the now obsolete *koppa* on the coins of Corinth or the archaic use of E for H at Athens.

The feature of the period is the development of the general type—head of a deity on obverse and reverse, the badge of the city—which usually has some reference to the deity also. We find

the latter prevailing in time so that when the old type has no reference to the deity chosen, it is dropped. The gradual abandonment of these old types gave a freer choice to the artist and the simple figures of animals, plants, fabulous animals, etc., give way to mythological groups. Symbols begin to appear on coins and are usually the marks of magistrates or otherwise mark the issues and change constantly. Occasionally we find the old badge of the town relegated to a subordinate position, like the tunny fish at Cyzicus. Names of towns and magistrates are written at greater length and those of artists begin to appear. Types are occasionally labelled like the Zeus at Locri Epizephyrii or the Ajax at Locri Opuntii.

**Predominance of Athens.**—The causes of the predominance of Athenian currency were firstly the development of rich silver mines in Laurium in the beginning of the 6th century, which provided the money to build the ships which defeated the Persians at Salamis in 480 and secondly the prosecution of her policy of prohibiting silver issues by any city or state that came within her power, whether as tributary or as a member of the alliance in which she was the predominant partner. The members of the Confederacy of Delos while nominally retaining their monetary rights bowed to the practical advantages of a common coinage—which was that of Athens. The fine quality of its silver, the accuracy of its weights and its numerous subdivisions made the Athenian tetradrachm welcome everywhere so that Athens gained the monetary hegemony in addition to the political. In 453 Aegina became tributary to Athens, which at once put a stop to the issue of the "tortoises" and the stater of Aegina practically disappeared from the international market where it had so long competed with the "owls." Eretrea on its conquest in 445 lost its right of coinage as did its neighbour Carystus. Tenos, Naxos and other Aegean islands also ceased coining. In Asia Minor, Miletus, Cnidos and other tributaries of the Confederacy issued only small change.

One notable exception is that of Melos, which had refused to enter the League and therefore could still continue its staters. Samos and Lesbos kept up their issues but they were allies of equal status to Athens; Ephesus which entered the Confederacy in 469 continued to coin silver till 460, but there was seemingly some special arrangement in this case. Aeolis, Mysia, and Troas only struck small change. Several towns of the south coast of Thrace, like Abdera, continued their coins but these with their different standards did not compete with those of Athens in the markets of the Aegean. Phocaea, Mytilene and Cyzicus continued their electrum in the 5th century but their silver ceases. The Athenian tetradrachms thus became predominant in the Aegean and beyond, completely ousting local currencies. If we occasionally find autonomous staters, it is a sign of rebellion or shows that the town in question entered the League with special reservations. With the first news of the disasters in Sicily a general defection began and the days of the economic supremacy of Athens were soon over. The Spartans seized the mines of Laurium in 413 and cut off the supply of silver. In 407 Athens was reduced to such financial straits that the gold statues of Victory from the Parthenon were melted down for an emergency coinage; in the next year she had to have recourse to a coinage of bronze which had an unfavourable reception as it could not, like the infinitesimal silver pieces, be carried in the mouth. After being almost extinct, Athenian coinage revived after Conon's successes in 394. On the formation of the second League against Sparta, her allies however struck coins on equality with Athens and used a common type of the infant Hercules with their own reverses and their own standards. Such staters are known of Ephesus, Cnidus, Rhodes, Samos, Cyzicus and other islands and towns of Asia. This diversity of standard in the League shows that there was no monetary convention. Among the rising coinages of this period one of the chief was that of Rhodes (Pl. I.-15) founded in 408. Its silver and gold coins have the punning type of the rose and head of Helios. Rhodes had its own standard and its rapidly increasing commerce spread its coinage and standard quickly in the Mediterranean. In 376 Athens regained her hegemony over the islands but for a generation only. Her coinage again became abundant but never regained a predominance over the numerous local coinages which had sprung up since the end of the 5th century. In addition to Rhodes the important mints of Amphipolis and Larissa begin to issue their beautiful coins and many smaller towns open their numismatic history. The ancient coinages of Samos and Chios disappear before Athenian vengeance in the middle of the 4th century but other towns of Asia and the islands, Cnidos, Ephesus, Tenedos, and notably Cyzicus, testify in their coins to the great prosperity which their autonomy brought them. Corinth and its colonies continued to issue their staters of the old types uninterruptedly up to their conquest by Philip II. and even then did not lose the right of coinage. With this exception however the great revival of autonomous coinage in the early 4th century was short-lived. Philip II. (Pl. I.-12) became politically supreme, and economically his gold and silver mines enabled him to drive the gold of Cyzicus and the silver of Athens from the market, but the Attic standard was to survive in the tetradrachm of Alexander. In 404 the people of Aegina after half a century of exile returned to their homes to resume the issue of their celebrated staters but replaced the turtle of the obverse by a tortoise.

The 5th century saw the beginning of one of the finest and most interesting series of silver coins, that of Elis. From about 471 when Elis became a city to its conquest by Macedon in 322 the staters form a continuous series. The whole land was sacred to the Olympian Zeus and his symbols, the thunderbolt or eagle clutching its prey, are usual types along with a Victory in various attitudes—running to crown a victor, standing or seated with outspread wings—the latter type was copied by Pistrucci for the Waterloo medal in 1815. At a later period the head of Zeus appears as does that of Hera and also the fine head of the nymph Olympia. The legend is always FA for (F)*aleion* and the long obsolete digamma survived to the end of the coinage in the middle of the 1st century B.C. The types and the additional legend *Olympikon* occasionally found show a close connection with the Olympic games which the Eleians claimed to control. There is an interesting numismatic record at Pisa of the successful effort on the occasion of the 104th Olympiad by the Pisatans to regain their ancient right of controlling the games which they had lost when the Eleians destroyed their city in 572 B.C.

**Italy and Sicily.**—It is in the west in Italy and Sicily that work of the finest period is seen in greatest profusion. In Italy, Tarentum, the capital of Calabria, continued its type of Taras on a dolphin on its silver. In the middle of the 5th century the agonistic type of a horseman appears and Taras is relegated to the reverse; the celebrated Tarentine cavalry are thus commemorated down to the middle of the 4th century. About 340 Tarentum issued a series of very beautiful gold coins with a head of Persephone and, reverse, the infant Taras appealing to Zeus enthroned. These gold coins, like sudden issues of gold elsewhere, were really a money of necessity.

In Lucania, Heraclea, founded in the middle of the 5th century, issues fine staters with a helmeted Athena and Heracles seated, strangling, or wrestling with a lion. Metapontum interrupts the monotony of its ear of corn type with a most striking head of its founder Leucippus. Other mints of the time are Neapolis, with its types the siren Parthenope and her father, the manheaded bull Archelous; Velia, with its head of a nymph and reverse the eastern type of a lion attacking a bull; Thurium, with its unusually fine head of Athena and the powerful bull on the reverse, and Terina, remarkable for its beautiful treatment of the Victory type.

It is in Sicily, particularly in Syracuse, that the engraver's art reaches a perfection never attained elsewhere before or since; from the middle of the 5th to the middle of the 4th century every coin is the work of an artist. In the 5th century Syracuse began to dominate the politics of Sicily as Athens was doing in the Aegean, and her artists spread the influence of her coin-types everywhere. The coins of Syracuse showed many varieties of the heads of Arethusa and Persephone and the chariot of the reverse was found capable of very varied treatment. After the middle of the 5th century her artists began to sign their work and we

can thus prove, what is frequently obvious, that other towns borrowed engravers from Syracuse. The Syracusan coinage is mainly silver. During the siege by the Athenians, beautiful little gold coins were struck with reverse Hercules strangling a lion (Pl. I.-22). With the prosperity following the enemy's defeat, Syracusan art reaches its zenith. As the *Demareteion* commemorates the defeat of the Carthaginians so the great series of decadrachms perpetuates the victory of 412. The agonistic types and word *athla* on some of them show that they were distributed at the games held to celebrate the victory; their types were widely copied and their engravers Kimon and Euainetos—otherwise quite unknown—have gained a place among the world's greatest artists. In the 4th century the coinage becomes somewhat stereotyped and has no longer any originality. We may note the issues of electrum by Dion in 357–353 and of gold by Timoleon who introduced the Pegasus type from Corinth on his coinage.

Among other cities of Sicily we may note the fine series of Agrigentum of the 5th century with its beautiful double eagle type and the Camarina type of the river god Hipparis and the nymph Camarina on a swan; Himera before its destruction in 408 issued some very interesting types such as the nymph Himera sacrificing while Silenus beside her bathes at the thermal spring for which Himera was noted,—or Pelops in his chariot, referring to a victory of a Himeran at the Olympic games which Pelops is said to have founded. Segesta, Eryx and other cities already Carthaginian, use Greek types and artists but have Punic legends. The nymph Segesta and the river god Crimissos are the best types of Segesta while Selinus abandons its parsley leaf and issues a number of very remarkable types, notably that of Apollo and Artemis in their quadriga with reverse the god Silenus sacrificing at an altar, a type which refers to the cessation of the plague as a result of appeals to Apollo as healer. In conclusion we may mention the wonderfully realistic Silenus with his wine-cup at Naxos.

**Period III. c. 336–c. 100 B.C.**—Alexander's conquest considerably extended the sphere of Greek influence and in this period there is a further extension of coinage. Egypt, hitherto coinless, now produces the richest series of the Hellenistic period. Bactria and Parthia too strike Greek coins. Spain and Mauretania begin to issue coins; in the north the Gauls, Britons and Germans begin early in the 2nd century to imitate Greek coins and soon learn to strike more independent issues. The influence of Alexander's coins (Pl. I.-13, 17) is decisive in the coinages of his successors in their different kingdoms. Only a few free towns strike their own silver and even they tend to use Alexandrian types. The period produced a number of coins of alliances like the Achaean and Thessalian Leagues. In the west the gradual advance of Rome is reflected in the coinages; local silver ceases earlier in Italy and Sicily than in Greece and Asia.

The accession of Alexander the Great in 336 inaugurates a new epoch in coin-types. The main feature of the period from his accession to the conquest of Greece by Rome is the final establishment of the portrait coin as the regular type of a currency and the great preponderance of regal issues.

The portrait of a living monarch took nearly a century to establish itself on a coin. Philip II. and Alexander the Great issued vast coinages throughout the ancient world but were content to put their name alone on the coin—latterly Alexander added the title *Basileus*. After his death his deified portrait appeared on the coins of Lysimachus in Thrace and on the early coins of Ptolemy I. in Egypt. It is not till 306 that we have a portrait of a living king on his coins when Ptolemy I. appears, still as god with the aegis of Zeus. Seleucus I. similarly puts himself on his coins as Dionysos; in time the divine attribute is dropped and the ruler appears as a mortal wearing only the royal diadem. In Macedon Arrhidaeus, Cassander and Antigonos still follow the types of Alexander and the early coins of Demetrius Poliorcetes (306–283) are without a portrait. Soon however his own portrait appears, still with the horns that deify him. His successors only have types of deities. Pyrrhus does not appear on any of his extensive coinages but the last two kings of Macedon, Perseus and Philip V. have left very fine portraits. The kings of Pontus notably Mithridates VI. have a magnificent series of portraits. The kings of Pergamon use the same portrait throughout, that of the founder of the dynasty, Philetairos I., and the Ptolemies in Egypt throughout their long series use only the head and legend of Ptolemy I. (Pl. I.-20), except on certain special issues (Pl. I.-21). Among the early Seleucids Antiochus I. was reluctant to drop the portrait of Seleucus I., but the portrait of the reigning monarch becomes the rule in this series (Pl. I.-18); farther east we have the long series of portraits of the Arsacids and the unparalleled series of Bactrian and Indian kings (Pl. V.-1). The smaller series of Persis give some portraits, but they rapidly become stereotyped as do the coins of Elymais and Oman. The Jews (Pl. II.-4) with that strict interpretation of the second commandment as is later the case among the Arabs have no portraits, but the Nabathaean kings have.

The reverse types also show the influence of Alexander; seated deities become common and go back to the Zeus on the tetradrachms of Alexander (Pl. I.-17), or standing deities which go back to the Nike on his gold (Pl. I.-13). The Seleucids have commonly a seated Zeus or Apollo. The Parthian series is unusual—the reverse shows the king seated, (perhaps) Arsakes I. the founder of the dynasty, treated with the respect due to a deity. The king's name remains on the reverse in keeping with its development as the successor to a town name and does not yet appear alongside of the portrait. The ancient world did not know the custom of numbering kings of the same name; they are as a rule sufficiently distinguished by their epithets.

After the vast issues of gold by Philip II., Alexander and Lysimachus, gold is but rarely struck, except in Egypt. Silver is the general metal of coinage and the Attic standard, which Alexander had adopted for his tetradrachms, became the monetary standard of the world, except in Egypt; there is a great increase in the bronze coinage, the local issue of which does not seem to have been seriously restricted by sovereigns and suzerains.

As the greater part of the Greek world was now ruled by the Diadochi, their various coinages naturally formed the main currencies of commerce. A number of civic and other coinages still survived however. Third century Athenian coinages are scarce except in bronze; occasionally as in 296 the issue of gold shows the straits to which the once wealthy city was come. In 229 when Macedon lost its supremacy over Athens and friendly relations were established with Rome a new era begins with the abundant issue of tetradrachms of the "new style" (Pl. I.-19) which went on for two centuries. The Athena of these coins is not the old one but a copy of the head of the Parthenos of Phidias and the owl on the reverse is now perched on a Panathenaic amphora. The AΘE still remains but a number of new legends and symbols are added to the reverse chronicling a long series of magistrates. Much light is thrown on the organisation of the Greek civic mints from these names and symbols. The other great coin-issuing city, Corinth, went on striking its stater till 229 when by its surrender to Doson the long series came to an end.

**Rise of Rome.**—The Roman conquest of Greece is reflected in the coinages. When the Romans overthrew Philip V. in 197 or Perseus in 168 they professed to be restoring the liberties of the Greeks and it is clear from the resumed activity of the mints that the Greek cities were autonomous in one respect at least. After the defeat of Philip V. the Thessalians formed a confederation with silver coins of the type of Zeus and Athena and the legend *Thessalōn;* a similar coinage was issued by the Boeotians. With the final overthrow of Macedon at Pydra in 168 begins the extensive issue of tetradrachms of Maronea and Thasos which became a great commercial currency for trade with the Barbarians across the Danube who continued to imitate them. Macedon itself as a Roman province issued tetradrachms bearing the names of Roman governors. In Asia after the defeat of Antiochus III. at Magnesia we have an outburst of tetradrachms of Attic weight and local types at towns like Lampsacus, Smyrna (Pl. II.-1), Magnesia and many others. Other cities similarly resumed the issue of Alexander tetradrachms, adding a small symbol to mark the town of issue—Miletus, Samos, Rhodes and many other Asiatic cities. These Alexander types continued down

to the middle of the 2nd century when the Roman province of Asia was set up and the *cistophori* replaced them. The first *cistophori,* so called from the Dionysiac chest which formed the principal type, were first struck at Ephesus at the end of the 3rd century; the reverse is a bow in quiver between two serpents (Pl. II.-3). The Pergamene kings popularised them and the Romans thus found it easy to substitute them for the Alexandrine tetradrachms with their undesirable associations. *Cistophori* were now struck in many Asiatic mints and bear the monogram of the town of issue. The last stage in the Roman conquest of the east was the defeat of Mithridates and those towns that had assisted him had their coins replaced by *cistophori* with the exception of Athens which obtained favoured treatment. The fact that Rhodes resisted Mithridates and assisted Sulla enabled its autonomous silver coinage to survive down to the Civil War:—it was the last autonomous coinage of Greece.

In the west the rise of Rome in the 3rd century introduced a new factor into the history of Greek coinage. The first coinage to disappear was the Etrurian after a life of two centuries. Rome's early intercourse with the Greek cities of Italy is reflected in the Romano-Campanian coinage. In the south the Italian campaign of Pyrrhus left its mark on various coinages, notably at Tarentum which also has some exceptional numismatic records of Hannibal's occupation. The towns of Magna Graecia gradually lost their silver coinage under Roman influence although their bronze lasted till the 1st century.

In Sicily in the 3rd century Syracuse began to dominate the whole island in coinage as well as politically; the types are mainly imitations of those of the 5th and 4th centuries; the coins of the other towns have little claim to originality. The Punic Wars brought the Romans to Sicily where the Carthaginians had been established since the end of the 5th century and had struck coins of Syracusan and other Sicilian types with Punic legends and later with their own types. When Syracuse fell to Rome in 210, Sicily became a Roman province; henceforth only bronze was struck in it; these local coins continued into the first century, when the last trace of Greek coinage in the west disappears.

**Period IV. c. 100 B.C.–A.D. 268.**—Under the Romans many Greek cities and districts continued to issue their own bronze coins but the geographical area over which this was done became considerably restricted under the empire. In the west—Italy, Gaul, Spain and North Africa—the right of coinage was abolished quite early in the empire, the latest local issue of these regions being a coin of Babba in Mauretania of the reign of Galba. In the east, particularly in Asia, these local bronze coinages went on down to the time of Gallienus in 268, when the complete depreciation of the Imperial silver coinage, now bronze washed with silver, made the issue of bronze for small change pointless. The language of the inscriptions is Latin in the west and Greek in the east—with a few exceptions in the latter case. The Imperial gold (solidus) and silver (denarius) became the main currencies throughout the Roman empire.

Before dealing in general with the bronze of the Greek cities, we may note one or two local subsidiary silver coinages issued by the Roman emperors in continuation of important pre-conquest coinages. The largest series of these was the Egyptian or Alexandrian series which runs from Augustus to Diocletian. In addition to bronze, this series at first included tetradrachms of billon of gradually decreasing fineness, which continued the tetradachms of the Ptolemies; later it is of bronze only. The legends are always in Greek; the coins bear the emperor's head on the obverse and the reverse types are at first usual Roman types but after the end of the first century begin to include native Egyptian types in increasing numbers, often of peculiar interest. The reverses are dated in regnal years in Greek numerals. From the reign of Claudius II. there is only one denomination, a small thick bronze piece originally coated with silver, which is probably still the commonest of all ancient coins. The earlier bronze which occasionally, although not generally, rival the work of the Roman mint have in the 2nd century a characteristic bevelled edge.

In Syria silver tetradrachms continued to be struck, mainly at Antioch but also at Tyre and a few other mints. These gradually became baser in the course of the early third century. Copper was also struck by the Romans at these mints and frequently bears the letters S C showing that this issue, as in Rome, was the prerogative of the Senate. Of several other local silver coinages the large series of drachms struck at Caesarea in Cappadocia from Tiberius to Commodus is the most important. The usual type is a local one of Mount Argaeus but common denarii reverses are also found.

A number of vassal states and protectorates continued to issue their own coinages in the precious metals until they became Roman provinces. The only gold coinage of this kind is that of the kings of the Bosporus who struck coins from the time of Augustus to the beginning of the 4th century with the Roman Emperor's head on one side and the local dynast's on the other. This coinage becomes gradually debased, passing from gold to electrum then to silver and billon and ultimately to copper in the 3rd century A.D. At the other end of the world, the kings of Mauretania continued to strike their own gold and silver until it became a Roman province in A.D. 40.

**Bronze Coinage.**—We now come to the regular series of Imperial Greek bronze coins which close the thousand years of Greece's numismatic history. They have no claim to artistic merit and are of local workmanship; therein they form a contrast to the regular Roman coins of the time which frequently attain a very high level. If they are devoid of artistic interest they have a very high historical and archaeological value.

The right of coinage is sometimes continuous and sometimes intermittently permitted by the Emperor or governor. Sometimes the right is held alternately by pairs of towns as in Moesia by Marcianopolis and Nicopolis. Coins are struck not only by single towns but jointly by alliances of towns (*homonoia*).

The general type is everywhere the same; obverse a bust and reverse a type of local interest. Under the Republic the Greek cities usually placed on the obverses of their coins an allegorical bust,—that of some local hero or of the "people" the "Senate" or the local city-goddess. The People (*Demos*) in Asia Minor is usually personified as a young male bust; the municipal council (*Boule*) and the Senate (*Sunkletos*) appear as young veiled females. The Tyche of the city appears as a female bust wearing a mural crown. The goddess Roma is found as a helmeted female, *e.g.,* at Smyrna. Pergamon and other towns of Asia Minor have Poseidon. Athena, Apollo and other well-known divinities are also found on the obverses.

Under the empire the usual obverse type is the head of the Emperor as on the regular Roman series. There are some notable exceptions. Macedonia for example had the head of Alexander the Great. Athens was privileged by Hadrian to use the head of Athena in place of the Emperor's. These are exceptions; the usual type is the bust of the Emperor and the obverse legend gives his name and titles in Greek, usually transcriptions or translations of his Latin titles, with occasionally some local allusion. The reverse type is reserved for the town of issue and the date when given is in a local era. The name of the town is in the genitive plural of the ethnic, very frequently with the addition of some proud epithet, of more or less significance. These epithets are of various kinds; many refer to the emperor either to flatter him or in memory of some benefit received. Some recall the origin of the inhabitants; Blaundus in Lydia, for example, calls itself Macedonian because it was originally a colony of Macedonian soldiers. Very favourite adjectives are "autonomous" and "free" but the most highly prized is that of *Neokoros,* which in Imperial times signified that the town had built a temple in honour of the Emperor. Ephesus for example proclaims in the reign of Caracalla that it had built 3 imperial temples. Capitals of provinces call themselves *Metropolis;* the title "first city" of the province is also highly prized and occasionally disputed, as we see from the coin-legends of Nicomedia and Nicaea in Bithynia or of Smyrna and Ephesus in the province of Asia. Towns in Phoenicia and Syria which had a temple with the right of asylum call themselves *ἱερὰ καὶ ἄσυλος*; a number of maritime towns bear the title *ναυαρχίς* officially granted them by the emperor in recognition

BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

## ANCIENT GREEK COINS

1. Electrum stater of Lydia. 2. Electrum stater of Ephesus. 3. Gold stater of Croesus. 4. Daric of Persia. 5. Alliance of Siris and Pyxus. 6. Knossos with Minotaur and Labyrinth. 7. Stater of Thasos. 8. Tetradrachm of Athens. 9. Stater of Corinth. 10. Gold stater of Lampsacus. 11. Stater of Aegina. 12. Stater of Philip II. 13. Stater of Alexander the Great. 14. Decadrachm of Syracuse. 15. Stater of Rhodes. 16. Stater of Lysimachus. 17. Tetradrachm of Alexander the Great. 18. Tetradrachm of Antiochus Hierax. 19. Late tetradrachm of Athens. 20. Tetradrachm of Ptolemy I. 21. Tetradrachm of Cleopatra. 22. Gold 100 litrae of Syracuse

# NUMISMATICS

BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

## ANCIENT GREEK AND ROMAN COINS

1. Tetradrachm of Smyrna. 2. "Noe" coin of Apameia. 3. Cistophorus. 4. Jewish shekel. 5–9. Roman Republican. 10. Denarius of Caesar and Antony. 11. Denarius of Brutus and Casca. 12–13. Aureus and denarius of Augustus. 14. Sestertius of Nero. 15. Sestertius of Vespasian. 16. Aureus of Hadrian. 17. Aureus of Carausius. 18. Antoninianus of Diocletian. 19. Solidus of Constantine I. 20. Solidus of Theodosius. 21. Solidus of Justinian. 22. Solidus of Justinian II.

of their naval importance. Damascus calls itself "illustrious," Syedra "brilliant," Nicaea "greatest and best" and there are many such empty titles.

Besides the ethnic these coins very often bear the names of magistrates and other officials; in the early years of the empire these include a few governors and other officials sent from Rome, some of whom even have their portraits on their coins, like the younger Cicero at Magnesia. But throughout the series the names and titles of local magistrates are vastly more common. These throw a good deal of light on local life and administration.

It is the reverse types of this series of coins that give them their importance. The coins of Athens preserve representations of many statues famous in antiquity which have long since perished such as the Athena Parthenos of Phidias, the great Athena Promachos on the Acropolis visible far out at sea, or the Dionysos of Alcamenes. A coin of Elis preserves for us the Olympian Zeus of Phidias and Lacedaemon the Apollo of Amyclees. Local cults are everywhere illustrated and incidents in the lives of all the divinities of Greek mythology are common types. Not only do we have gods and goddesses but also all kinds of local deities like river gods and nymphs. Local celebrities are also recorded; thus we have Homer at several of the various towns that claimed him as a native notably Smyrna, Anacreon at Teos, Sappho at Eresos in Lesbos, Herodotus at Halicarnassus, Alcaeus at Mytilene which records on its coins a whole series of its famous men, the majority of whom are not otherwise known. Not only are famous Greeks commemorated; the travels of Hadrian in the provinces led to the issue of many specially fine coins, some of which bear the portrait of his favourite Antinous.

Agonistic types are very numerous on account of the great part played by games and festivals in the life of the time. Their celebration is frequently recorded on coins; sometimes we learn that the town was not able to bear the expense and that officials or private individuals were ready to bear the expense in return for the honour of presiding and this is duly chronicled. In addition to the four great Hellenic Games we find many of more recent origin instituted in honour of the Emperor, like the Actian games in honour of the victory of Augustus at Actium, celebrated at Tyre and other towns, the Philadelphian in honour of Caracalla and Geta at Nicaea, etc., or in honour of local deities like the Panathenaic at Athens, or the Heraclean at Perinthus commemorated by a series giving the labours of Hercules. When two or more cities combined to have a joint festival, this is commemorated by a joint issue of coins. In conclusion we may mention a notable example of the preservation of a local tradition on a Greek imperial coin. On a coin of Septimius at Apameia in Phrygia we have as reverse type a man and woman in a chest or ark floating on water with a raven on the top and a dove flying above with a branch in her beak; to remove any doubt as to what scene is represented the ark is labelled ΝΩε and the coin is evidence of the local tradition that the ark rested on the mountain behind Apameia (Pl. II.-2).

## ROMAN COINS

It was comparatively late in her history that Rome emerged from obscurity and became a great city. The adoption of a coinage was one of the most significant signs of the change. In very early times Rome had reckoned values in oxen and sheep, hence the word *pecunia* (money), from the same root as *pecus* (head of cattle). Later she began to use bronze as a means of payment,—but as yet only in rough, unstamped lumps (*Aes rude*), not as coins. The later tradition represents her as ridiculously poor in the precious metals, and the little that we know confirms it.

The exact date at which Rome passed on to the use of metallic currency is subject to some doubt. It is certainly not earlier than 338 B.C. (the date proposed by E. J. Haeberlin), and a strong case can be made for a date rather later. The Roman authors, who attributed the innovation to the king Servius Tullius, had no real knowledge of the facts. The first pieces issued were heavy cast coins of bronze (*Aes Grave*) representing the As, the unit, a pound of bronze and its subdivisions—semis, ($\frac{1}{2}$), triens ($\frac{1}{3}$), quadrans ($\frac{1}{4}$), sextans ($\frac{1}{6}$), uncia ($\frac{1}{12}$)—a cumbrous coinage that needed wagons to transport it. It seems to be a clumsy attempt to apply the Greek institution of coinage to the bronze system of Italy. But very soon afterwards silver also was issued in the Roman name; its superior convenience was soon felt and, after the First Punic War at latest, it ranked as the chief metal in the Roman market.

The earliest Roman silver coins were didrachms struck on a standard familiar in Campania and issued in part at least in that district. They are coins of a normal Greek pattern and with the small token bronze that accompanies them, were clearly meant to circulate in districts accustomed to Greek coins—that is to say in Campania and its neighbourhood, Lucania and Bruttium and to some extent Samnium and Apulia. The coinage, whether we regard it as primarily military or commercial, certainly arose in the course of the great wars, which ended in making Rome supreme in Italy by about 270 B.C. It represents one result of the closer contact of Rome with the Greek south.

The *Aes Grave,* to a large extent, runs in series parallel to the silver, but can hardly have circulated in the same districts. It is simplest to regard it as the counterpart of the silver coinage, issued for Rome and her Italian allies, in North Italy, Latium, the Sabine country and, to some extent, Samnium and Apulia. As Haeberlin has demonstrated, Rome's first system of coinage is a dual one: it is only unified, when the more cumbrous Italic system yields to the Greek. Our knowledge of details is as yet very imperfect. There are variations in the weight of the *As* or pound, which do not answer to any obvious explanation; there is a reduction in the weight of the didrachm, which may or may not be due to inflation in the Pyrrhic War. We do not know how the didrachm and the As were related. Fortunately, the historical meaning of the coinage is clear. Rome began to open her doors to Greek ways and she was soon followed by her colonies in the South—Cales, Suessa, Teanum, which struck didrachms like hers—and by other colonies, in districts less Greek, which cast *Aes Grave*—Hatria in Picenum, for example, and Luceria in Apulia, or by independent cities such as Iguvium and Tuder in Umbria.

It was under the strain of the Punic Wars that Roman Republican coinage assumed the form in which we know it best. The denarius, traditionally assigned to 269–268 B.C., replaced the didrachm as the main Roman silver piece; it was equal in value to 10 asses, while its half, the quinarius, equalled 5, its fourth, the sestertius $2\frac{1}{2}$. The As, originally a pound in weight, was reduced to about 5 oz.; then by slow descent to little more than 3 oz., again to 2 oz. and finally to 1 oz. Gold was issued on two separate occasions, as an emergency coinage—once in 217 B.C., once perhaps earlier. One fact, which has been obscured by modern writers, is the issue of *Aes Grave,* with the reverse type, in great masses during the First Punic War; Rome was short of silver and fell back upon her native Italian bronze and the strain of the war led to inflation, expressed in the reduction of the weight of the bronze unit, the As.

By the end of the Second Punic War Roman coinage had assumed its lasting form. The denarius was without question the master coin. Second to it in importance came a second silver piece, three-fourths of it in weight, the "Victoriate" or "Victory coin," struck for foreign trade in the Western Mediterranean, South Italy and the Adriatic. It may only have been introduced just before or during, the Second Punic War. The As, now reduced to one ounce, was a tenth of the denarius in value. Pliny has recorded a change of tariff to sixteen to the denarius in the Second Punic War, while admitting that the value of ten to one still held in the pay of the soldiers. As the coins themselves only show the new value much later, we are uncertain how far Pliny can be trusted. There was no gold coinage except in case of emergency.

The political supremacy of Rome in Italy afterward found expression in the supersession of all other Italian coinages, except a few of token copper in the South, by the Romans. This change did not take place very early or all at once—and favoured allies, such as Naples or Velia, probably coined in their own name longer than the Latin allies, with their closer bond with Rome: it was

probably hardly complete before the end of the Second Punic War.

In the great period of expansion after 200 B.C., denarius and victoriate went out to conquer the markets of the world. In the West progress was rapid, but the East, with its abundance of coinage, offered a successful resistance. Rome in her Eastern wars learned to use Eastern currencies, gold staters of Macedon and silver tetradrachms of Athens or Asia, and brought them into her own service: it was thus that she could dispense with any gold coinage and be content with a silver piece of less value than a shilling. About 135–130 B.C. the value of the denarius was raised to 16 asses, in place of 10, and, after a period in which the two values conflicted, that of 16 won the day (*c.* 100 B.C.). The great Social War of 91–89 B.C., when the Italian allies almost overthrew Rome in their eagerness to share her citizenship, led to confusion and inflation. The policy of the Gracchi, with its demands for land settlement and foreign colonies, had necessitated great issues of money, and, as early as 122 B.C. the senate had begun to inflate, by issuing base, plated denarii among the good ones. This policy was now vastly extended: the silver became so mixed and impure, that no one could tell what he really possessed. To add to the confusion the As was reduced from 1 oz. to ½ oz.; and, finally, in 87 B.C., the state declared itself bankrupt by ordering that all debts should be cleared at five shillings in the pound (*quadrans* for *As*). A praetor, M. Marius Gratidianus, attempted to find a remedy by sorting out the good denarii from the bad: at the same time, a new coinage of pure silver (theoretically pure, at least) was issued. Sulla, however, on his return and triumph, butchered M. Marius and annulled his policy, insisting that the money of the state must be accepted at its issue value: but, in future, the senate used its powers with strict moderation. The bronze coinage was allowed to sink into the background. The only further development of the Republic was the introduction of a permanent gold coinage by Julius Caesar, after previous experiments by Sulla.

The control of the coinage was in the hands of the senate, acting for the sovereign people; major changes had to be sanctioned by the passing of special laws. The responsibility for the striking of coins was normally entrusted to a special commission of three, "tresviri aere argento auro flando feriundo," but also, if less commonly, to other officials, such as quaestors or curule aediles. Roman coins were issued not only at Rome, but also at other mints in Italy and, later, in the provinces. But it is probable that these outside coinages were not at first administered in any way differently from the home and that issues outside Italy occur but rarely until the time of Sulla. In the period after Sulla these provincial issues became more and more important and less and less dependent on the senate. The generals abroad assumed the right to issue money to their troops in their own name and the senate raised no objection. In the end this military coinage of the provinces gave birth to the imperial coinage.

Roman coinage was historical in a sense in which modern coinage is not, but it is only late in the Republic that this element becomes strong. Rome began by placing on the obverse of her denarius the helmeted head of Roma, the protectress of the city and on the reverse, the Heavenly Twins, Castor and Pollux, who "fought so well for Rome" at the battle of Lake Regillus in 494 B.C. These types, with their somewhat general reference to Rome's divine protectors, remained in vogue for more than a hundred years. Variety first began in the reverse types, when figures of deities driving chariots began to replace the Dioscuri—Diana or Victory driving a biga or Jupiter or Apollo driving a quadriga. From about the time of the Gracchi an even greater freedom begins to prevail, and, extends to the obverse as well. In the succeeding period the types vary from issue to issue, with rare and passing revivals of traditional types. The choice is dictated by two considerations (1) the family pride of the moneyer, who selected incidents of interest from his family history (2) a natural interest in current politics, which leads the moneyer to select such types as can be brought into relation with current events.

A few examples will illustrate these tendencies. Sex. Pompeius Fostlus strikes a reverse, showing his ancestor Faustulus, the shepherd, finding the twins, Romulus and Remus, with the she-wolf; he probably strikes in the days of Tiberius Gracchus, when the thought of Roma Renascens, the "re-birth of Rome" was in men's minds—hence an appropriateness in the reference to her origins.

A group of moneyers of the year 118 B.C. issuing coins for the new colony of Narbo in Gaul, put on their reverses a Gallic warrior, probably Bituitus, king of the Arverni, in his war-chariot: in this case the public interest in Gaul has displaced any personal references. L. Tiburius Sabinus, striking *c.* 87 B.C., refers to the legendary Sabine king, Talicus, and to the rape of the Sabine women: the parallel between Rome's troubles with her neighbours in the past and in the present was obvious to all. Sulla, in the East, struck gold coins, with obverse types of Venus, whose favourite he claimed to be: later, in Rome itself, he commemorates his own triumph. Pompey the Great, perhaps in 61 B.C., struck a similar coin in honour of his Eastern victories, with a glance too at Africa, where his career of triumph had begun. The twenty years from 70 to 50 B.C. yield a host of references to history. M. Lepidus, probably the man who was afterwards triumvir with Octavian and Antony, has a gallery of family types, celebrating an earlier Lepidus, who at the age of 15 killed an enemy and saved a fellow-countryman in battle; the Marius Lepidus, who was sent to Alexandria to be tutor to King Ptolemy V. of Egypt in 200; the vestal virgin Aemilia, for whom Vesta miraculously rekindled the sacred fire; the Lepidus who restored the Basilica Aemilia and hung it with shields in 78 B.C. A. P. Hypsicus goes back still further to Neptune and his daughter, Leucronoe, the origin of his line.

With the outbreak of the great Civil War, the personal element burst out into full prominence. The coinage of Julius Caesar from the first bears the stamp of his personality and in the last year of his life the senate authorized him to place his portrait on the coins. Hitherto, the obverse of the coins had been considered the prerogative of a god or goddess: at the most, room might be made there for a hero of early days, such as Scipio Africanus. Caesar's own generation had begun to engrave the portraits of its fathers and now, at last, the portrait of the living man appears. Rome had come back to the monarchy, by whatever name she might call it. From this point to the end of the Republic, we have no true Republican coinage but only the preparations for the Imperial. Even the murderers of the tyrant Caesar in their last struggle for the Republic in the East, placed their own portraits on their coins. Brutus, on one famous reverse, set the daggers that had stabbed Caesar, with the comment EID. MAR. (the fatal Ides of March). Antony strikes in the East associating with himself first his wife in Rome, Octavia, later his Egyptian enchantress, Cleopatra. For his army and navy before the battle of Actium, he strikes denarii with the eagle and standards and prow on the reverse. Sextus Pompey, the pirate son of Pompey the Great, celebrates his chief naval victory over Octavian by a coin showing him as "son of Neptune"—proud title of a successful admiral.

The Roman bronze coinage never outgrew its conventional types. It grew to importance in the First Punic War, when the reverse represented the prow, the sign of sea power, the obverses the great gods of the state. These types it kept throughout: the ordinary Latin word for the "tail" of a coin is "navis" (ship).

**Augustus.**—The Empire, founded by Augustus, has a dual aspect; on the one side it is a monarchy, based on the support of the troops; on the other it is simply an exalted magistracy of the Roman Republic, created with special powers to deal with special problems. The imperial coinage faithfully mirrors this duality. The Emperor, as paymaster of the soldiers, keeps in his own hands the issue of the precious metals; but he leaves to the senate, now the one representative of the Roman people, the right of issuing the token coinage of brass and copper. The mint of the senate is naturally in Rome itself. The imperial mint is early centralised in the same place, but it is important to note that Augustus began by striking his money for the troops in the provinces, continuing the practice of the generals of the late Republic. His mint was not the successor of the senatorial, but

a new creation of his own. It was probably Caligula who opened the first mint in the capital. Henceforth gold and silver was normally struck in Rome. Provincial issues occur freely in times of civil war, but hardly to any extent otherwise. It was only in the 3rd century that a number of provincial mints came into being, to meet the needs of the chief armies, Antioch in Syria among the first. The example once given soon spread. By the time of Gallienus, imperial coins were struck in Viminacium, Siscia, Lugdunum, Mediolanum—perhaps at other mints too—as well as at Rome and Antioch; and from Aurelian on, the principle of the local issue of imperial coins is dominant. The senate struck mainly in Rome—at first only for Rome and Italy. The mark S.C., "senatus consulto," attests its authority. Antioch in the East and Lugdunum in Gaul also issue coins with this mark, which we must regard as also issued under senatorial authority. After the first two Emperors this coinage was probably current over the whole Empire; but it never played any large part in the East.

The commission of "tresviri" of the mint continued to exist as late as the 3rd century; but the names of these magistrates cease to appear on the coins before the death of Augustus. They may still have played a part in the senatorial issues; the imperial coinage fell within the range of the chief imperial officer of finance, the "a rationibus," and, under him, were administered by imperial procurators. The actual striking was entrusted to a staff of imperial freedmen and slaves. From an early date the Emperor began to exercise a controlling influence over the bronze token coinage also. The two mints may after a time even have been housed in the same building; at any rate the authority of the senate came to be more and more an empty form.

The Roman Republic had only known gold as an emergency or as a foreign coinage. Augustus from the first made his standard gold piece, the "aureus," the head of his system. The denarius however continued to be struck pure and of unimpaired weight; the coinage rested on a bi-metallic basis. The aureus weighed the forty-second part of a pound, the denarius the eighty-fourth; twenty denarii went to the aureus. The token coinage consisted of the sestertius and the dupondius, struck in brass, the fourth and the eighth part of the denarius respectively. The as, the fourth of the sestertius, and the quadrans, the fourth of the as, were struck in copper. Gold and silver were both struck almost pure. Base, plated denarii were not uncommon, but were the work of forgers. Under Caligula and Claudius, however, there is reason to think that the government abandoned its sound principles and condescended to make an unlawful profit by this device itself.

**Later Imperial Changes.**—Nero reformed the coinage, reducing the weight of the aureus to the forty-fifth part, that of the denarius to the ninety-sixth part of a pound. More important still, he added ten per cent of alloy to the hitherto pure silver. The relations of the coins to one another remained unchanged. Various more or less respectable motives for this reform have been suggested; and, so far as concerns the reduction of weight, there may have been justification for this measure of inflation. It is impossible to judge the debasement of the silver so charitably. It can be nothing but a device of a spendthrift government for meeting its obligations cheaply.

The evil consequences of Nero's debasement were slow to make themselves felt; but they were nevertheless disastrous. Again and again under stress of circumstances the government resorted to the same expedient. The percentage of alloy in the silver rose to as much as forty per cent under Septimius Severus.

Caracalla took the next step. He reduced the weight of the aureus to a fiftieth part of the pound and issued a new silver coin, the "antoninianus" or double denarius at the weight of about a denarius and a half. In the following period the aureus continued to decline in weight and the denarius, after a struggle, succumbed to the less honest double piece.

A final debasement of the silver by Gallienus at the crisis of his reign, when Valerian was a Persian captive and the West cut loose under an Emperor of its own, overtaxed the patience of a long-enduring public. The Antoninianus was no longer taken at its nominal value; confusion reigned and prices rose to absurd heights.

It was Aurelian, the "restorer of the world," who stabilized the coinage. The details of his work are obscure; what is certain is that his stabilization was so unpopular that it led to a riot, on the scale of a miniature civil war in Rome. A coin like the antoninianus was struck, but its value was reduced far below par. Gold was not restored on a reliable basis and the process of inflation began again. Diocletian had no choice but to deal summarily with this problem, before he could restore a coinage that deserved confidence.

**Non-imperial Coinages.**—In the West, local coinage in South Italy, Sicily, Gaul, Spain and Africa is found commonly under Augustus and Tiberius and sporadically, down to Galba. When this local coinage ceased, the duty of supplying the whole of the West fell on the mints of Rome, sometimes assisted by branches at Lugdunum (Lyons). In the East the case was very different. Coinage had been known there for so long, that the Romans found it expedient to leave a large part of the issues to local mints. Provincial silver or billon was struck in Asia, at Caesarea in Cappadocia, at Antioch in Syria, and at Alexandria in Egypt. Small change was issued freely not only in a number of provincial issues, but also at a vast number of city mints. It may fairly be said that the right to issue such small change was freely granted to almost every urban community. Under these circumstances the part assigned to imperial coinage was a restricted one. The aureus, indeed, had hardly a rival, the denarius circulated beside the provincial silver; but the token coinage in use was almost exclusively of local make. Not till late in the 3rd century did this local coinage succumb before the debasement of the imperial silver and the opening of provincial mints for imperial coin. The provincial coinage was, in its degree, a concern of the imperial government; the local coinage, however, was in theory independent. Its types are largely taken up with local interests; and, although reference to the Emperor or senate or people of Rome, is common, it is by no means universal and expresses a compliment rather than a definite acknowledgment of sovereignty.

**Portraiture.**—We have seen how under Julius Caesar interest in the living individual found expression on the coins in the form of portraiture. This tendency was developed to an immense degree under the Empire; but, as was only natural, interest was now focussed on the Emperor himself and the members of his family. Beside them there was no room for individual distinction. The Emperor, as head of the state, enjoys the right of portraiture on the obverse—a right which extended, at first sparingly, later more freely, to living Empresses or princes or to deceased members of the line. The reverse types, too, are full of his personality and his prowess. His victories, his triumphs, his distributions to the poor of Rome, his public shows, his measures for the welfare of Italy or the provinces, his arrivals and departures, his marriages, the birth of his heirs, his provision for the succession—these and many more, find constant reference on the coins. It is significant of the growth of imperial influence over the senatorial coinages, that, after a time, such reference is found as freely on the bronze coinage as on the gold and silver.

Religion still plays a large part. But even the great gods of the state are freely brought into connection with the Emperor and his protectors or as types of his qualities; and what is true of them is even more true of the minor deities, or virtues, who were so widely worshipped by the Romans. The virtues of the Emperor provide a symbolism fit to cover the whole of the imperial administration; his valour and victorious power, his care for the corn-supply of Rome, his spirit of constitutionalism, his liberality, his justice and his mercy. The coinage has throughout a strongly propagandist character. It serves to make known the achievements and to advertise the policies of the government.

The imperial system produced its own cult, the worship of those Emperors who, after death, were adjudged worthy of the honour of consecration. The worship of the "divi," as these deified Emperors were called, bulks large on the coins. They wear the radiate crown of the Sun-god as the symbol of their divinity;

while on the reverses appears the eagle, the symbol of the soul flown heavenwards, the pyre, the temple, or types of "Aeternitas," that world beyond time, conceived of as in the starry heavens, to which the soul of the good depart.

**Diocletian.**—Diocletian refounded the Roman Empire, but in a form that Augustus would hardly have recognized. The Emperor is now a monarch of the Eastern pattern, even in his lifetime receiving something like divine worship.

The mints formed a section of the department of the chancellor of the exchequer and, under him, were administered by "rationales." The moneyers, like so many other professions of the age of Diocletian, were organized as a rigid caste, from which escape was barely possible. They were subject to severe discipline and terrible penalties for abuses: but, despite this, false coinage was immensely prevalent and flourished in the face of repression.

Diocletian in A.D. 296 completed the task which Aurelian had begun. He finally cleared away the depreciated coinages of the 3rd century and issued a new coinage, based on sound gold and silver coins. His gold piece was struck at sixty to the pound of gold, his silver at ninety-six to the pound of silver. His successors continued his policy in the main lines unchanged. Constantine substituted the *solidus,* a piece of $\frac{1}{72}$nd of the pound, for Diocletian's sixtieth; this standard found general acceptance and passed on to the famous "besant" of the Byzantine Empire. In the first thirty-five years of the 4th century silver was very sparingly struck. When its free issue was resumed, new denominations, the *miliarense* ($\frac{1}{1,000}$ of the gold pound) and *siliqua* ($\frac{1}{1,728}$ of the gold pound) soon replaced Diocletian's ninety-sixth. The silver came more and more to be struck below standard weight—that is to say, to become a subordinate token coinage. The basis of the system was the steady supply of a standard gold coin.

Whether Diocletian and his successors issued a regular coinage in bronze or copper is very doubtful. They certainly continued to issue the very base billon, which represented the last stage of the debasement of the double denarius.

Diocletian's reform must have brought some improvement on the chaos of the great anarchy of the third century. But one great evil persisted—the cost of living remained high and would not come down. Diocletian's edict of A.D. 301 fixing maximum prices, was undoubtedly only one of a series of blows aimed at a recurrent social evil.

**Influence of Christianity.**—The spirit of the coinage undergoes a change, similar to that of its form. The divine Emperor dominates the entire coinage: even the gods hardly appear except as patrons of the new dynasty—Jupiter for Diocletian, Hercules for Maximian, Mars for Galerius, Sol for Constantius I. When Christianity, surviving the great persecution, received full tolerance and increasingly marked favours from Constantine, the pagan element in the coinage declined. Little of Christianity, however, took its place. For many years types and legends of a neutral character were preferred, though Christian signs and emblems—cross, monogram of Jesus Christ, *labarum* (Christian standard) begin to appear. There was in fact an unavowed truce between old and new. After Julian—who revived pagan types on his coins—notably the Apis bull of Egypt—the Christian element becomes stronger. The Emperor appears more and more as the defender of the faith, the imperial Victory shades off into the Christian angel. But the full development of the Christian tradition in coinage was reserved for Byzantium.

The Roman coinage of the East passes on without interruption into that of Byzantium. In the West, the Empire, succumbing to the barbarians in the late 5th century, left them its coinage as part of its legacy.

## MEDIAEVAL AND LATER EUROPEAN COINS

With the fall of the Western empire, the coinage of the Byzantine empire became the great influence in European currency. The Byzantine period in coinage may be considered to begin in the reign of Anastasius. The coins are in the three metals, but the silver is rare, and was probably struck in small quantities. At first the gold and silver are fine, but, towards the close of the empire, much alloyed. The gold coin is the solidus of Constantine (Pl. II.-19), with its half and its third (semissis and tremissis). The Byzantine solidus (besant) (Pl. II.-21) throughout the middle ages was the gold coin of European trade until the introduction of Italian gold in the 13th century. The chief silver coin was the miliarision, and a smaller coin, the siliqua or keration.

In 498 Anastasius introduced a new copper coinage, bearing on the reverse, the following marks of value in place of a type: M, K, I and E, 40 nummi, 20, 10 and 5. These coins bear beneath the values the abbreviated name of the place of issue. Justinian I. added the regnal year in A.D. 538, his twelfth year; this is the first appearance of annual dating on European coinage. The money of this class shows extraordinary variations of weight, which reflect the state of the imperial finances. Under Basil I. the bronze money to all appearances was reformed, but the absence of marks of value makes the whole later history of the coinage in this metal very difficult. There was one curious change in the shape of the money. Early in the eleventh century the solidus begins to assume a cup-shaped form, and this subsequently became the shape of the whole coinage except the smaller bronze pieces. These coins are called *nummi scyphati.* The types, except when they refer simply to the sovereign, are of a religious and Christian character.

On the reverse of the oldest coins we have such types as a Victory holding a cross (other personifications all but disappear), but on those of later ones a representation of Christ or the Virgin Mary. Christ first appears on a coin of about A.D. 450, where He is represented marrying Pulcheria to Marcian. He does not appear again until the end of the 7th century, when His bust is introduced by Justinian II. From the 9th century Christ appears in various forms on the coins; about 900 we find the Virgin; a few years later saints, St. George, St. Michael, St. Theodore, etc., begin to appear. A remarkable type was introduced by Michael VIII. Palaeologus, who recovered Constantinople from the Latins in 1261, and issued coins with the Virgin standing in the midst of the walls of the city. Another notable type is the adoration of the Magi. The principal inscriptions for a long period almost invariably relate to the sovereign, and give his name and titles. The secondary inscriptions of the earlier coins indicate the town at which the piece was struck, and in the case of the larger bronze pieces, the year of the Emperor's reign is given. From about the 10th century there are generally two principal inscriptions, the one relating to the emperor and the other to the sacred figure of the reverse, in the form of a prayer. The secondary inscriptions at the same time are descriptive, and are merely abbreviations of the names or titles of the sacred personages beside the representations of whom they are placed. From the time of Alexius I. (Comnenus) the principal inscriptions practically disappear, and descriptive ones alone are given. These are nearly always abbreviations, like the secondary ones of the earlier period. The language of the inscriptions was at first Latin with a partial use of Greek; about the time of Heraclius Greek began to take its place on a rude class of coins, probably local; in the 8th century *Basileus* and *despotes* replace *Augustus;* by the 9th century Greek inscriptions occur in the regular coinage; and by the time of Alexius I. Latin has wholly disappeared. The Greek inscriptions are remarkable for their orthography, which indicates the changes of the language. In the 11th century we have a few metrical inscriptions, a practice commoner in Asia than in Europe. From the time of Justinian (6th century) onwards the profile which has been usual for centuries practically disappears from the coinage, and is replaced by a facing bust. The last Byzantine gold coin (a piece of John V., 1341–91) shows a figure of John the Baptist imitated from the Florentine coinage.

**Cognate Groups.**—Besides the regular series of the Byzantine empire, there are several groups connected with it, either because of their similarity, or because the sovereigns were of the imperial houses. These are the coinages of various barbarians, and the money of the emperors of Nicaea, of Thessalonica, and of Trebizond (Pl. V.-2, 3). The last groups consist of small silver pieces, which were prized for their purity; they were called Comnenian white-money (ἄσπρα κομνήνατα), the princes of Trebizond hav-

BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

## GREEK, ROMAN AND EARLY MEDIAEVAL COINS

1. Delphi, *c.* 480 B.C. 2. Istrus, 4th century B.C. 3. Syracuse, *c.* 410 B.C. 4. Egypt, 271–46 B.C. 5. Magnesia, *c.* 190 B.C. 6. Nero and Agrippina, A.D. 54–55. 7. Constantine Jun., 317–37. 8. Constans, 337–50. 9. Honorius, 395–423. 10. Tiberius Constantine, 578–582. 11. Offa of Britain, 757–796. 12. Coenwulf of Britain, 796–822. 13. Conrad II., 1024–39. 14. Edward the Confessor, 1042–66. 15. Thuringia (Germany), 1190–1200. 16. Frederick II., 1226–50. 17. Florin (gold) of Florence, 1252–1300. 18. Ducat (gold) of Venice, 1280–89. 19. Henry III. of England, 1257. 20, 21. Louis IX. of France, 1226. 22. Philip II. of France, 1270–85

# NUMISMATICS

BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

## MEDIAEVAL AND LATER EUROPEAN AND ASIATIC COINS

1. Byzantine cup-shaped coin of Andronicus II. (1282–1328). Byzantine. 2. Philip VI. of France (1328–50). 3. Florin (gold) of Edward III. of England (1344). 4. Noble (gold) of Edward III. 5. The Black Prince (1368). 6. John II. (The Good) of France (1350–64). 7. Visconti family of Milan (1354–85). 8. Edward IV. of England (before 1471). 9. Milan (1479–94). 10. Austria (1486). 11, 12. Henry VII. of England. 13. The Great Mogul Jahangir (1610) India. 14. Charles II. "Petition" crown made by Thomas Simon

ing sprung from the illustrious family of the Comneni.

The coinage of the other states of the West falls into well-defined periods which have been distinguished as (1) transitional period, from Roman to true mediaeval coinage, *i.e.*, from the fall of Rome (476) to the accession of Charlemagne (768); (2) true mediaeval period, during which Carolingian money was the currency of Western Europe; this covers the period from Charlemagne to the end of the Swabian house in 1286; (3) early Renaissance from the first issue of the florin at Florence in 1252 to the beginning of the classical Renaissance in the middle of the 15th century; (4) the Renaissance and (5) modern period.

**Mediaeval.**—The main feature of the mediaeval period is the disappearance of gold and rise of silver and the return of gold from the 15th century onwards. The inconvenience of gold money when it represents a very large value in the necessaries of life must have caused its abandonment and the substitution of silver by the Carlovingians. The denier (denarius) or penny of about 24 grains was at first practically the sole coin. The solidus in gold was struck but very rarely, perhaps as a kind of proof of the right of coining. The Byzantine solidus or bezant was used and probably the equivalent Arab gold. The new coinage spread from France, where it was first royal and then royal and feudal, to Germany, Italy, where the Byzantine types did not wholly disappear, England, Scandinavia, Castile and Aragon. In Germany and France feudal money was soon issued, and in Italy towns and ecclesiastical foundations largely acquired from the empire the right of coinage, which was elsewhere rare. The consequence of the extended right of coinage was a depreciation in weight, and in the middle of the 12th century the one-sided deniers called bracteates appeared in Germany, which were so thin that they could only be stamped on one side. The types of this whole second coinage are new, except when the bust of the emperor is engraved. The most usual are the cross; and the church as a temple also appears, ultimately taking the form of a Gothic building. There are also sacred figures, and more rarely busts in the later age.

The great precursor of the Renaissance was the emperor Frederick II. (1215–50). In his restoration of the gold coinage he had already been preceded by the Norman Duke of Apulia, who for the convenience of these Arab subjects and for commercial reasons also had continued the gold coinage of the Fatimids, the great currency at that time of all the western Muslims. Roger II. (1130–54) also struck Latin coins of his own as DVX APVLIAE, the first ducats. Frederick II., continuing the gold standard, also struck his own Roman gold money, solidi and half solidi, with his bust as emperor of the Romans, Caesar Augustus, and on the reverse the imperial eagle, in keeping with the obverse title. In workmanship these were the finest coins produced in the middle ages. It is not till the great Swabian that we get the final establishment of a worthy coinage, a necessity of their large commercial schemes. The famous gold florin was first issued in 1252 and at once became popular. The obverse type is the standing figure of St. John the Baptist, the reverse bears the lily of Florence. The weight was about 54 grains, but the breadth of the coin and the beauty of the work gave it dignity. The commercial greatness of Florence and the purity of the florin caused the issue of smaller coins in almost all parts of Europe. Venice was not long in striking (in 1248) a gold coin of the same weight as the florin, but with the types of a standing figure of Christ, and the doge receiving the gonfalon at the hands of St. Mark, a type suggested by Byzantium. It was first called the ducat, the name it always bears in its inscription; later it is known as the zecchino or sequin. Though not so largely imitated in type as the florin, the extreme purity of the sequin made it a world currency down to the 19th century. Genoa likewise had a great gold currency, and the other Italian states struck in this metal. Many varieties of gold money appear in course of time in France, England and to a less extent in other countries. The need for heavier silver coinage caused the issue of the large denier (grossus denarius, gros or groat). This coin appears early in the 14th century. The types from the 14th century onwards are many and distinctly worthy of the art of the time, which as yet is purely decorative and conventional, so that portraits are not possible. The religious intention also is gradually giving way to the desire to produce a beautiful result, and the symbol of the cross is varied to suit the decorative needs of the coin. Heraldic subjects also appear, and in the shield, which is frequently a reverse type, we see the origin of the usual modern reverse of the most important coins.

With the classical Renaissance we find ourselves in the presence of modern ideas. It is a period of innumerable small states and kingdoms with no uniformity of coinage yet most modern series can be traced back to it. Its most remarkable characteristic is the revival of portraiture and from the 16th century with the opening of the new world the enormous increase in output of coins in gold and silver. With the institution of the German thaler in 1518, it speedily became the chief European piece in its metal, and to its popularity is no doubt due the large silver pieces of other countries—crowns, ecus and scudos.

In the west a number of coins carry on the Roman tradition. They cover the period from the 5th to the 8th centuries, and are of considerable historical significance. The types throughout are monotonous: the bust of a Roman emperor or local ruler, a cross of some kind, a Victory, etc. The style is quite barbarous. The classification of the earliest servile imitations of Roman and Byzantine money rests only on origin and is uncertain. The following general series are distinguished: (A) The Vandals (Pl. V.-1) (Africa, 428–534) issued gold (?), silver and bronze from Hunneric (477–84) to Gelamir (530–34); the gold is anonymous. (B) The Suevians (Spain, 409–585) had little but imitations of Byzantine gold; but Richiar (448–456) issued a denarius in his own name. (C) The Ostrogoths (Italy, 489–553) were preceded by the Herulian Odoacer (476–94), who coined silver and bronze; their kings (including Theodoric, 493–526, and Totila or Badulla, 541–52) issued gold, silver and bronze in their own names, from Rome, Ravenna, Milan, etc. (D) The Lombards (Italy, 568–774) had no coins in their own names before Grimoald, duke of Beneventum (662–71); later there are gold solidi and thirds and silver from many mints. Gold was issued for the duchy of Beneventum in the 8th century. (E) The Burgundians (Gaul, to 534) first issued recognizable coins under Gondebald (473–516). (F) The Visigoths (South Gaul and Spain) had imitative gold thirds in the 5th and 6th centuries; the kings' names appear from Leovigild (573–586) to Roderic (710–11). Sixty-one mints were in operation. (G) The Meroving Franks first issued under Clovis I. (481–511) coins recognizably Frankish (solidi and thirds). Royal names first appear on silver and copper under Theoderic of Austrasia (511–34) and Childebert I. of Paris (511–58). The chief Frankish inscribed coinage is, however, of gold solidi and thirds, from Theodebert I. (534–48), who broke down the Roman imperial prerogative and issued gold with his own name in full, to the beginning of the 8th century. The last Merovingians issued no coins in their own names, being mere puppets. From the middle of the 6th century the coins with kings' names are far less numerous than those bearing the names only of mints and moneyers; some 800 places (not only in what is now France, but in Germany, the Low Countries and Switzerland) are thus named. This coinage seems to have been intimately connected with the fiscal organization, though the generally accepted theory that the taxes collected in each place were there and then converted into money is by no means proved. Certain religious establishments also possessed the right of coining in their own name. The close of the Merovingian dynasty saw a revival of silver in the *saiga,* which heralded the introduction of the denier. (H) In England the Anglo-Saxons began with an imitative coinage similar to the Merovingian, viz., gold, *solidi* and *thirds,* and silver *sceattas* of about 20 grains troy, and *stycas,* first of silver, then of copper. The gold is rare and confined to the south; only two *solidi* are known, imitations of Honorius, with Runic legends on the reverse.

**Portugal.**—The coinages of the various countries of Europe from the end of Roman coinage and its imitations can be briefly mentioned in geographical order from west to east. The money of Portugal begins, after the expulsion of the Moors, with Alphonso I. (1112); it is exclusively regal, and not of great interest except as affording indications of the wealth and commercial activity of the state in the early part of the 18th century.

The early golds are of interest as by the arrangement of their type and inscription they try to look as like Moorish coins as possible.

**Spain.**—The coinage of Spain, after the reconquest from the Moors, is almost without exception regal. The Kingdom of Navarre had a coinage from the time of Sancho III. (1000–35). The series of Castile and Leon begins with Alphonso VI. (1053) with deniers and obols. Aragon first has coins under Sancho Ramirez I. (1063). Gold (as in Portugal imitated from Moorish money) is introduced in the middle of the 12th century. A plentiful coinage was issued after the union of the crowns in 1479. The Spanish dollar of the 17th and 18th centuries was one of the most widely circulating currencies in the West.

**France.**—In France in 755 Pepin the Short abolished the gold coinage of his Merovingian predecessors and introduced the silver denier (denarius = penny); the coinage became a royal prerogative once more and confined to a few mints. The denier (Pl. V.-6), which at first weighed *c.* 1·28 gramme (19¾ grains), was for centuries the chief of European silver coins. Under Charlemagne the weight was slightly raised; the Caroline monogram appears and there are other modifications in the types. Charlemagne also issued money from various Italian, German and Spanish mints. He also introduced the obol, and struck gold (chiefly at Italian mints). Among his types must be noted the temple with the inscription XPISTIANA RELIGIO. Louis le Debonnaire (814–840) was the last Carolingian to strike gold. In the 9th century are perceptible the first traces of the movement which led to the extensive feudal coinage. The advent of the house of Capet made no great change in the system, but the feudal issues now become important. The most widespread denier was that of the abbey of St. Martin at Tours (*denier tournois*); the royal coinage was known as the *monnaie parisis*. Louis IX. (1226–70) effected a great reform late in his reign, making the sou (hitherto a money of account) into a real coin as the *gros* and introducing a gold coinage. Henceforward the coinage increases in complexity; in the 14th century it has great artistic merit, especially the gold; from the end of the 16th century it becomes conventional.

**Belgium.**—Passing on to Belgium, its coinage, which, except for the few mints operating under the Merovingians and Carolingians, does not begin until the 11th century, comprises many pieces struck by foreign rulers, and has little of an independent character in either the regal or the seignorial class. The most important coinages are those of the house of Burgundy and Charles V. and his son, and of the bishops of Liége. The coinage of Belgium approaches the French on the one side, the German on the other.

**Switzerland.**—The multitudinous coinage of Switzerland illustrates the varying fortunes of this central state, and its gradual growth and consolidation. First we have the gold money of the Frankish kings, among whose mints Basel, Lausanne, St. Maurice-en-Valais and Sitten (Sion) already appear. The silver deniers, which Charlemagne made the coinage of the empire, are issued by fewer mints; the dukes of Swabia began to strike at Zürich in the 10th century, and the empire granted during the 10th and down to the 13th century the right of coinage to various ecclesiastical foundations, bishoprics and abbeys. Bern was allowed a mint by the emperor Frederick II. in 1218, and other towns and seigneurs subsequently gained the same right. The demi-bracteate appears about the middle of the 11th century, and about 1125 is superseded by the true bracteate, which lasts until about 1300. The 14th century witnessed the rise of the Swiss confederation, and by degrees the cantons struck their own money. These, together with the coins of some few sees and abbacies, form the bulk of Swiss money of the mediaeval and modern periods. The separate cantonal coinage, interrupted by the French occupation, was finally suppressed in 1848, when a uniform currency was adopted.

**Italy.**—Italy, with Sicily, has special features. Here the barbaric coinages were mixed with the Byzantine issues which marked the recovery of the Eastern empire, and left a lasting influence in the north at Venice, and in the south at Beneventum. Later the Arab occupation of Sicily and the predominance of Arab coins left their mark in the curious Oriental coinages with Arabic inscriptions of the Normans of Sicily and of the Emperor Frederick II., mixed after his fashion with Latin coinage. The earliest money is that of the barbarian Ostrogoths and Lombards, and local Byzantine issues in Sicily. This is followed by the deniers of Charlemagne and his successors, succeeded by the gold currencies of the Normans and Frederick II. The age of the free cities is marked by the great coinages of Florence, Venice and Genoa, while the Angevin and Aragonese princes coined in the south, and the popes began to issue a regular currency of their own at Rome. The Italian princes of the next period coined in Savoy, and at Florence, Modena, Mantua and other cities, while Rome and the foreign rulers of the south continued their mintages, Venice and Genoa of the republics alone surviving.

The money of Florence, as may be observed, is disappointing in its art, for the great commercial currencies have to be conservative. The silver florin was first struck in 1189. It is heavier than the denier, weighing about 27 grains, and bears the lily of Florence and the bust of St. John the Baptist. These are thenceforward the leading types, the flower never changing, but the representation of the saint being varied. On the gold florin, first issued in 1252, the Baptist is represented standing, while in the contemporary silver florins he is seated. The latter have a rhyming legend, "Det tibi florere Christus, Florentia vere."

Venice as a mint rivals Florence in conservatism, and the early style is distinctly Byzantine; commercial reasons had to prevail in keeping coin types unchanged even in a great artistic city. The famous Venetian zechino or sequin, the rival of the florin of Florence, appears to have been first issued under Giovanni Dandolo (1284). On the obverse St. Mark gives the gonfalon to the kneeling doge, and on the reverse is a standing figure of the Saviour within an oval nimbus and a rhyming legend, "Sit tibi, Christe, datus Quem tu regis, iste ductus."

The series of the coins of Rome is rather of historical than of artistic merit. The popes begin to strike money under Adrian I. (A.D. 772–795), whose deniers are in a Byzantino-Lombard style. The coins of his successors, excepting few, down to Leo IX. (1049) associate the names of pope and emperor (Pl. V.-5). From Leo IX. to Urban V. (1362) there is no papal coinage. The Roman senate strikes from 1188 onwards. We then see on the silver the style of the senate and Roman people, and ROMA CAPUT MUNDI. Some coins have the figures of St. Paul and St. Peter, others Rome seated and a lion. Charles of Anjou, King of Sicily (1263–85), strikes as a senator, and Cola di' Rienzo (1347–48) as tribune. The gold ducat of about 1300 imitates the types of the Venetian sequin. St. Peter here gives the gonfalon to a kneeling senator. The arms of the moneying senator next appear in the field. The papal coinage is resumed at Avignon; and Urban V., on his return to Rome, takes the sole right of the mint. From Martin V. (1417) to Pius IX. there is a continuous papal coinage. The later coins, though they have an interest from their bearing on the history of art, are disappointing in style (Pl. V.-10). We have beautiful gold coins of Giovanni Bentivoglio, lord of Bologna, who employed Francia at his mint, and we know that the artist remained at his post after Julius II. had taken the city. There are also pieces of Clement VII. by Cellini, vigorous in design but careless in execution. There were papal mints at Ancona, Bologna, Piacenza, Parma, Ferrara and other Italian towns; and coins were also struck at Avignon from 1342 to 1700. When the City of the Vatican state was created in 1929 it was accorded the right of issuing its own coinage.

The coinage of Sicily, afterwards that of the Two Sicilies, or Naples and Sicily, begins with the Normans. Theirs is a curiously mixed series. It begins with Robert Guiscard as duke of Apulia (1075) and Roger I. of Sicily (1072). The gold money is almost wholly Arabic though Roger II. struck the Latin ducat, the earliest of its class; the silver is Arabic, except the great Latin scyphati of Roger II. with Roger III.; the copper is Latin (Pl. V.-4) and Arabic. The gold series (*Augustales*) of the emperor Frederick II. (1198–1250) shows the first sentiment of reviving classical art, its work far in advance of the age. These are Latin coins; he also struck small Arabic pieces in gold. Under Conrad and Manfred there is little coinage, copper only, but with Charles I. (Pl. V.-9) of Anjou (1266–85) the gold money in purely mediaeval style is beautiful, quite equal to that of his brother, St. Louis of France.

After this time there is a great issue of gigliati, silver coins with, for reverse, a cross fleurdelisée cantoned with fleur-de-lis (Pl. V.-7).

**Germany.**—The money of Germany, with which we include Austria and Hungary is, like that of Italy, far too varied for it to be possible here to do more than sketch some of its main features. In the Frankish period mints were in operation at cities in the west, such as Mainz, Strassburg, Speyer, Treves, Worms, Cologne. Pepin issued denarii from Strassburg and Mainz; under his successors denarii and obols were also coined at other mints, as Bonn, Cologne, Spires, Treves. After the reign of Louis the Child (910–11) the Carolingian system was continued until the advent of the Swabians with Conrad III. (1138–52). In the succeeding period which ends with the introduction of the grossus and the gold coinage under Louis of Bavaria (1314–47), the uniformity of the currency disappears. In the west (in Lotharingia, including the southern Low Countries, the Moselle and Rhine-lands, in Frisia, Bavaria, parts of Franconia and Swabia) the denier continues; but elsewhere we find the bracteate. The right of coinage is acquired in an increasing measure by the feudatories of the empire. With the introduction of the regular gold coinage (consisting for the most part of florins) and the grossus in the 14th century, Germany enters on the modern period. From the 16th century the thaler (so called from Joachimsthal in Bohemia, where the counts of Schlick first struck the coin in 1518) dominates the silver currency. The thalers and other large coins of the 16th and 17th centuries are often good and always vigorous in workmanship. By the convention of 1857 the thaler was recognized as the unit for Berlin and the north, the florin of 100 kreuzers for Austria, the florin of 60 kr. for the south. A uniform system, based on the gold reichsmark of 100 pfennigs, was established all over the German empire in 1876. Of particular currencies in Germany we must be content with the mention of some of the more important. Among the great rulers we note the dukes of Bavaria, who coined from Henry I. (948–55), and issued fine thalers in the 16th century. The Counts Palatine of the Rhine coined from 1294, their mints being at Heidelberg, Frankfort, etc. The Saxon coinage begins with Duke Bernard (973) and includes a large series of bracteates and thalers, the latter being especially famous. The Brunswick coinage begins in the 11th century; besides its bracteates we note the large mining-thalers of the 16th and 17th centuries (up to ten thaler-pieces). There are good bracteates and thalers of the margraves of Brandenburg; from 1701 they coin as kings of Prussia. In Austria there is a ducal coinage from the 12th century; the gold florin of Florentine character appears under Albert II. (1330–1358). The marriage-coin of Maximilian and Maria of Burgundy (a 16th-century reproduction of a medal made by the Italian, Candida in 1479) is a striking piece, and in the 16th century there is a large series of fine thalers. The thalers of Maria Theresa became popular on either side of the Red Sea, and those of the date 1780 are still recoined for trade there. In Bohemia there is a ducal coinage from the early 10th century to 1192; then came the regal bracteates. Wenceslas II. (1278–1305) struck the first German grossus at Prague. The gold florin made its appearance under John of Luxemburg (1310–47). In Hungary the regal coinage begins with St. Stephen (1000). Charles I. of Anjou (1310–42) introduced the florin and grossus. Of historical interest is the money of John Hunyadi as regent (1441–52). The abundance of gold about this time and later shows the metallic wealth of the land. The same is true of the rich gold coinage of the Transylvanian princes in the 16th and 17th centuries. Of ecclesiastical coinages the most important are at Münster, Cologne, Mainz, Treves, Augsburg, Magdeburg, Spires, Würzburg, Salzburg. The Cologne series of coins is almost continuous from the Frankish period; the archbishops first received the right from Otto I., Brune (953–65) being the first to coin; from Pilgrim (1021–36) the series, issued at various mints in the Rhineland, is very complete down to 1802. The series of Treves ranges from Theodoric I. (965–75) to Clement Wenceslas (1794). The archiepiscopal coinage of Mainz begins with Willigis (975) and lasts until 1802; its mints included Erfurt, Bingen and many other places. The Salzburg series (beginning 996) is remarkable for its fine thalers (especially of Mathias Lang, 1519–1540). The patriarchs of Aquileia, who may be mentioned here, acquired the right of coinage from Louis II. in the 9th century, but the first who can be identified on the coins is Godfrey (1184); thence onwards there is an interesting series of denarii and smaller coins down to the early 15th century. Of cities with large coinages it is sufficient to mention Aix-la-Chapelle (from the time of Frederick I. to 1795), Frankfort-on-the-Main, Hamburg (with great gold pieces of the 16th and 17th centuries, up to 10 ducats) and Nuremburg.

**Scandinavian Countries.**—The origin of the coinage of the Scandinavian states: Norway, Denmark and Sweden, is clearly English and due to the Danish conquest of England. The Runic alphabet is employed, though not by any means exclusively, on many of the early coins of Denmark and Norway. The Norwegian series begins with Hakon Jarl (989–96), who copies the pennies of Aethelred II. In the second half of the 11th century begins a coinage of small, thin pennies, which develop into bracteates. Magnus IV. (1263–80) restores the coinage, more or less imitating the English sterlings of the time. Norway and Denmark were united under Eric of Pomerania in 1396. The money of Denmark begins with pennies of Sweyn (985–1014) which are copied from the coinage of Aethelred II.; the coins of Canute the Great (1014–1035) and Hardicanute (1036–42) are mainly English in character. With Magnus (1042–47) other influences, especially Byzantine, appear, and the latter is very strong under Sweyn Aestrithson (1047–76). Bracteates come in in the second half of the 12th century. The coinage is very difficult of classification until the time of Eric of Pomerania (1396). There are important episcopal coinages at Roskilde and Lund in the 12th and 13th centuries. Sweden has very few early coins, beginning with imitations of Olaf Skötkonug (995) of English pennies and showing the usual bracteate coinage. The money was restored by Albert of Mecklenburg (1363–87). The thaler is introduced by Sten Sture the younger (1512–20). The money of Gustavus Adolphus is historically interesting. Under Charles XII. there is highly curious money of necessity. The daler is struck as a small copper coin, sometimes plated. The types include the Roman divinities. At the same time and later there was a large issue of enormous plates of copper, stamped with their full value in silver money as a countermark.

**Russia.**—The earliest Russian coinage begins with the princes of Kiev as early as the end of the 10th century; it shows strong Byzantine influence. The grand princes from the early 15th century struck curious little silver pieces. The coinage was modernized by Peter the Great, who introduced a regular gold coinage. The large silver and copper coins of his successors are very plentiful. Nicholas I. (1825–55) introduced a platinum coinage of about two-fifths the value of gold.

**Other Countries.**—The Christian coinages of the northern Balkan States are of great morphological interest. They are chiefly silver grossi, showing a mixture of Byzantine and Venetian influences. The Bulgarians had a regular silver coinage from Asien I. (1186–96) to John Sismana (1371–95). The Serbian coinage lasts from Vladislas I. (1234–40) to the middle of the 15th century. There is also a coinage of the Bans of Bosnia (late 13th to 15th century). The modern coinages of the Balkan States are of the 19th century only. The independent city of Ragusa is remarkable for the bold style of its early copper (13th century, inspired by Roman models of the 4th century) and the richness and variety of its later issues.

## BRITISH COINS

The earliest coins struck in Britain were rude uninscribed imitations of the stater of Philip II. of Macedon (359–336 B.C.), one of the great currencies of the ancient world; they reached Britain through Gaul where they had been imitated by the various tribes there (Pl. VI.-1). The exact distribution of the earliest coins of this type found in Britain between British and Gaulish mints is still uncertain. These coins are of gold of gradually diminishing purity and are at first uninscribed. Under Roman influence we have the introduction of silver and copper coins towards the end

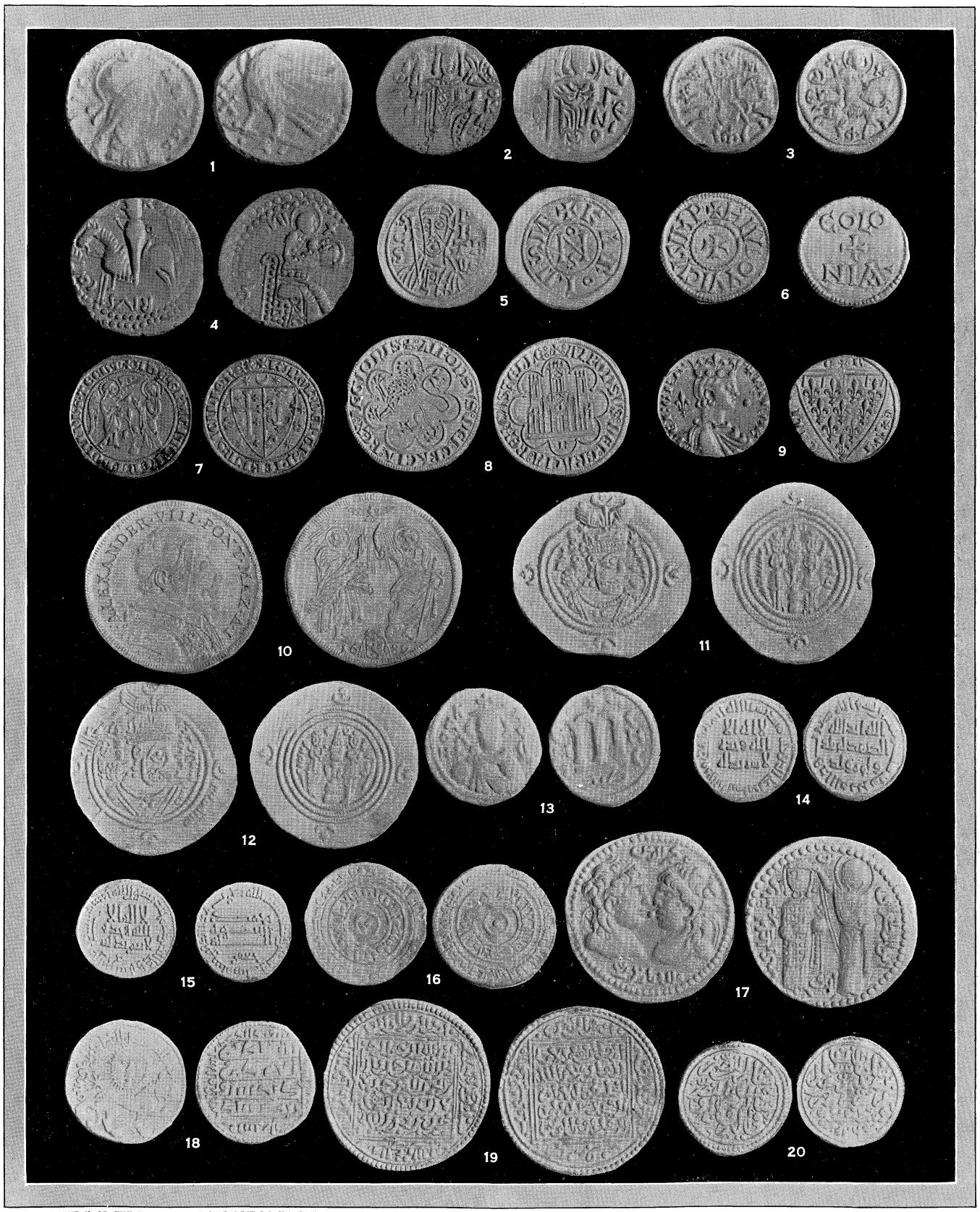
of the last century B.C.; inscriptions also now appear on the coins so that we can identify the coinage of Tincommius and Cunobelinus (Cymbeline) (Pl. VI.-2) and others known and unknown to history. With the Roman conquest native coinage disappears and if we except the Roman coins from the mint of London in the 3rd and 4th centuries A.D., we have no British coinage again till the departure of the Romans. Gradually degenerating copies of Roman types formed the currency of Britain from the 5th to the 7th century, when we are once more able to attribute the coins to definite rulers. In the 7th century we have the extensive coinage of little silver pieces known as "sceats" with a considerable variety of types and legends in Runic letters, which enable some to be attributed, for example to Peada, king of Mercia, (655–57 A.D.). About the same time in the kingdom of Northumbria we have the small copper coins known as "stycas" (Pl. VI.-3), which record a long series of kings from Ecgfrith (670–85) onwards. But it is from the reign of Offa (757–96) who introduced the silver "penny" that English coinage may be said to date. In its broad flat fabric, contrasted with the thick fabric of its predecessors, it shows the influence of its Carolingian prototype but the designs are thoroughly Anglo-Saxon and the portrait of Offa (Pl. VI.-4), a remarkable piece of work, reaches a level not equalled again in English coinage till the reign of Henry VII. The inscriptions, obverse name of the king and reverse that of the moneyer, were to remain unchanged in form till the reign of Edward I.; for the same period also the silver penny was the only English coin. A remarkable coin struck by Offa is his imitation of an Arab dinar of the Caliph al-Manṣūr with the additional legend OFFA REX, one of the few and exceptional gold coins of the Anglo-Saxon period. About the same time we find the Archbishops of Canterbury beginning to issue coins, the earliest being those of Jaenberht (766–90) bearing the names of the suzerain Offa also. The kings of Kent and the kings of East Anglia also began to strike pennies: the rise of Wessex after the battle of Ellandune in 825 can be traced in the coinage; the earliest coins of Wessex were those struck at Canterbury by Ecgberht and his conquest of Kent, and the mints of Alfred's reign (Pl. VI.-5) reveal how West Saxon power had expanded. The Danish invaders have also left extensive numismatic records, some of exceptional historical interest like the London coinage of Halfdan. The troubled state of the country is reflected in the many barbarous and hurriedly struck coins of this period. The peace and prosperity which returned after the peace of Wedmore (878) is seen in the improved workmanship of the coinage, with a more careful treatment of the portrait and a great variety of original work in the reverse types, a feature which was not long maintained. In the 10th century it became the regular practice to add the name of the mint as well as that of the moneyer on the reverse. In the edicts of the Council of Greatley (928) we have the earliest surviving mint ordinances. Coins were only to be struck at certain towns and each town was to have only one moneyer with certain specified exceptions (*e.g.*, 8 for London). The number of mints increased till in the reign of Aethelred II. we have over seventy; from about his time also the king's portrait, which had only been occasionally used, became the regular obverse type on the coinage, while the reverse type also became stereotyped to some form of cross (Pl. VI.-6).

The Norman conquest made no change in the coinage or mint system and we even find that pre-conquest moneyers stayed in office and struck coins for William I. (Pl. VI.-7). But the coin-types were now regularly changed partly as a source of revenue, for the moneyers had to make a payment when new dies were issued, partly as a check on forgery. The dies were made in London and sent to the country mints. The pennies of William II. have nothing in their legend to distinguish them from his father's issues but students have been able to allot eight types to William I. and five to his son. Forgers gave Henry I. much trouble and one step he took to prevent it was to issue his later coins with a snick in the edge to show that the silver was good. The civil wars of Stephen's reign produced many interesting coins such as those struck in Matilda's name and the pennies of Eustace Fitzjohn and other barons.

Henry II. ceased the practice of regularly changing the types which had been the custom since William I.'s reign and struck one type till 1180. In this type the work of the English mints reached its lowest level; the coins frequently have only a letter or two of the legends and fragments of the type. His second type the "short-cross," so called from its reverse design, first issued in 1180, remained unchanged—including the name Henricus—not only by Henry II. but also by Richard and John and Henry III. till 1247. In 1247 Henry III. coined the "long-cross" penny with the arms of the cross extended to the edge of the coin with a view to preventing clipping. He also reduced considerably the number of mints. In 1279 Edward I. introduced a new type of penny obv.: bust of the king and reverse: long cross with three pellets in each angle, a type which was much imitated abroad and persisted in the silver coinage till the reign of Henry VII. The moneyer's name disappeared from the reverse legend and its place was taken by the name of the mint CIVITAS LONDON, etc. He also struck halfpennies and farthings to replace the cut pennies which had hitherto done duty for small change. He also introduced a groat or fourpenny piece (Pl. VI.-9) (groat=gros=*grossus*, large *denarius*-penny) but the time was not yet ripe for this larger coin and it did not establish itself till Edward III.'s reign. The coins of Edward I., II., III. cannot be distinguished by their legends; a minute study of them has, however, enabled them to be attributed satisfactorily.

Henry III. had attempted to issue a gold coinage by striking the gold penny (Pl. VI.-8) of the value of 20 pence silver, later raised to 24, but the difficulty of rating gold to silver proved insuperable and the coinage was withdrawn. In 1344 Edward III. with the issue of his fine series, the florin, leopard, and helm ($\frac{1}{2}$ and $\frac{1}{4}$ florin) again attempted without success to introduce a gold currency: the attempt was renewed with the noble and after various experiments with its weights a gold coinage was finally established in currency in 1351 with a noble of 120 grains of gold and its subdivision the half and quarter noble. The silver penny was reduced to 18 grains and the groat first issued in the same year. The noble (Pl. IV.-4) was valued at 6s. 8d. The obverse type of the noble, the king in a ship, is supposed to allude to the naval victory of Sluys. The reverse type is a floreate cross with considerable ornamentation. Edward IV. distinguished his noble by a rose on the ship (rose-noble or ryal) and raised its value to 10s., while a new gold coin, the "angel," was introduced to replace the old value of the noble at 6s. 8d.; the penny was reduced to 12 gr.

The angel (Pl. IV.-8) is so called from its type of St. Michael and Lucifer. The reverse is a ship with a cross in front of the mast. The angel in the 16th century became the piece given to those touched for king's evil; it was struck for this purpose down to the reign of Charles I.; it was not again issued as legal tender but small copies of it were struck by the later Stuarts and pretenders for presentation at the ceremony of touching for king's evil. The next important change in the coinage was not till the reign of Henry VII. This was the introduction of the sovereign (Pl. IV.-11), a large gold coin of 240 grains current for 20s.; the obverse type was the king seated in an elaborate throne and the reverse a Tudor rose with a shield of arms in the centre. The same ruler also issued the first English shilling or testoon, a handsome coin with a fine portrait, in 1583, but this did not attain much currency. Henry VIII. altered the types of the smaller silver coins by replacing the three centuries old cross and pellets by a long cross and shield while the inscription POSUI DEUM ADJUTOREM MEUM took the place of the mint legend; the stereotyped bust was replaced by an excellent profile portrait on the groat and the seated king on the penny: Henry VIII. debased the gold and reduced the weight of the sovereign, the reverse type of which was now the royal arms supported by a lion and dragon. He introduced the gold crown of 5s. and half-crown and raised the angel to 7s. 6d., introducing the George noble to take its old value of 6s. 8d.—so called from its type of St. George and Dragon (Pl. VI.-10). In 1544 he issued the base shilling or testoon of 12 pence and debased the silver coinage. It was in his reign that the archiepiscopal mints of Canterbury, York and Dur-

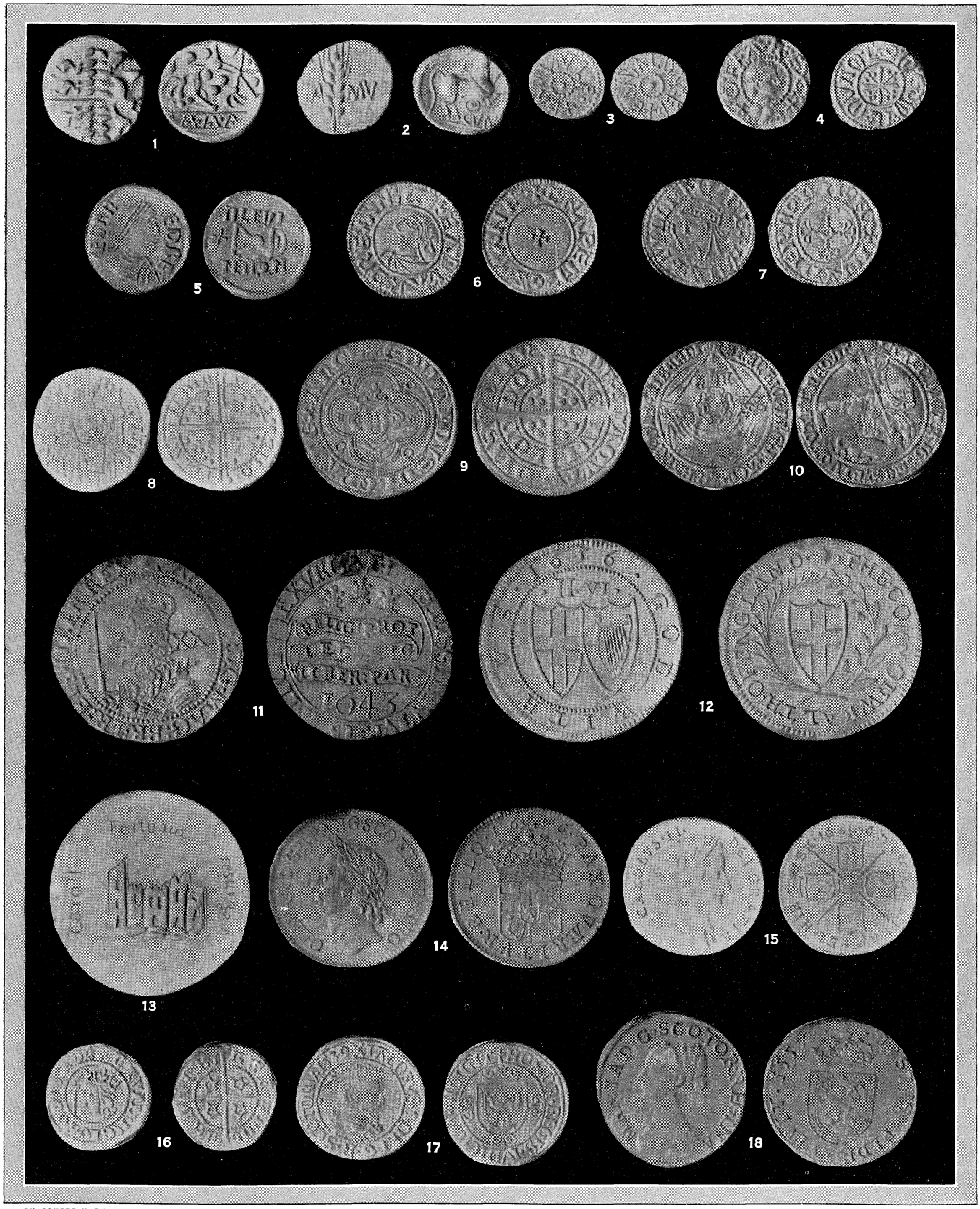



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

## MEDIAEVAL COINS

1. Vandal. 5th and 6th century, Africa. 2–3. Trebizond, Aspers. 4. Roger II. of Sicily (copper). 5. Pope John VIII. and Charlemagne. 6. Denier of Louis I. 7. Ducat of Charles II. of Sicily. 8. Ducat of Alfonso XI. of Spain. 9. Ducat of Charles I. of Sicily. 10. Scudo of Pope Alexander VIII. 11. Dirhem of Khusru II. 12–14. Early Arab. 15. Dinar of Harun al-Rashid (A.D. 786–809). 16. Dinar of the Fatimids, Arab. 17. Copper Seljuk coin with reverse of Virgin crowning a Byzantine emperor (1152–76). 18. Silver Seljuk coin of the Lion and Sun type (1236–45). 19. Moroccan dinar. 20. Turkish sequin

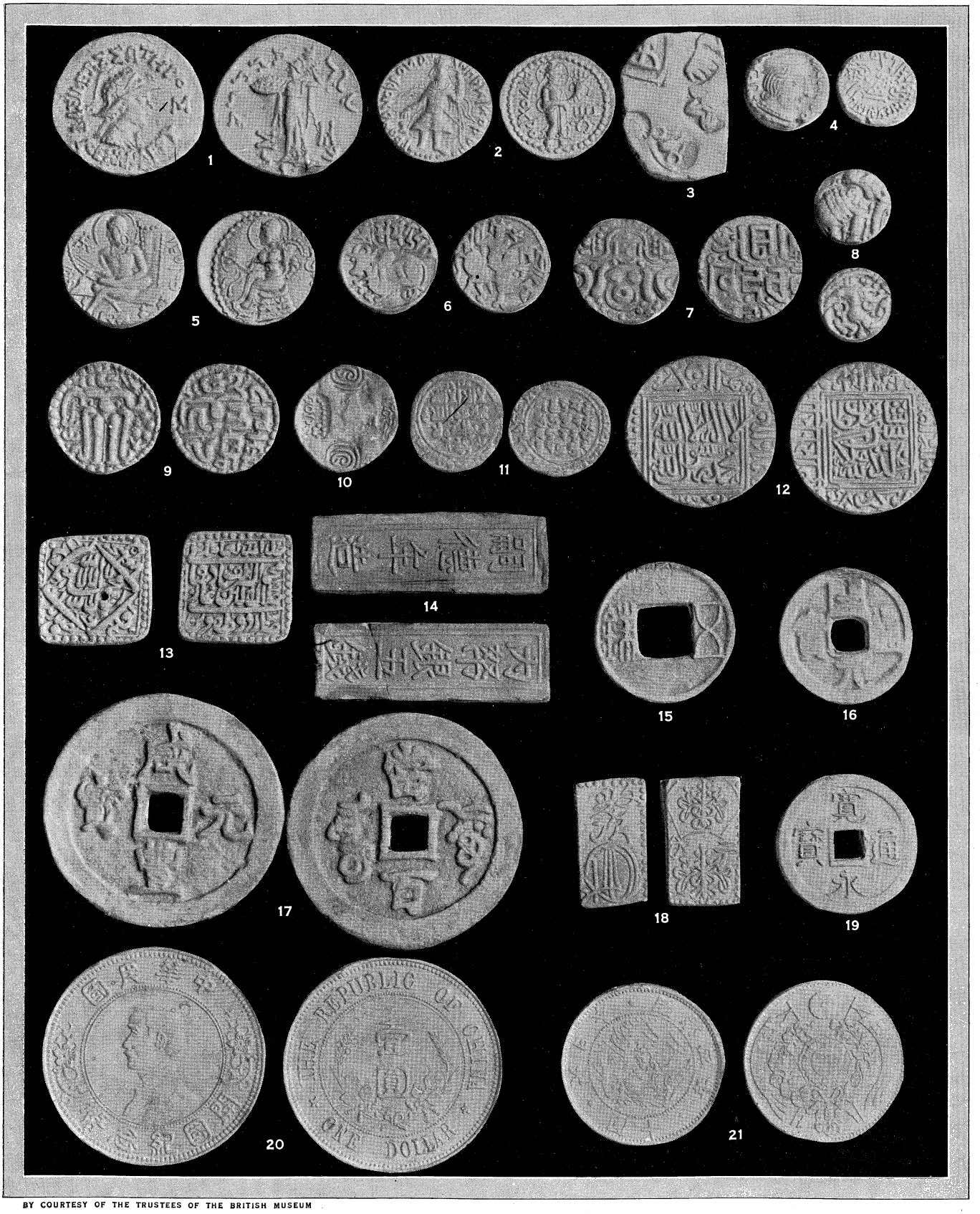
# NUMISMATICS




BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

## BRITISH COINS

1. Ancient British stater. 2. Stater of Cunobelinus (Cymbeline) 1st century A.D. 3. Northumbrian styca (copper). 7th century A.D. 4. Penny of Offa. 8th century. 5. Penny of Alfred. 6. Penny of Edward the Martyr. 7. Penny of William I. 8. Gold penny of Henry III. 9. Groat (fourpenny piece) of Edward I. 10. George noble (6s.8d.) of Henry VIII. 11. Unite or sovereign (gold) of Charles I. 12. Half-crown of the Commonwealth. 13. Colchester siege-piece. 14. Broad of Oliver Cromwell. 15. Guinea of Charles II. 16. Penny of David II. of Scotland. 17. Bonnet-piece of James V. of Scotland. 18. Ryal of Mary Queen of Scots




BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

## ANCIENT AND MODERN ORIENTAL COINS

1–13. INDIAN. 1. Tetradrachm of Menander. Graeco-Indian, *c.* 2nd–1st century B.C. 2. Stater of Kanishka. 3. Punch-marked, *c.* 3rd century B.C. 4. Western satrap. Silver, 1st century B.C.–4th century A.D. 5. Samudragupta, 4th century. 6. Samantadeva. 7. Govindachandra. 8. Chera, mediaeval. 9. Massa of Ceylon, *c.* 1200. 10, 11. Mahmud of Ghazna, 11th and 12th century. 12. Sher Shah rupee. 13. Mohur (gold) of Akbar. 14. ANNAM. Tu Duc, 1847–83. 15–17, 20. CHINESE. 15. Five-chu piece (copper), *c.* A.D. 500–550. 16. Kai Yuan, A.D. 618–627. 17. Hsien Feng, struck for Chinese Turkistan. 20. Republic. 18–19, 21. JAPANESE. 18. 2 *bu* piece (gold). 19. Sen. 21. Modern gold 10-yen piece

# NUMISMATICS

BY COURTESY OF THE AMERICAN NUMISMATIC SOCIETY

## EARLY AMERICAN COLONIAL AND UNITED STATES COINS

1. The New England shilling, the first coin made by the colonists. Struck in Massachusetts. 2. The Pine Tree shilling, 1652. Made by John Hull in Boston. 3. The Lord Baltimore sixpence. Made in England for Maryland about 1659. 4. The St. Patrick farthing brought from Ireland by Mark Newby in 1681 and used in New Jersey. 5. The Rosa Americana twopence made in England for the American Colonies in 1722 and 1723. 6. A copper token made about 1737 by John Higley at Granby, Connecticut, to pass for threepence. 7. A halfpenny made in England for Virginia in 1773. 8. A cent made by the State of Connecticut from 1785 to 1788. 9. A cent made by Vermont in 1785 and 1786. 10. A cent made by New Jersey from 1786 to 1788. 11. A cent made by Massachusetts in 1787 and 1788. 12. The Nova Constellatio cent made for the United States in 1785 before the Mint was established. 13. The half disme, 1792. One of the first coins made in the Mint, and said to have been made from silver furnished by George Washington. 14. The first type of cent, 1793. 15. The first type of half eagle (five dollar gold piece). 16. The first type of the silver dollar. 17. The Confederate half dollar. Four only were made at the New Orleans Mint

ham were abolished, the former having exercised its privilege for nearly eight centuries. When Edward VI. again restored a coinage of fine silver he introduced the silver crown of five shillings, which took the name of the gold piece of the same value introduced a few years earlier. The reign of Mary is notable for the appearance of her husband Philip II. of Spain on the shilling.

Elizabeth continued her father's denominations and restored the purity of the silver coinage. By introducing the sixpence and threepence of silver she gave the groat its deathblow, although it and the twopence continued to be struck. She also introduced coinage by machinery (mill and screw) although it was not really established until after the Restoration. James I. introduced a number of new gold coins, the most important being the "unite" or sovereign (20s.), so called from its legend (*Faciam eos in gentem unam*) alluding to the union of the crowns. In his reign the number of denominations in use reached its maximum. Charles I. (Pl. VI.-11) made no changes in the coinage of the last years of his father, but the Civil War and the king's financial difficulties added many new coins to the English series. These were 20s. and 10s. pieces in silver and the large gold pieces, *e.g.*, £3 pieces of Oxford and Shrewsbury, the fine Oxford silver crown by Rawlins with a view of Oxford behind the usual type of the king on horseback; the siege pieces rudely struck on pieces of silver plate at various Royalist strongholds show to what straits the king's party was reduced (Pl. VI.-13). Under James I. and Charles I. we have the first English copper coins, the "Harrington" farthings; they were not struck by the king but by contract. The coinage of the Commonwealth is remarkable for the simplicity of its types and this is the only period of English coinage when the legends have been in English (Pl. VI.-12). A series of coins were struck with Cromwell's bust and superscription but, although not uncommon, they never seem to have been put into currency (Pl. VI.-14).

The modern coinage dates from the reign of Charles II. After issuing the old denomination of hammered money in the first two years of his reign, he replaced the unite or broad in 1662 by the guinea (Pl. VI.-15), so called from the provenance of its gold, still a 20s. piece. It was not till 1717 after various oscillations that its value was fixed at 21s. His silver coins were the crown, half crown, shilling, etc., all regularly and beautifully struck by Jan Roettier with the new mill which was then established at the mint. In 1672 he introduced the bronze halfpenny and farthing with the Britannia type. The finest coin of his reign is not a regular issue. It was the "Petition" crown (Pl. IV.-14) made by Thomas Simon, engraver at the mint under the Commonwealth, and bears on the edge a petition to the king that he might be given the same office under the new régime. The coinage of the 18th century calls for no remark; one may just mention the practice of recording the provenance of the metal of particular issues as in the VIGO issues of Anne struck from captured Spanish bullion in 1702, the Welsh Copper Company shillings of George I. and LIMA coinage of George II. made of bullion brought by Anson from his voyage round the world. Towards the end of the century the scarcity of government silver was largely made good by Spanish dollars, with or without a bust of George III. countermarked upon them, and by tokens issued by the Bank of England while the deficiency in copper was made up by the private issue of vast numbers of tokens. In 1816 the great recoinage took place with the introduction of the sovereign and silver coins each with Pistrucci's design, St. George and the Dragon. In 1848 in the reign of Queen Victoria the 2s. piece (florin) was issued and proved a most popular coin; the double florin which was first issued in 1887 did not take the public fancy and the practical disappearance of the crown piece also from circulation reflects the public prejudice against large coins. The gold sovereign was last struck in 1917 but it had disappeared from currency in 1914 soon after the outbreak of war, after a career of three hundred years as sovereign, unite, guinea, and again sovereign.

Wales has never had a regular coinage but there exist two unique coins of Welsh kings, a penny of Howel Dda (*c.* 910–40) and another of Llewellyn (1075–79).

**Scotland.**—The coinage of Scotland followed similar lines to that of England as regards types and weights: the earliest coins are silver pennies (Pl. VI.-16) resembling the contemporary coins of England. The silver coins are baser and of inferior work but the rarer gold coins present several remarkably fine pieces of workmanship (Pl. VI.-17); the Scots coinage decreased in quantity after the union of the crowns in 1603 and ceased in 1709 after the union of the parliaments. The only extensive and varied coinage is that of Mary Queen of Scots.

**Ireland.**—Ireland had an extensive silver coinage in the 10th century, mainly copies by Danish kings, Sihtric III. and his successors, of the Anglo-Saxon coinage. The Anglo-Irish coinage began in 1177 with pennies and halfpennies of John, the only coins to bear his name which does not occur on the English coins. The quality of the coinage became more and more debased, reaching its final degradation under the Tudors. Gold was never struck by the government but copper was introduced quite early. The Civil War as in England produced a number of siege-pieces, notably the Inchiquin and Ormonde money. James II. in his campaign in Ireland issued vast numbers of gun-metal coins ranging from the 2/6 downwards. These were to be cashed for silver when he regained the throne. They are unusual as bearing the date in months. Irish coinage under the British régime did not actually come to an end until the reign of George IV., the last issue being in 1822. In 1928 coinage by the Irish Free State was introduced.

We may note that the Isle of Man had its own coinage from 1709 under the Earls of Derby to 1864 under Victoria and that the Channel Islands of Jersey and Guernsey have had their own bronze coinage for over a century

## ASIATIC COINS

**Achaemenids.**—The ancient kingdoms of the nearer East, Sumerian, Assyrian, Babylonian and Hittite, had no coined money, nor had the earlier Achaemenids of Persia. Not till after Cyrus conquered Lydia in 546 B.C. did the Persians learn the art of coinage. It is not certain which Achaemenid ruler first struck coins but it was likely Darius Hystaspes (521–486) as Herodotus suggests. The coins of the dynasty were the daric (Pl. I.-4) (*i.e.*, the coin of Darius) of gold of very pure quality and the siglos in silver. Thus early we have the relationship of sovereign and shilling anticipated, for 20 sigloi (shekels) made a daric which weighed a little more than an English sovereign. The types of both coins were the same: obverse the Persian king in a kneeling position holding a bow in his left hand and a spear in his right; the reverse bears no type but only a rough irregular incuse caused in the striking. In shape they are roughly oval being struck from round or rather egg shaped globules of metal. These pieces were uninscribed and remained in issue unaltered in type till the fall of the empire. The issue of gold was the royal prerogative, but the conquered Greek and other cities and states were allowed to issue silver and copper while a number of Persian satraps struck silver in their own names; to this latter class we owe a number of the earliest and finest portraits on coins. On the fall of the empire, various satraps, like Mazaeus who ruled Babylon for his new master Alexander the Great, struck silver coins of their own.

**Parthians.**—In the middle of the 3rd century the Parthians rebelled and cast off the Greek (Seleucid) yoke and soon became a great power in Persia. They had an extensive but monotonous coinage in silver (tetradrachms and drachms) and copper. The tetrodrachms and drachms bear the bust of the king and Arsakes, the founder of the dynasty, seated holding the Parthian bow on the reverse of the drachms. The usual reverse on the tetradrachms is the king seated receiving a wreath from a Victory or a city goddess. The coins do not bear the name of the issuer but that of Arsakes, the founder of the dynasty, and the inscriptions range in length from the simple (coin of) "king Arsakes" to legends like (coin of) "the great king of kings, Arsakes, the just, the illustrious, the divine, the friend of the Greeks." After Phraates IV. the coins are dated in the Seleucid era; on the later coins the Greek becomes corrupt and broken and is joined by an inscription in Pehlevi, a language now more intelligible to those who used the coins.

The kings of Persis, who became independent about the same

time as Parthia, began their series with very fine portrait tetradrachms but the coins rapidly degenerated; their reverse type a fire altar with or without attendant priests was revived by the Sassanians so that it had a life of nearly 1,000 years; numerous debased silver, almost copper, tetradrachms of the rulers of Characene and of the Omani on the lower Tigris down to the sea still exist to record the names of forgotten rulers.

**Sassanians.**—In the beginning of the 3rd century A.D. Ardashir, a native Persian prince, overthrew the last remnants of Parthian power and founded the great Sassanian empire which ruled all western Asia. The Sassanian coinage was very extensive in silver and the early emperors regularly coined gold although the latter was rare. The copper coinage also seems to have been small. The coin types throughout the dynasty are the same for all metals; on the obverse is a bust of the king with a long legend of the form (Ardashir, etc.) "worshipper of Ahura Mazda, divine king of kings of Iran," and on the reverse a fire altar usually with two attendant priests and the legend "the fire of (Ardashir or other emperor)"; from the time of Kobad the reverse legend gives the mint and the regnal year of issue. The standard of the gold coins is derived from that of the Roman solidi; the silver coins are drachms following the Parthian standard and are remarkable for their broad thin fabric which was copied by the Arabs from their silver coins (Pl. V, 11). The execution of the portraits especially in the 3rd and 4th centuries is remarkably fine.

**Caliphates.**—The early Arabs were unacquainted with the art of coinage which had died out in Arabia with the extinction of the Himyarite kingdom in the south; it was not till the conquering armies of Islam had wrested Syria from the Byzantines in the east and overthrown the Sassanian empire of Persia in the west that they became acquainted with regular currencies and with the sudden accession of wealth found the need of one. At first they issued gold and bronze pieces imitated from contemporary Byzantine coins, modifying the cross on the reverse of the latter somewhat to suit Muslim susceptibilities; the earliest silver coins were copies of late Sassanian coins with the addition of *bismillah* (in the name of God) on the margin (Pl. V, 12). The need for a purely Arab coinage worthy of the now vast Arab empire was soon felt and towards the end of the 7th century the fifth Omayyad caliph, 'Abd al-Malik (A.D. 685–705), instituted a coinage more in keeping with the principles of Islam. This coinage was of gold, silver and copper and the names *dinar* (denarius aureus), *dirhem* (drachm) and *falus* (follis) were borrowed from the Byzantines, as also the weights of the gold and bronze. It is interesting that the gold and bronze (Pl. V, 13) kept the thick fabric of the Byzantine originals while the silver retained the thin fabric of the Sassanian drachms; it was some centuries before this distinction of fabric disappeared. The strict interpretation of some sayings of Mohammed on image making had removed a vast field of activity from the Muslim mint engraver by limiting him to legends instead of types. This, however, gave Arab coins a historical value which the coinage of no other race possesses. From the earliest times they bear the mint and date and in time the ruler's name and title often with valuable genealogical data and titles of historical interest. Every Muslim claimant to sovereign power took the earliest opportunity of striking coins and we possess coins of rulers and pretenders known to have had the briefest reigns and in some cases their coins still testify to the existence of rulers unrecorded by history.

The dirhem of 'Abd al-Malik bears on the obverse the Muslim profession of faith. "There is no god but God: he has no associate" and around is the marginal legend. "In the name of God this dinar was struck at —— in the year ——." The reverse area has a quotation from Koran cxii "God is alone; God is eternal: He begets not and is not begotten nor is there any one like unto Him." Around is Koran ix, 33. "Mohammed is the Prophet of God sent with guidance and the religion of truth to make it prevail over all other religions averse though the idolators may be." This type of coin (Pl. V, 14, 15), issued from Spain and Morocco to the borders of China, gave Muslim coinage the character which it held for centuries. In mid-8th century the 'Abbāsids overthrew the Omayyad caliphate but at first made little change in the coinage. The long reverse formula was replaced by the simple statement "Mohammed is the Prophet of God" and in time the caliph's name was added and at the provincial mints that of the local governor and in the 9th century a second marginal inscription was added: "To God belongs the order before and after and in that day believers shall rejoice in the help of God" (Koran xxxi, 3–4). Among the more remarkable coins of this series are those of Hārūn al-Rashid (786–809) which bear the name of his vizier and boon companion the ill-fated Barmecide Ja 'afar (Pl. V, 15), whose fame, like that of his master, has been spread by the *Arabian Nights*. The extensive gold coinage of the 'Abbāsids became one of the great currencies of the mediaeval world and Offa in his efforts to found an English coinage imitates a dinar of al-Manṣūr (A.D. 754–775).

The 'Abbāsid caliphate broke up in the 9th and 10th centuries and the succeeding independent governors regularly put their own names on the coins although they retained that of the caliph of Baghdad whose spiritual authority was still recognized. Among such dynasties were the Omayyads of Spain, who issued an extensive coinage mainly in silver from the middle of the 8th till the end of the 11th century, the Idrīsids, Tūlūnids, 'Aghlabids and Ibhshīdids, all short-lived dynasties in north Africa and Egypt, coining mainly in gold. In central Asia there was the extensive coinage of the Sāmānids of the days when Samarkand and Bukhārā were great centres of culture and poured their wealth into northern Europe to buy costly furs as the great finds of Arab coins around the Baltic show. The 'Abbāsid coinage continued down to the 13th century but Baghdad was almost its only mint in its latter days; its last coins were very handsome large gold pieces. Minor dynasties mainly of Persian origin were the Ṭāhirids, Saffarids and Būyids whose silver coins are still valuable historical documents. In the 10th century the Fāṭimid caliphate, of Shī'a origin, arose in western Africa and in time conquered Egypt. Its extensive currency of gold introduced a new type of dinar with legends of the usual type but arranged in three concentric circles (Pl. V, 16); they held Sicily for a time and the coins struck were imitated by their Norman successors. A little later the Turks arose in the west, swept before them the smaller dynasties and ultimately ruled all western Asia. As the Ghaznevids, they ruled in Afghanistan and part of India; Mahmud of Ghazni struck coins with inscriptions in Arabic and Sanskrit, the latter for his Indian dominions (Pl. VII, 11). His regular gold coinage and those of the great Seljuk Tughril Bey are among the last issues of the old type and in the 13th century we have a series of remarkable innovations. The descendants of the original Seljuk conquerors divided their conquests in western Asia into numerous small states. Their scarce gold coinage follows orthodox lines, while giving a wealth of historical information, but the most remarkable of their issues was an extensive series of large copper coins bearing a remarkable number of different types borrowed from all sources, ancient Greek and Roman and Byzantine. They seem to have taken a childish delight in reproducing any coin type or even picture that took their fancy. Such are the coins of Karā Arslān (1168–1174) with reverse the familiar Byzantine type of Christ seated or of Alpī (1152–1176) with the virgin crowning a Byzantine emperor (Pl. V, 17). Their silver coins were directly influenced by the aspers of the Byzantine emperors and more particularly by those of the empire of Trebizond. From the latter comes the type of a horseman with a mace over his shoulder (Pl. V, 3), popular with the Seljuks of Asia Minor. Notable among the silver coins of this period are those of Kai Khusru II (1236–45) with the Lion and Sun type (Pl. V, 18), the horoscope of his beautiful Georgian wife whose portrait he even wished to put on his coins. It is these Turks, Seljuk, Ortukid and Ayyubid who were the "Saracen" opponents of the Crusaders, the best known of them being Saladin, the Ayyubid sultan of Egypt and Syria; his silver coins and those of his family give their titles at great length to the exclusion of religious legends. During this period and a little later some of the most beautiful coins the Muslim world has produced were being struck by the Almohads and Almoravids in western Africa. These large thin pieces of fine gold (Pl. V, 19) bear very long genealogical and

religious legends written in a beautiful and often elaborate script. Ibn Baṭṭūṭa, the famous Moorish traveller, remarks that nowhere were the dinars so large and beautiful as in his native land.

In the 13th century we note that the Mongols swept through all Asia except India until checked on the Egyptian frontiers. Of the Mongol lines, the Khans of the Golden Horde in the north issued an extensive series of small silver coins; the greater and wealthier line of the Ilkhans of Persia struck large and handsome coins in all three metals, with the Khan's titles in Mongol on the reverse and the Mohammedan creed in the Shī'a form on the obverse. In Egypt the Bahrī and later the Burjī Mamluks struck a series of large gold coins down to the 16th century; their silver coins are rarer. In the 14th century the great Tamerlane (A.D. 1369–1404), a distant descendant of Jenghiz Khan, revived the power of the Mongols; the majority of his coins (silver and copper) bear the name of his nominal sovereigns Suyurghatmish and Mahmud on the reverse and the kalima on the obverse. His son and ultimate successor Shāh Rukh introduced a new type of dirhem, obverse kalima with the names of the first four caliphs on the margin and his titles on the reverse, which remained popular throughout the 15th, 16th and early 18th centuries; gold was not struck in Asia during this period. In the meanwhile the eastern half of the Muslim world was passing to the Ottoman Turks. Their coinage of gold and silver, which became gradually baser and baser, and bronze, is monotonous in its legends of stereotyped titles and mints only. Their wealth of mints gives their coins a certain historical interest as they trace the expansion and decline of Ottoman power in Europe, Asia and North Africa. A notable feature of the Turkish coinage is the tughra, an elaborate monogram formed of the sultan's name and titles which occupies one side of the coin from the 16th century onwards. Latterly Constantinople and Egypt were the only Turkish mints of importance. The coinage of Morocco rapidly degenerated in every way from the 16th century onwards, though its most recent issues struck in Paris, Berlin and Birmingham show an improvement.

**Persia.**—The earlier coins of the shahs of Persia are descended through the Shaibanids from those of Shāh Rukh; at first they are large thin silver pieces of Central Asian style but in the 18th century the fabric changes and the coins become smaller and thicker as in India. The coins, especially the larger pieces, are remarkable for their fine calligraphy; the legends are usually in the form of rhyming couplets; gold is not common till the 18th century. Copper was not a regal but a local issue and each city issued its own which are remarkable from the fact that each has some type, usually an animal. Some of the products of the Persian mint are of huge size; these are pieces struck for presentation to distinguished officials, for example a gold piece of 80 tumans weighing over a pound. In the latter part of the 19th century Nasir al-Din (1868–1896) abolished the provincial mints and instituted a coinage from a central mint in Tehran with European machinery. Henceforth the coins of Persia bear the portrait of the shah on the obverse and the "lion and sun" on the reverse.

**Afghanistan.**—The emirs of Afghanistan who became independent of Persia in the 18th century and carved out a kingdom at the expense of their neighbours in Persia, Central Asia and India, struck coins in gold and silver on the standards of the Moghul emperors whose poetical legends they also copied. At the end of the 19th century a mint on European lines was established in Kabul and the high flown distichs were replaced by a representation of a durbar hall. The Afghan coinage of the 19th century has been mainly silver although in its early days gold also was common.

Of the various smaller modern dynasties who ruled Central Asia till the Russian conquest, the emirs of Bukhara and of Khokand are notable for their extensive issues of gold pieces, to the practical exclusion of other metals.

**India.**—There is no reason to doubt the independent origin of coinage in India although it was soon so much modified by Greek influence that the question was long disputed. The earliest coins are pieces of silver (Pl. VII, 7), very commonly square, and of copper punched with various symbols on both sides; of about the same date are the square and round cast copper pieces with similar but less varied symbols. These pieces circulated all over India and belong to at least the 4th century B.C. although they circulated after this date and may be somewhat earlier. Contemporaneously from the 3rd century onwards are the copper coinages of numerous states and dynasties which show increasing Greek influence and whose few silver coins are directly influenced by the hemidrachms of the Greek rulers of N.W. India of the 2nd century B.C. The types of these are of considerable mythological and religious interest. Technically they are interesting as showing the evolution of a type from a series of separate punches to the grouping of the punches on a die.

Early in the 2nd century B.C. the Greeks of Bactria began to invade India and their coinage is remarkable for its fine series of portraits and for the number of names it records of rulers otherwise unknown (Pl. VII.-1). Prakrit legends begin to appear alongside of corrupt Greek; the Greek in time becomes more and more corrupt as the Greek rulers were replaced by Scythian and Kushan invaders who copied their types. The Greek deities gradually give place to Indian ones on the coins. In the middle of the 1st century A.D. the Kushans founded a great empire in N.W. India; they have left a wealth of gold and copper coins with legends in an Iranian language in a corrupt Greek character:—at this period Roman gold in enormous sums went to India every year and was recoined there. The Kushan coins (Pl. VII.-2) bear on the obverse the king sacrificing and on the reverse deities of all the religions of the time, Greek, Roman, Zoroastrian, Hindu and Buddhist. This type of king on obverse and deity on reverse became the general type of North Indian coinage for the next thousand years; the Kushan coinage continued, rapidly degenerating till the fourth or fifth century, over a much more limited area; the type was continued by the kings of Kashmir down to the 10th century and adopted and modified by the great Gupta emperors in the 4th century. The latter struck an extensive gold coinage with long legends in poetical Sanskrit and many interesting types, often medallic (Pl. VII.-5) in nature, but, on their coins for general currency at least, always betraying the Kushan prototype. Among the more notable Gupta coins are those that commemorate Sandragupta's horse-sacrifice, or those that record his skill as a lyrist, to which he also testifies in his inscriptions. The art and correct Sanskrit legends of these coins are in keeping with the great Hindu revival of the period. In Western India a dynasty of Western Satraps of Persian origin had been ruling since the 1st century B.C. Their extensive coinage of silver only is dated and therefore of a historical value unusual in Indian or any early coinage (Pl. VII.-4). They look modern in that they bear on the obverse a bust of the ruler; they resemble Roman denarii and may have been influenced by them but their prototype is rather to be sought in the hemidrachms of the later Greek kings of India. This kingdom was overthrown by the Guptas at the end of the 4th century and they at once began to imitate this silver coinage not only locally but also in their own territory which seems to have had hitherto no silver coins. The barbarian Huns who destroyed the Gupta and other civilisations in the 6th century have left numerous coins, imitated from Sassanian, Gupta or Kushan prototypes. Degenerate copies of these seem to have been the coinages of Northern India till the revival of various Hindu dynasties from the 10th century onwards. A notable innovation was the neat silver coinage of the Shahis of Gandhara of the "bull and horseman" type in the 9th and 10th centuries (Pl. VII.-6), extensively imitated by the Mohammedan conquerors of India and the contemporary minor Hindu dynasties. The other type favoured by the mediaeval Hindu dynasties for their gold coinage was that of a seated goddess—going back to a Gupta reverse—and an inscription with the king's name on the other side (Pl. VII.-7).

The coinages of Southern India form a class by themselves. In the later centuries B.C. and early A.D. the Andras ruled a great kingdom in central South India; their coinage is mainly of lead and has types of the usual indigenous character. The later mediaeval dynasties of South India struck coinages mainly of gold, the type of which is usually the badge of the dynasty; the Cheras (Pl. VII, 8) of Malabar for example had an elephant and the Chalukyas of the Deccan a boar (Pl. VII, 10), the Pandyas a fish and the

cup-shaped pieces of the Kadambas bear a lotus. The Chola dynasty introduced under northern influence the type of a king standing on obverse and on the reverse the king seated, which spread through South India and was taken to Ceylon by the Chola conquest and adopted by the local rajas there (Pl. VII.-11). The great Hindu kingdom of Vijayanagar (Mysore) has left a large series of small gold and copper coins with the types of various deities which had considerable influence on the modern coinages of Southern India including those of the various foreign companies.

The earliest Arab invaders had reached India in the 8th century and founded a dynasty in Sind which has left numerous very small silver coins of the Omayyad type. Not till the 11th century was India seriously affected by Muslim invasions when Mahmud of Ghazna (Pl. VII.-11) conquered the Punjab. His empire was short-lived. In 1193 the Ghorid Mohammed bin Sam defeated the allied Hindu forces and became lord of India. His descendants ruled Northern India from Delhi till the Mogul conquest. Their coinage is varied and extensive, mainly gold and silver tankas (or rupees) of 178 grains. They are large thick pieces with the profession of faith on one side and the name of the king, mint and date on the other. A feature of this coinage is the unsuccessful attempt made by Mohammed III. b. Tughlak (A.D. 1324–1357) to replace gold and silver coinage by brass tokens. Gold was hardly issued at all in the 15th and 16th centuries and for a time the coinage was mainly billon. Sher Shah (1539–45) (Pl. VII.-12), one of the ablest of the line, issued a large silver currency of a type, kalima and names of the four caliphs, which was imitated by the Mogul successor of the Suris. During the latter half of the period of the sultans of Delhi, various dynasties made themselves independent; such were the rulers of Bengal, Gujarat, Jaunpur, Malwa, etc., whose coins all follow the standards of the central power. Those of Bengal are mainly silver rupees with rare gold; the currency of Jaunpur, gold and billon; Malwa and Kashmir gold and silver coins were square.

The coinage of Bāber and Humāyūn, the first two of the Mogul conquerors of India, are not extensive and are of Central Asian types. With the next two, the Great Moguls Akbar (Pl. VII.-13) and Jahāngīr, we have a series unrivalled for variety and within their limitations beauty:—the gold coins of Jahāngīr are noble examples of Muslim calligraphy, an art evidently cultivated as much as painting at his court (Pl. IV.-13). The mints of the Mogul coins reflect dynastic fortune—even Shāh Jahān's brief occupation of Balkh is at once recorded on a gold mohur. The close association in the Muslim mind between sovereignty and the right of the coinage is exemplified in the existence of the coins of many pretenders to the imperial throne, some of whom we know from history to have had the briefest spell of power. The general type throughout is the same. In the 16th century the type that goes back to Sher Shah prevails, the Kalima with the names of the first four caliphs and the emperor's titles on the other side; Aurangzib replaced the confession of faith by the mint and date and this remained the usual type till the end of the dynasty. The emperor's name is usually enshrined in a Persian couplet to the effect that the metal of the coins acquires added lustre from bearing the emperor's name. Nearly fifty such verses are found on Jahāngīr's coins. The latter's reign is also remarkable for the series of coins bearing the sign of the zodiac and the set of portrait mohurs, one of which represents him holding a wine-cup. He also allowed his wife Nūr Jahān to strike coins in her own name, and she is also said to have inspired the issue of the zodiacal series. From the beginning of the 18th century the coins become stereotyped and the epigraphy loses its beauty; numerous native states began to arise and throw off the Mogul yoke, but right down to the middle of the 19th century they continued to coin on Mogul lines. The English and French East India Companies for years copied the native types from the coinages and did not strike on European lines till the 19th century. The right of native states to mint their own coinage has been gradually curtailed by the British government and there are now very few independent coinages. The most important native state mint at present is Hyderabad, which a few years ago instituted a mint with European machinery. Before leaving India we may just mention the extensive coinage in gold and silver with Sanskrit legends of Nepal, which is still being issued, the long series of octagonal gold and silver of Assam struck down to the British conquest, and the brief coinage of Burma in the 19th century.

**Chinese.**—In spite of the very early references to money in Chinese literature, there is no reason to believe that the earliest coins are much older than the seventh century B.C.; that is to say that coinage originated in the Far East about the same time as it did in the west and independently. The earliest Chinese coins are small bronze spades and knives, copies of the spades and bill-hooks and other small articles of husbandry that had been used for barter. The knives are about six inches long and bear the value and name of authority issuing it; *pu* money, a modified form of the spades circulated widely in the 5th and 4th centuries B.C. Small change was supplied by cowrie shells in this period, as it had been long before the invention of a coinage. There was an issue of bronze cowries in the 7th century B.C. Round money with a hole in the centre was issued as early as the 4th century but it was not till 221 B.C. that the reforming Shah Huang Ti (221–210 B.C.) superseded all other currencies by the issue of round coins of half an ounce (*pan-liang*), which were continued by the Han dynasty. This coin became gradually reduced and debased and was replaced in 118 B.C. by the Emperor Wu Ti's five-chu piece which remained the coin of China for the next eight centuries; a break in the monotony of the regular coinage is formed by the archaistic innovations of the usurper Wang Mang (A.D. 9–22) who issued a modified form of the *pu* and knife currency and a new round coin (*ho tsien*). The history of Chinese coins is the history of a series of gradual debasement of the government currency until it is overwhelmed by the increasing activity of forgers and a new coin is instituted. On one occasion at least the most skilful of the forgers were given work at the government mints. The five-chu piece lasted till the rise of the T'ang dynasty when the emperor Kau Tsu in 618 issued the *Kai-yuan* coin (Pl. VII.-16) which gave the coinage of all the Far East its form till the end of the 19th century—a round coin with a square hole and a four character legend of the form "current money of (regnal period)." The Southern Sung dynasty (A.D. 1137–1278) dated their coins on the reverse in regnal years and the Ming dynasty (A.D. 1368–1628) put the mint name on the reverse as did the Ching dynasty (A.D. 1628–1911), the latter giving it in Manchu characters. Paper money has been in use in China since the 9th century and was current almost to the exclusion of regular coins under certain of the Mongol emperors, for example Kublai Khan, whose paper money is described by Marco Polo. For over 2,000 years the copper cash with occasional multiples of it was the only coinage of China; gold and silver were current by weight only, the latter in the form of boat shaped ingots. The monotony of the series is only rarely broken as for example by the nail-mark of the emperor Wen-Teh on the Kai-yuan pieces, an issue of lead coins in the 12th century and the issue of large token pieces (Pl. VII.-17) going up to 1,000 cash in value during the Tai Ping rebellion when the rebels held the copper mines. With the increasing popularity of Spanish Colonial and Mexican dollars as a silver currency in China, several attempts were made to institute a silver coinage in the 19th century; not till the very end of the 19th century were mints established to strike silver and copper coins of European style in all the provinces. One of the last of these, a rupee of Sze-Chuan, was the only coin of the Chinese empire to bear the head of an emperor. This was because it was intended to compete for Tibetan trade with the Indian rupee. Under the Republic, coins were at once struck with the portraits of Sun Yat Sen and Yuan Shih Kai and the various generals who have since been fighting for China have issued their own coins with their portraits. A feature of the issues of the latter has been the number of gold coins they have issued, for the first time in Chinese history. The very extensive series of talismans, coin-like in shape but usually larger should be noted. Many are Taoist and Buddhist in their legends and types; others are simply lucky pieces.

**Japan.**—The art of coinage was borrowed from China by Japan whose first bronze coins were issued in A.D. 708. Twelve

different issues were made down to the middle of the 10th century, each of a different reign. For the next six hundred years, however, no government coins were issued and the currency was supplied by imitations of contemporary Chinese coins made by the great nobles. In the 17th century the copper *kwan-ei* (Pl. VII.-19) was first issued in 1624 and remained in vast variety the usual issue for over two centuries. The *ei-raku* and *bun-kyu* sen of the 19th century were the only other regular copper coins. Unlike China, Japan has had a gold and silver currency since the 16th century. The gold coins are large flat pieces in the shape of rectangles with circular corners the largest size being *obans* and the smaller *kobans*; these bear various small official stamps and a large signature in ink of a mint official. They range in length from 6 inches to ½ inch. Other gold pieces are the small rectangular pieces of 1 and 2 *bu* (Pl. VII.-18) issued from time to time; round gold is rare and usually of provincial mints. There have not been many issues of silver, usually in small rectangular pieces; the so-called bean money with the figure of Daikoku is not a currency but was made to add to the large, long silver presentation pieces to bring them up to a certain weight. A notable Japanese coin is the oblong silver piece struck in 1765 out of confiscated silver ornaments by an official named Taruna.

In 1869 a mint on European lines was established in Tokio and gold, silver (yen or dollar) and copper have since been regularly issued from it. The *e* sen of Japan are not coins but amulets and bear figures of Daikoku, the god of wealth, Itsibu fishing, etc.

**Korea.**—Korea has had a bronze coinage of the Chinese style since the 12th century, but it is only with the institution of *Shang Ping* cash at numerous mints, with an elaborate system of dating or rather numbering the issues between 1790 and 1881, that its coinage becomes common. Attempts were made to establish a silver currency during the last years of its independence. Annam began by imitating Chinese coins and had a regular bronze coinage of its own on the Chinese model from the 10th to the 19th century. Silver became common in the 19th century in the form of narrow oblong bars (Pl. VII.-14). Annam also has its amulets or rather presentation pieces. These are in gold, silver, and copper with a variety of designs bearing auspicious inscriptions, quotations from the Chinese classics, etc., in addition to the king's name. The native coinage ceased when it became a French possession.

**Siam.**—Siam down to the middle of the 19th century struck gold and silver in the form of balls formed by doubling in the ends of a short thick bar of silver, and bearing the stamp of the reigning monarch. Since 1850 it has had a coinage on European lines with portraits and issues in gold, silver and copper and more recently in nickel.

The native kingdoms of the Malay Straits used lead for their coinage, these are usually round with Malay or rarely with Chinese inscriptions; an exception is found in the "hat money" of Pahang in the form of a hollow square with truncated pyramids and a Malay inscription along the bottom. The spear money of the Nagas, the canoe-shaped and willow leaf money of the Shan States and the "snail shells" in silver of the more primitive parts of Burma can only be mentioned here.

BIBLIOGRAPHY.—I. Periodicals: *Numismatic Chronicle* (London); *Revue numismatique* (Paris); *Zeitschrift für Numismatik* (Berlin); *Numismatische Zeitschrift* (Vienna); *Rivista italiana di numismatica* (Milan); *Revue belge de numismatique* (Brussels); *Nomisma* (Berlin).

II. General Works: F. Lenormant, *Monnaies et médailles* (1883); W. Ridgeway, *Origin of Metallic Currency* (1892); S. Lane-Poole and others, *Coins and Medals* (3rd ed., 1894); E. Babelon, *Origines de la monnaie* (1897); A. von Sallet, *Münzen und Medaillen* (1898); G. Macdonald, *Coin-Types* (1905) and *Evolution of Coinage* (Cambridge, 1916); G. F. Hill, *Coins and Medals* (1920); L. Forrer, *Biographical Dictionary of Medallists*, etc. (1904–1916), *Supplement* (1923).

III. Greek: A. *General:* J. H. von Eckhel, *Doctrina numorum veterum* (1792–98); J. C. Rasche, *Lexicon univ. rei num. veterum* (1785–1804); T. E. Mionnet, *Descr. de médailles gr. et rom.* (1807–37); W. M. Leake, *Numismata Hellenica* (1854–59); Poole, B. V. Head, P. Gardner, W. Wroth and G. F. Hill, E. S. G. Robinson, *Brit. Mus. Catal. of Greek Coins* (Italy, Sicily, Greece, Asia Minor, Syria, Egypt, etc., begun in 1873); F. Lenormant, *La monnaie dans l'antiquité* (1878, 1879); P. Gardner, *Types of Greek Coins* (1882), and *History of Ancient Coinage* (1918); F. Imhoof-Blumer, *Monnaies grecques* (1883); F. Imhoof-Blumer and P. Gardner, *Numismatic Commentary on Pausanias* (1885, 1886); B. V. Head, *Historia numorum* (sec. ed. 1911); F. Imhoof-Blumer, *Griechische Münzen* (1890); Head, *Guide to the Coins of the Ancients* (4th ed., 1895); Hill, *Handbook of Greek and Roman Coins* (1899); G. Macdonald, *Catalogue of the Hunterian Collection* (3 vols., 1899–1905); E. Babelon, *Traité des monnaies grecques et rom.* (1901–27); Th. Reinach, *L'Histoire par les monnaies* (1902); *Corolla numismatica*, Numism. Essays in honour of B. V. Head (1906); G. F. Hill, *Historical Greek Coins* (1906), and *Select Greek Coins* (1927); K. Regling, *Sammlung Warren* (1906) and *Die Antike Münze als Kunstwerk* (1924); R. Münsterberg, *Beamtennamen auf griechischen Münzen* (1914), *Collection R. Jameson* (1913). Periodicals: *Journal international d'archéologie numismatique* (Athens); *Nomisma* (Berlin).

B. *Metrology:* J. Brandis, *Münz-, Mass- und Gewichtswesen* (1866); F. Hultsch, *Griech. u. röm. Metrologie* (1882); *Gewichte des Altertums* (1898); C. F. Lehmann, articles in *Verhandl. der Berl. Ges. für Anthropologie* (1889, 1891); *Das alt-babylonische Mass- und Gewichtssystem* (1893); O. Viedebantt, *Forschungen zur Metrologie des Altertums* (1917).

C. *Special Districts:* (*See* also the respective volumes of the *British Museum Catalogue.*) (*a*) Spain.—A. Heiss, *Monn. ant. de l'Espagne* (1870); Zobel de Zangróniz, *Estudio historico de la mon. ant. esp.* (1878–80); E. Hübner, *Monum. linguae Ibericae* (1893). (*b*) Gaul.—E. Muret and M. A. Chabouillet, *Catal. des monn. gaul.* (1889); H. de la Tour, *Atlas des monn. gaul.* (1892); J. A. Blanchet, *Traité des monn. gaul.* (1905). (*c*) Italy.—F. Carelli, *Num. Ital. veteris* (1850); L. Sambon, *Presqu'île italique* (1870); R. Garrucci, *Mon. dell' Italia ant.* (1885); A. J. Evans, *The "Horsemen" of Tarentum* (1889); *Berlin Museum Catalogue*, iii. 1 (1894); A. Sambon, *Monn. ant. de l'Italie* (1903–04). (*d*) Sicily.—B. V. Head, *Coinage of Syracuse* (1874); A. J. Evans, articles in *Num. Chr.* (1890–94); A. Holm, "Gesch. des sicil. Münzwesens" (in vol. iii. of his *Gesch. Siciliens*, 1898); G. F. Hill, *Coins of Ancient Sicily* (1903); E. Sabrici, *La Monetazione delle Bronze nella Sicilia antica* (1927). (*e*) Northern Greece.— L. Müller, *Alexandre le Grand* (1855); *Lysimachus* (1858); F. Imhoof-Blumer, *Münzen Akarnaniens* (1878); P. Burachkov, *Greek Colonies in S. Russia* (Russian, 1884); *Berlin Museum Catalogue*, i., ii. (1888, 1889); Berlin Academy, *Die antiken Münzen Nordgriechenlands* (1898– ). (*f*) Central Greece, Peloponnesus and Islands.—E. Beulé, *Monn. d'Athènes* (1858); J. N. Svoronos, *Crète ancienne* (1890) and *Monnaies d'Athènes* (1923–26); C. T. Seltman, *The Temple Coins of Olympia* (1913–14), do. (*g*) Asia Minor.—M. Pinder, *Über die Cistophoren* (1856); Th. Reinach, *Trois royaumes d'Asie Mineure* (1888); F. Imhoof-Blumer, *Griechische Münzen* (1890); E. Babelon, *Les Perses achéménides*, etc. (1893); F. Imhoof-Blumer, *Lydische Stadtmünzen* (1897); E. Babelon, *Inventaire de la coll. Waddington* (1898); F. Imhoof-Blumer, *Kleinasiatische Münzen* (1901, 1902); W. H. Waddington, Th. Reinach and E. Babelon, *Recueil général des monn. gr. d'Asie Mineure* (1904–12); H. von Fritze, *Elektronprägung von Kyzikos* (1912), *Silberprägung von Kyzikos* (1914). (*h*) Syria, Phoenicia, and the Greek East (*see* also *Oriental*).—F. de Saulcy, *Num. de la terre sainte* (1874); F. W. Madden, *Coins of the Jews* (1881); E. Babelon, *Rois de Syrie*, etc. (1890); *Perses achéménides* (1893); Th. Reinach, *Jewish Coins* (trans. M. Hill, 1903). (*i*) Egypt and Africa.—L. Müller, *Monn. de l'ancienne Afrique* (1860–74); G. Dattari, *Numi Augg. Alexandrini* (1901); J. N. Svoronos, Νομ. τοῦ Κράτους τῶν Πτολεμαίων (1904).

IV. (*a*) Roman: Th. Mommsen, *Hist. de la monn. rom.*, trans. Duc de Blacas and J. de Witte (1865–75); H. A. Grueber, "Roman Medallions," *Brit. Mus. Catal.* (1874); W. Fröhner, *Médaillons de l'empire rom.* (1878); H. Cohen, *Monn. frappées sous l'empire rom* (1880–92); E. Babelon, *Monn. de la république rom.* (1885, 1886); H. A. Grueber, "Roman Republican Coins," *Brit. Mus. Catal.*; E. J. Haeberlin, *Systematik des ältesten römischen Münzwesens* (1905), *Aes Grave* (1910); G. F. Hill, *Historical Roman Coins* (1909); H. Willers, *Geschichte der römischen Kupferprägung vom Bundesgenossenkrieg bis auf Kaiser Claudius* (1909); H. A. Grueber, *Catalogue of the Roman Republican Coinages in the British Museum* (1910); H. Mattingly, E. A. Sydenham and P. H. Webb, *Imperial Roman Coinage* (1923– ); H. Mattingly, *Handbook of Roman Coins* (1928); do. *British Museum Catalogue of Coins of Roman Empire* (1923); K. Menadier, *Die Münzen und das Münzwesen bei den Scriptores Historiae Augustae*; J. Maurice, *Numismatique Constantinienne* (1908–12); F. Grecchi, *Medaglioni Romani* (1912). (*b*) Byzantine.—J. Sabatier, *Monnaies byzantines* (1862); Warwick Wroth, *Catalogue of the Imperial Byzantine Coins in the British Museum*, 2 vols. (1908) and *Catalogue of Coins of the Vandals, Lombards, etc.* (1911); J. Tolstoi, *Monnaies Byzantines* (1911).

V. GENERAL: K. Neumann, *Beschreibung der bekanntesten Kupfermünzen* (1858–72); J. A. Blanchet, *Numism. du moyen âge et moderne* (1890); A. Engel et R. Serrure, *Numism. du moyen âge* (1891–1905); *Numism. moderne* (1897–99); A. Luschin von Ebengreuth, *Allgemeine Münzkunde u. Geldgesch.*, 2nd edition (1926); E. Martinori, *La Monetà* (1915).

*Transitional Period:* J. Friedländer, *Münzen der Ostgothen* (1844); A. Heiss, *Monn. des rois wisigoths d'Espagne* (1872); C. F. Keary, *Coinages of Western Europe* (1879); *Brit. Mus. Catal. of English Coins*, i. (1887); M. Prou, *Les Monn. mérovingiennes* (1892); A. de Belfort, *Descr. générale des monn. mérovingiennes* (1892–95).

C. *Countries:* (*a*) Portugal.—A. C. Teixeira de Aragão, *Descr. das moedas de Portugal* (1874–80). (*b*) Spain.—A. Heiss, *Mon. hispano-cristianas* (1865–69). (*c*) France.—F. Poey d'Avant, *Monn. féodales de France* (1858–62); supplement by E. Caron (1882–84); H. Hoffmann, *Monn. royales de France* (1878); Gariel, *Monn. roy. de France sous la race carolingienne* (1883–84); M. Prou, *Les Monn. carolingiennes* (1896); A. Dieudonné, *Les Monnaies Capetiennes* (1923); J. A. Blanchet and A. Dieudonné, *Manuel de Numismatique française* (1912–16); "Médailles françaises," "Médailles de la révol. franç.," "Méd. de l'emp. Napoléon," *Trésor de numismatique* (1834–40); N. Rondot, *Les Médailleurs et les graveurs de monnaies, etc., en France* (1904); F. Mazerolle, *Les Médailleurs français* (1902–04); Periodical, *Revue numismatique.* (*d*) Low Countries.—P. O. van der Chijs, *Munten der Hertogdommen Braband en Limburg* (1851) and other works (1852–1862); R. Serrure, *Dict. géogr. de l'hist. mon. belge* (1880); A. de Witte, *Histoire monétaire du Brabant* (1894–99); G. van Loon, *Hist. métallique . . . des Pays-Bas* (Fr. ed. 1732–37), supplement to ditto (1861–71); J. Chautard, *Imitations des monnaies au type esterlin* (1871); periodical, *Rev. belge de numismatique.* (*e*) Switzerland.—R. S. Poole, *Catal. of Swiss Coins in South Kensington Mus.* (now transferred to the British Museum) (1878); Wunderly v. Muralt, *Münz- u. Medaillen-Sammlung* (1895–99); L. Coraggioni, *Münzgesch. der Schweiz* (1896); periodical, *Revue suisse de numismatique.* (*f*) Italy.—F. and E. Gnecchi, *Bibliografia numismatica delle Zecche italiane* (1889); V. Promis, *Tavole sinottiche delle monete battute in Italia* (1869); G. Sambon, *Refertorio generale delle monete coniate in Italia* (1912); *Mon. dei Reali di Savoia* (1841); C. Serafini, *Catalogo delle monete pontificie* (1910–27); F. and E. Gnecchi, *Monete di Milano* (1884); N. Papadopoli, *Mon. di Venezia* (1893); C. Desimoni, *Mon. della Zecca di Genova* (1891); H.M. the King of Italy, *Corpus Numorum Italicorum;* J. Friedländer, *Italienische Schaumünzen* (1880–82); A. Heiss, *Médailleurs de la Renaissance* (1881–92); A. Armand, *Médailleurs italiens* (1883–87); C. von Fabriczy, *Italian Medals* (trans. Hamilton, 1904); G. F. Hill, *Renaissance Medals* (1920); periodical, *Rivista italiana di numismatica* (Milan). (*g*) Germany.—H. P. Cappe, *Münzen der deutschen Kaiser u. Könige* (1848–50); G. Schlumberger, *Bractéates d'Allemagne* (1873); H. Dannenberg, *Deutsche Münzen der sächs. u. fränk. Kaiserzeit* (1876–1905); A. Engel et E. Lehr, *Num. d'Alsace* (1887); M. Donebauer, *Sammlung böhmischer Münzen u. Medaillen* (1888–90); E. Bahrfeldt, *Münzwesen der Mark Brandenburgs* (1889–95); *Sammlung in der Marienburg* (1901–06); F. von Schrötter, *Das preussische Münzwesen im 18ten Jahrh.* (1902–04); *Trésor de numismatique,* "Médailles allemandes" (1841); A. Erman, *Deutsche Medailleure* (1884); K. Domanig, *Porträtmedaillen des Erzhauses Österreich* (1896); *Kön. Museen zu Berlin, Schaumünzen des Hauses Hohenzollern* (1901); F. von Schrötter, *Das preussische Münzwesen* (1902–13); K. Domanig, *Die deutsche Medaille* (1907); G. Habich, "Studien zur deutschen Renaissance-Medaille," Berlin *Jahrbuch* (1906–07–13). Periodicals, *Zeitschrift für Numismatik* (Berlin), *Numismatische Zeitschrift* (Vienna). (*h*) Poland.—E. Hutten-Czapski, *Monn. et méd. polonaises* (1871–80). (*i*) Russia and Scandinavia.—Baron de Chaudoir, *Monn. russes* (1836–37); Ct. J. Tolstoi, *Coins of Kieff* (1882), *Coins of Great Novgorod* (1884), *Coins of Pskoff* (1886; in Russian); (*j*) Mansfeld-Bûllner, *Danske Mynter* (1887); P. Hauberg, *Danmarks Myntvaesen og Mynter, 1241–1377* (1885, 1886); *Myntforhold og Udmyntinger i Danmark indtil 1146* (1900). (*k*) Latin East, etc.—G. Schlumberger, *Num. de l'orient latin* (1878); E. H. Furse, *L'Ordre souverain de St. Jean de Jérusalem* (1885). (*l*) America.—D. K. Watson, *Hist. of American Coinage* (1899); A. Weyl, *Fonrobertsche Sammlung* (1878); A. Rosa, *Monetario americano* (1892); J. Meili, *O Meio circulante no Brazil* (1897–1905). (*m*) Money of Necessity.—P. Mailliet, *Monn. obsidionales et de nécessité* (1870–73); A. Brause-Mansfeld, *Feld-, Not- und Belagerungsmünzen* (1897–1903).

VI. GREAT BRITAIN AND IRELAND.—R. Ruding, *Annals of the Coinage* (1840); B. E. Hildebrand, *Anglosachsiska Mynt* (1881); J. Evans, *Ancient British Coins* (1864, 1890); E. Hawkins, *Silver Coins of England* (3rd ed. by Kenyon, 1887); R. Ll. Kenyon, *Gold Coins of England* (1884); C. F. Keary and H. A. Grueber, *Brit. Mus. Catal. of English Coins,* i. ii. (1887, 1893); H. A. Grueber, *Handbook of Coins of Great Britain and Ireland* (1899); G. C. Brooke, *Catalogue of Norman Coins in the British Museum* (1916); E. Hawkins, A. W. Franks and H. A. Grueber, *Medallic Illustrations of the History of Great Britain and Ireland* (1885; plates to ditto, 1904–12); L. W. Hewlett, *Anglo-Gallic Coinage* (1920); R. W. Cochran-Patrick, *Records of the Coinage of Scotland* (1875); E. Burns, *Coinage of Scotland* (1887); Richardson, *Catal. of the Scottish Coins in the Nat. Mus., Edinburgh* (1901); R. W. Cochran-Patrick, *Catalogue of the Medals of Scotland* (1884); Aquilla Smith, various papers on Irish coinage; D. T. Batty, *Copper Coinage of Great Britain, Ireland,* etc. (1868–98); W. Boyne, *Trade Tokens issued in the 17th Century* (ed. G. C. Williamson, 1889); R. Dalton and S. H. Hamer, *Provincial Token Coinage of the XVIII. Cent.* (1910–17); R. Chalmers, *History of Currency in the British Colonies* (1893); periodicals, *Numismatic Chronicle; British Numismatic Journal.*

VII. ORIENTAL.—A. *Pre-Mohammedan.*—(*a*) Persia and the Greek East.—E. Babelon, *Les Perses achéménides* (1893); W. Wroth, "Parthia," *Brit. Mus. Catal.* (1903); G. F. Hill, *Arabic and Persian Brit. Mus. Catal.* (1922); (*b*) India, etc.—J. Prinsep, *Essays on Indian Antiquities* (ed. Thomas, 1858); A. Cunningham, *Alexander's Successors in the East* (1873); T. W. Rhys Davids, *Ancient Coins, etc., of Ceylon* (1877); P. Gardner, "Greek and Scythic Kings of Bactria and India," *Brit. Mus. Catal.* (1886); W. Elliott, *Coins of Southern India* (1886); A. Cunningham, *Coins of Ancient India* (1891); *Coins of the Indo-Scythians* (1892); *Coins of Medieval India* (1894); E. J. Rapson, "Indian Coins" (in Bühler's *Grundriss,* 1898) and *Coins of the Andhras* and Western *Kshatrapas* (Brit. Mus. Cat. 1908); Vincent A. Smith, *Catal. of Coins in the Indian Museum, Calcutta,* vol. i. (1906); J. Allan, *Coins of the Guptas, Brit. Mus. Catal.* (1928).

B. *Mohammedan:* W. Marsden, *Numismata orientalia* (1823); C. M. Fraehn, *Recensio num. Muhammedanorum* (1826); F. Soret, *Numismatique musulmane* (1864); W. Tiesenhausen, *Coins of the Oriental Khalifs* (1873, Russian); R. S. Poole and S. Lane-Poole, *Catal. of Oriental Coins in the British Museum* (1875–91); R. S. Poole, *Catalogue of Persian Coins in the British Museum* (1887); S. Lane-Poole, *Catalogue of Indian Coins in the British Museum* (1884–92); F. Codera y Zaidin, *Numismatica arabigo-española* (1879); H. Lavoix, *Catal. des monn. musulmanes de la bibliothèque nationale,* i.–iii. (1887–91); C. J. Rodgers, *Catal. of the Coins of the Indian Museum* (1893–96); *Catal. of the Coins of the Lahore Museum* (1893–95); Kön. Museen zu Berlin, H. Nützel, *Katalog der orientalischen Münzen,* i.–ii. (1898–1902); O. Codrington, *Manual of Musulman Numismatics;* E. H. Walsh, *Coinage of Nepaul* (1908); H. Nelson-Wright, *Catal. of the Coins in the Indian Museum, Calcutta,* vols. ii.–iii., Sultans of Delhi and Moghul Emperors (1907–08); J. Allan; vol. iv. *Native States* (1927); R. B. Whitehead, *Catalogue of Coins in the Panjab Museum* (1914); C. J. Brown, *Catalogue of Moghul Coins in the Lucknow Museum* (1920), and *India Coins* (1927).

C. *The Far East:* W. Vissering, *Chinese Currency* (1877); Terrien de la Couperie, *Catal. of the Chinese Coins in the Brit. Mus.,* 7th century B.C.–A.D. 621 (1892); J. H. S. Lockhart, *Currency of the Farther East* (1895–98) and *Catalogue of My Collection* (1915); N. G. Munro, *Coins of Japan* (1904); D. Lacroix, *Numismatique annamite* (1900); A. Schroeder, *Annam, Études numismatiques* (1905); C. T. Gardner, *Coinage of Corea* (Journ. North China Branch of R. Asiatic Soc., vol. xxvii. [1892–93]). (J. AL.)

## TECHNIQUE AND ART

The technique of production of coins and medals has remained in principle the same from the earliest period of coinage to the present day; the gradual introduction of more complicated machinery, while lessening the part played by human hand and eye in the later stages of the process, has never, unless the so-called photosculpture be acknowledged as an art, eliminated the part of the artist in producing in one form or other the actual relief of the coin or medal type.

**Casting and Striking** are the two sharply distinguished methods of production. The former, although it was little employed in antiquity save for large coins, may be described first, since it was the method that metal-workers used on a larger scale for the solid casting of statues, statuettes and decorative work, etc. A model was first built up in wax or clay. The process of carving the model out of a mass of wax was occasionally employed, sometimes partly combined with the building up process, but there is no evidence of this before the days of the Renaissance. Another method of producing the model, that of carving it in boxwood or pearwood or in fine stone, such as Solnhofen stone or slate, was brought to a high degree of perfection by the Germans of the Renaissance; it was almost unknown in Italy. The model once made was impressed in a mould of fine sand or other material, and a cast was made. Some of the German medallists of the Renaissance seem to have carved the design in reverse in clay (just as if they were carving a matrix in hard material) which was then baked and used as mould. In the case of small coins a number of moulds were often combined, with channels leading from one to the other. Tree-like sets of coins produced in the Far East by such casting *en chapelet* are still extant.

The coins produced by this process are seldom of precious metals and almost entirely negligible as works of art, being of the roughest kind. But the method was employed by all the greatest medallists, from the founder Pisanello, in the 15th century, onwards, in preference to the more mechanical process of striking. Casting was carried to a high degree of excellence (especially by the Germans), the ideal being to reproduce the wax model without subsequent chasing. The Italian medallists were sometimes content with the roughest representation of their work. Others depended on chasing with the burin or graver to remove the irregularities of the cast; and often the chasing was by an alien hand. Any coin or medal could be used as a model, for impressing

in moulding material, so that a new cast could be made. The vast majority of the extant medals supposed to be of the 15th or 16th century are after-casts to the nth degree. Detail has disappeared and the actual diameter has decreased since metal contracts in cooling.

**The Repousse Process** (*q.v.*) can of course also be used in making medals, in shells, of which the two halves are worked separately. This process was especially favoured in Holland in the 17th century. The process of pressure-casting has also, it is said, been used in recent times. Plaquettes (which are small metallic reliefs, differing from medals in being primarily decorative, not commemorative, usually one-sided and more frequently rectangular than circular) are produced like medals.

**Striking** of coins or medals is done by means of dies, engraved in intaglio, and impressed on the metal by blows or pressure. It is the method of impressing a signet on wax applied to a hard material, the type of a coin being, indeed, in origin and principle the signet of the issuing authority. The die had first to be engraved in a hard material. Not until Roman times was iron and occasionally steel used for this purpose. The Greeks used bronze, and analysis of two of the extremely few Greek dies that have survived shows a proportion of from 18 to 22% of tin, the rest being copper with negligible impurities. Such proportions mean a very hard quality of bronze. Modern dies are all of steel.

**Hubbing and Cutting.**—The die can be cut direct in reverse as an intaglio gem is cut. Or a positive punch or hub can be carved in relief in hard metal, and hammered into a piece of softer metal, which can then be hardened for use as a die. Details which cannot be produced by hubbing in this way can be finished by direct cutting. Both methods were known to the ancients; though no ancient hubs, and very few ancient dies are preserved, examination of the struck coins reveals certain details which can only be due to hubbing. The amount of time and labour saved by hubbing is immense; with one hub many dies can be made, whereas if the design is represented by a die alone, when that breaks or wears out all the work has to be done again. The instruments used in antiquity by die-engravers were the graver or scauper and the dotting-punch. There is no evidence that they used the drill, although that instrument was in the hands of every gem-engraver. The fineness of the work, the almost microscopic detail, must have necessitated the use of magnifying glasses, and there is evidence, literary and material, that these were known to the ancients. (*See* ENGRAVING.)

**The Reducing Machine.**—The second way of obtaining a die was invented in the 19th century and, greatly to the detriment of the art, ousted the method of cutting by hand. It involves the use of the reducing machine, which dates in origin from about 1839 (*see* MINT). The artist first makes a model in wax or plaster at least four times the size of the piece to be produced. This, reproduced in a nickel-faced copper electrotype, is placed in the machine, which works on the familiar principle of the pantograph. A tracer at one end of the proportional arm moves over the whole surface of the model. At the other end a cutting point, revolving rapidly, cuts an exact, mathematically reduced reproduction of the model. Thus is produced a punch which, when driven into another piece of soft steel, afterwards hardened, gives the die which can be used to strike the coin or medal. It is obvious that the die so produced is at least three stages removed from the artist's original model which may not be suitable for a small scale relief, however exact.

The result of the introduction of this machine has been that artists have ceased to trouble themselves about the final metallic product. Not having to cut the metal themselves, they have lost the sense of material. They model in wax or plaster, and the coins or medals which are struck from the dies produced without their intervention appear as if they were made of wax or plaster coloured to look like metal.

**Preparing the Blanks.**—In ancient times dies were cast, sometimes actually in globular form, more usually in a form approximating to that of the final product, with sufficient convexity to allow the metal to penetrate to the deepest recesses of the die. They could also be cut from bars. The thin blanks of the middle ages were clipped out of a sheet of metal; in modern times they are punched out of a rolled bar. In antiquity, the lower die, which produced the obverse, was let into an anvil. The upper (for the reverse) was on the end of a cylindrical bar. The blank being placed on the anvil die, the reverse die was placed above it, and a sledge-hammer brought down on the upper end of the bar. How far the blank was heated before being struck we do not know. Such a primitive method of striking, without a collar to keep the blank in shape, produced great irregularities, splitting of the edge, double-striking and the like. The Greeks were indifferent to such things. The methodical Roman was more careful, and his coins are less irregular in shape. The sledge-hammer blows of course placed great strain on the dies. The first invention to obviate that disadvantage consisted in placing the dies in a frame and hammering wedges in between frame and dies, thus forcing the latter on to the blank between them. In the reign of Julius II. (1503–17) Bramante began experimenting with a press for papal leaden seals; and Leonardo da Vinci also made experiments with a coining press, and more particularly in the process of drawing strips of metal to the right thickness and punching out blanks. Out of such experiments grew the screw-press, the essential advantage of which was that the upper die was brought down on the blank not with a blow, but with a gradual pressure.

**Relief and Lettering.**—Those qualities which make a coin most serviceable as currency are not necessarily favourable to its beauty as a work in relief. The Greeks, for instance, being pre-eminently sculptors, made their coins in high relief. They thus suffered in circulation. It was only in the 4th century of our era that the relief of coins began to become flat, making way for the flat pattern-like treatment which is characteristic of the middle ages. That was not due to a recognition of the suitability of such treatment so much as to the decay of technique. In the use of lettering the Byzantines made an effort at decoration (Pl. IV.-1), but the finest development of lettering as an art on coins was left to the Muslims (Pl. IV.-13). In the 16th century printing wrought disaster on medal lettering.

**The 13th Century.**—Frederick II. attempted to revive the older Roman style; his gold augustale (Pl. III.-16) has a head in medium relief, inspired by the Roman gold of the Constantinian period. But this was a false start. The beautiful Gothic coinages of the 14th century in France, England, the Low Countries, Italy, etc. (Pl. IV.-2-7), show the high-water mark of the flat pattern style, which is by far the most suitable for a coinage which has to be packed in rouleaux and circulates widely. The facing head ousted the profile under the Lower empire (Pl. III.-9). In obedience to a Roman principle, the frontal pose was alone proper to the imperial majesty.

Towards the end of the 15th century the influence of the medal, for which the profile was alone suitable, made itself felt on the coinage and the facing head thus practically disappeared. The early testoons of the Sforzas (Pl. IV.-9) at Milan are the supreme example of profile treatment in very low relief, the finest combination of portraiture with decorative treatment that coinage can show. So far as mere engraving was concerned the highest excellence was probably reached in the 17th century by artists like Briot and Thomas Simon (Pl. IV.-14); and, so far as mere finish is concerned, a Pistrucci, a Wyon or an Andrieu leaves nothing to be desired.

The problem of composing within a circular field was solved by the ancients. The posing of a head, the combining of two or more heads in a group, whether they are jugate or addorsed or opposed, were the main problems of the obverse. The jugate or accollate position was not attempted until the 3rd century B.C. (Pl. III.-4), and does not become common until Roman times. The confronted pose offers no difficulty, and pleased the Roman taste for symmetry (Pl. III.-6); but the Greeks disliked it and it is not found on their coins before Roman times. The Greeks liked symmetry, but it had to be dynamic and full of movement; while they knew all that need be known about what is called heraldic opposition (Pl. III.-1, 2), and occasionally used it, it never played much part in their designs.

The remarkable outburst of artistic effort in England in the

middle of the 8th century, when a real profile portrait head of Offa appears on his coins (Pl. III.-11) at a time when the designs of all other parts of Europe were entirely without merit, had no duration or repercussion. Not even the excellent ornamental designs on the Anglo-Saxon coinage of this time (Pl. III.-12), due perhaps to Irish influence, inspired Continental contemporaries to efforts for better coins. Equally without effect was such an innovation as the type of the sovereign seated in majesty on Edward the Confessor's penny (Pl. III.-14), as on the Great Seal. France had to wait two centuries until Philip II. (1270–85) ventured to introduce the majesty-type (Pl. III.-22). The Norman Conquest caused a definite set-back in English art.

**Germany.**—In the next period we must turn to German lands to find the first signs of relief from the degradation of the engraver's art. About 1125 the curious pieces known as bracteates (Pl. III.-15), extremely thin and bearing on one side only a type which shows through on the reverse, began to be produced in Thuringia and Lower Saxony. The designs—the figure of the king seated facing, the half-figures of king and queen side by side, the emperor on horseback, the figures of saints, often in an architectural setting, and the like—are a not unworthy reflection of the greater art of the Romanesque period. The style reaches its zenith in the second half of the 12th century under Frederick Barbarossa and Henry VI., when the coins sometimes attain a diameter of 50 millimetres. It was, however, in the middle of the 13th century that the real revival began.

A similar effort was made by the little republic of Ragusa in the same century. But other States, though they wisely did not attempt to attain high relief, did begin to play with the idea of making their coins interesting or significant. Florence placed on the gold coins, which were to become world-famous as florins, its graceful lily and the figure of St. John the Baptist (in 1252). Venice started its equally famous gold sequins or ducats in 1280 with the interesting types of the figure of Christ blessing in a border of stars, and of the doge receiving the gonfalon from St. Mark (Pl. III.-18). These types were not entirely new; they had been already used in a less elaborate form on silver.

It must have been the florin that suggested to Henry III., that enlightened patron of art, the introduction of his beautiful gold "penny" in 1257 (Pl. III.-19). His example was followed by St. Louis in his *denier d'or* in 1266—an admirably executed coin of heraldic design (Pl. III.-20). St. Louis must also be credited with a far-reaching innovation in the shape of the large silver piece or gros (Pl. III.-21) of 12 deniers, the forerunner of the English groat or fourpence, though that coin did not come into regular use until 1351. The enlarged size eventually made possible the introduction of more interesting designs, though France continued to cling to conventional patterns, and England to the conventional facing head and cross. In the grossi of Wenceslas II. of Bohemia (1278–1305) the opportunity afforded by the larger flan was seized for a fine heraldic design.

**The 14th Century.**—But the time of Edward III. and his contemporaries is the golden age of European coinage. There is no distinction in style between the Anglo-French coins and those of the French kings, and foreign workmen were employed at the English mint. At this period there is no evidence of an independent English art. The fine period of the Anglo-French coinage closes about 1368; the gold coin of the Black Prince issued at that time is a distinct attempt at portraiture on a small scale (Pl. IV.-5). In England we have the beautiful, but abortive first issue by Edward III. in 1343 of the gold florin (Pl. IV.-3) and smaller denominations: the most beautiful coins in the whole English series, but demonstrably the work of two Florentines, Giorgio Chierichino and Lotto Nicolini. These coins are followed by the gold noble, the obverse bearing the king in his ship as type (Pl. IV.-4). In 1465 Edward IV. introduced a type of rude strength, the angel (Pl. IV.-8), in which there is something peculiarly English, especially in contrast with the St. Michael on the French coins of a century and a quarter earlier (Philip VI., Pl. IV.-2) and the angelot of Louis XI.

Towards the end of the 15th century the Tudor coinage makes its appearance with a flourish; the sumptuous "sovereign" of Henry VII., first struck in 1489, is still Gothic, but effete: it mistakes restlessness and over-decoration for strength (Pl. IV.-11). As in England, the art of coinage in the Low Countries in the 14th and 15th centuries presents no essential difference from what is to be seen in France; Germany during the same period lags far behind the West, its coinage being monotonous and crude.

**Italian Influence.**—It was from Italy that the new revival was to come; and the splendour of its coinage in the last quarter of the 15th century was directly due to the sister art of the medal. The portrait-medal founded by Pisanello, with his incomparable series of portraits made between 1438 and 1449, showed the possibilities of the profile relief. After a few artists, like Enzola of Parma, had in the '60s and '70s made groping experiments in die-cut portraits on small medals, others, notably in Milan—though the attribution of the Sforza series to the Milanese Caradosso may be baseless—succeeded towards the end of the century in producing pieces which, as we have said, reached the high-water mark of portraiture in coinage. Early in the 16th century the influence made itself felt outside Italy. It was a German, Alexander of Bruchsal in Baden, who was employed by Henry VII. from 1494 to 1509, but the beautiful profile portraits by which, from 1503 onwards, he left his mark on the English coinage are obviously inspired by the Italian fashion (Pl. IV.-12). His work sealed the doom of the facing-head on English coins although examples lingered on to the reign of Edward VI.

**The Thaler.**—Meanwhile Germany had taken an important step in the invention of the thaler, again the size giving greater scope to the designer (Pl. IV.-10). The Tyrolese guldengroschen of 1484—the earliest of the class afterwards generally known as thalers—is evidently inspired, clumsy though it be, by an Italian model. It is the ancestor of all the large silver coins, thalers, dalers, dollars, scudi, crowns, of the 16th and 17th centuries. It did not add greatly to the art of coinage, which attains its highest perfection on a field of not more than an inch and a quarter. For a larger field, the medallic art, unrestricted in relief by its nonuse as currency, is proper.

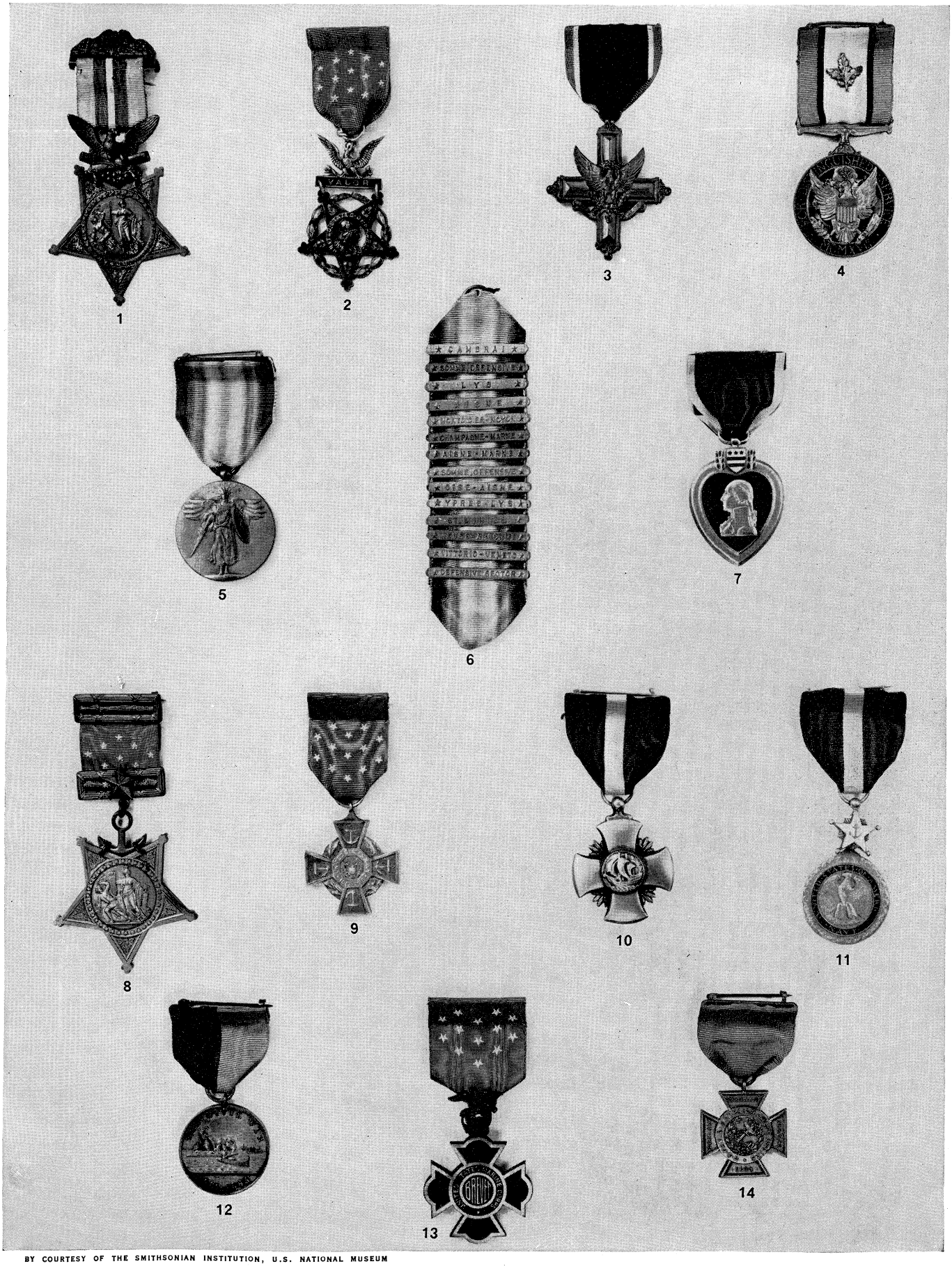
**Portraiture.**—The development of portraiture on coins, as seen in the second half of the 15th century, must be traced to the Italian medal (Pl. VIII.-1, 2). Pisanello's first medal, representing the Emperor John VII Palaeologus, was made in 1438 (Pl. VIII.-1). It revealed the possibilities of profile portraiture on a small scale, suitable for coinage. What the medallists showed was that modern portraits, and not mere imitations of the antique, could find a place on modern coinage. In the '60s and '70s engravers in Milan, Parma and Venice were producing both small medals and portrait-coins from dies. By the beginning of the 16th century the technical difficulties had been overcome (Pl. VIII.-3); and soon the facility afforded by striking for the mass production of medals began to have a reaction on the medallic art. The art of coinage had reached its culmination; all future developments added nothing to its artistic content, and were due merely to increased technical dexterity.

But the medal had still a course to run. The best medallists continued throughout the 16th century to use the casting process for their most important work, even when they were also die-engravers by profession. But official patronage favoured the struck medal, satisfied with number rather than quality. The technical dexterity of the modeller continued nevertheless to increase. In Germany especially, where the art of the medal culminated in the period from 1520 to 1540, a series of portraits was produced unsurpassed in the realism of their presentation and technique of casting (Pl. VIII.-2). In Italy after about 1530 the cast medal continued to develop as an art that had lost its inspiration; facile, graceful but superficial, the elegant portraits of Pastorino of Siena (Pl. VIII.-5) are typical of the school. The modeller begins to lose the sense of material; the original wax-model is all that he cares about and the final product in metal is merely a means of perpetuating it. By the end of the 16th century the Italian vein was worked out. Italian influence, however, had passed across the Alps. German lands, especially Austria, France and Flanders, had all felt it, though none of them in the 16th century produced medallists who marked an epoch. It

BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

## FIFTEENTH, SIXTEENTH AND SEVENTEENTH CENTURY MEDALS

1. John VII., by Pisanello, 1438
2. Christoph Tetzel, by M. Gebel, 1528
3. Vittorio Gambello, by himself, 1508
4. Giovanni Toscani, by Lysippus
5. Edward Courtney, by Pastorino, 1556
6. Marie de Médicis, by G. Dupré
7. George Monck, by Thomas Simon, 1660




BY COURTESY OF THE SMITHSONIAN INSTITUTION, U.S. NATIONAL MUSEUM

## U.S. MILITARY AND NAVAL MEDALS AND DECORATIONS

ARMY MEDALS: 1. Medal of honour, 1st design. 2. Medal of honour, 2nd design. 3. Distinguished service cross. 4. Distinguished service medal. 5. Victory medal. 6. Victory medal clasps. 7. Purple Heart. NAVY MEDALS: 8. Medal of honour, 1st design. 9. Medal of honour, 2nd design. 10. Navy cross. 11. Distinguished service medal. 12. Civil War service medal. 13. Marine 2nd medal. 14. Marine service medal.

remained for France in the first half of the 17th century to do for the art of the medal what Italy through Bernini did for sculpture. As masters of the baroque portrait Guillaume Dupré (Pl. VIII.-6), Jean and Claude Warin should be mentioned beside Bernini, though they too had his excessive virtuosity, as well as his brilliance. In England Thomas and Abraham Simon (Pl. VIII.-7) are almost on the same level. In Holland a native school is distinguished by hardy vigour. These developments are the last flowering of the medallic art before the dead period of the 18th century.

**The 19th Century.**—In the last quarter of the 19th century the monotonous academic tradition which had reigned for nearly two centuries began to break down. The French revival took its rise in Ponscarme (1827–1903). By the study of character in portraiture, the search for a dignified realism, and for a harmonious relation of type to background, and by such external reforms as the abolition of the raised border which had so long been the fashion, he inaugurated a return to the true principles of the art (Pl. IX.-1). The French school reached its zenith under Chaplain (1839–1909), but unfortunately, thanks to modern machinery, exploited with immense skill by Oscar Roly and his school (Pl. IX.-4), the medal in French hands became a merely pretty art, lacking virility and sincerity. In Germany native vigour interposed, and the portraiture by such artists as the Viennese Anton Scharff (1845–1903) is of a fine seriousness. In England Alphonse Legros (1837–1911), with a true instinct rejecting the machine-made medal, produced a remarkable series of cast portraits (Pl. IX.-2); but he found no successor.

Later developments are not sufficiently important to require detailed mention. We are still in the age of experiment. The immense output of medals, especially in Germany, during the World War should have revealed original artists if there were any, but the only one to rise above a journalistic level was Ludwig Gies (Pl. IX.-3) and he often trespassed beyond the limits of his art. There is at the present moment no lack of fine and accomplished portraiture, and although for the purposes of mass production the use of machinery is unavoidable, the better medallists, such as Theodore Spicer-Simpson, are content to produce their works by the nobler method of casting in limited editions of two or three specimens. (*See* METAL WORK; SEALS; GREEK ART; ROMAN ART.)

BIBLIOGRAPHY.—On the technique of making coins and medals *see* G. F. Hill, "Ancient Methods of Coining," *Numismatic Chronicle* (1922) and *Medals of the Renaissance* (1920). On the place of coins in art, the literature is confined to ancient coins: B. V. Head, *Guide to the Coins of the Ancients* (4th ed., 1895); P. Gardner, *Types of Greek Coins* (1882); K. Regling, *Die Antike Münze als Kuntstwerk* (1924); G. F. Hill, *Select Greek Coins* (1927). (G. F. H.)

## TOKENS FOR WAR SERVICE

From the earliest times service of all kinds has been rewarded by honours and distinctions. We learn from Josephus ("Antiquities of the Jews") that in the 3rd century B.C. Jonathan, the high priest, successfully led the Jews in battle thereby aiding Alexander, who "sent to Jonathan, and gave testimony of his worth, and gave him *honorary rewards,* as a *golden button,* which it is the custom to give King's kinsmen." Later Jonathan received another golden button for similar service. These honorary rewards of golden buttons are the earliest form of medal to commemorate war service.

### BRITISH MEDALS

**War Medals.**—The earliest medal in existence struck for an Englishman for war service is that awarded to John Kendal in 1480. Kendal was prior of the English Knights of St. John of Jerusalem and in 1480, relieved Rhodes. His medal is now in the British Museum.

Although decorative medals were common before her reign, Queen Elizabeth appears to have been the first sovereign to bestow a medal for particular military service to the Crown, this being the "ark in flood" medal (so called from its design) to commemorate the victory over the Armada in 1588. James I. (1603–1625) issued a medal "in reward for naval achievements" on which the design was repeated.

Under a royal warrant, dated May 18, 1643, Charles I. authorized the issue of "Badges of silver, containing our Royal image and that of our dearest son, to be achieved to wear on the breast of *every man* who shall be certified under the hands of their Commander-in-Chief to have done us faithful service in the Forlorn-Hope" (*i.e.,* the tactical advanced guard of those days and not a hopeless adventure).

During the Commonwealth, statutory provision was made for the bestowal of medals as naval awards under a minute of the council of State, Nov. 15, 1649. There was also a "Medal of the Parliament" for land service, one being awarded to Col. Mackworth, governor of Shrewsbury, as a mark of the parliament's favour. This medal was given with "a chain of gold to the value of one hundred pounds." The first English campaign medal is that issued by the Commonwealth to commemorate Dunbar, Sept. 3, 1650. A week after the battle the House of Commons authorized the medal "both for officers and men." Cromwell protested against his effigy appearing on the medal, but this was overruled, and his effigy placed thereon. The finest medals of this period are those granted to Blake, Monk, Penn and Lawson for their victory over Van Tromp, July 31, 1653. The medals are in gold, with gold chains.

One interesting medal granted by James II. was to Bishop Mew, for his services as commander of the king's artillery at Sedgemoor, 1685. Before entering the church Mew had been an able soldier, and his ecclesiastical duties had not interfered with his continued study of the military art. Almost all writers on the subject classify the "Cumberland" medal (sometimes called the "Culloden" medal) as a commemorative war medal. This is incorrect. The battle was fought on April 16, 1746, the English being commanded by the young duke of Cumberland. To commemorate his success a number of admirers formed the Cumberland Society, a rule of which was that each member on joining was to be presented with a medal. No evidence has been found to show that the victory was *officially* commemorated by the grant of a medal.

Only one medal was issued for the American War of Independence, this being awarded to a Captain Ewing who distinguished himself at Bunker Hill.

Credit is due to the Honourable East India Company for instituting the regular practice of making the grant of medals a "general distribution" and not solely to officers. Some of their early grants include the "Deccan" medal for service during 1778–84, the "Mysore" medal (1791–92) and the "Seringapatam" medal (1799), and they continued this practice until the Crown assumed the Government of India after the Indian Mutiny. The lack of medallic recognition to the rank and file prompted Davison, Nelson's prize agent, to present a medal to every man who took part in the battle of the Nile (1798). His example was followed in 1805 by Boulton, of the Soho Mint, Birmingham, who presented medals to all ranks who had taken part in the battle of Trafalgar (1805). But, it is stated, that as the medals for the men were only made of pewter they deemed them of no value and the majority threw them away. These are the only instances of medals being awarded to service men by private individuals.

British war medals enter upon a new era with those awarded to admirals and captains for Lord Howe's victory over the French on "the Glorious 1st of June" (1794), generally known as the *Navy Gold Medals,* in that the first official reference is made to *medal ribbon* in connection with them.

The Peninsula Campaign was two years old before any medals were authorized to commemorate the successful major operations therein. The battles of *Roleia* (Roliça), *Vimiera, Corunna* and *Talavera* had all been fought before the *Army Gold Medals* were instituted under general order, Sept. 9, 1810. In addition to the foregoing the *Army Gold Medal* was authorized for officers, not below the rank of battalion commander, for the following operations: *Sahagun, Benevente, Busaco, Barossa, Fuentes d'Onor, Albuhera, Ciudad Rodrigo, Badajoz, Salamanca, Vittoria, Pyrenees, St. Sebastian, Nivelle, Nive, Orthes* and *Toulouse.* Originally a separate medal was awarded for each separate operation and many officers became entitled to several medals. This,

however, caused inconvenience to the recipients and a new system was instituted in 1813 under which only one medal was to be borne by each officer entitled thereto. For the second and third occasions gold clasps, the first ever sanctioned, were added to the medal ribbon, and on becoming entitled to a fourth mark of distinction the medal was surrendered and a *Gold Cross* issued in its place, on the four arms of which were inscribed the four battles for which marks of distinction had been awarded. On becoming entitled to a fifth or further marks of distinction, gold bars inscribed with the name of each battle were added to the *Gold Cross* ribbon. The substitution of a cross for a medal was never repeated.

Of the 20 operations in the Peninsula Campaign for which medals, crosses and clasps were awarded, the Duke of Wellington had distinctions for 14, viz. (*a*) inscribed on the *Gold Cross:*— *Roleia* and *Vimiera, Talavera, Busaco, Fuentes d'Onor,* (*b*) clasps to the *Gold Cross: Ciudad Rodrigo, Badajoz, Salamanca, Vittoria, Pyrenees, Nivelle, Nive, Orthes* and *Toulouse.*

The first war medal to be issued to all ranks, alike in all respects, was the *Waterloo Medal*—this, at the suggestion of the Duke of Wellington.

The fact that the *Waterloo Medal,* the *China Medal* (1840–42) and the *Jellalabad Medal* (1842) were given to all ranks alike without discrimination, appears to have started an agitation amongst those who had taken part in operations for which the *Army Gold Medal* and *Gold Cross* had been awarded but for which they were not eligible, owing to their rank. In this case, the Duke of Wellington opposed granting such a medal but it was adopted as the *Army General Service Medal.* The *Military Ribband* was worn with the medal. It was usually referred to as the *Peninsula Medal,* colour being lent to the idea by Wellington's figure appearing thereon, but it included campaigns in which Wellington had no military concern. Clasps were added.

The grant of the Army G.S.M. naturally led to a similar medal being authorized for the Navy, the *Navy General Service Medal* which covered operations from 1793 to those off the coast of Syria in 1840. Clasps included: *Howe's Victory* (June 1, 1794), *Camperdown* (Oct. 11, 1797), *Nile* (Aug. 1, 1798), *Copenhagen* (April 2, 1801), *Trafalgar* (Oct. 21, 1805), *Navarino* (Oct. 20, 1827).

Later medals commemorate service in the Crimea, the Indian Mutiny, New Zealand campaigns and those in Egypt.

The Honourable East India Company followed the example of the home Government and instituted the "India 1851" medal. Four further India general service medals have been granted to cover operations from 1849–95, 1895–98, 1901–02, and from 1908 to 1928. For the late Lord Roberts' march from Kabul to Kandahar in 1880 there is a bronze, known as *Roberts' Star.* For minor campaigns, the *General Service Medal* is granted.

**Gallantry Medals, Crosses or Orders.**—The most famous of this class is the *Victoria Cross* instituted in 1856. All ranks and civilians are eligible for the award, to qualify for which the recipient must have performed some conspicuous act of bravery in the presence of the enemy. The ribbon now is red (claret) for all recipients, but was previously blue for the Royal Navy. Recipients who are granted a second distinction are awarded a bar. The award carries a pension. The V.C. takes precedence of all other orders and medals.

Other awards of lesser degree in this class are: *Distinguished Service Order,* instituted in 1886 and the *Military Cross* (1914); only officers are eligible for the award. *Distinguished Conduct Medal* instituted in 1854, also the *Military Medal* (1916); only "other ranks" are eligible for the award. *Meritorious Service Medal,* instituted in 1845, awarded to sergeants as a reward for distinguished or meritorious service; it carries a gratuity. *Conspicuous Gallantry Medal,* originally sanctioned for Crimean War only, reinstituted 1874 and now available for any war; only "other ranks" of Royal Navy and Royal Marines are eligible for the award. *Indian Distinguished Service Medal,* instituted 1907, only Indian officers and "other ranks" are eligible. The Royal Air Force has medals, etc., comparable to the foregoing. See also on next page under *Other Medals and Decorations.*

**Good Conduct Medals.**—There are a number of medals granted for good conduct combined with a prescribed number of years' service, the conditions of eligibility varying according to the service, and whether Regular, Auxiliary, Colonial, etc. The first of these medals was the *Long Service and Good Conduct Medal* instituted in 1830.

### UNITED STATES MEDALS

The premier decoration of the United States is the *Medal of Honor* which is comparable to the *Victoria Cross.* It was instituted in 1862 as a reward for conspicuous acts of bravery during the Civil War. In the course of time the details of the design have changed; the present description of the Army medal is a five-pointed star superimposed on a wreath, in the centre of the star the head of *Minerva,* surrounding which is a circle inscribed "UNITED STATES OF AMERICA." The star is suspended from a bar attached to the two top points, and on the bar is inscribed "VALOR," above which is the American Eagle. Attached to the eagle's head is a ring through which passes the ribbon. The ribbon is light blue with stars embroidered thereon, and the medal is worn round the neck. The Navy medal differs in a few details from the Army pattern. This medal takes precedence of all other United States decorations. "Medal of Honor" lapel buttons are optional for wear in civilian clothes; they are hexagonal rosettes made of light blue silk with 13 white stars. There was a *Merit Medal,* awarded with the "Certificate of Merit" for which only enlisted men were eligible, but this was abolished in 1918.

War commemorative medals follow the British practice. An interesting example is the *Civil War Medal,* on the obverse of which is a portrait of Lincoln, surrounded by an inscription taken from his famous Second Inaugural: "WITH MALICE TOWARDS NONE, WITH CHARITY FOR ALL." On the reverse is inscribed "THE CIVIL WAR, 1861–1865." The "Indian Wars" Medal is also interesting from the fact that the reverse was copied for reverses of many other campaign medals.

### MEDALS OF OTHER COUNTRIES

**France.**—Before 1802 gallantry in the field was awarded by grants of swords of honour, muskets of honour and other weapons but in that year Napoleon instituted the *Legion d'Honour.* The original cross of the Legion of Honour was a white enamel gold badge, with five rays of double points, each point tipped with a silver ball, the whole on a wreath of oak and laurel: in the centre of the obverse, Napoleon's effigy with "NAPOLEON" inscribed around it. The present badge is much the same in appearance but instead of Napoleon's effigy on the obverse there is a female head, and inscribed round it, "REPUBLIQUE FRANÇAISE, 1870." The order is divided into five grades: Grands Croix, Grands Officiers, Commandeurs, Officiers and Chevaliers. The Legion of Honour is the premier order of France and is only conferred for gallantry in action or for 20 years' distinguished military or civil service in peace. The *Médaille Militaire,* instituted in 1852, is comparable with the British D.C.M. It is only conferred upon general officers in command of armies and to N.C.Os. and men of the Navy and Army for distinguished service in action. It was awarded to the late Field-Marshal Lord French. As regards commemorative war medals the first is interesting, viz., *St. Helena Medal,* instituted in 1857 for operations between 1792 and 1815. The medal is bronze and bears on one side the effigy of Napoleon, and on the other, in French, "Campaigns of 1792 to 1815. To his comrades in glory, his last thought. St. Helena, May 5, 1821." Another interesting war medal is the *Pontifical Cross,* instituted in 1867, by Pope Pius IX., and granted to all members of the French forces who took part in the defence of Rome in 1867.

**Germany.**—A renowned German decoration was the *Iron Cross,* instituted in 1813, as a reward for distinguished service in the War of Liberation. It was revived for the Franco-Prussian War of 1870 and was again issued for service in the World War. The cross is a Maltese Cross of cast iron edged with silver. On the upper link is a crown, on the lower link the date of the campaign, that for the World War being "1914," in the centre the initial or initials of the sovereign at the date of issue. There are three classes of the Order of the *Iron Cross.* The Grand Cross, dou-

ble the size of the ordinary cross, is worn round the neck, and is awarded solely for the winning of an important battle, or equivalent exploit. With the rank and file the cross carries with it a gratuity. *The Order of Military Merit (Prussia)*, founded in 1665, was bestowed for conspicuous war service.

**Belgium.**—The *Order of Leopold II.* was instituted in 1900. There are six classes. It is awarded to N.C.Os. and men and "ranker" officers for exemplary service after a number of years (20–30). The *Ordre de la Couronne,* instituted in 1897, was originally the premier order of the Independent Congo State but was transferred to the Ministry of Foreign Affairs in 1910. It is awarded to officers after a number of years' exemplary service (20–32) and to N.C.Os. after 38 years' exemplary service. The *Military Medal,* instituted in 1902, is comparable with the British Military Medal.

**Japan.**—The *Order of the Rising Sun,* instituted in 1875, is awarded to all ranks of Army and Navy for gallant service in war or distinguished service in peace. The *Order of the Sacred Treasure,* instituted in 1888, is awarded to both military and naval officers for meritorious service. The *Order of the Golden Kite* was instituted in 1891. There are several classes, the higher for officers and the lower for N.C.Os. and men. It therefore corresponds approximately to the British D.S.O., D.S.C., M.C. and D.C.M. The medal to commemorate the Russo-Japanese War of 1904–05 is made of light bronze.

**Italy.**—The *Order of Saint Maurice and Saint Lazarus* was founded in 1434, and revised in 1831, 1837 and 1855. The *Military Order of Savoy,* founded in 1815, is awarded for special distinguished war service. Medals for military valour are awarded for acts of bravery in much the same manner as British gallantry medals. The *Messina Medal* was awarded by the King of Italy to officers and men of the British men-of-war and to certain others who assisted in succouring the injured after the terrible earthquake at Messina and Reggio in Dec. 1908. The ribbon is green with white edges.

**Serbia.**—The *Order of the White Eagle,* instituted in 1883, consists of five classes. The badge consists of a double-headed eagle in gold, ensigned with a crown. The *Star of Kara George,* instituted in 1904, consists of four classes.

## WORLD WAR MEDALS AND DECORATIONS

By resolutions passed by a committee of the Peace Conference in Paris in March 1919, it was decided that the victorious Allies and associated Powers (*i.e.*, Great Britain and her dominions, France, Belgium, Italy, Spain, United States of America, Japan, etc.) should have a medal common to the Powers in general design. The medal was to be called the *Victory Medal* and was to be round, made in bronze (36mm. wide), the colour, surface, thickness and attachment to be similar to the French Medal of the 1870 war, on the obverse a winged figure of Victory full length in the middle, on reverse the inscription, "The Great War for Civilization," in the language of the country granting the medal, the rim plain. The ribbon to be identical for all countries and to consist of two rainbows joined by the red in the centre.

One of the objects of issuing a medal similar in design in all countries was to obviate the interchange of Allied commemorative war medals. No clasps have been issued with the medal except in the U.S. The exact conditions under which the medal was awarded varied in each country, but generally it was issued to all who went into a theatre of war in any capacity between the first declaration of war in 1914 and the date of the Armistice, Nov. 11, 1918. In the British service it was also granted for post-Armistice operations in North Russia and Siberia, ending on Oct. 12, 1919, and in Trans-Caspia, concluding on April 17, 1919. Also in the British service an emblem in the form of an oak leaf in bronze was placed on the Victory Medal to indicate that the recipient had been mentioned in despatches during the World War.

### OTHER MEDALS AND DECORATIONS

**Great Britain.**—(*a*) *1914 Star* (commonly known as the Mons Star), instituted in 1917, and awarded to all ranks, including nursing staffs, who actually served in France or Belgium on the establishment of a unit between Aug. 5, 1914, and Nov. 22–23, 1914. (*b*) *1914–15 Star,* instituted in 1918, similar in design to the *1914 Star.* (*c*) *British War Medal,* instituted in 1919. In general terms it was granted to all personnel of the Army who served overseas in a theatre of operations in any capacity during the war, and to the Navy for one month's service during the war. (*d*) *Mercantile Marine War Medal,* granted to members of the Mercantile Marine for service during the World War; (*e*) *Territorial Force War Medal,* instituted in 1920, granted to members of the T.F. and T.F. nursing service for service outside the United Kingdom during the war subject to certain conditions (those awarded the *1914 Star* or *1914–15 Star* were ineligible for the T.F.W.M.); (*f*) *Military Cross,* instituted in 1914, an army decoration for which only captains, junior officers and warrant officers are eligible; (*g*) *Distinguished Service Cross* (established as Conspicuous Service Cross in 1901) re-named in 1914 and its award extended to all naval and marine officers below the relative rank of lieutenant-commander; (*h*) *Distinguished Service Medal,* instituted in Oct. 1914 for other ranks of Royal Navy and Royal Marines; (*i*) *Order of the British Empire,* instituted in June 1917, as a reward for war service in any capacity; (*j*) *Military Medal,* instituted in 1916; all other ranks are eligible for the award; (*k*) *Silver War Badge,* instituted in 1916, issued to all ranks who served at home or abroad during the World War and who on account of age, or physical infirmity arising from wounds or sickness caused by military service, had been compelled to leave the forces; (*l*) *Royal Air Force.* The following decorations were instituted under a royal warrant dated June 3, 1919, and have been awarded: *Distinguished Flying Cross, Air Force Cross, Distinguished Flying Medal* and *Air Force Medal.*

**United States of America.**—(*a*) *Distinguished Service Cross, Army,* instituted Jan. 12, 1918, awarded to those who since April 6, 1917, have distinguished themselves in connection with military operations in circumstances which do not justify the award of the Medal of Honour. (*b*) *Distinguished Service Medal, Army and Navy,* instituted Jan. 12, 1918, awarded for exceptionally meritorious service. (*c*) *Navy Cross,* terms of award similar to *Distinguished Service Cross, Army.* The United States *Victory Medal* has battle clasps.

**France.**—*Médaille de la Reconnaissance Française,* instituted in 1917, is awarded to persons who performed acts of devotion in the public service. The following war medals were also issued: *Médaille Commémorative d'Orient* and *Médaille Commémorative Française de la Grande Guerre.*

**Turkey.**—For the Gallipoli campaign Turkey issued a white metal five-pointed star, in the centre of which is the Sultan's cypher, and the characters representing "El Ghazi" (The Victorious), below the date "333" (*i.e.*, 1915). The ribbon is scarlet moire with a white stripe towards the edges.

**Japan.**—This medal is similar to that granted for the Russo-Japanese War. The ribbon is dark blue with a broad white stripe.

**Egypt.**—*The Military Star of the Sultan Fouad* was instituted in 1919 for officers of the Egyptian Army who are mentioned in despatches for post-Armistice operations.

**Belgium.**—*Croix de Guerre,* instituted in 1915, awarded for exceptional acts of bravery. Medal *De la Reine Elisabeth,* instituted in 1916, and awarded to ladies, without distinction of rank, who assisted Belgians during the war. Other medals are *Médaille du Roi Albert; Croix Militaire; Décoration Militaire; Médaille de l'Yser.* Three medals for the general campaigns on the Continent and in Africa were also struck: *Médaille Commémorative de la Campagne 1914–1918, Médaille Commémorative de la Campagne d'Afrique 1914–18,* and *Étoile de Service du Congo.*

**Rumania.**—*Order of St. Michael The Brave,* instituted in 1916, solely for service in the field.

**Portugal.**—*Victory Medal* and *Medalha commemorativa das campanhas do Exercito Portugues* (to which were added clasps) were issued for the general campaign.

**Germany.**—Several medals were issued in Germany of which the following are the most important: (*a*) a silver medal was struck for the *March on Paris.* On the obverse is the bust of Gen. von Kluck and "1914–1915"; reverse, a naked fury on horse-

back carrying two blazing torches and "Nach Paris, 1914"; (*b*) a bronze medal was struck for the anticipated German entry into Paris. Obverse the Arc de Triomphe; among rays spreading from the top "1871–1914"; in the background the Eiffel Tower, and inscribed round the whole, "Entry of the German Troops into Paris." Reverse, the 1914 Iron Cross and "Nach aussen entschlossen. Nach innen geschlossen" (Resolute in the face of the enemy, united on the home front). An attempt was made to suppress it when the German hopes were not realized, but a few specimens are in existence, one being in the British Museum; (*c*) the Failure Before Paris is commemorated by a cast-iron medal. Von Kluck's bust with "1914–1915" on the obverse, with an eagle perched on a gun-emplacement, gazing at distant "Paris" on the reverse; (*d*) the new Triple Alliance is commemorated by a bronze medal, bearing on the obverse the busts of Kaiser Wilhelm II., Kaiser Franz Josef and the sultan of Turkey, and the inscription "Glory to God alone." Reverse, eagle perched on an oak branch, with the inscription "Brotherhood in arms, 1915, Germany, Austria-Hungary, Turkey"; (*e*) Russian defeat at Tannenberg: medal cast in iron and bronze. Obverse, bust of Hindenburg; reverse, "Tannenberg–Ortelsburg 1914" and "Queller of the Russians, liberator of East Prussia"; (*f*) the battle of the Falkland isles, Dec. 8, 1914, is commemorated by a bronze medal; (*g*) the Submarine War medal is cast in bronze. Obverse, bust of Admiral von Tirpitz. Reverse, Neptune with trident, seated on conning-tower of a submarine, shaking his fist at the distance where are two British sailing ships, one sinking; in middle distance, another submarine, inscription, "Gott strafe England, 18 Februar, 1915"; (*h*) the sinking of the "Lusitania." Obverse, ticket office of the Cunard company in New York, with Death issuing tickets to a crowd of passengers, motto "Business First." Reverse, the Lusitania (showing guns, aeroplanes, etc., on board) sinking. Inscription, "No contraband" and "The liner Lusitania sunk by a German Submarine, May 5, 1915." The liner was sunk on May 7 not May 5. "The authenticity of this medal has sometimes been denied, but the fact that it was issued has been frequently admitted by responsible German authorities as well as by the artist (K. Goetz) himself" (vide *Historical Medals in the British Museum*); (*i*) the Zeppelin attack on London on the night Aug. 17–18, 1915, was commemorated by a medal cast in iron; (*j*) the failure of the Allies Dardanelles Expedition was commemorated by a satirical medal in bronze. (T. J. E.)

BIBLIOGRAPHY.—Royal warrants, general orders and Army orders, dealing specifically with medals and decorations. *A Guide to the Exhibition of Historical Medals in the British Museum* (1924), fully illustrated; J. H. Mayo, *Medals and Decorations of the British Army and Navy* (up to 1895), a most authoritative work; T. Dorling, *Ribbons and Medals,* a useful handbook relating to all countries.

**NUMMULITE:** *see* PROTOZOA.

**NUN,** a member of a community of women, living under vows a life of religious observance (*see* MONASTICISM; MONK).

**NUNATAK,** a name applied in Greenland to a hill or mountain peak appearing above the surface of a glacier. Greenland is for the most part covered by an ice-cap of a certain thickness which moves slowly downwards to the sea. It will rise upwards and pass over a barrier if there is no outlet, but it will flow between and around mountain peaks leaving them standing as hills (nunataks) above the general surface of the ice-cap.

**NUNCIO,** a representative of the pope sent on diplomatic mission, sometimes called *Nuntius apostolicus.* The nuncios are of lower rank than the *legati a latere,* but have practically superseded them as ambassadors of the papacy. Nuncios were permanently established during the 16th century.

**NUNCOMAR** or NANDA KUMAR (d. 1775), Indian official, best known for his connection with Warren Hastings (*q.v.*), was governor of Hugli in 1756, and in 1764 he was appointed collector of Burdwan in place of Hastings, which resulted in a long-standing enmity. In 1775, when Hastings was governor-general, Nuncomar brought accusations of peculation against him, which were entertained by Francis and the other members of council inimical to Hastings. While the matter was still pending Nuncomar was indicted for forgery, condemned and executed. Warren Hastings and Sir Elijah Impey, the chief justice, were both impeached, and were accused by Burke and afterwards by Macaulay of committing a judicial murder; but Sir James Stephen, after investigation, reached an opposite conclusion.

*See* Sir James Stephen, *The Story of Nuncomar* (2 vols., 1885); and H. Beveridge, *The Trial of Nanda Kumar* (Calcutta, 1886).

**NUNEATON,** a municipal borough in the Nuneaton parliamentary division of Warwickshire, England, 9.7 mi. N.W. from London by the L.M.S.R. It is on the river Anker and the Coventry canal. Pop. (1938) 48,864. Area, 5.2 sq.mi. The prefix of the name of the town is derived from a priory of nuns founded there in 1150. In the reign of Henry III a weekly market was granted to the prioress. Nuneaton was incorporated in 1907 and the boundaries were later extended. The church of St. Nicholas consists of nave, chancel and aisles, with a square embattled tower having pinnacles at the angles. The grammar school was founded in 1552. The ribbon industry is of less importance than formerly. The weaving of worsted goods is carried on, and there is a considerable industry in the making of bricks, tiles and drain pipes. Local mines of coal and ironstone employ many hands.

**NUNEZ, PEDRO** (PETRUS NONIUS) (1492–1577), Portuguese mathematician and geographer, was born at Alcacer do Sal, and died at Coimbra, where he was professor of mathematics. He published a translation of portions of Ptolemy (1537), and a treatise in two books, *De arte atque ratione navigandi* (1546). His clear statement of the scientific equipment of the early Portuguese explorers has become famous. A complete edition of all his writings appeared at Basel in 1592.

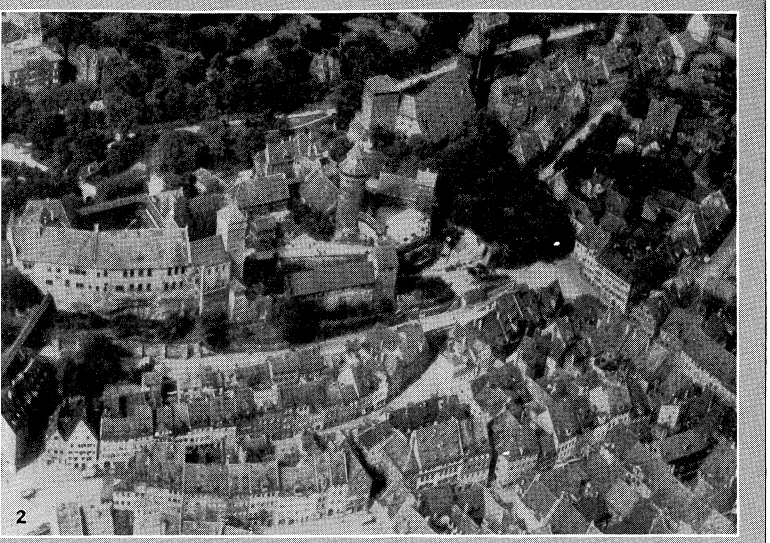
*See* F. de B. Garcão-Stockler, *Ensaio historico sobre a origem e progressos das mathematicas em Portugal* (Paris, 1819); R. H. Major, *Prince Henry the Navigator* (London, 1868, p. 55).

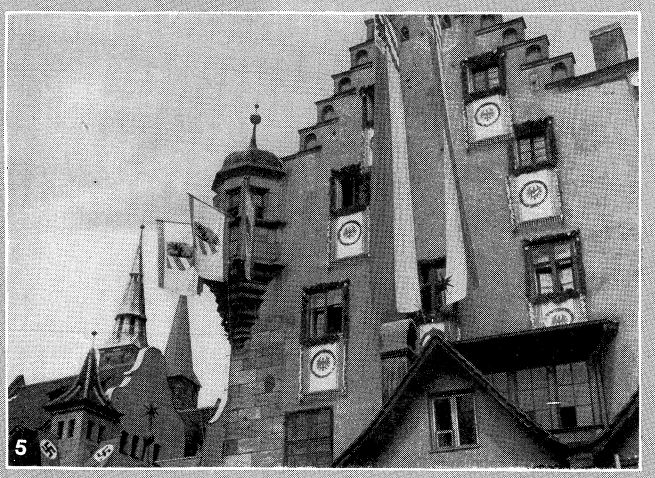
**NUÑEZ CABEZA DE VACA, ALVARO** (*c.* 1490–*c.* 1564), Spanish explorer, was the lieutenant of Pamfilo de Narvaez in the expedition which sailed from Spain in 1527; when Narvaez was lost in the Gulf of Mexico, Cabeza de Vaca succeeded in reaching the mainland to the west of the Mississippi, and, striking inland with three companions, reached the city of Mexico in 1536. Returning to Spain in 1537, he was appointed "adelantado" or administrator of the province of Rio de la Plata in 1540. Sailing from Cadiz in the end of that year, after touching at Cananea (Brazil), he landed at the island of St. Catharine in March 1541. Leaving his ships to proceed to Buenos Aires, he set out in November with about 150 men to find his way overland and reached Ascension (Asunción) for the relief of his countrymen there the next year. Though successful, he was sent home under arrest in 1544, and in 1551 was banished to Africa by the council of the Indies for eight years. He was recalled and appointed judge in Seville, where he died not later than 1564.

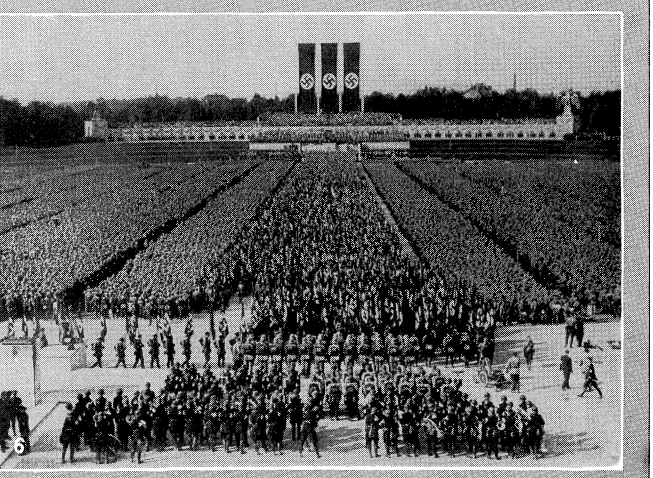
The *Naufragios* ("Shipwrecks") of Cabeza de Vaca, which relate to the Florida expedition and his journey to the city of Mexico, appeared at Zamora in 1542; the work has frequently been reprinted, and an annotated English translation was published by T. Buckingham Smith in 1851. His *Comentarios* (1555) chronicle the events of the South American expedition. *See* Fanny Bandelier, *Journey of A. Nuñez Cabeza de Vaca* (ed. A. F. Bandelier, New York, 1905).

**NUÑEZ DE ARCE, GASPAR** (1832–1903), Spanish poet, dramatist and statesman. Deputy for Valladolid in 1865, he was imprisoned at Cáceres for his violent attacks on the reactionary ministry of Narvaez, acted as secretary to the revolutionary Junta of Catalonia, and wrote the "Manifesto to the Nation" (Oct. 26, 1868). He served under Sagasta as minister for the colonies, the interior, the exchequer and education; but ill-health compelled him to resign in 1890.

Nuñez de Arce first came into notice as a dramatist with such plays as *La Cuenta del Zapatero* (1859), and *El haz de leña* (1872). But his talent was more lyrical than dramatic, and his celebrity dates from the appearance of *Gritos del combate* (1875), a collection of poems exhorting Spaniards to save the country from anarchy and lay aside domestic controversies. He was maintained in popular esteem as the only possible rival of Campoamor by a series of philosophic, elegiac and symbolic poems: *Raimunae Lulio, Ultima lamentación de Lord Byron* (1879), *Un Idilio y una Elegía* (1879), *La Selva oscura* (1879) and *La Visión de Fray Martín* (1880). The old brilliance sets off the naturalistic observa-







BY COURTESY OF (2, 3) THE GERMAN TOURIST INFORMATION; PHOTOGRAPHS, (1, 6) PAUL'S PHOTOS, (4) DONALD MCLEISH, (5) SCHALL-PIX

## SCENES OF INTEREST IN THE OLD CITY OF NÜRNBERG

1. The old fortress castle, on the north side of the city
2. Aerial view of Nürnberg looking down on Castle hill (centre, left) and its mediaeval fortifications around which the town developed. At the left is the imperial castle, and in the centre the Vestner-Turn (round tower), built 1561. Behind it in a diagonal line is the Five-Cornered tower, in which was the torture device known as the "Iron Maiden"
3. Looking across the roofs of Nürnberg to Castle hill. St. Sebald's church (1230–73), with twin towers, is on the left
4. House (centre) of Albrecht Dürer. It has been owned by the city since 1826, and has been restored
5. Detail of an old house on Adolf Hitler Platz, with characteristic gable
6. The Luitpold arena during a nazi party congress prior to World War II

tion of *La Pesca* (1884) and *La Maruja* (1886). The list of his works is completed by *Poemas cortos* (1895) and *¡Sursum corda!* (1900); *Hernán el lobo,* published in *El Liberal* (Jan. 23, 1881), and *Luzbel* remain unfinished. Gracious in his vision, sincere and patriotic, his weakness was sentiment and rhetorical sympathies.

(J. F.-K.)

**NÜRNBERG** [NUREMBERG], second town in Bavaria, Germany, in size, and first in commercial importance. It lies in the district of Middle Franconia in a sandy, well-cultivated plain, 124 mi. by rail N.N.W. from Munich. The city stands on the Pegnitz, which is here crossed by 14 bridges.

**History.**—The first authentic mention of the town of Nürnberg, which seems to have been called into existence by the foundation of the castle, occurs in a document of 1050; and about the same period it received from the emperor Henry III permission to establish a mint and a market. It is said to have been destroyed by the emperor Henry V. in 1105, but in 1127 the emperor Lothair took it from the duke of Swabia and assigned it to the duke of Bavaria. An imperial officer, styled the burggrave of Nürnberg, became prominent in the 12th century. This office came into the hands of the counts of Hohenzollern at the beginning of the 13th century. The town was ruled by patrician families. German monarchs frequently resided and held diets here, and in 1219 Frederick II. conferred upon it the rights of a free imperial town.

Like Augsburg, Nürnberg attained great wealth as an intermediary between Italy and the East on the one hand, and northern Europe on the other. Its manufactures were well known. The town gradually extended its sway over a territory nearly 500 sq.mi. in extent, and was able to furnish the emperor Maximilian with a contingent of 6,000 troops. But perhaps the great glory of Nürnberg lies in its claim to be the principal fount of German art. Adam Krafft, Veit Stoss and Peter Vischer are famed as sculptors. In painting Nürnberg claims Wohlgemuth and Dürer. A large proportion of the old German furniture, silver-plate and stoves was made in Nürnberg workshops. Its place in literary history it owes to Hans Sachs and the other meistersänger.

Nürnberg was the first imperial town to embrace Protestantism (about 1525). The first blow to its prosperity was the discovery of the sea-route to India in 1497; and the second was inflicted by the Thirty Years' War, during which Gustavus Adolphus was besieged here for ten weeks by Wallenstein. The downfall of the town was accelerated by the illiberal policy of its patrician rulers. In 1803 Nürnberg was allowed to maintain its nominal position as a free city, but in 1806 it was annexed to Bavaria.

After 1933 Hitler's National Socialist party held its annual September convention at Nürnberg with great displays of fervent oratory and parades of troops, Hitler Youth and other nazi organizations. Here were decreed in 1935 the "Nürnberg laws" which divided the people of Germany into three classes: (1) German (Aryan) citizens enjoying full rights; (2) Jews, who had two or more Jewish grandparents and who were excluded from the ordinary rights of citizenship, could not marry Germans and were virtually condemned to a ghetto existence; and (3) "mixed" or "hybrid" persons, who had one or two Jewish grandparents, were not of Jewish faith or married to a Jew, and who might marry Germans and become assimilated into the German people. For the party conventions Hitler began the construction of a gigantic stadium, to be the largest in the world, in the Zeppelin field near Nürnberg.

During World War II several severe British air raids destroyed or damaged many of Nürnberg's famous buildings, including the Dürer house.

**Population and Industries.**—The population of Nürnberg was, in (1939) 425,529, more than two-thirds of whom are Protestant. The city is a garrison town. The manufactures are toys and fancy articles in metal, carved wood and ivory, which are collectively known as Nürnberg wares. It is also famous for pencils, needles, electric apparatus, chromo-lithography and motors. Nürnberg is ordinarily the chief market in Europe for hops. It is an important junction for railways and is served by the Ludwig canal, connecting the Danube and the Main.

**Buildings.**—Considerable sections of the ancient walls and moat still remain; of the 365 bastions which formerly strengthened the walls, nearly 100 are still *in situ,* and a few of the old gateways have also been preserved. Most of the streets are narrow and crooked, and the majority of the houses have their gables turned towards the street. The general type of architecture is Gothic, but the rich details, which are lavished with especial freedom in the interior courts, are usually borrowed from the Renaissance. Most of the private dwellings date from the 16th century, and there are practically none of earlier date than the 15th century. The roofs are of red tile.

The old castle (Kaiserschloss), on a rock on the north side of the town, dates from the early 11th century, but received its present form about 150 years later. It was restored in 1854–56.

Nürnberg contains several churches, the finest of which are those of St. Lorenz, of St. Sebald and of Our Lady. All three are Gothic edifices and are notable for their elaborately carved doorways, in which free play has been given to the exuberant fancy of the Gothic style. The church of St. Lorenz, the largest of the three, was built in the 13th and 14th centuries and has recently been restored. In it is the masterpiece of the sculptor, Adam Krafft, consisting of a ciborium, or receptacle for the host, in the form of a florid Gothic spire 65 ft. high; the carving of this work is exquisitely minute and delicate. The shrine of St. Sebald, consisting of a bronze sarcophagus and canopy, in the richest Gothic style, adorned with numerous statues and reliefs, is looked upon as one of the greatest achievements of German art. It was executed by Peter Vischer, the celebrated artist, in bronze, who was occupied on the work for 13 years (1506–19). The church of Our Lady possesses some fine old stained-glass windows and some paintings by Michael Wohlgemuth. The Tuchersche altar, with its winged picture, is one of the finest works of the Nürnberg school about the middle of the 15th century. Other noteworthy churches are those of St. Jacob, founded about 1200 and restored in 1824; and of St. Aegidius.

The town hall (Rathaus), erected in the Italian style in 1616–19, contains frescoes by Dürer, and a curious stucco relief of a tournament held at Nürnberg in 1446. The building incorporated an older one of the 14th century, of which the great hall, with its timber roof, is part. The most interesting secular buildings are the houses of the old patrician families. A special interest attaches to the dwellings of Albert Dürer and Hans Sachs, the cobbler-poet. The streets are embellished with several fountains, the most noteworthy of which are the Schöne Brunnen, 1385–96, in the form of a large Gothic pyramid, adorned with statues, and the Gänsemännchen or goose-mannikin.

The Germanic national museum, established in an old Carthusian monastery includes masterpieces by Holbein, Dürer, Wohlgemuth and others. The municipal library contains many thousands of manuscripts and books, some of which are of great rarity.

**NURSERIES, NURSERY TREES:** *see* ARBORICULTURE.

**NURSERY EQUIPMENT.** A baby should room alone, if possible, and must always sleep alone. Nursery equipment should be simple and all furniture and fittings of a type that may be readily washed. Painted walls are preferable but fresh clean wall paper is permissible. The best floors are well oiled or waxed hard wood or linoleum with a few small, washable, cotton rugs. Muslin curtains and dark window shades permit of good ventilation and subdued lighting. The necessary furniture consists of: A table of plain wood about two by three feet in size and low enough so that the mother may reach anything on it from her chair. Two low chairs without arms; one may be a rocker. A screen with removable washable panels to be used for protection from draughts and as a rack for airing the clothing. Two accessible shelves on the wall for the toilet articles. A closet with shelves or a bureau to hold the clothing. A wall thermometer and a covered pail to hold soiled diapers.

**The Bed.**—A crib or bassinet may be used. The latter is advised for the first two months; the best kind is the ordinary clothes basket with handles at either end. This affords free ventilation, is easily cleaned, may be placed upon two chairs or a bench and is moved about readily. For a mattress an ordinary hair pillow

is best; a feather pillow must not be used but one of felt or kapoc is a good substitute. Large pillow cases are preferable to sheets; one to hold the mattress and so serve as a lower sheet; the other to hold the blankets and serve as an upper sheet and bed spread. A small blanket rolled tightly may be placed at the foot of the bed before the upper sheet and blankets are tucked in; this will hold the upper bedding away from the baby's feet and permit free movement of the legs. A pillow for the head is not needed.

**Care of the Nursery.**—The bed should be placed in a corner of the room well protected from a direct draught and too strong a light. The wall thermometer should be placed on the wall above the head of the bed. The temperature of the nursery should not be above 68° F nor below 66° during the daytime. For the first three months the proper night temperature is from 62 to 64° and later this may be reduced to from 50 to 54 degrees. In winter the proper ventilation may be secured by the use of a window board and in summer the windows, thoroughly screened, may be left open during the cooler part of the day and at night. The room should be well cleaned and aired every day and the baby in his basket taken out of the room while this is done. Soap and hot water with sunshine are the best cleaners and disinfectants to use.

**The Bath.**—Tub baths may be given as soon as the umbilical cord drops off, usually about the tenth day after birth. Until that time sponge baths only are permitted. The equipment needed for the bath consists of: A portable bathtub of rubber or enamel ware. Rubber apron for the mother. Small soft blanket. Supply of soft and absorbent towels. Two wash cloths; one for the face and head and the other for the body. A tray holding a cake of castile or other pure white soap, a tube or jar of baby cream, plain unscented talcum powder, a few covered glass jars to hold small squares of sterile gauze, cotton pledgets and liquids needed, safety pins of assorted sizes, a bottle of boric acid solution and a bath thermometer. These articles should be replaced on the tray after use and covered with a clean towel until needed again. When all the equipment is in place, undress the baby and lay him on the bed wrapped in the soft blanket. Put on the rubber apron and pour the water into the tub. The temperature of the water must be tested with the bath thermometer at the last moment before the bath is given. For the first few weeks this should be 100° F. From the second to the sixth month the right temperature is 98 degrees. For the remainder of the first year, 95° is proper. During the second year the temperature of the bath water may be lowered to from 85 to 90° F. When the water is at the right temperature, take the baby in your lap and place the towel about him in place of the blanket. Before placing the baby in the tub use one of the wash cloths to bathe his face with plain water. Then soap the cloth well and gently wash the head, neck and back of the ears. Be careful not to get any of the soap in the baby's eyes. Rinse the wash cloth and wash off the soap from the head and neck. Now lift the baby by placing your right hand and arm under his buttocks and your left arm under his back with the forearm supporting his head. Set him gently in the tub keeping his back and head well supported, leaving your right arm and hand free for giving the bath. Soap the second wash cloth and rub the body, arms and legs all over, gently but thoroughly. Then rinse the cloth and wash off the soapy lather. The bath should not take more than a few moments during the first few weeks, later it may be given more leisurely. Now lift the baby from the tub and wrap him in the bath towel on your lap. The drying process consists of a series of gentle pattings; do not irritate the baby's delicate skin by rubbing. The head and face should be dried first and then the arms, legs and body. Do not wash out the baby's mouth, ears or nostrils unless so advised by your doctor. If the eyes need special care they may be wiped gently with a pledget of sterile cotton wet with sterile water or boric acid solution. When this is done, the baby should be turned on his right side while the right eye is washed and on the left side for the left eye; this turning is necessary to prevent the solution used for one eye from running into the other eye. After the baby is well dried it is a good plan to smear all of the folds of the skin in the groin, under the arms and about the neck with a little of the baby cream or with olive oil. Then comes a light dusting of the body with talcum powder and the baby is ready for his clothing, his feeding and his nap. Diapers must be changed as soon as soiled, placed in a pailful of cold water and once each day thoroughly scrubbed with soap and hot water, rinsed in hot water and then boiled for five minutes. If possible, dry the diapers in the sunlight.

**Clothing.**—Three points to remember about the baby's clothing are that it must be loose, light in weight and of materials that will not irritate the skin. The same weight clothing should be worn indoors both summer and winter. On very hot days the shirt, diaper and dress are sufficient. In cold weather, a light weight knitted shawl or blanket may be used for added warmth. For out of doors in cold weather, a warm cloak, hood and bootees are necessary. Socks or stockings may be worn if needed for warmth but their use is rarely desirable except in very cold weather. The list of articles needed for a layette is as follows: 6 dresses, 6 petticoats without sleeves, 4 shirts, 3 flannel abdominal bands for the first month, 4 nightgowns, 4 dozen diapers, 1 wrapper, 1 cloak, 1 hood, 4 pairs of socks or stockings, 1 light weight woollen shawl. The best materials for the dresses are; fine muslin, nainsook or lawn cloth. Do not use lace or embroidery around the neck or cuffs as it is apt to irritate the delicate skin. For the petticoats use a light weight flannel or cotton flannel. Knitted cotton goods is best for the undershirts; wool is needed only in the coldest climates. The dresses and petticoats should be made twenty inches long from neck to bottom of hem and should be opened all the length of either the back or the front. Both methods of opening have advantages. The full opening down the back permits the petticoat and dress to be drawn aside when the baby is put into his bed and so prevents soiling of the clothing. When the dress and petticoat open all the way down the front, the entire clothing may be put on as a unit. In this method, the dress is laid out flat on the bed or table with the wrong side up. The petticoat is laid over the dress with its armholes over the armholes of the dress. The sleeves of the undershirt are then drawn through the armholes of both petticoat and dress. The diaper is laid in place on top of the clothing and the abdominal band laid across the top of the diaper and the lower end of the shirt. The baby is then laid on the clothing, the band and diaper fastened in front, the arms drawn through the combined armholes of the shirt, petticoat and dress and the latter fastened in front. With this method of dressing, the baby is not turned at all and is handled only when the arms are being put through the armholes. It has many advantages as a method of dressing as the baby is disturbed so little that digestion is not interfered with, sleep comes more readily and consequently health is markedly improved. (*See* INFANCY.)

BIBLIOGRAPHY.—L. E. Holt, *The Care and Feeding of Children* (New York); Francis Tweddell, *How to Take Care of the Baby* (New York); Richard E. Smith, *The Baby's first Two Years* (Boston); L. T. Royster, *Nutrition and Development* (New York); S. Josephine Baker, *Healthy Babies* (Boston); D. Patterson, and J. F. Smith, *Modern Methods of Feeding in Infancy and Childhood* (London); J. Comby, *Alimentation et Hygiene des enfants* (Paris).

(S. J. B.)

**NURSERY SCHOOLS.** The nursery school is a comparatively modern section of education arising from the necessity of providing a suitable environment for the mental and physical development of children of pre-school age.

**Great Britain.**—The age of compulsory school attendance is five years, but education authorities have the option of admitting children at three years. In the 19th century the general opinion was that the children of the elementary school class were better in school than out of it, and there were large classes of "younger infants" (three to five years old), in most elementary schools in urban districts in England. In Scotland there was no general demand for the admission of children under five.

By the beginning of this century the conditions essential to the right physical and mental development of the young child were more fully understood, and the school education of the "under fives" was attacked both by doctors and educationists. The doctors asserted that epidemics were spread in crowded class rooms, and physical development retarded and impaired by lack of activity and fresh air; the educationists, that the formal instruc-

tion given in the three R's retarded intelligence.

In 1904 five women inspectors, appointed by the Board of Education to enquire into the education of children under five years of age in public elementary schools, reported in terms so adverse that in 1908 the board appointed a consultative committee to report on the school attendance of children below the age of five. The conclusions of the committee, based on a survey of the field in Great Britain and in France, Belgium, Switzerland and Germany, were that, where home conditions were satisfactory, the natural place for the child under five was the home; that "many homes now exist in which the mental and physical development of young children cannot be properly secured"; that the elementary schools were not providing the right sort of education for these children; that the children from "imperfect homes" should be sent to places specially intended for their training, the best place for this purpose being a nursery school as described in the report. The conditions there described were abundance of air and sunshine; open space; hygienic structures; opportunity for physical activity and sleep; education on kindergarten lines; training in right habits, and enlightened teachers. The board took no action, however, to establish such schools, and the local authorities increasingly excluded the "under fives."

Voluntary effort had already opened day nurseries for "under threes," and one or two free kindergartens on Froebelian lines for children from two to five. Nursery schools on these lines though in small numbers, became centres of light and healing in slum areas. The majority were held in adapted houses, seldom with more than a small garden attached, but all sought to provide conditions for healthy development of body and mind; formal lessons were replaced by training of the senses and of speech and movement; independence and self-control were encouraged; happy activity and comradeship in a friendly community fostered social virtues. The influence of Mme. Montessori was added to that of Froebel. Co-operation was established with infant welfare clinics and the public medical services. In 1914 a notable advance was made by Rachel and Margaret Macmillan, who in a riverside slum area in Deptford, London, established a large nursery school under completely open air conditions with remarkable results.

In 1918 the president of the Board of Education supported enlightened opinion by including in the Fisher Act regulations giving local authorities power to supply, or aid the supply, of nursery schools (or nursery classes) for children from two to five years of age. Again economy nipped the new growth. Few new schools were established, but grants helped to maintain those in existence. There are now 24 nursery schools in England and 12 in Scotland. Meanwhile the "under fives" have returned in large numbers to the elementary schools, the best of which are in sympathy with the new ideals.

**Other European Countries.**—Institutions analogous to nursery schools are, as already indicated, to be found on the continent of Europe. In Belgium they are called *écoles gardiennes* or *jardins d'enfants,* in Austria *Kindergarten* and in Germany and Switzerland *Kindergarten, Krippen* and *Kleinkinderbewahranstalten.*

(For nursery schools in France *see* EDUCATION: *France;* INFANT SCHOOLS; KINDERGARTEN; MONTESSORI SYSTEM.)

BIBLIOGRAPHY.—*Report of the Consultative Committee upon the School Attendance of Children under the Age of Five* (cd. 4,259, 1908); "Provision made for Children under Compulsory School Age in Belgium, France, Germany and Switzerland" in *Special Reports on Educational Subjects,* vol. xxii. (cd. 4,477, 1909); The Education Act of 1918; P. B. Ballard, *The Changing School* (1925). (E. St.)

## UNITED STATES

It is evident that development of science in the fields of biology, psychology and sociology had emphasized the importance of the years from two to five, and it was recognized that during the pre-school years the child gains control of his body; develops the beginnings of response to tone, rhythm, colour and form; and forms his speech habits and acquires a vocabulary. It was shown also that the physical habits of sleeping, feeding, elimination and exercise, the mental habits of concentration, self-control and self-reliance, or their opposites, and the social attitudes toward authority, reality and affection, whether good or bad, are developed in this period and are likely to be little changed in future years. These scientific developments led many parents to seek help in training children during the years when the child is ordinarily dependent upon the home for all his contacts. Study groups of mothers, magazine articles, and books assisted.

In 1919 the Bureau of Educational Experiments in New York city organized a nursery school to serve as a basis for studying the educational factors in the environment of pre-school children and for research. The State of Iowa in 1917 authorized the establishment of a child welfare research station at the State university which, in Oct. 1921, opened a play school to provide a laboratory in child psychology for experimental work with pre-school children. In 1916 a fund was left in Detroit, Mich., to finance a centre for teaching child care, and in Jan. 1922, the Merrill-Palmer Nursery school was established for the purpose of training pre-school children and their parents, as well as a group of prospective parents and teachers. Since that time a considerable number of institutions of college and university grade have established similar centres for training and research which have stamped the American nursery school as an agency for parental education as well as a centre for child development. Research schools also provide a laboratory for the scientific study of the pre-school child; the experimental type, organized to study and experiment with the educational factors in the environment of the pre-school child; the co-operative type, organized by the parents themselves and conducted with their active co-operation; the high-school or training school type, organized to give high-school girls training in child care; and the collegiate type, by far the largest group, organized in connection with colleges and universities for the purpose of providing a laboratory for the teaching of child care to pre-parental and parental groups. A number of nursery schools represent a combination of one or more of these types. The only outstanding American experiment comparable to the social type represented by the English nursery school is the Nursery Training school of Boston, formerly the Ruggles Street Nursery school, established in 1922.

In an educational programme for pre-school children, participation in living activities and play form the basis for physical and mental development. The essentials of the nursery school, therefore, include spacious rooms equipped for small children, with plenty of suitable play equipment, adequate bath and toilet facilities, sleeping space, a garden and outdoor equipment, and the supervision of skilled teachers. In order that the programme may be suitable for the individual child, and the parents furnished with accurate information, the services of specialists of various types must be available. On the physical side, a physician, nutritionist, physiotherapist, and dentist are essential if a complete picture is to be secured. Daily inspection of the children by a nurse is an essential service, since at these early ages they are especially susceptible to infections. A psychologist specially trained to determine the mental level and character traits of the pre-school child and a liaison officer between the school and the home are also essential. Experience has shown that the pre-school period of the child is also the most desirable time for training the parent whose ideas are then less crystallised.

BIBLIOGRAPHY.—Grace Owen, *Nursery School Education* (1920); A. Gesell, *Mental Growth of the Pre-School Child* (1925); Ilse Forest, *Pre-school Education* (1927); H. M. Johnson, *A Nursery School Experiment* (Bureau of Educational Experiments; *Progressive Education,* vol. ii.; *Pre-school and Parental Yearbook* of the National Society for the Study of Education (1929). (E. N. W.)

**NURSING.** The evolution of the sick-nurse is mainly due to three very diverse influences—religion, war and science—to name them in chronological order. It was religion which first induced ladies, in the earlier centuries of Christianity, to take up the care of the sick as a charitable duty. The names of the oldest foundations which still survive, such as the Hôtel Dieu in Paris, St. Thomas's and St. Bartholomew's in London, the order of St. Augustine, the order of St. Vincent de Paul, and (in the form of a modern revival) that of St. John of Jerusalem, sufficiently indicate the original religious connection.

The training of nurses, which was inaugurated in Germany in

1836 on a semi-religious basis, received great impetus from the Crimean War, which was further emphasized by the Civil War in America and the subsequent great conflicts in Europe. The despatch of Florence Nightingale with a staff of trained nurses, to superintend the administration of the military hospitals was the direct result of the publicity given to the details of the Crimean War by *The Times* newspaper. The work undertaken and accomplished by this lady was far more important than the mere nursing of sick and wounded soldiers. She had grasped the principles of hygiene, which were then beginning to be understood, and she applied them to the reform of the hospital administration. In civil life it had a marked effect in stimulating the training movement and raising the status of the nurse. It remained for the third influence to develop systematic nursing to its present dimensions. Since 1880 advances in medical knowledge, particularly in respect of bacteriology, antisepsis and asepsis, have revolutionized nursing in the home, the hospital and the Poor Law infirmary. The nurse is now looked upon as following a great vocation for which she has to be qualified by years of training.

## GREAT BRITAIN

**Training of Nurses.**—In Great Britain the training of the nurse is regulated by the state through the Nurses' Registration Act of 1919. This act was only carried into law after years of controversy, ending with the War. There is a general nursing council for England and Wales and another for Scotland, and 16 of the 25 members of the English council must be registered nurses elected by persons registered under the act.

In addition to the ordinary registration of nurses with a general training (which occupies three or four years) there are five supplementary registers for male, mental, fever, mental defectives' and sick children's nurses. Nurses usually begin their general training in recognized training schools at an age not less than 21, though for certain kinds of training (such as those for nurses of fever or sick children) probationers are taken earlier. The nurses usually live in the hospital or in hostels near it; and as a rule, those who remain in hospital retire about the age of 50 or 55, when a pension is frequently provided with or without contribution. Post-graduate teaching is developed in the best schools, as is the system of providing tutor-nurses. There is not as yet much connection with the universities though the University of Leeds grants a diploma in nursing. The matron of a great hospital holds a very important position as regards her staff, which is divided into sisters, staff nurses and probationers. There are specialists in electric and other technical work, but these have usually first completed their general training. Strenuous efforts have been made to reduce the hours of service and to increase the salaries, which for many years have been extremely low.

In 1916 a college of nursing was established and in 1925 it had a membership of 24,000 with 42 branches and sub-branches throughout the United Kingdom. Connected with it are a student nurses' association for nurses in training, a section for sister tutors and a section for public health workers. It is recognized by the Ministry of Health as an approved centre for the training of health visitors.

Although a large number of nurses serve in hospitals, these are regarded mainly as training schools, where the young nurse is carrying on her studies as well as gaining practical experience. The difficulty with the present hours of duty is to provide the necessary time for her studies and for preparing for frequent examinations, state and hospital. In early days, the importance of the training was not fully recognized, and the nurse was regarded as one who simply performed certain useful functions. Now, the doctor or surgeon looks to the nurse for assistance in his work; he can only see the patient at intervals but she has him always under observation, and the accuracy of her report is of vital importance.

*District Nurses.* On completing her general training, usually of four years, a nurse may take her district training and be placed on the roll of the Queen's nurses, which are supervised from headquarters but supported locally. There are still "cottage nurses," with a short training, but those with a higher standard are rapidly increasing, more especially as they are eligible to do county health work under the medical officer of health. Those holding the certificate of the Central Midwives Board are often employed in infant and child-welfare work.

*Public Health Work.* In addition to child welfare work many nurses are employed under county, burgh or city schemes. The education authorities require a large staff for following up the cases of children inspected by their medical officers. Nurses are also required for fever and isolation hospitals. Poor Law infirmaries give excellent training and have certain advantages over hospitals, which are also schools for the medical profession.

*Private Nursing.* This form of nursing has expanded enormously and though some visiting nurses come in for the day they are mainly residential. Nurses who undertake this work are to be had either from a hospital which sends out its nurses after they gain their certificates, or from an institution, possibly a co-operative institution or home. Nurses are employed in many private nursing-homes for the well-to-do.

*Mental Nurses.* The training for mental nurses is usually conducted in a recognized institution for the treatment of mental disorders where the candidate serves for three years, and enters for the state examination for mental nurses. The nurses and attendants are of both sexes, but women are being increasingly employed even for male patients.

*Midwives and Maternity Nurses.* Midwifery is controlled by a Central Midwives Board, established in London, with jurisdiction in England and Wales, and there are separate boards for Scotland and Ireland. The number of midwives on the roll in England and Wales is approximately 78,000. These boards regulate the issue of certificates and the conditions of admission, and have also the power to remove names from the roll. In 1910 it was forbidden to any person to attend women in childbirth for gain (otherwise than under direction of a qualified medical practitioner) unless certified under the act. An incorporated Midwives Institute has done splendid work in promoting the interests of midwives. Many trained nurses take the midwives' certificate, for which a six months' special course is required while a twelve months' course of midwifery is necessary for those who are not trained nurses.

*Masseurs and Masseuses.* The Chartered Society of Massage and Medical Gymnastics grants a certificate to those who have taken a prescribed training at a recognized school and have passed an examination. After June 1927, examination on massage ceased as a single subject.

*Various Services.* A voluntary advisory nursing board was established in 1921 under the Prison Commission of the Home Office, and trained nurses are now appointed for the care of sick prisoners. A nursing service deals with hospitals under the Ministry of Pensions, and a matron-in-chief is at its head.

The Overseas Nursing Association sends trained nurses to the Crown Colonies and small British communities abroad. There is also an Indian nursing service for Europeans in India.

Queen Alexandra's Imperial Military Nursing Service originated in 1902. A nursing board advises the secretary of state on matters connected with the service. A matron-in-chief is at its head and principal matrons, matrons, sisters and staff nurses are subordinate to her.

In the first year of the World War there were 2,323 fully trained reserve nurses in addition to the regular service, and by 1918 the number reached 10,304. There is likewise a service called Queen Alexandra's Military Families Nursing Service. The Territorial Army Nursing Service, established in 1907–8 in connection with the Territorial Army, supplied the largest number of British nurses available on the outbreak of the World War. The probable number required is about 4,000, but the territorial nurses are only called up in case of necessity. Like the Territorial Army, they enroll with overseas obligations.

Queen Alexandra's Royal Naval Nursing Service is a small one, which also has a reserve. The Royal Air Force Nursing Service was established in 1921. (*See* MEDICAL SERVICE, ARMY.)

(E. S. H.)

## UNITED STATES

Nursing in the United States under the Nightingale plan,

according to which student nurses are educated by nurses as well as by physicians, began in 1873 at the Bellevue hospital, New York, the Connecticut Training school, New Haven, and the Massachusetts General hospital, Boston. Mention of it, however, is made earlier in connection with care of the sick in the Pennsylvania hospital, the charter of which was granted in 1751, the New York hospital in 1798, the Philadelphia dispensary in 1855 and the New England Hospital for Women and Children in 1859–60.

Training generally begins at 18, though in some hospitals the minimum entrance age is 19, 20 or 21. Under the apprenticeship system, making of a hospital and school of nursing not two separate institutions but one and the same, the nursing in the wards is done by these young students in most of the hospitals where they are trained. After from one to four years training nurses pass out into professional life at the average yearly rate of about 18,000. Each state has a board of nurse examiners with which properly accredited nurses may register after passing an examination.

A field for nurses developed generally in 1905 when the Massachusetts General hospital, Boston, instituted hospital social service. The idea originated in 1879 when the Ethical Culture society of New York employed a nurse with a visiting physician in connection with the dispensary.

As a profession, nurses in the United States are organized into three national organizations for which they themselves are responsible, the American Nurses association, the National Organization for Public Health Nursing and the National League of Nursing Education.

**Government Nursing Services.**—The army nursing service was established by act of congress in 1901 and the navy nursing service in 1908. The army school of nursing, Washington, D.C., was established on progressive lines in 1918 with hospital affiliations to give its students the experience necessary for complete training. The U.S. public health service employs a staff of nurses under a woman superintendent to assist in carrying out its extensive public health program in hospitals, in foreign and domestic quarantine and various sanitation projects. The U.S. Veterans administration nursing service also has a woman superintendent who is a registered nurse. The U.S. government has a great nursing reserve upon which it can draw in time of need in the American Red Cross Nursing service (*see* RED CROSS: *America*) which has been closely linked with the American Nurses association throughout its history, and membership in this association is essential to enrolment, as an insurance of standards. (*See* also HEALTH VISITOR.) (X.)

BIBLIOGRAPHY.—Sarah Tooley, *History of Nursing in the British Empire* (1906); M. Adelaide Nutting and Lavinia L. Dock, *A History of Nursing* (1907); the same edited by L. L. Dock in 4 vols. (1921); Sir Henry Burdett, *The Nursing Profession* (1915); Lavinia L. Dock and Isabel M. Stewart, *A Short History of Nursing* (1920); Elizabeth S. Haldane, *The British Nurse in Peace and War* (1923); an abridged ed. of E. T. Cook's *The Life of Florence Nightingale* (1925) ed. Mrs. R. Nash; H. E. Cuff and W. Pugh, *Practical Nursing, including Hygiene and Dietetics* (London, 1927); A. Worcester, *Nurses and Nursing*, Harvard (1927); I. V. Kelley, *Text-book of Nursing Technique* (Philadelphia, 1926); B. Harmer, *Methods and Principles of Teaching the Principles and Practice of Nursing* (New York, 1926); E. M. and A. R. Hassard, *Practical Nursing for Male Nurses in the R.A.M.C. and other Forces* (London, 1927).

*American Journal of Nursing* (1900–28); M. A. Burgess, "Nurses, Patients and Pocketbooks" (*Report*, Committee on the Grading of Nursing Schools, 1928); "Hospital Statistics," report of the Committee on Medical Education and Hospitals of the American Medical Association in *Journal of the American Medical Association* (March 1927); *Nursing and Nursing Education in the United States*, report of the Committee for the Study of Nursing Education (1923).

**NUSKU,** personification of the new-moon, the name of the light and fire-god in Sumer, Babylonia and Assyria, who is hardly to be distinguished from a god Gibil. Nusku-Gibil is the symbol of the heavenly as well as of the terrestrial fire. As the former he is the son of Anu, the god of heaven, but he is likewise associated with Enlil of Nippur, the earth god, and regarded as his messenger. A centre of his cult in Assyria was in Harran, where, because of the predominating character of the moon-cult, he is viewed as the son of the moon-god Sin (*q.v.*). He is often called upon to cleanse the sick and suffering in the magic fire rituals.

The fire-god is also viewed as the patron of the arts and the god of civilization in general, because of the natural association of all human progress with the discovery and use of fire, and as the protector of the family. He becomes the mediator between humanity and the gods, since it is through the fire on the altar that the offering is brought into the presence of the gods.

While temples and sanctuaries to Nusku-Gibil are found in Babylonia and Assyria, he is worshipped more in symbolism than the other gods. Nusku and Gibil are symbolized by the lamp.

*See* A. Deimel, *Pantheon Babylonicum*, Nos. 598 and 2367. H. Zimmern, *Keilinschriften und das Alte Testament*, 416–420.

**NUT,** a term applied to that class of fruit which consists generally of a single kernel enclosed in a hard shell. Botanically speaking, nuts are one-celled fruits with hardened endocarps, sometimes enveloped in a cupule or cup, formed by the aggregation of bracts as in the hazel and acorn. A great number of nuts enter commerce for various purposes, principally as articles of food or sources of oil and for several ornamental and otherwise useful purposes. Certain of the edible species such as pecan, hickorynut, Brazilnut, sapucaianut, butternut, Persian walnut, coconut, pistachionut, and others are especially rich in fat, while such others as the lychee, chestnut, chufanut and the waterchestnut are notably rich in carbohydrates. Some nuts yield oils hardly fit for human consumption, yet very valuable in soapmaking, while still others furnish oils used in making paints, varnishes and many other products. Some nuts are used only in making buttons, cigarette holders and other similar products of turnery.

While most nuts of leading importance are discussed separately elsewhere in alphabetical order, there is here included a list of many plant products commonly known under this name, together with an indication of their original source and the principal uses of either the nut or the plant, or both. Following are brief comments concerning a few that are of special interest.

The sweet almond is one of the world's best-known and best-liked nuts of the market. While of greatest importance as a crop in the Mediterranean basin, it is also of great importance in California and Australia. The bitter almond is grown chiefly in northern Africa. It is an important source of almond flavouring extract and prussic (hydrocyanic) acid.

Beechnuts are of little importance for human food, although in parts of Europe they are used as the source of a pleasing salad oil. The trees are of chief value for timber and ornamental planting.

The betelnut is chewed in the Philippines and other eastern tropics in much the same manner as tobacco.

Brazilnuts and sapucaianuts are close relatives from the Amazon region and elsewhere in northern South America. The former are well-known and much prized. The latter are not well known but are among the choicest nuts obtainable from any source.

The breadnut, a relative of the true breadfruit (*Artocarpus altilis*) is about an inch in diameter and contains a single seed, which when roasted or boiled is pleasant and nutritious.

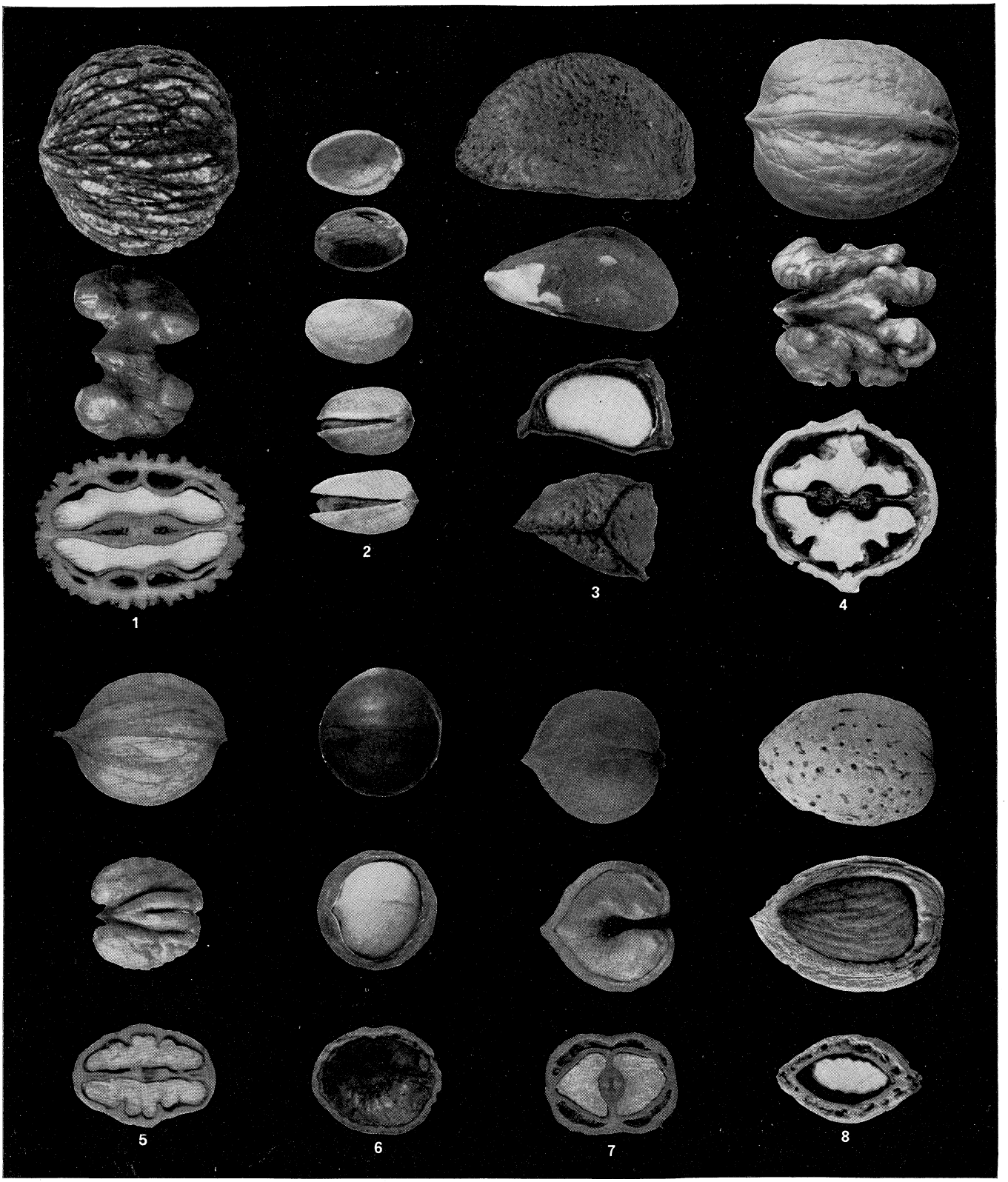
The true butternut is the seed of a member of the walnut family which grows in northeastern United States and Canada. It is considerably hardier than is the Eastern black walnut but of less value for timber. Its kernels are preferred by some to those of any other *Juglans*.

The cashewnut is a native of the American tropics but is grown to greatest extent in southern India, Ceylon and East Africa. Marketed little except in the shelled and roasted condition, it is one of the cheapest and most pleasing of the world's nuts.

The castanopsis is a warm-country evergreen which produces a nut resembling the chestnut in bur and an oak in seed. It is eaten to a considerable extent although in flavour it is intermediate between an acorn and a chestnut.

The chestnuts were originally important as food and timber producers in Europe, Asia and North America. Between 1900 and 1940, the American and European trees, which were abundant in the eastern part of the United States, were practically destroyed there by chestnut blight. By 1943, much headway had been made toward reestablishing orchards with resistant strains and varieties of Chinese origin.

| Common names in order of preference | Latin name | Original source | Principal use of nut or plant |
|---|---|---|---|
| Allegany oilnut; Elknut; Buffalonut | *Pyrularia pubera* | Eastern U. S. | Botanical interest |
| Almond (sweet) | *Prunus amygdalus* | Mediterranean basin | Food |
| Almond (bitter) | *P. amygdalus*, var. *amara* | Mediterranean basin | Flavouring extract; Prussic acid |
| Araucarian pinenut; Piñon; Pinyonie | *Araucaria araucana* | Chile | Food; Ornamental tree |
| Arnut; Yer-nut; Earth chestnut; Hawknut; Lousy-nut | *Bunium* spp. | Western Europe to Caucasus | Food |
| Babassu nut | *Orbignya oleifera* | Brazil | Food; Fuel oil; etc. |
| Bambarra-nut; Groundnut | *Voandzeia subterranea* | Tropical Africa | Food |
| Barbadosnut; Physic nut | *Jatropha curcas* | Tropical America | Medicine |
| Beechnut, American | *Fagus grandifolia* | Eastern U. S. | Mast; Timber |
| Beechnut, European | *Fagus sylvatica* | Central Europe; S.W. Asia | Salad-oil; Mast and timber |
| Ben-nut | *Moringa oleifera* | India and West Indies | Artists' oil |
| Betelnut; Arecanut; Pinang | *Areca catechu* | Eastern Pacific islands | Masticatory |
| Bladdernut, American | *Staphylea trifolia* | Temperate North America | Ornamental plant |
| Bladdernut, European | *Staphylea pinnata* | Southern Europe; S. Asia | Necklaces |
| Bomah-nut; Bome N.; Boomah N. | *Pycnocoma macrophylla* | Africa | Tanning; Poison plant |
| Bonduc nut | *Caesalpinia bonduc* | Tropics | Medicine; Beads |
| Brazilnut; Castanea; Creamnut; Paranut; Butternut; Niggertoe; Castana | *Bertholletia excelsa* | Northern South America | Food; Timber. *See* BRAZILNUT |
| Breadnut | *Brosimum alicastrum* | Tropical America | Food |
| Butternut; Long or White walnut | *Juglans cinerea* | Eastern U.S.; S.E. Canada | Food; Timber. *See* BUTTERNUT |
| Candlenut; Lumbang; Kukui; Varnish tree | *Aleurites moluccana* | Tropical Pacific islands | Manufacturing oil. *See* ALEURITES |
| Capechestnut | *Calodendrum capense* | Southern Africa | Ornamental plant |
| Cashewnut; Acajou; Caja; Cajou | *Anacardium occidentale* | West Indies and Tropical America | Food. *See* CASHEW |
| Castanopsis nut | *Castanopsis* spp. | S.E. Asia; California | Food; Ornamental evergreens |
| Chestnut, American | *Castanea dentata* | Eastern U. S. | Food; Timber; Tannin. *See* CHESTNUT |
| Chestnut, Chinese | *Castanea mollissima* | Northern China; Chosen | Food; Timber |
| Chestnut, European; Spanish, French, Italian C.; Marron | *Castanea sativa* | Southern Europe; N.Africa; S.W. Asia | Food; Timber |
| Chestnut, Japanese | *Castanea crenata* | Japan; Chosen | Food; Timber |
| Chilehazel | *Gevuina avellana* | Chile | Food; Ornamental plant |
| Chinkapin, Alabama | *Castanea alabamensis* | Southeastern U. S. | Food; Timber. *See* CHESTNUT |
| Chinkapin, Allegany; Dwarf chestnut | *Castanea pumila* | Southeastern U. S. | Food |
| Chinkapin, Ashe | *Castanea ashei* | Southeastern U. S. | Food; Tannin |
| Chinkapin, Florida | *Castanea floridana* | Southeastern U. S. | Food; Tannin |
| Chinkapin, Henry | *Castanea henryi* | China | Food; Timber |
| Chinkapin, Ozark | *Castanea ozarkensis* | Arkansas | Food; Timber |
| Chinkapin, Trailing; Creeping Chinkapin | *Castanea alnifolia* | Southeastern U. S. | Botanical interest |
| Chocolate nut; Cacao (Cocoa) | *Theobroma cacao* | Central and South America | Food and beverage |
| Chufa; Rush nut; Earthnut; Ground almond | *Cyperus esculentus* | Southern Europe | Food |
| Cobnut. See *Hazelnut* and *Filbert*, below | | | |
| Cobnut of Jamaica | *Ophalea triandra* | West Indies and Tropical America | Food |
| Coconut; Cocoanut | *Cocos nucifera* | Tropics generally | Food |
| Cohunenut; Cahoun nut | *Attalea cohune* | Honduras | Soap oil |
| Colanut; Kolanut; Ombene; Temperance nut; Bissy-bissy nut; Guru nut | *Cola acuminata* | West Africa | Food; Beverage |
| Coquilla nut | *Attalea funifera* | Brazil | Turnery |
| Coquita-nut; Monkey's coconut; Dwarf coconut; Coker-nut | *Jubaea spectabilis* | Chile | Soap oil |
| Cumaranut (Tonka or Tonquin bean) | *Dipteryx odorata* | Tropical South America | Perfume |
| Dika-nut | *Irvingia gabonensis* | West Africa | Food; Oil |
| Filbert, American (Hazelnut) | *Corylus americana* | Eastern North America | Food. *See* FILBERT |
| Filbert, Beaked | *Corylus cornuta* | Eastern North America | Food |
| Filbert, California | *Corylus californica* | West Coast of U. S. | Food |
| Filbert, Chinese | *Corylus chinensis* | Central and West China | Food; Timber |
| Filbert, European; Cobnut; Hazelnut | *Corylus avellana* | Europe | Food |
| Filbert, Giant | *Corylus maxima* | Europe | Food |
| Filbert, Himalaya | *Corylus ferox* | Himalayas | Food |
| Filbert, Japanese | *Corylus sieboldiana* | Japan | Food |
| Filbert, Mildred | *C. americana* x *avellana* | United States | Food |
| Filbert, Siberian | *C. heterophylla* | China; Siberia; Japan | Food |
| Filbert, Turkish; Constantinople hazel | *Corylus colurna* | Turkey; Southern U.S.S.R.; Himalayas | Food; Timber; Ornamental tree |
| Ginkgonut | *Ginkgo biloba* | China; Japan | Food; Timber; Ornamental tree |
| Goatnut. See *Jojoba*, below. | | | |
| Grugru nut; Corozo nut | *Acrocomia aculeata* | Tropical South America | Beads |
| Hazelnut. Synonym for Filbert | | | *See* FILBERT |
| Heartnut; Japanese walnut; Cordate W. | *Juglans sieboldiana cordiformis* | Japan | Food. *See* WALNUT |
| Hican (Pecan x shellbark hybrid) | *Carya illinoensis* x *laciniosa* | Indiana; Illinois; Iowa | Novelty trees and nuts. *See* HICKORY |
| Hickorynut, Bitter | *Carya cordiformis* | Eastern U.S.; Ontario | Timber; Nut inedible |
| Hickorynut, Black; Buckley hickory | *Carya texana* | Texas; Okla.; Arkansas | Food; Fuel |
| Hickorynut, Carolina; Southern Shag | *Carya carolinae-septentrionalis* | Southeastern U.S. | Food; Timber |
| Hickorynut, Cathay | *Carya cathayensis* | China | Food; Timber |
| Hickorynut, Fernow | *Carya fernowiana* | Southwestern U.S. | Food; Timber |
| Hickorynut, Hammock | *Carya ashei* | Southeastern U.S. | Timber; Fuel |
| Hickorynut, Mockernut; Bigbud H.; Bullnut | *Carya tomentosa* | Eastern U.S.; Ontario | Food; Timber |
| Hickorynut, Nutmeg | *Carya myristicaeformis* | Southwestern U.S. | Food; Timber |
| Hickorynut, Pig or Hognut | *Carya glabra* | Eastern U.S.; Ontario | Mast; Timber |

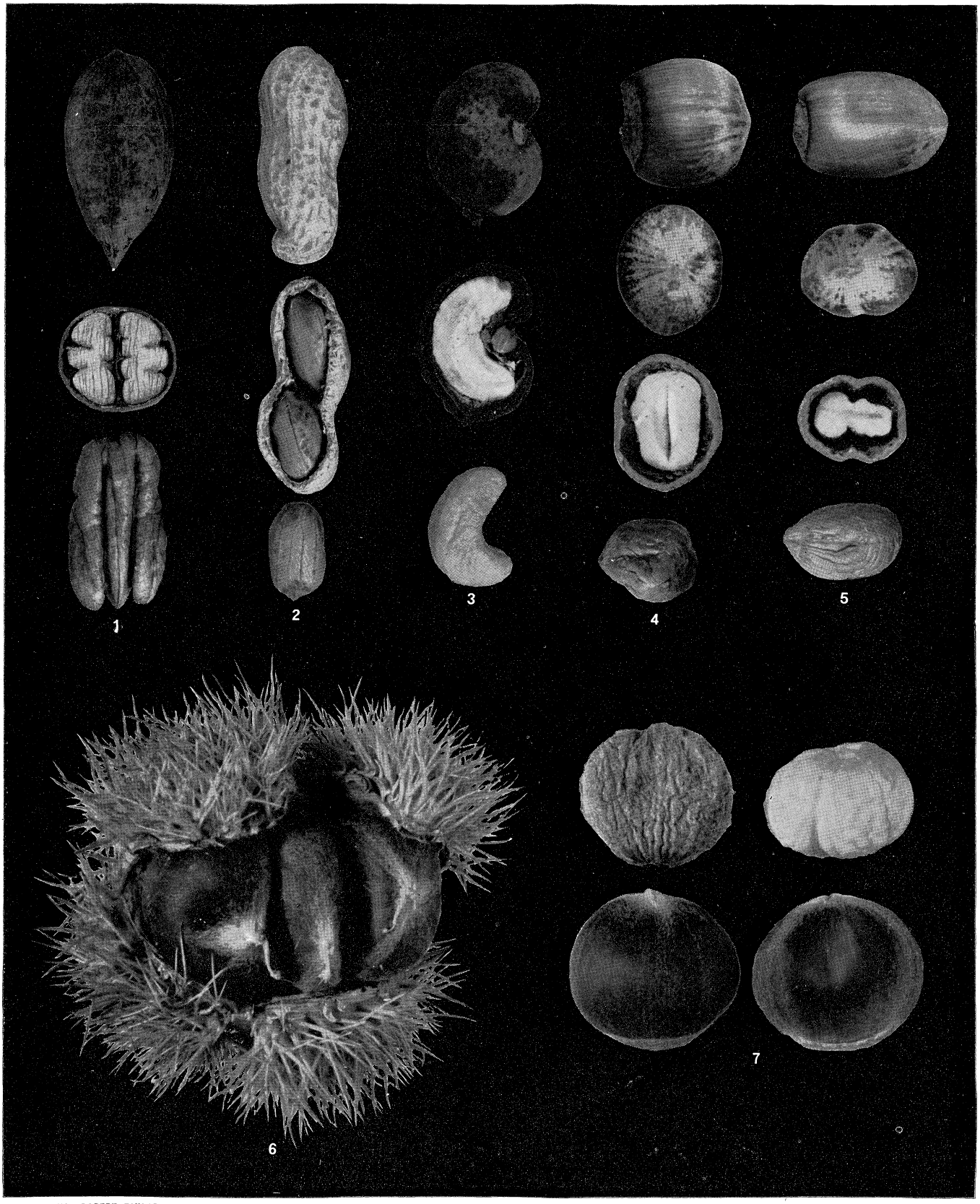



PHOTOGRAPHS, ROBERT TAYLOR

## VARIOUS KINDS OF COMMERCIAL AND EDIBLE NUTS

1. Eastern black walnut, *Juglans nigra*, Thomas variety
2. Pistachionut, *Pistacia vera*. Top, nut with shell removed; below, three nuts in shell
3. Brazilnut, *Bertholletia excelsa*
4. Persian (English) walnut, *Juglans regia*, Placentia variety
5. Shagbark hickory, *Carya ovata*, Lingenfelter variety
6. Queensland nut, *Macadamia ternifolia*. Top, whole nut; middle, kernel with half of shell removed; bottom, empty half shell
7. Heartnut, *Juglans sieboldiana cordiformis*, Lancaster variety
8. Sweet almond, *Prunus amygdalus*, Peerless variety

# NUT




PHOTOGRAPHS, ROBERT TAYLOR

## VARIOUS KINDS OF COMMERCIAL AND EDIBLE NUTS

1. Pecan, *Carya illinoensis*, variety Schley (Sly)
2. Peanut, *Arachis hypogaea*
3. Cashewnut, *Anacardium occidentale*
4. European filbert, *Corylus avellana*, Barcelona variety
5. European filbert, *Corylus avellana*, Du Chilly variety, said by some to be identical with Kentish cob
6. Chinese chestnut, *Castanea mollissima*, nuts in bur at ripening time
7. Chinese chestnut, *Castanea mollissima*. Top: left, kernel with pellicle still attached; right, pellicle removed. Below, outer and inner views of end nuts

| Common names in order of preference | Latin name | Original source | Principal use of nut or plant |
|---|---|---|---|
| Hickorynut, Red; False shagbark | *Carya ovalis* | Eastern U.S.; Ontario | Food; Timber |
| Hickorynut, Sand; Paleleaf hickory | *Carya pallida* | Southeastern U.S. | Mast; Timber |
| Hickorynut, Scrub; Florida hickory | *Carya floridana* | Florida | Fuel |
| Hickorynut, Shagbark; Little scalybark; Tuscatine | *Carya ovata* | Eastern U.S.; S.E. Canada | Food; Timber |
| Hickorynut, Shellbark; Bigleaf H.; Bottom H.; Big scalybark | *Carya laciniosa* | Central, Eastern U.S. | Food; Timber |
| Hickorynut, Swamp | *Carya leiodermis* | Louisiana; Mississippi | Food; Fuel |
| Hickorynut, Tonkin | *Carya tonkinensis* | Southern China; Indo-China | Food; Timber |
| Hickorynut, Water; Bitter Pecan | *Carya aquatica* | Southern U.S. | Fuel; Inedible |
| Horsechestnut | *Aesculus hippocastanum* | Europe | Starch; Ornamental tree |
| Hyphaene-nut; Doum-nut; Dom-nut | *Hyphaene crinita* | South Africa | Turnery |
| Indiannut. Synonym for various North American edible pinenuts | | | |
| Javaalmond; Luzon-nut; Philippine N. | *Canarium commune* | Pacific Tropics | Food |
| Jojoba nut; Goatnut | *Simmondsia chinensis (californica)* | California and Mexico | Food and hair oil |
| Lychee; Chinese nut | *Litchi chinensis* | South China. | Food |
| Macadamia. Synonym for Queenslandnut | | | |
| Markingnut; Marany; Marsh nut | *Semecarpus anacardium* | India | Ink; Varnish |
| Marron. French name for large chestnuts | | | |
| Moretonbaychestnut; Black Bean | *Castanospermum australe* | Australia | Food |
| Mu-yu-oil-nut; Mu-yu-shu | *Aleurites montana* | South China. | Manufacturing oil. *See* ALEURITES |
| Nittanut; Nuttanut | *Parkia africana* | Africana | Food |
| Nutmeg | *Myristica fragrans* | East Indies | Spice |
| Nut Pine. Synonym for North American edible pinenut | | | |
| Olive-nut | *Elaeocarpus ganitrus* | India | Beads and turnery |
| Oysternut; Tabui | *Telfairia occidentalis* | Africa | Food |
| Palm nut | *Elaeis guineensis* | W. Africa | Oil. *See* PALM |
| Pascualito nut; Pinonchillo | *Garcia nutans* | Mexico to Venezuela | Hard, quick-drying oil |
| Peanut; Goober; Pindar; Groundnut | *Arachis hypogaea* | Brazil | Food. *See* PEANUT |
| Pecan; Illinois-nut | *Carya illinoensis* | Southern U.S. | Food; Ornamental tree. *See* HICKORY |
| Pekeanut. Synonym for Sawarrinut | | | |
| Pilinut | *Canarium ovatum* | Pacific tropics | Food |
| Pinenut; Indiannut | *Pinus* spp. | | |
| Pinenut, Aleppo | *Pinus halepensis* | Southern Europe; W. Asia | Food |
| Pinenut, Colorado Pinyon | *Pinus cembroides edulis* | Southern Wyoming; Colo.; N. Mex.; Ariz. | Food |
| Pinenut, Coulter | *Pinus coulteri* | California | Food |
| Pinenut, Digger | *Pinus sabiniana* | California | Food |
| Pinenut, Italian Stone (Pignolia) | *Pinus pinea* | Mediterranean region | Food |
| Pinenut, Jeffrey | *Pinus jeffreyi* | California; Oregon | Food |
| Pinenut, Korean | *Pinus koraiensis* | Chosen; Japan | Food |
| Pinenut, Lacebark | *Pinus bungeana* | Northwestern China | Food |
| Pinenut, Limber | *Pinus flexilis* | Alberta to Texas | Food |
| Pinenut, Mexican Pinyon | *Pinus cembroides* | Southwestern U.S., Mexico | Food |
| Pinenut, Parry Pinyon | *Pinus cembroides parryana* | California | Food |
| Pinenut, Ponderosa | *Pinus ponderosa* | Western U.S. | Food |
| Pinenut, Singleleaf Pinyon | *Pinus cembroides monophylla* | Southwestern U.S. | Food |
| Pinenut, Sugar | *Pinus lambertiana* | Oregon to Lower California | Food |
| Pinenut, Swiss Stone (Pignolia) | *Pinus cembra* | Central Europe to Siberia | Food |
| Pinenut, Torrey; Soledad Pinenut | *Pinus torreyana* | Southern California | Food |
| Pinenut, Western White | *Pinus monticola* | Northwestern U.S.; B.C. | Food |
| Pinenut, Whitebark | *Pinus albicaulis* | Northwestern U.S.; B.C. | Food |
| Piñon. Synonym for Pinenut | | | |
| Pistachionut; Pistache; Green almond | *Pistacia vera* | Mediterranean basin to Southwestern Asia | Food. *See* PISTACHIONUT |
| Poisonnut | *Strychnos nuxvomica* | India | Medicine |
| Quandongnut | *Fusanus acuminatus* | Australia | Food |
| Queenslandnut; Australian nut; Macadamia; Australian hazel | *Macadamia ternifolia* | Australia | Food |
| Ravensara nut | *Ravensara aromatica* | Madagascar | Spice |
| Sapucaianut; Paradise nut | *Lecythis zabucajo* | Tropical South America | Food |
| Sassafras nut | *Ocotea* spp. | South America | Aromatic |
| Sawarrinut; Pekeanut; Peruvian almond; Butternut; Piki | *Caryocar nuciferum* | Peru; Brazil | Food |
| Sheanut | *Butyrospermum parki* | British Africa | Food; Soap oil |
| Snakenut | *Ophiocaryon paradoxum* | Guiana | Charm for snakebite |
| Soapnut | *Sapindus saponaria* | Southern Florida to Northern S. America. | Washing; Ornament |
| Taguanut; Ivorynut; Vegetable ivory | *Phytelephas macrocarpa* | Central America | Buttons, etc. |
| Tahiti-chestnut; South Sea chestnut | *Inocarpus fagiferus* | South Seas | Food |
| Tallownut, Chinese | *Sapium sebiferum* | China | Wax for soap and candles |
| Tropical-almond; Myrobalan; Tavolanut; Demerara almond | *Terminalia catappa* | Southwestern Asia | Food; Street tree |
| Tungnut; Wood-oil tree | *Aleurites fordii* | South China. | Paint and varnish. *See* ALEURITES |
| Tungnut, Japanese | *Aleurites cordata* | Japan to Formosa | Oil. *See* ALEURITES |
| Walnut, American | *Juglans nigra* | Eastern U.S. | Trade name for lumber of this sp. |
| Walnut, Ancona | *Juglans regia* | Persia | Trade name indicating streaked figure in Persian Walnut |
| Walnut, Argentine | *Juglans australis* | Argentina | *See* WALNUT |
| Walnut, Arizona Black | *Juglans major* | Southwestern U.S. | Food; Lumber |

| Common names in order of preference | Latin name | Original source | Principal use of nut or plant |
|---|---|---|---|
| Walnut, Bixby | *J. cinerea* x *sieboldiana* | U.S. | Food; Novelty tree |
| Walnut, Bolivian Black | *Juglans boliviana* | South America | Food; Lumber |
| Walnut, California (S. Calif.) Black | *Juglans californica* | Southern California | Food; Lumber |
| Walnut, Cathay | *Juglans cathayensis* | China | Food; Fuel |
| Walnut, Circassian | *Juglans regia* | Persia | Trade name for lumber of Persian W. |
| Walnut, Claro | | California | Trade name for lumber of California and Hinds Walnuts; also California hybrid walnuts |
| Walnut, Colombian | *Juglans columbiensis* | | |
| Walnut, Cuban | *Juglans insularis* | Cuba | Lumber; Food |
| Walnut, Eastern Black | *Juglans nigra* | Eastern U.S.; Ontario | Lumber; Food |
| Walnut, Ecuador | *Juglans honorei* | Ecuador | Lumber; Food |
| Walnut, Guatemalan | *Juglans mollis* | Guatemala | Lumber; Food |
| Walnut, Hinds; N. California Black W. | *Juglans hindsii* | Northern California | Food; Shade; Lumber |
| Walnut, Intermediate | *J. nigra* x *regia* | U.S. | Hardy ornamental |
| Walnut, Manchu; Manchurian W. | *Juglans mandshurica* | N. China; Manchuria; Chosen | Food; Fuel |
| Walnut, Nigorica | *J. californica* x *nigra* | California | Vigorous ornamental |
| Walnut, Nigrind | *J. hindsii* x *nigra* (Paradox in part) | California | Vigorous ornamental |
| Walnut, Nigroldiana | *J. nigra* x *sieboldiana* | U.S. | Ornamental tree |
| Walnut, Notha | *J. regia* x *sieboldiana* | U.S. | Ornamental tree |
| Walnut, Perbut | *J. cinerea* x *regia* | U.S. | Ornamental tree |
| Walnut, Persian; English; French; Turkish; Italian; Roumania; Common *et al.* | *Juglans regia* | Persia | Food; Lumber; Ornamental tree |
| Walnut, Regifornica | *J. californica* x *regia* (Paradox in part) | California | Vigorous ornamental tree |
| Walnut, Siebold; Japanese walnut | *Juglans sieboldiana* | Japan | Food; Ornamental tree; Fuel |
| Walnut, Texas | *Juglans rupestris* | Texas, Oklahoma; N. Mex. | Food; Ornamental tree; Fuel |
| Waterchestnut | *Trapa natans* | South China | Food; Conservatory plant |
| Waternut | *Eleocharis tuberosa* | South China | Food |
| Wingnut; Caucasian walnut; False walnut | *Pterocarya fraxinifolia* | Southwestern Asia | Ornamental tree |

The chinkapins are closely related to the chestnuts, but are generally inferior in size of nuts and in timber values.

The chocolate nut is the source of the well-known material used in making candies and cocoa. It is extensively cultivated in many tropical regions.

The chufa is a small sedge plant producing a nut-like tuber underground which is an important hog food in the tropics and subtropics. While edible, it is rarely used as human food.

The coconut is the fruit of a palm grown in practically all tropical regions, where it furnishes food, healthful drinks, intoxicants, fibre and coconut oil.

Colanuts, now much cultivated in the American tropics, are the source of an important article of commerce used in making mildly stimulating drinks.

Coquilla nuts, or "coquilhos" as known in Portuguese, are the small coconut-like seeds of the piassava palm of Brazil. They are a by-product from the tree; the main product is fibre. They are elongated oval and 3 or 4 in. long and much used in turnery.

Coquita-nuts are the small, roundish seeds of the Syrup palm from Chile which is much prized as a conservatory plant. The seeds furnish an oil used in making soap.

The filberts are seeds of a number of temperate zone species, some of which are low shrubs while others become large trees. The nuts are roundish or oblong, yellowish brown, usually with gray tomentum over the apical end, a medium thin shell and a single kernel, which is usually slightly hollow at the centre. The filbert is one of the half-dozen or so most important nut-bearing plants of the north temperate zone.

The ginkgonut is the small, whitish, smooth-shelled seed of the Oriental ginkgo tree, also known as Maidenhair tree and as Kew tree. It forms within a fruit greatly like the American persimmon in its mushiness, but exceeding it in foul odour. The seed is roasted by Chinese, who are said to regard it as a great delicacy.

The several hickorynuts, including the pecan, are important food crops grown in the eastern and southern United States. Of these the pecan is the choicest and far the most important. Several others are of great value for their timber.

The javaalmond and the pilinut are close relatives from the eastern Pacific islands, including in particular the Philippines. The shells are very hard and thick, yet the kernels are regarded by many as being fully equal to any other nuts on the world's market.

The lychee is a brownish, roundish, thin, papery and pimpled-shell product containing a raisin-like pulp surrounding a hard, smooth-shelled seed. The edible portion is the pulp. This nut is common in most Chinese stores. It is considered a great delicacy.

The markingnut is closely related to the cashew and is equally poisonous in its effects upon the skin of susceptible persons. The immature juice of the nut is mixed with quicklime and used as an ink. When dry, the juice is the basis of a valuable caulking material and varnish. The seed is edible and is the source of a useful oil.

The pinenuts are seeds of a considerable number of species, native to remote and often more or less arid parts of the earth. The nuts are borne in the axils of the cone scales. The stone pines of Europe and Asia, the pinyon pines of North America, and the Araucarian pine of the Andean region of South America are the most important. With the exception of the Italian stone pine, the seeds of which are sold as "pignolia" and exported, pinenuts are largely consumed in the general regions where they are produced. They are fairly rich in oil and are very pleasing to the taste.

The pistachionut is the small, whitish, thin, but bony-shelled seed of a medium or small-sized tree native to the region including the Mediterranean basin and extending to southwestern Asia. The kernel is of fine texture and of pale green colour throughout; it is much used in colouring and flavouring confections. It is fairly rich in fat.

The quandong is a small, roundish, thick-shelled seed of an Australian tree which is mainly used as a preserve.

The ravensara nut is a Madagascar product considerably used as a spice under the trade name of "clove nutmeg," although it is not a true nutmeg.

The sawarrinut is the fruit of a tall-growing tree, the forest timber of which is used in building ships. The trees are cultivated in the American tropics for their very fine nuts. The latter are seldom seen in the world's market, except locally.

The taguanut is the inedible seed of a palm from northern South America, which becomes exceedingly hard and is much used in making buttons. It takes a high polish, colours well and burns with intense heat.

The tungnuts and their close relatives, the candlenut and the mu-yu-oil-nut, are sources of valuable oils used in many forms of manufacture. (*See* ALEURITES.)

PHOTOGRAPHS, CLARENCE A. REED

## FLOWERS AND LEAVES OF VARIOUS NUT PLANTS

1. Shagbark hickory, *Carya ovata*. Pistillate and staminate flowers
2. Pecan, *Carya illinoensis*. Staminate flowers on branch
3. American chestnut, *Castanea dentata*. Flowers and leaves
4. Eastern black walnut, *Juglans nigra*. Staminate and pistillate flowers

The waterchestnut and its close relative, the singharanut, are important sources of human food, rich in starch. Both are annuals extensively grown in the Asiatic subtropics. The former is very abundant in the slow-moving or stagnant waters in the vicinity of the Yangtze river. It multiplies rapidly and may easily get beyond control, as it has in alcoves of the Potomac river below Washington, where it forms a practically impassable blockade at many points near the shore.

The waternut (*matai* in Chinese) is the edible corm of a sedge plant grown under irrigation in southern China. It is much used in making chop suey and is well suited to occidental cookery. The wingnut is the winged seed of a highly ornamental tree from western China. The nut is too small to be of value. (C. A. Rd.)

**Nut Culture in the U.S.**—Numerous varieties of the pecan are planted for commercial production in the southern states. Hardy strains are producing successfully, however, in Missouri and Illinois. In 1937, which was an excellent year, the U.S. production was estimated by the U.S. department of agriculture at 76,893,000 pounds. The yearly average for 1927–36 was 61,274,000 pounds. Texas led all other states in this ten-year period with an average annual yield of 23,380,000 pounds.

The commercial production of almonds is restricted to various forms of the sweet variety (var. *dulcis*), with increasing preference for those having thinner walls in the stone, as in the paper-shell almonds. The climatically suitable districts are comparatively limited, being confined chiefly to the Pacific states. In California, which usually grows about 99% of the United States crop, the production of almonds in 1938 was approximately 12,100 tons; in 1937, an unusually good year, it was about 20,000 tons.

The commercial production of the old world or Persian walnut, in the United States often called English walnut, has attained its greatest development in specially selected and prepared soils under irrigation in California. However, hardy strains are grown locally with considerable success in the eastern states from Massachusetts westward and southward to Arkansas, especially in climatic situations similar to the Great Lakes region of western New York; Oregon also produces a considerable quantity. In California, where more than 90% of the commercial crop is ordinarily grown, the estimated production in 1938 was 44,000 tons.

**NUT** (Engineering): *see* Bolt.

**NUTATION** [from Lat. *nutare,* to nod], a deviation of the celestial pole from its mean position, due to inequalities in the action of the sun and moon on the equatorial protuberance of the earth. The main part of the nutation is a motion of the pole in a circle of 9″ radius in a period of 18.6 years. *See* Precession of the Equinoxes.

The name is also used in reference to the phenomena of certain organs in plants which bend alternately in opposite directions. In some cases the apex of the stem will describe a spiral movement, inclining to all points of the compass in succession; this being termed *circumnutation. See* Lianes.

**NUTCRACKER** (*Nucifraga caryocatactes*), a European bird of the crow family (*Corvidae*). The plumage is mottled and the tail feathers have conspicuous white tips. The beak is long and the flight undulating. The nutcracker feeds mainly on conifer seeds, but also takes fruits, insects and young birds. The nest is built on the bough of a tree, about 20 ft. from the ground, and is a large structure of sticks lined with grass. The eggs are of a very pale bluish-green, freckled with pale olive or ash colour. Another species (*N. columbiana*) is found in America.

The Siberian nutcracker migrates into western Europe in large flocks, at intervals of approximately 11 years. *See* also Crow.

**NUTHATCH,** a small bird, so called from its habit of hacking or chipping nuts, which it cleverly fixes, as though in a vise, in a chink or crevice of the bark of a tree, and then hammers with the point of its bill till the shell is broken. The common nuthatch, *Sitta europaea,* is widely distributed through Europe and Asia, some two dozen local races being recognized. The type form, *S.e.europaea,* described by Linnaeus, lives in Scandinavia and north Russia; *S.e.affinis* in England; *S.e.caesia* in middle Europe; and other races in Spain, the Atlas mountains, Italy, Sicily, Asia Minor, Iran, China, Japan, the Caucasus mountains, Siberia, and Kamchatka.

Without being very plentiful anywhere, it is generally distributed in suitable localities throughout its range, those localities being such as afford it a sufficient supply of food. During the greater part of the year it feeds on insects, which it diligently seeks on the boles and larger limbs of old trees, but in autumn and winter it feeds on nuts, beech-mast, the stones of yew-berries and hard seeds. Its bold disposition and the fact that trees favouring its mode of life often grow near houses make it quite tame and it will become familiar with humans on slight encouragement. Its feathers are ash-gray and warm buff and its manner is sprightly. It generally makes its nest in a hollow branch, plastering up the opening with clay and leaving only a circular hole, just large enough to afford entrance and exit. The interior contains a bed of dry leaves or the filmy flakes of the inner bark of a fir or cedar, on which the eggs are laid.

The rock nuthatches, *S. neumayeri* and its races and close relatives, nest and hunt among rocks rather than trees; they range from southeast Europe to Palestine, Iran, and Turkestan. Four other little-known species of *Sitta* occur in various parts of Asia. Four familiar species, using no mud in the nest, are found in North America: red-breasted nuthatch, *S. canadensis,* mostly in Canada but southward in mountains to North Carolina and to California and New Mexico; white-breasted nuthatch, *S. carolinensis,* southeast Canada to South Carolina and northern Texas, with six races, two in Lower California, one in the Panamint and White mountains of California, southeastern United States, Rockies from Canada into Mexico, and the Pacific coast and its ranges; brown-headed nuthatch, *S. pusilla,* of the southeastern United States, with a local race in Florida; and pygmy nuthatch, *S. pygmaea,* of the middle California coast, with one local race from southern California into Lower California and another along the Rockies from British Columbia to the Mexican border.

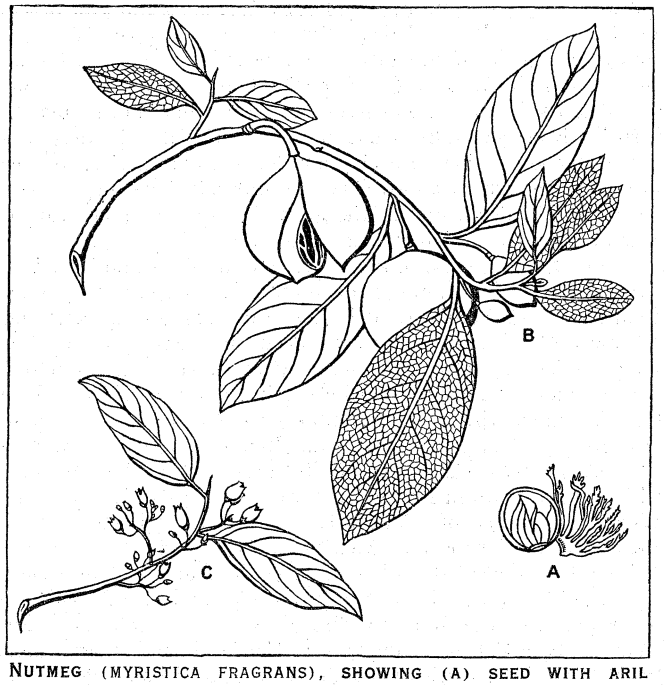
No nuthatches are found in South America, none in Africa from the Sahara southward, none in New Zealand. A peculiar genus with a single species, *Hypositta corallirostris,* is confined to Madagascar. The Malay velvet-fronted nuthatch, pink and black, and the deep-blue nuthatch with a beautiful blue belly, belong to an allied genus, *Dendrophila,* living in India and the Malay countries and islands. The genus *Neositta,* comprising some seven species and various races of Australian tree-runners, is also found in New Guinea, to which the single species of *Daphoenositta* is confined.

**NUTKA.** This people held the west coast of Vancouver island, and with the Makah of Cape Flattery form one branch of the Wakashan family, the Kwakiutl constituting the other. The speech relationship of Nutka and Kwakiutl is not close, and the two bodies must have been distinct a long time. Nutka culture is that of the north Pacific coast, with specializations, such as whale hunting, that reflect frontage on the open ocean. Their trade influence is shown by the considerable proportion of words they contributed to the composite Chinook jargon. (*See* G. M. Sproat, *Scenes of Savage Life,* 1868.)

**NUTLEY,** a town of Essex county, New Jersey, U.S.A., on the Passaic river, 13 mi. W. of New York city, adjoining Belleville and Bloomfield. It is served by the Erie railroad and bus lines. There are paper, silk, woollen mills and a pharmaceutical laboratory, but the town is primarily a suburban residential community. The 1920 population of 9,421 was more than doubled in the following decade and had reached 21,954 by 1940. Nutley was originally called Franklin, after William Franklin, governor of the colony of New Jersey from 1763–76.

**NUTMEG,** the commercial name of a spice representing the kernel of the seed of *Myristica fragrans,* a dioecious evergreen tree, about 50 to 60 ft. high, found wild in the Molucca islands and extending to New Guinea. Nutmeg and mace are mostly obtained from the Molucca islands, although the cultivation has been attempted with varying success in Singapore, Penang, Bengal, Réunion, Brazil, French Guiana and the West Indies. The trees yield fruit in eight years after sowing the seed, reach their prime in 25 years, and bear for 60 years or longer. Almost the whole surface of the Molucca islands is planted with nutmeg trees,

which thrive under the shade of the lofty *Canarium commune*. The ripe fruit is about 2 in. in diameter, of a rounded pear-shape, and when mature splits into two, exposing a crimson aril surrounding a single seed. When the fruit is collected the pericarp is first removed; then the aril is carefully stripped off and dried, in which state it forms the mace of commerce. The seed consists




NUTMEG (MYRISTICA FRAGRANS), SHOWING (A) SEED WITH ARIL (MACE) ROUND IT; (B) BRANCH SHOWING RIPE FRUITS, ONE OF WHICH IS SPLITTING AND SHOWS SEED INSIDE; (C) TWIG WITH FLOWERS

of a thin, hard shell, enclosing a wrinkled kernel, which, when dried, is the nutmeg.

To prepare the nutmegs for use, the seed enclosing the kernel is dried at a gentle heat in a drying-house over a smouldering fire, the seeds being turned every second or third day. When thoroughly dried the shells are broken and the nutmegs picked out and sorted, the smaller and inferior ones being reserved for the expression of the fixed oil which they contain, and which forms the so-called oil of mace.

"Oil of mace," or nutmeg butter, is a solid fatty substance of a reddish-brown colour, obtained by grinding the refuse nutmegs to a fine powder, steaming it and then compressing it while still warm. The brownish fluid which flows out being afterwards allowed to solidify. Nutmegs yield about one-fourth of their weight of this substance. It is partly dissolved by cold alcohol, the remainder being soluble in ether. The latter portion, about 10% of the weight of the nutmegs, consists chiefly of *myristin*, which is a compound of *myristic acid*, $C_{14}H_{28}O_2$, with glycerin.

The name nutmeg is also applied to other fruits or seeds in different countries. The Jamaica or calabash nutmeg is derived from *Monodora Myristica*, the Brazilian from *Cryptocarya moschata*, the Peruvian from *Laurelia sempervirens*, the Madagascar or clove nutmeg from *Agathophyllum aromaticum*, and the Californian or stinking nutmeg from *Torreya californica*.

**NUTRITION.** Despite the fact that life may be continued for many weeks without food and for several days without water, for the practical maintenance of life we must have a regular intake of food; nutrition must go on. Food is required for two main purposes: (1) to supply the necessary energy for the production of internal and external work and the maintenance of the body temperature and (2) to supply the necessary material to make good the wear and tear of the tissues in the adult and also, especially in the child, the material required for growth. The study of the problem of nutrition demands therefore the study of the methods by which the various foodstuffs are digested, absorbed and utilized in the body and further how the waste products formed during the various tissue activities are got rid of.

The evidence available would seem to point to the fact that the majority of mankind eat too much rather than too little. Excessive intake may prove to be, probably is, harmful. Certain experiments carried out for purely commercial purposes on the breeding of pelt-bearing animals go to show that such animals do best on a diet just slightly in excess of the bare maintenance ration. (*See* DIET AND DIETETICS.)

### CHEMISTRY OF DIGESTION

The essential step which prepares the ordinary food for utilization in the body, for the change into living matter, is digestion, a process which the food undergoes under the influence of the ferments or enzymes present in the gastro-intestinal tract. By this process it is broken down into simpler substances, which can be utilized by the body tissues for conversion into protoplasm and as the supply of energy.

**Enzyme Action in General.**—The substances which bring about this change are known as ferments, enzymes or zymins. Formerly it was believed that there were two distinct classes of enzymes: those which were living or associated with living cells, and those which were non-living. In 1897, however, E. Buchner and M. Hahn showed that from living cells (yeast) a ferment could be obtained which acted quite as well extracellularly as when it was bound up within the cell. Subsequent work has shown that other organisms act by the enzymes they contain, so that it is now recognized that there is no essential difference between the living or organized ferment and the non-living or unorganized ferment. All ferments probably act as catalysts. Catalysis (*q.v.*) is the process by which reactions are either initiated or accelerated by the mere presence of certain substances which remain unchanged during the process. It has been shown that the action of ferments is specific; *i.e.*, the ferment only exerts its action on definite substances or substrates of definite structural arrangement. The relation of ferment to substrate has been compared to that of a key to its lock. Ferments which bring about the breakdown of proteins are without influence on fats and carbohydrates; those which decompose fats leave proteins and carbohydrates untouched, and so on.

The chemical composition of enzymes is unknown, but it would seem certain that all enzymes have not the same chemical structure. One of their most important physical properties is their colloidal nature, shown by the fact that they cannot, or only with extreme difficulty, pass through a parchment membrane.

Most of the ferments are soluble in water or saline solutions, and in glycerol and water. The ferments are found to have an optimum temperature of action. This temperature in most cases ranges from 37° to 40° C. All true ferments are thermolabile, being destroyed at about 70° C. The action of many of them is retarded when the products of their action are allowed to accumulate. Just as when a chemical reaction is set up its rate tends to decrease and finally comes to a standstill before the reaction is completed—an equilibrium being established—so the reactions set up by enzymes also tend to come to an equilibrium before the complete conversion of the original substance.

A number of the body ferments have now been shown to exist in the tissues in an inactive form. This condition is known as the proferment or zymogen state, and before any action can be exerted it must be activated, usually by some specific substance, as in the case of the activation of trypsinogen by means of enterokinase. The table on page 649 gives a list of the principal ferments concerned in the digestion and metabolism of food-stuffs.

Certain oxydases, catalases and de-aminizing enzymes are found in the tissues generally and play an important part in the various metabolic processes.

**Digestion in the Mouth.**—The first of the digestive secretions which food encounters is the saliva. It is produced by the three large salivary glands, the parotid, the sub-maxillary and the sub-lingual, is a colourless or slightly turbid viscous fluid with a faintly alkaline reaction and of low specific gravity, and exercises a twofold function. First, it has a mechanical action moistening the mouth and the food and thus aiding mastication and swallowing by securing the formation of a proper bolus

| Material acted on | Enzyme | Where found |
|---|---|---|
| I. Protein | Pepsin | Gastric juice |
| | Trypsin | Pancreatic juice |
| | Erepsin | Small intestine |
| | Various autolytic enzymes | Tissues generally |
| II. Fats | Lipase | Pancreatic juice and certain tissues |
| III. Carbohydrates | Ptyalin (salivary diastase) | Saliva |
| | Pancreatic diastase | Pancreatic juice |
| | Maltase | Pancreatic juice |
| | | Small intestine |
| | Invertase | Small intestine |
| | Lactase | Small intestine |
| | Various tissue diastases | Liver, muscle, etc. |

of food; it also assists by binding the particles together, an action of special importance when the food is dry. Second, in man and in some of the lower animals the enzyme ptyalin exerts an action in digestion on part of the carbohydrates of the diet. The starches or polysaccharides are broken down, first of all to the simple dextrins and then to the still more simple disaccharide, maltose. The action of ptyalin on starches is thus very similar to that of acids, except that it stops at the formation of maltose. Ptyalin acts best at a temperature of about 40°C and in a neutral or faintly alkaline medium, its action being inhibited by the presence of even very dilute solutions of the mineral acids. If the acid be in sufficient amount the enzyme is destroyed. For this reason the action ceases in the stomach whenever the bolus is completely permeated by the gastric juice. As it takes time for the gastric juice thoroughly to permeate the food mass, which remains for a considerable period in the fundus of the stomach unmixed with the secretion, salivary digestion goes on for about half an hour after food is taken.

**Gastric Digestion.**—The stomach has two digestive functions: (i.) it acts as a store chamber permitting a full meal to be taken; (ii.) it acts as a digestive organ of importance in preparing the food for further attack in the intestinal canal. But the stomach cannot be regarded as an essential organ, since it has been removed in dogs and in man without apparent interference with health.

Gastric digestion is brought about by the action of the gastric juice, a clear watery, colourless and strongly acid fluid with a specific gravity of about 1003. The amount of hydrochloric acid present in the juice varies with the period of digestion. The acid exists in the stomach in two forms, as free hydrochloric acid and as combined hydrochloric acid. The amount of each depends on various factors: (i) the secretion itself; (ii.) the nature of the food; and (iii.) the rapidity with which the stomach empties itself, etc. For instance, after a protein-free meal the hydrochloric acid is for the most part free, whereas, when protein is present, it combines with it and, unless secreted in very large amount, most of the acid is in a fixed condition.

The hydrochloric acid is formed by the activities of certain gland cells in the middle region of the stomach, and the fact that it does not exist as such in the blood proves that it is formed within these cells. That the chlorine comes from the sodium chloride in the food has been shown by the fact that, when the tissues are deprived of this salt, and sodium bromide is given, hydrobromic acid may appear in the gastric secretion.

The hydrochloric acid is essential for the action of the gastric enzyme, pepsin, in splitting up the protein of the food. In addition to this, the acid has a slight action in splitting polysaccharides and disaccharides. Lastly, it acts as a bactericidal agent, preventing bacterial decomposition from taking place, and it may thus prevent certain noxious bacteria, taken in in the food, from gaining access to the intestinal tract, where there is a chance of their flourishing in the rich alkaline medium.

The quantity of juice secreted varies with the nature of the food consumed. Each separate food seems to give rise to a definite hourly secretion of the juice and to a characteristic alteration in its properties.

The principal ferment found in the gastric juice is pepsin, which acts only in the presence of a mineral acid. The action proceeds best at a temperature of about 37°C in an acid medium of 0·2% to 0·3%. Pepsin is elaborated in the so-called chief cells of the gastric glands as an inert precursor—propepsin. It is only when it comes into contact with the acid of the juice that it is activated into attacking the protein of the food.

As already mentioned, the main function of the gastric juice is to deal with the protein moiety of the food and to prepare it for further digestion in the intestine. The first result of the action of this secretion on protein matter is to render it soluble—a metaprotein or acid albumin being formed. This body may be regarded mainly as the product of the action of the hydrochloric acid independently of the pepsin.

The following steps of decomposition are the result of the action of pepsin. From the metaprotein primary and secondary proteoses are formed, and from these peptones are finally produced. The result of this process of digestion or hydrolysis induced by the pepsin is that complex insoluble protein substances of high molecular weight are converted into simpler soluble protein bodies of comparatively low molecular weight. The contents of the stomach—products of protein digestion—are passed on into the duodenum, chiefly as proteoses and peptones.

In addition to pepsin some workers hold that another enzyme is present in the gastric juice. This is the ferment rennet, rennin or chymosin, the sole action of which, so far as is known at present, is to bring about the curdling of milk, the curd formed being subsequently dealt with in the ordinary way by the pepsin. Clotting of milk under the action of rennin occurs at a suitable temperature with great rapidity. This process is said to take place in two stages: (1) the rennin converts the caseinogen of the milk into soluble casein, and (2) this soluble casein unites with the lime salts present in the milk and forms the curd or precipitate. That lime salts are absolutely essential for this process of clotting has been shown by the fact that, if they are removed by precipitation as by oxalates, no clotting will take place even after the addition of a large amount of active rennin. Immediate clotting takes place, however, when the necessary lime salts are restored.

The speed with which the stomach empties itself depends to a great extent on the nature of the food. Plain water leaves the stomach almost at once, salt and sugar solutions at a somewhat slower rate. On a mixed diet, emptying of the stomach in man proceeds very slowly, requiring about four hours. Cannon, by feeding with food impregnated with bismuth and using X-rays, showed that carbohydrates leave most rapidly, then mixtures of carbohydrates and proteins, then proteins, then fats and finally mixtures of fats and proteins. The diet which remains longest in the stomach is a mixture of fats and proteins—rich food, as it is popularly called. Here two factors enter to prevent rapid emptying: (1) the presence of much fat, and (2) the acid secretion engendered by the abundant protein.

There is no doubt that fats present in fine emulsion can be decomposed in the stomach. The action proceeds in a medium which is slightly acid or neutral, being entirely prevented by the presence of strong acids and alkalis. Many workers believe this gastrolipase to be of pancreatic or intestinal origin, and suppose that it gains entrance to the stomach by a reflux flow through the pylorus.

No specific enzyme for carbohydrates has been found in the stomach in man. Certainly a small amount of polysaccharide decomposition takes place, but this is dependent (1) on the ptyalin which comes from the mouth, and (2) on a certain amount of hydrolysis due to the action of the free hydrochloric acid.

**Digestion in the Intestine.**—The food so far digested in the stomach is known as chyme, and it is passed on to undergo intestinal digestion under the influence of (1) the enzymes of the pancreas, and (2) of other enzymes present in the different secretions of the intestine.

*Pancreatic Digestion.* The pancreatic juice is the secretion from the pancreas and is discharged into the duodenum. It is a clear, usually thin fluid with a specific gravity of about 1008, and with an alkaline reaction. The most important inorganic constit-

uent is sodium carbonate, which gives the alkaline reaction. This alkaline salt, along with that contained in the intestinal juice, plays an important part in neutralizing the acid chyme.

In the pancreatic secretion there are at least three important enzymes, each with a definite action: (*a*) trypsin, the proteolytic enzyme which brings about the further breakdown of the food proteins; (*b*) a diastase which deals with the carbohydrates, and (*c*) a lipase which acts on the fats.

(*a*) *Trypsin.* This ferment, in the form in which it is secreted—trypsinogen—is inert. Before it can exert its hydrolytic action it must be activated. This activation is brought about by another enzyme found in the intestinal tract—enterokinase. The conversion is brought about as soon as the trypsinogen comes into contact with the enterokinase, the merest trace of which suffices to activate a large amount of trypsinogen.

Trypsin acts on the protein just as pepsin does, by bringing about hydrolytic changes. It differs from the latter in acting best in an alkaline or neutral medium. Its effect is much more energetic than that of pepsin, so that the protein molecule is more completely decomposed.

The character and properties of the products formed in such digestion depend on the nature of the protein acted upon. As will be seen from the following table, proteins vary fairly widely in the proportion of amino acids which they contain.

*Approximate Amino-Acid Percentage Composition of Several Proteins*

| | Gliadin (wheat) | Gelatin | Caseinogen (milk) | Albumin (milk) | Fish muscle (protein) | Ox muscle (protein) |
|---|---|---|---|---|---|---|
| Glycine | 0·0 | 25·5 | 0·45 | 0·37 | 0·00 | 2·06 |
| Alanine | 2·0 | 8·7 | 1·85 | 2·41 | +? | 3·72 |
| Valine | 3·34 | 0·0 | 7·93 | 3·30 | 0·79 | 0·81 |
| Leucine | 6·62 | 7·1 | 9·7 | 14·03 | 10·33 | 11·65 |
| Phenylalanine | 2·35 | 1·4 | 3·88 | 1·25 | 3·04 | 3·15 |
| Tyrosine | 3·04 | 0·0 | 5·36 | 1·95 | 2·39 | 2·20 |
| Serine | 0·20 | 0·4 | 0·5 | 1·76 | (?) | (?) |
| Cystine | 2·40 | 0·16 | 0·25 | 4·1 | .. | .. |
| Proline | 13·22 | 9·5 | 8·7 | 3·76 | 3·17 | 5·82 |
| Hydroxyproline | ? | 14·1 | 0·23 | 0·0 | .. | .. |
| Aspartic acid | 0·58 | 3·4 | 4·1 | 9·30 | 2·73 | 4·51 |
| Glutamic acid | 43·66 | 5·8 | 21·77 | 12·89 | 10·13 | 15·49 |
| Hydroxyglutamic acid o | 2·40 | .. | 10·5 | 10·00 | .. | .. |
| Tryptophane | 1·10 | 0·0 | 1·6 | 2·40 | Present | Present |
| Arginine | 3·2 | 8·22 | 3·81 | 3·47 | 6·34 | 7·47 |
| Lysine | 0·63 | 5·92 | 8·38 | 9·87 | 7·45 | 7·59 |
| Histidine | 1·49 | 2·94 | 2·5 | 2·61 | 2·55 | 1·76 |
| Ammonia | 5·22 | 0·49 | 1·61 | 1·31 | 1·33 | 1·07 |

(*b*) *Diastase.* This ferment is found in the pancreatic juice apparently secreted in an active form, although some observers hold that it also is secreted in a zymogen form. It is practically identical in its action with the ptyalin of the saliva, converting starch into maltose. It deals with all the starchy food which has escaped conversion into the simple sugars by the ptyalin.

(*c*) *Lipase.* Most of this ferment, if not all, is apparently secreted in the form of a zymogen. There is evidence that the bile salts are the activating agent here, just as the enterokinase acts in the case of trypsin. Lipase can act in any medium acid, neutral or alkaline, and both on emulsified and non-emulsified fats. It converts the fats by a process of hydrolysis into fatty acids and glycerol. It has been found that not only can this enzyme break up fats into their components, but that it also has the power to act in the reverse direction, and in this way bring about the union of fatty acids and glycerol so as to form fats, a process which occurs in the intestinal epithelial cells after absorption.

2 *Intestinal Digestion.* By this is meant the other digestive processes which go on in the intestine under the action of the secretion of Lieberkühn's follicles—the *succus entericus.* This is a yellowish, often opalescent, strongly alkaline fluid. The alkalinity is due to the presence of sodium carbonate. Most of the ferments are found in very small amount in the intestinal juice. They seem to be present actually within the epithelial cells lining the intestine, for extracts made from the intestinal mucous membrane are richer in ferments than the secretion.

The intestinal secretion contains no trace of a ferment acting on native protein, but a ferment—erepsin—is present in fair amount in the intestinal mucous membrane and in small amount in the secretion, which acts in an alkaline medium on proteoses, peptones, and on casein, converting them into amino acids. A lipase has also been detected which is very similar to pancreatic lipase; it, however, attacks only emulsified fats.

Several carbohydrate hydrolysing enzymes have been described in the small intestine. Invertase, the ferment which splits cane-sugar, is present in small amount in the secretion, more abundantly in the extract of mucous membrane. In all probability it deals with the saccharose after or in process of absorption. Maltase is also present in large amount, and here again in greater amount in the extract than in the secretion. The question of the presence of lactase has been much discussed, and it seems probable that suckling animals do possess this enzyme.

**Bile.**—This fluid, in all probability, has little direct action in ordinary digestion, although it contains substances which act indirectly. The bile salts act as solvents for fats and fatty acids, and as activators of pancreatic lipase. The salts also serve to keep cholesterol in solution. Bile is to be looked upon rather as an excretion, the result of the hepatic metabolism, than as a digestive juice. It has an orange-brown colour, but the colour varies according to the pigment present. It is more or less viscous (not so viscous as bile taken from the gall bladder) and has a specific gravity of about 1010. It has a slightly alkaline reaction, a bitter taste and a characteristic smell. On analysis it is found to have over 2% of solids, of which more than half are organic. It contains in addition to a nucleo-albumin, derived mainly from the bile passages and gall bladder, bile acids, bile pigments, cholesterol, lecithine, etc. The most abundant solids are the salts of the bile acids, of which in man the most important is sodium glycocholate, sodium taurocholate being present in small amount. The bile acids are formed in the liver cells, and when the duct is ligatured they tend to accumulate in the blood.

The pigments amount to only about 0·2%. In human bile the chief pigment is bilirubin, whilst in herbivores biliverdin is more abundant. They are derived from the haemoglobin of the blood, but the pigments are iron-free. They may be regarded as purely excretory products arising from the breakdown of the haemoglobin of effete blood corpuscles.

Cholesterol is a monatomic alcohol, and is probably a waste product. Fats and lecithine are both derived from the liver cells. Of the inorganic constituents calcium phosphate is the most abundant.

The secretion of bile is practically continuous, but it seems to enter the duodenum intermittently. The taking of food increases the flow of bile. The entry of the acid chyme into the duodenum is the stimulus which brings about the ejection of the bile.

**Faeces.**—The bulk of the waste matter arising from the foods along with the secretions from the alimentary canal form the faeces. On a diet giving little residue the faeces are almost purely intestinal in origin. As a channel of excretion of nitrogenous metabolic waste products they are not very important, although they do play a certain part. The nature of the excreted nitrogenous substances has not been fully examined. It is, however, very difficult to come to any definite conclusion as to what is unabsorbed material and what excreted.

## ABSORPTION

**Stomach.**—No absorption of food-stuffs takes place in the mouth. Absorption from the stomach occurs only to a small extent. Water passes rapidly through the stomach and is practically unabsorbed. Salts are apparently absorbed in a limited amount from their watery solution, the extent of absorption depending to some extent on the concentration of the solution. Sugar is also absorbed to a small extent from its solutions. Alcohol is readily absorbed from the stomach. A small amount of the products of protein digestion may be absorbed. There is no evidence that fats are absorbed under any conditions.

**Intestine.**—The greatest absorption of the foods takes place in the intestines, especially in the small intestine. It has been shown that practically all the protein digest products have disappeared before the lower end of the small intestine is reached. There are two channels for the removal of the material from the intestine: (1) the blood capillaries spread in the villi, and (2) the lacteals also present in the villi. The foods may reach the blood direct or through the various lymph channels into the thoracic duct and finally into the blood. The lacteals of the villi are channels for the absorption of the fatty parts of the food. The products of the digestion of the proteins and carbohydrates reach the body directly through the capillaries via the portal system. Whether the nervous system plays any part in absorption is not yet determined.

*Carbohydrates.* These reach the body, as already mentioned, by way of the blood, and in the form of monosaccharides or simple sugars. It has been shown that if lactose be put into a lactase-free intestine, no absorption takes place, the lactose gradually disappearing under bacterial action, whereas when the ferment lactase is present, glucose and galactose, the products of its splitting, are absorbed as readily as cane-sugar and maltose. The body deals with its carbohydrate supply in the form of monosaccharides as if solutions of various sugars, mono- and disaccharides be injected, it is found that the simple sugars are retained, whereas the double sugars are excreted in the urine. The only disaccharide which can be dealt with in the body is maltose, as there is a maltase present in the blood which splits it. Carbohydrates which are not absorbed from the intestine are disposed of by bacterial action.

*Fats.* Fats are absorbed from the intestine in the form of fatty acids and glycerol, *i.e.,* in the form in which they exist after the action of the lipase. That a resynthesis takes place in the epithelium is shown by the fact that as fat absorption goes on fat droplets are seen to grow in the protoplasm away from the free margin of the cells. As already mentioned, the fat is removed by the lacteals from the cells to the thoracic duct, and then to the general circulation. A small amount of the fat may pass into the body via the blood, but this is practically all retained by the liver. The amount of fat absorbed depends largely on the nature of the fat, especially with reference to its melting-point, fats of low melting-point being most readily taken up.

*Protein.* It is unquestionable in the light of modern work that the great bulk of the digested protein is absorbed from the intestine via the portal blood stream in the form of amino acids. The work of Abel with his vivi-diffusion apparatus demonstrated very clearly that amino acids circulated in the blood and the work of Folin and van Slyke demonstrated that the amino acids were taken up by the various tissues.

In the large intestine, little absorption of nutrient matter takes place under normal conditions, mainly of course because most of the absorbable material is removed whilst the food is in the small intestine. The principal substance absorbed here is water; and thus the excreta become firm and formed.

## METABOLISM

Within the living protoplasmic mass of the tissue-cells activity is ceaseless. The whole series of changes has been given the name of metabolism and within this title are recognized the two phases of building up, *anabolism,* and of breaking down, *catabolism.* There is a constant interplay between these two phases, sometimes rapid, sometimes slow, with a straining towards an equilibrium which is never reached whilst life goes on. When this metabolism is analysed further it is customary to divide it into two parts, the metabolism of energy and the metabolism of matter or material. But it must be made clear that within the living cell metabolism is one and indivisible. Further, although for descriptive purposes it is necessary to discuss the metabolism of the different proximate principles, *e.g.,* protein, carbohydrate, etc., individually the fact must be appreciated that the living protoplasmic mass which forms the content of the cell is not a mere conglomerate of protein, carbohydrate, fat, salts and water, where each constituent may be envisaged as a separate entity. Protoplasm, on the contrary, is a complex colloid—an intimate compound of its various constituents. No constituent can be metabolized without influencing the metabolism of the others.

**Protein.**—After absorption the amino acids are taken up by the cells of the various tissues and would seem for the most part to undergo sooner or later a disintegrative change, deaminization, in which the amino group ($NH_2$), is broken off. It is commonly believed that the freed amino group is converted into ammonia ($NH_3$), which of course does not remain in the free state but becomes neutralized mainly by carbon dioxide to form ammonium carbonate. This ammonium carbonate in its turn is conveyed eventually to the liver, where it is finally transformed into urea and eventually excreted in the urine as a waste product. The nitrogen-free remainder is utilized for energy purposes either directly or indirectly. The work of Lusk and others has shown that under certain circumstances about 58% of the protein molecule can be converted into sugar. Such would seem to be the history of the fate of the bulk of the protein ingested. Of course a certain amount of the ingested material is not broken down in the way above described but is utilized intact by the organism as building material for the repair of tissue waste and for the formation of new tissue as in growth. Despite the variation in composition of the ingested proteins of a mixed diet the fact that all in the course of digestion are reduced to their simple amino-acid components serves a useful purpose in that it permits the various tissues, which have, of course, varying needs, to exercise a selective action over what they will retain and what reject. It is the composition of the tissues which determines the type of retention.

Evidence of the importance of the chemical composition of the protein fed has been had from another aspect which has shown definitely that the organism must receive certain, probably the majority, of its amino acids in the preformed state. Feeding experiments on young growing animals have been carried out where the protein fed was abnormal in that certain amino acids were completely absent. One of the proteins used was zein (from maize), which lacks the amino acids tryptophan and lysine. When young animals were fed on a well selected diet with zein as the sole protein they rapidly went downhill and died. When to the diet as before the appropriate amount of tryptophan was added to make good the deficiency in this amino acid, the animals remained alive but did not grow; when as a further addition lysine was added the animals not merely lived but grew.

**Carbohydrate.**—Carbohydrate may be regarded as the foodstuff which most readily gives up its energy in the organism. The tendency of modern work is to accept carbohydrate as *the* fuel. After absorption into the blood stream any excess above immediate requirements would seem to be deposited in the liver and muscles in the form of animal starch or glycogen as a readily available form of reserve. If there is a persistent overingestion the excess carbohydrate would seem to be converted into fat and thus there is built up a more permanent reserve of energy. Finally if the organism is suddenly flooded with sugar as the result of the ingestion of excessive amounts, much of the sugar is excreted as such in the urine—alimentary glycosuria. Normally the sugar is completely burnt in the organism to form carbon dioxide and water. The complete utilization of the sugar is intimately related to a special secretion of the pancreas to which the name of insulin has been given by its discoverers, Banting, Best, Macleod and Collip. When there is a disturbance of this insulin formation as in the disease known as diabetes, sugar is excreted as such in the urine, the body having lost the power to utilize it. Just how insulin acts is unknown. There is very good reason also, due primarily to the interesting work of Harden and Young on fermentation, to believe, certainly as regards muscle, that before the carbohydrate can be broken down it first enters into combination with phosphorus to form a hexose diphosphate.

**Fat.**—Fat is not apparently readily metabolized in the body, but it is not probably so stable as one might deduce from the apparent readiness with which it is deposited. It is undoubtedly, so to speak, invested capital, whereas carbohydrate may be looked upon as capital in current account or at most on deposit receipt. When combustion is carried out normally it is complete, the end

products being carbon dioxide and water. For this complete combustion it is essential that a certain amount of carbohydrate be present as is evidenced by the fact that when carbohydrate is withheld from the diet or when it is not available as in diabetes a condition known as acidosis ensues. In acidosis the combustion of fat ceases before combustion is complete, with the result that there is formed in the body and excreted in the urine $\beta$-hydroxybutyric acid, aceto-acetic acid and acetone. These substances can be caused to disappear from the urine if a supply of carbohydrate is made available. It would seem that there are two chemical actions involved in the breakdown of the long fatty acid chain, a special process of oxidation known as $\beta$-oxidation, associated with desaturation which renders the chain unstable. Although the evidence for the conversion of carbohydrate to fat is plain, there is still lacking indubitable evidence of the conversion of fat to carbohydrate, although many workers accept the idea.

**Salts.**—Although the mineral salts do not directly contribute to the supply of energy to the body and although generally speaking, they themselves undergo no metabolic change in the body they play a very important part in the various tissue activities. Unless the salts be present in proper amount and in proper proportion, metabolism is impossible. The principal mineral elements found in the body are sodium, potassium, calcium, magnesium, iron, phosphorus, sulphur, chlorine and iodine, with in addition traces of many other elements. Of course these various elements do not exist in the tissues in their free state but as compounds which, in the majority of instances, would seem to be inorganic. As all these substances are continually being lost from the body in the various excretions, it is essential that a sufficient supply be always available in the food. These mineral constituents play the main rôle in the maintenance of the faintly alkaline reaction of the various tissue fluids. As the result of the different metabolic processes which take place in the tissues there is a constant production of acid, chiefly from sulphur and phosphorus, which requires to be neutralized by basic elements like sodium and potassium and probably also calcium and magnesium. The kidney for the most part regulates in a very selective fashion the output of these various inorganic constituents. It must not be imagined, however, that the body can completely protect itself from excessive salt loss, a loss so great that it may give rise to symptoms of a serious character. Thus it has been shown that men who are, in the course of their work, exposed to high environmental temperatures with consequently much sweating, are very liable to a form of cramp. Further it has been noted that the cramp is frequently exacerbated where the men drink freely of water to allay their thirst. Recently it has been found that the condition is due to an excessive loss of sodium chloride from the body carried away in the sweat and that the condition may be cured or prevented by giving the men saline fluid to drink.

Although five-sixths of the total mineral matter of the body is found in bone and in spite of the fact that bone has all the appearance of being firm and resistant the evidence available goes to show that the bony structures must be regarded as active storehouses of mineral matter. When the need arises the body as a whole can draw upon the bones for constituents like lime and phosphates. Under certain conditions the bones indeed may give up so much of their mineral matter that they become soft and can no longer function as an effective frame work.

The other one-sixth of the mineral constituents found in the body are not distributed uniformly throughout the remainder of the tissues. As regards this varying distribution of salts in the tissues and the blood Macallum, in his study of palaeochemistry, produced some most interesting evidence in favour of his view that the present composition of the blood plasma, in so far as its inorganic constituents are concerned, is probably identical with that of the sea water just before the Cambrian period and that the salt concentration in protoplasm represents conceivably the salt concentration of the primaeval ocean in which life first appeared. At any rate the curious ratio of potassium and calcium to sodium, which is characteristic of protoplasm, is reflected in the salt relationship in water drawn from pre-Cambrian formations.

The mineral constituents play an important part without doubt in digestion in that acid must be secreted for gastric digestion and alkali for intestinal digestion.

**Water.**—In so far as water forms about 60% of the bodyweight of man it is very obvious that the part it plays in metabolism must be an important one. It is indeed true that the whole series of chemical actions which are so intimately related to the life of the living organism, be it animal or vegetable, are ultimately referable to changes which take place in solution. It has been conclusively shown that the younger the animal the richer it is in water. It has also been found that the fatter the animal the smaller the percentage amount of water present.

So far as is known water undergoes no change in the body, but nevertheless all the water present in the organism does not come from some source external to the body but is in part formed in the tissues during the metabolism of the various foodstuffs and of the tissues themselves. According to one calculation this internal source of supply accounts for about 16% of the water excreted. It has been also maintained that this intracellularly formed water is of greater value to the living structure than the imbibed water as it presumably does not bring about drastic osmotic changes. It is impossible, however, with the information now available to decide whether the metabolic water in the cell differs in any way from the water received from external sources.

It is of interest to note that animals which live in arid regions, in contradistinction to those which live where water is abundant, excrete as their main nitrogenous waste product uric acid which is voided with the minimum waste of water instead of urea, which has to be excreted in solution.

**Methods of Investigation.**—Brief reference may here be made to the methods employed in investigating metabolism. No matter the line of attack selected, the investigator is handicapped by the fact that he can only deal with the end products of metabolic activity.

If the extent and degree of metabolic activity of a subject have to be determined we may do so by direct calorimetry. The subject is enclosed in a special chamber or calorimeter so devised that all the heat given off by the subject can be directly collected and measured (fig. 1). These calorimeters, which we owe mainly to the ingenuity and skill of Atwater, Rosa and Benedict, are very delicate and costly pieces of apparatus. In order that there be no escape of the body heat to the environment, the double copper walls of the chamber are fitted up with elaborate electrical equipment which permits of so delicate a balance that heat can neither pass out nor into the chamber. In order to measure the heat given off by the subject, a current of cold water is circulated within the box in continuous piping. If the temperature of the incoming and outgoing water is carefully measured and if the

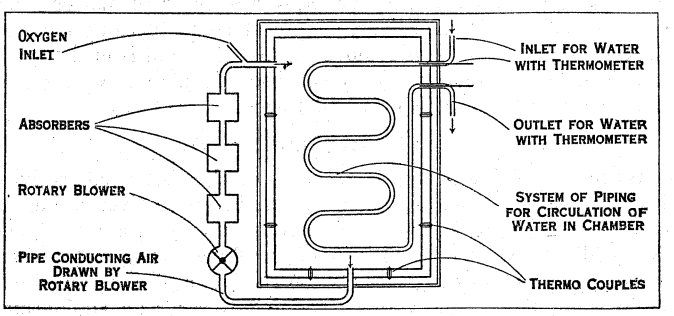
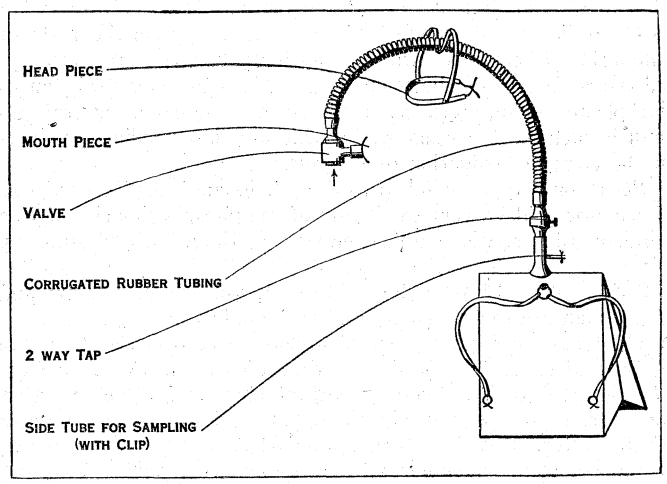



FIG. 1.—SCHEMA PRINCIPLES OF ATWATER-ROSA-BENEDICT RESPIRATION CALORIMETER

quantity of water passing through be also known the heat lost by radiation and conduction by the subject in a given time can be determined. As part of the heat lost, amounting to about one-fourth of the whole, is eliminated by the subject in the form of water vapour this must be and is also determined by absorbing the water lost in sulphuric acid and subsequent weighing of the acid container. This method of direct calorimetry is very accurate and reliable, but the method is difficult and the apparatus is very liable to get out of order. In addition to this direct measurement of the heat output, the metabolic activity of the subject

can be calculated from a determination of the amount of carbon dioxide given off and the amount of oxygen utilized by the subject in a given period. This method of Indirect Calorimetry can be carried out simultaneously with the direct method and serve as a check upon it. The calorimeter chamber in which the subject is enclosed is gas-tight and the air is circulated through a gas-tight absorbing system (fig. 1) by means of a rotary blower. The




FROM CATHCART, PATON AND PEMBREY, "PRACTICAL PHYSIOLOGY" (EDWARD ARNOLD & CO.)

FIG. 2.—INDIRECT CALORIMETRY: DOUGLAS BAG

carbon dioxide given off is absorbed by means of soda lime, the amount absorbed being determined by weighing the soda lime container at the beginning and the end of the experiment. The carbon dioxide free air is returned to the chamber after the deficiency in oxygen, which is approximately determined by reduction in volume, has been made good from a cylinder of pure oxygen. The amount of oxygen used during the experiment is determined either by measuring by a meter the amount of oxygen passed in or by weighing the cylinder before and after the experiment. The heat lost by the subject can be determined from the amount of oxygen used. The caloric value of a litre of oxygen used in the tissue combustion has been determined. This value varies with the carbon dioxide–oxygen ratio, called also the respiratory quotient (R.Q.), from 4·795 calories with an R.Q. of ·713 which is held to represent the combustion of fat alone to 5·058 calories with an R.Q. of 1·00, which is accepted as representing the combustion of pure carbohydrate by the tissues. The two methods of direct and indirect calorimetry have been found to give almost identical results.

It is obvious that the use of the chamber would act as a great handicap if the determination of energy expenditure were confined to it. To enable measurement of energy expenditure of subjects engaged in actual work a portable apparatus was first devised by Zuntz and later much simplified by Douglas (fig. 2). In this last form the subject wearing either a mask or special mouthpiece, with nose clip, fitted with two one-way valves breathes into a gas-tight bag carried on his back. The air collected in the bag at the end of the experiment is measured by passage through a meter, a sample of the expired air is analyzed in the Haldane gas analysis apparatus and the amount of carbon dioxide and oxygen present is determined. As the composition of the atmospheric air is known it is readily calculated how much carbon dioxide the subject excreted and how much oxygen is utilized in a given time and the caloric values can be determined as above. In order to relate the carbon dioxide output and oxygen utilization to the non-protein moiety of the food the protein metabolized during the period of the experiment is determined from the nitrogen output in the urine. For every gram of urinary nitrogen derived from protein 8·45g. of oxygen are required and 9·35g. of carbon dioxide are given off. Hence to determine the non-protein utilization the appropriate amounts of carbon dioxide and oxygen are deducted from the total amounts. As the amount of nitrogen excreted during the period of examination is minute, in practice it is usually ignored.

When the alterations of the gaseous metabolism are considered they are commonly referred to variations from the so-called Basal or Standard Metabolism. The basal metabolism may be defined as that of a subject lying comfortably at rest in a warm bed and in the post-absorptive condition, *i.e.*, about 12 to 15 hours after the last meal. With the subject in such a condition the metabolism reaches its lowest level. As it has been estimated that functional activities of the various organs may account for about 25% of the resting metabolism (thus the activity of the heart for about 3·6%, respiratory movements for about 10% and the kidney for about 5%) Krogh maintains that it is better to call this resting metabolism standard rather than basal. It, of course, could only be truly basal if all functional activities were in abeyance at the time of the determination.

It is obvious, in view of the fact that humanity is of varying sex and size, that if a universally applicable standard is to be obtained there must be some fundamental unit on which to base assessments. It has been shown that body-weight is not satisfactory. The modern unit selected is the surface-area of the body. A very useful formula for the determination of this area based on height × weight × a constant has been worked out by E. F. and D. Du Bois. As the result of their work it is common practice now to take as the fundamental unit the calorie output per square metre surface area.

This basal metabolism is shown to be high in childhood and that as adolescence is reached it falls to a level which is more or less uniformly maintained until about the age of fifty. Thereafter the decline is steady although small. The basal metabolism is also influenced by the sex of the subject, the nature of the food consumed, and environmental conditions like temperature, climate, etc. The most potent factor is, however, muscular work.

## FACTORS WHICH INFLUENCE NORMAL METABOLISM

**Fasting.**—During fasting the body draws upon its own reserve of stored material for its requirements in the production of energy, and the rate of breakdown varies with the energy requirements. An individual kept warm in bed, therefore, stands fasting longer than one who is compelled to take exercise in a cold place. The breakdown of tissue during the early days of a fast is much greater than later, for as the fast progresses the body becomes more economical in its utilization of tissue. During a fast the tissues do not waste at an equal rate; those which are not essential are utilized at a much greater rate than those which are essential to the maintenance of the organism. For instance, it has been shown that during a fast the skeletal muscles may lose over 40% of their weight, whereas an essential organ like the heart loses only some 3%.

The essential tissues obtain their nourishment from the less essential by ferment action, a process which has been termed autodigestion or autolysis. The autolytic products of tissue digestion are practically identical with those which arise during the ordinary gastro-intestinal digestion.

**Muscular Work.**—The muscular tissue plays the most important part in general metabolism. Not only is muscle the most abundant tissue present, but it is constantly active and is the great energy-liberating machine of the body. Formerly it was believed on the authority of Liebig that muscular work was done at the expense of the protein material, but it has been conclusively shown that the real source of energy in moderate work is the non-protein material, carbohydrates and fats; of these the former plays the greater part in a man on ordinary diet. That there is some influence on protein is shown by the fact that there is a definite but small increase in the output of nitrogen in the urine as the result of muscular work, but it is in no sense proportionate to the work done; whereas the output of carbon dioxide produced by the combustion of the carbohydrates and of the fats is increased proportionately to the work done.

**Internal Secretions.**—Evidence is accumulating to show that the activities of the various tissues of the body are presided over and controlled not merely by the action of the nervous system but also by certain chemical substances elaborated in special glands known as endocrine glands or glands of internal secretion. The

active secretions of these glands are poured out into the blood stream. We have direct evidence that some of these secretions like thyroxin from the thyroid gland and insulin from the pancreas exercise a very active influence on metabolism. As regards the other secretions we know more about their action on various tissues than of their direct influence on metabolism.

### EXCRETION

While we know comparatively little of the intermediate stages in the breakdown of the food constituents, and more particularly of the protein moiety, our knowledge of the final products of the metabolic changes excreted is fairly full. The urine is the main channel of excretion for the nitrogenous waste products. Water is excreted by the lungs, the kidneys and the skin.

The urine is a yellowish fluid which varies greatly in its depth of colour, from pale amber to a deep brown. It has a specific gravity of about 1020, varying with the percentage of solids in solution, and it usually has an acid reaction. Among the principal organic substances present are urea, ammonia, purines (uric acid and the so-called purine bases, xanthin, etc.), creatinine, conjugated sulphates, various aromatic bodies and many other substances in small amount, together with the water and inorganic salts.

The following table from Folin gives a good idea of the average composition of the urine as regards the nitrogen-containing constituents, and its variation according to the nature of the diet when this is free of creatin, creatinine and the precursors of the purines:—

| | Nitrogen-rich diet | Nitrogen-poor diet |
|---|---|---|
| Total nitrogen | 14·8–18·2g. per day | 4·8– 8·0g. per day |
| Urea nitrogen | 86·3–89·4% of total | 62·0–80·4% of total |
| Ammonia nitrogen | 3·3– 5·1% „ „ | 4·2–11·7% „ „ |
| Creatinine nitrogen | 3·2– 4·5% „ „ | 5·5–11·1% „ „ |
| Uric acid nitrogen | 0·5– 1·0% „ „ | 1·2– 2·4% „ „ |
| Undetermined nitrogen | 2·7– 5·3% „ „ | 4·8–14·6% „ „ |

*Urea,* which forms the chief nitrogenous constituent, amounting on an ordinary diet to about 30g. per diem, is for the most part formed in the liver, from ammonia obtained either directly from the blood after absorption from the intestine, or resulting from the deaminization of the amino acids. There is at present a controversy as to the true chemical nature of this substance.

*Ammonia* is present in the form of ammonium salts, and forms about 4% of the total urinary nitrogen. It may exceed this amount under certain conditions, for the most part pathological. The ammonia is utilized by the body to neutralize acids which arise during the various metabolic processes.

*Purines* (uric acid, xanthin, hypoxanthin, etc.) are all members of a series which have as their common nucleus a body which E. Fischer called purine. The most important member of this series is uric acid. It forms about 2% of the total urinary nitrogen. Recent work has shown that it has two quite definite sources of origin: (1) from ingested food containing the precursors, and (2) from the tissue metabolism. The first is known as the exogenous source, and the second as the endogenous. This acid is chemically known as trioxy-purine, and may be regarded as the union of two urea molecules with a three-carbon chain fatty acid. All the uric acid formed in the body is not excreted as such, part being, as already mentioned, converted into urea. The amount which is converted into urea varies with the species of animal. The other chief purine bodies present in urine are xanthin and hypoxanthin, purines less oxidized than uric acid; the first is a dioxy-purine, and the second is a monoxypurine. The main source of total purine supply would seem to be muscle metabolism. The mother substances from which all are derived in the body are the nucleo proteins. These complex bodies are apparently first broken down by enzyme action to aminopurines. These in their turn have their amino groups split off, and then, according to the degree of oxidation, the different purine bodies are formed.

*Creatinine.* The physiological significance of this substance is as yet unknown. The daily excretion varies little with the character of the diet, provided, of course, that the diet be creatinine-free. It would seem to be derived from the creatine of muscle, a substance which is very readily changed into creatinine outside the body. Whatever its source, after urea and ammonia it is one of the important nitrogenous substances excreted.

The *sulphur* excreted in the urine comes chiefly from the sulphur of the protein molecule. It is excreted in various forms: (1) as the ordinary preformed sulphates, *i.e.,* sulphur in the form of sulphuric acid combined with the ordinary bases; (2) as ethereal sulphates, *i.e.,* in combination with various aromatic substances like phenol, indol, etc.; (3) in the form of so-called neutral sulphur in such substances as cystin, which are intermediate products in the complete oxidation of sulphur.

*Phosphorus* appears linked to the alkalis and alkaline earths as phosphoric acid. A very small part of the phosphoric acid may be eliminated in organic combination such as the glycero-phosphates, etc.

Sodium (mostly as sodium chloride), potassium, calcium and magnesium are the common bases present in the urine.

The lungs are *the* important channel of excretion for the waste product of carbon metabolism, carbon dioxide or $CO_2$ (*see* RESPIRATION); and also a very important channel for the excretion of water. As regards the skin, the sweat carries off a large amount of the water. It has been estimated that about 900 c.c. is excreted per diem under normal resting conditions, rising to 7,000 c.c. and over when hard work is done. Sweat contains salts, chiefly sodium chloride, and organic waste products. Of the organic solids excreted from this source, urea forms the most important under normal conditions. Under pathological conditions, especially when there is interference with free renal action, the amount of nitrogenous waste excreted may become important.

BIBLIOGRAPHY.—E. Starling, *Principles of Human Physiology* (1926); W. M. Bayliss, *Principles of General Physiology* (1924); G. Lusk, *Science of Nutrition* (1928); J. J. R. Macleod, *Physiology and Biochemistry in Modern Medicine* (1926); E. F. DuBois, *Basal Metabolism in Health and Disease* (1927). (E. P. C.)

**NUTTING, MARY ADELAIDE** (1858– ), American nurse educator, was born at Waterloo, Quebec, Canada, on Nov. 1, 1858. Educated in private schools, she became a member of the first class in the Johns Hopkins hospital school of nursing, Baltimore, of which school she was principal from 1894 to 1907, when she was given the chair of institutional administration at Teachers' college, Columbia university, New York. There in 1910 the first university department for the education of nurses was created and she was assigned to the chair of nursing and health. During World War I she was appointed by President Wilson chairman of the committee on nursing under the National Defense council. In 1920 the "Adelaide Nutting Historical Collection," showing the progress in America and other countries of the profession she had helped to develop, was established in her honour at Teachers' college. She retired in 1925. With Lavinia Dock she wrote *A History of Nursing* and she was also the author of *A Sound Economic Basis for Schools of Nursing.*

**NUX VOMICA,** a poisonous drug, consisting of the seed of *Strychnos Nux-Vomica,* a tree (Fam. *Loganiaceae*) indigenous to most parts of India, and found also in Burma, Siam, Cochin China and northern Australia. The tree is of moderate size, with a short, thick, often crooked stem and ovate entire leaves, marked with three to five veins radiating from the base of the leaf. The flowers are small, greenish-white, tubular and arranged in terminal corymbs. The fruit is the size of a small orange, and has a thin hard shell, enclosing a bitter, gelatinous white pulp, in which from one to five seeds are vertically embedded. The seed is disc-shaped, about 1in. in diameter, and $\frac{1}{4}$in. thick, slightly depressed towards the centre, and in some varieties furnished with an acute keel-like ridge at the margin. Externally, it is greyish-green and satiny from a coating of appressed silky hairs. Internally it consists chiefly of horny albumen, which is easily divided along its outer edge into halves by a fissure, in which lies the embryo. The latter is about $\frac{3}{10}$in. long, and has a pair of heart-shaped membranous cotyledons.

The chief constituents of the seeds are the alkaloids strychnine (*q.v.*) and brucine, the former averaging about 0·4%, and the latter about half this amount. The seeds also contain an acid, strychnic or igasuric acid; a glucoside, loganin; sugar and fat. The pharmacology of nux vomica is practically that of strychnine.

**NYACK,** a village of Rockland county, New York, U.S.A., on the west bank of the Hudson river (which there expands into Tappan Zee, 3 mi. wide) 25 mi. above New York city. It is served by the Erie railroad and a ferry to Tarrytown, nearly opposite. Pop. (1930) 5,392; in 1940 it was 5,206. With the adjacent villages of Upper Nyack, South Nyack, Central Nyack and West Nyack, the population exceeded 10,000 in 1940. The industries include shipyards, machine shops and several factories. Permanent settlement there dates from about 1700. Nyack was incorporated in 1833 and was named after a tribe of Algonkin Indians.

**NYANZA,** the Bantu name for any water area of considerable size; especially applied to the great lakes of east Central Africa. The word is variously spelt, *e.g.*, Nyanja, and Nyasa.

**NYASA,** the third in size of the great lakes of Central Africa. It occurs south of the confluence of the two great rift valleys and extends from 9° 29′ S. to 14° 25′ S. The lake measures along its major axis, which is slightly inclined to the west of north, exactly 350 m., while the breadth varies very little, the maximum being 45 m. about the middle. The total area may be estimated at 11,000 sq.m. The lake lies at an altitude of about 1,650 ft. above the sea. The sides of the valley in which Nyasa lies, which are somewhat irregular towards its southern end, take a decided character of parallel fault scarps in the northern third, and are continued as such beyond the northern extremity. The depth seems to vary between 200 and 400 fathoms, in accordance with the steepness of the shores. The lake receives its water-supply chiefly from the streams which descend from the mountains to the north, all the rest becoming very small in the dry season. Like other lakes of Central Africa it is subject to fluctuations of level, apparently caused by alternations of dry and wet series of years.

At the north-western end is a plain of great fertility, traversed by the Kivira, Songwe and other streams. On the delta of the Rukuru, is the British station of Karonga, the northern port of call for the lake steamers. Southwards the plain narrows, and the sandstone scarp of Mt. Waller rises sheer above Florence bay, the high western plateaux continuing to fall steeply to the water. At Cape Chirombo (11° 40′ S.) the coast bends to the west, and soon the plateau escarpments recede, and are separated from the lake along its southern half by an undulating plain of varying width, with Bandawe and Kota Kota ports on the coasts. A little north of the latter the Bua river, coming from a remote source on the upper plateau, enters by a projecting delta. At Domira bay the coast turns east, contracting the lake to a narrow neck, with Fort Rifu (west), and Fort Maguire, near Makanjira point (east). Beyond this the lake runs southwards into two bays separated by a granitoid peninsula, off which lie several small rocky islands. From the extremity of the eastern bay the Shiré makes its exit to the Zambezi. On the eastern side the escarpments and the boundary fault keep close to the lake, leaving few plains along its shores. In the north-east, the coast is formed by the unbroken wall of the Livingstone range (*q.v.*). On this coast is the station of Lumbira (Tanganyika Territory). The valley of the Ruhuhu, the only important stream which enters the lake from the east, breaks through the Livingstone range. The formation is here Karroo sandstone, corresponding to that of Mt. Waller on the opposite shore. Just north of the Ruhuhu is Manda, on an excellent harbour. To the south the wall of mountains recedes somewhat, and the remainder of the eastern shore shows a variation between rocky cliffs, marshy plains and low hills, to be followed farther south by a wide semicircular bay, generally rock-bound, and ending in Malo point, off which are the largest islands the lake possesses, Likoma and Chisamulu. In the southern half the coast is highest where the Mapangi hills rise to 3,000 ft.

Nyasa, reached in 1859 both by David Livingstone (from the south) and by the German, Albrecht Roscher (from the east), was explored by the former to about 11°, and to its northern end by E. D. Young in 1876. From this date onwards it has been the scene of much civilizing work on the part of British missionaries, traders and government officials, and of Germans also. Its shores are divided between Great Britain (with Tanganyika Territory and Nyasaland Protectorate) and Portugal (with Portuguese East Africa). British steamers, including gunboats, have been launched on Nyasa, which forms an important link in the water-route from the Zambezi mouth to the heart of the continent. The first detailed survey of its shores was executed by Dr. James Stewart (1876–1877), but this has been superseded by later work.

BIBLIOGRAPHY.—A. R. Andrew and T. E. G. Bailey, "The Geology of Nyasaland," with note on fossil plants, fish remains, etc., by E. A. N. Arber and others and bibliography in vol. 66 of *Quart. Jnl. Geog. Society* (May 1910); Gen. J. C. Smuts, "East Africa," *Geogr. Journal* (1918); also Blue books and Colonial Office reports.

**NYASALAND PROTECTORATE.** Nyasaland covers rather more than 40,000 sq.mi., of which 37,374 are land. The country is situated between 9° 45′ and 17° 15′ S., and between 33° and 36° E. Its length from north to south is about 520 mi., while its width varies from 50 to 100 miles. It is bounded on the west by Northern Rhodesia and Portuguese East Africa, on the northeast by Tanganyika Territory, and on the east and south by Portuguese East Africa. The northern half of its eastern boundary is formed by Lake Nyasa.

**Physical Features.**—Nyasaland consists of elevated plateaus, sometimes separated by low-lying ground. The most important of these are the Nkonde mountains in the northwest, 6,000 to 7,000 ft. high, the Nyika plateau, rising to more than 8,000 ft., and the Angoniland plateau, whose highest points range between 5,000 and 6,000 ft., both of these plateaus being on the western side of the lake: the Mlanje massif, in the extreme southeast, mostly more than 6,000 ft., with several peaks rising above the general level, one attaining 9,843 ft., and the Shiré highlands between Lake Shirwa and the Shiré river, reaching, in their highest point, an elevation of 7,000 feet.

Lake Nyasa (*q.v.*), situated 1,645 ft. above sea level, receives a number of comparatively small rivers from the neighbouring highlands, and is drained southward by the Shiré river, which flows into the Zambezi. The lake has few good harbours, and is swept from time to time by violent northerly and southerly winds. Other large lakes are Lake Shirwa and Lake Chiuta, a sheet of water situated north of Lake Shirwa, and being 30 mi. long and from 2 to 8 mi. broad. The water of Lake Chiuta, like that of Lake Nyasa, is fresh.

**Climate.**—Three distinct climatic zones may be distinguished. In the low-lying Shiré valley the climate is hot, in October and November temperatures rising to 115° F. In the highlands, at an altitude of 3,000 ft. and above, extreme heat is unknown. Along the shores of Lake Nyasa the high degree of humidity makes the climate particularly trying to Europeans, although the temperature rarely rises above 95°. The dry season lasts from May to September, the weather being comparatively dry and cool. In higher mountain regions occasional frost may even occur during the night. The first rains, accompanied by violent thunder storms, set in after the middle of October and continue periodically until the end of December, when the season of heavy rains begins, lasting from January through March. The annual rainfall is about 50 in. in the highlands, 35 in. in the lowlands.

**Vegetation.**—Large tracts of the country are still covered with forest, especially away from the centres of European or native settlement. The forests are of little economic value, apart from their effect in checking rapid run-off and soil erosion. Most of the trees are small, the diameter of their trunks at about 4 ft. from the ground being usually from 4 to 12 inches. Timber trees of greater size and value are to be found in damp ravines on the mountain sides and along the banks of the rivers. The most important of these are the patches of Mlanje cypress (*Widdringtonia Whytei*), which yields a soft, durable wood, immune from the attacks of termites. These trees grow on the higher slopes of Mlanje mountain, and are not found elsewhere in Nyasaland. Two species of Brachystegia—Mombo and Nchenga—provide the natives with material for bark cloth and ropes. Tree planting is encouraged, and seeds are easily procurable of the Mlanje cypress, and of several kinds of eucalyptus, which is the most important

of the exotic trees.

**Population.**—In 1940 the population consisted of 2,180,104 Africans, 2,177 Asiatics and 1,812 Europeans. Almost half of the Europeans live in Blantyre (*q.v.*) and Zomba; the remainder are scattered widely in various parts of the protectorate. The average density is 57.64 persons per square mile, one of the most thickly populated areas in Africa. The native Africans belong to the Bantu and are composed of many ethnic groups of which the Nyanja, Nguru, Yao (*q.v.*) and Ngoni (or Angoni *q.v.*) are numerically the strongest.

**Administration.**—The protectorate is administered by a governor appointed by the crown. He is assisted by executive and legislative councils consisting of official and unofficial members. The principal departments of administration are in Zomba. Since March 1, 1945, the country has consisted of three provinces—Northern, Central and Southern—which are divided into three, seven and ten districts respectively. Provincial commissioners are in charge of the former; district commissioners supervise the latter. Towns are administered by town councils; that of Zomba is appointed by the governor, those of Blantyre and Limbe are elective. The native administration after 1933 followed the pattern of indirect rule, allowing African chiefs limited authority under the supervision of the district commissioners. In 1944 advisory councils composed of African chiefs were established in the provinces; these are designed to enable Africans to be more closely associated with the central administration.

**Religion and Education.**—The majority of the Africans are pagans; only 11% are classified as Christians and 10% as Moslems. Missionary activities are of long standing; the first mission opened near Zomba in 1861. Of the 11 missions which were active in 1940 the following may be mentioned: the Universities mission, the Livingstonia Mission of the Church of Scotland, the Church of Scotland mission, the Dutch Reformed Church mission, and the White Fathers. Education is primarily managed by missions which, in 1938, bore 65% of the expense. The education department assumed control in 1926. In 1942 there were four private schools for Europeans providing education to standard VI only, two schools for Asiatics and 4,171 primary schools for Africans with an enrolment of 173,692 children. Attendance is irregular, and few students complete the four-year course. Forty-seven vocational schools provide training for teachers; 453 men and 155 women were in training in 1941. Chief educational institution is the Jeanes Training Centre at Domasi.

**Economy.**—Agriculture is the chief occupation in Nyasaland. Besides maize and millet, which are the staple foods of the Africans, both European settlers and African natives grow tobacco, cotton and tea for export. The total tobacco production in 1942 was 24,800,000 lb.; in 1941 17,800,000 lb. were exported. Most of the tea is grown on European estates in the Mlanje district, but there are some plantations in the Cholo district. According to the international tea agreement (1938), Nyasaland agreed not to plant more than 17,700 ac. or produce more than 18,750,000 lb. for sale in the world's markets. The 1942 export was 5,600 short tons. Cotton production was developed gradually, chiefly among Africans, who exported more than 2,240 short tons in 1942. The production of tung oil is encouraged as an export crop; about 5,000 ac. were under cultivation in 1940, and in 1943 58,000 lb. were exported. Coffee production is insignificant. Livestock supply the needs for local markets. There has been an intensive search for minerals by the British South Africa company, holding the mineral rights for the country. The only prospect is the bauxite deposit in the Mlanje district, estimated as 67,200,000 short tons. Ten thousand natives engaged in fishing in Lake Nyasa and Lake Chilwa supply the local markets. Although the African is primarily an agriculturist working on his own farm, many have taken to wage earning. In 1937, 50,000 were seasonally employed in Nyasaland on European estates, while 100,000, or more than 18% of the fit adult population, had found employment outside the country, chiefly in Southern Rhodesia.

The value of exports in 1940 was £1,042,310; in 1941 it rose to £1,271,000; tobacco and tea accounted for more than 95%. Imports consisting of provisions, building material, agricultural implements, and textiles, were valued at £792,966 in 1940 and £1,004,000 in 1941; textiles accounted for more than 35% of the 1941 total. Nyasaland, falling under the Congo Basin treaties of 1885, cannot give a preference in its customs tariff to any state.

Wages in Nyasaland are low; unskilled labourers earn from 6*s.* to 10*s.* a month, domestic servants earn from 6*s.* to 30*s.* Special food allowances are normally provided.

**Communications.**—Nyasaland is connected with the port of Beira in Portuguese East Africa by a single track 3 ft. 6 in. gauge railway. In 1939 the Nyasaland railways extended from Salima via Chipoka and Blantyre to Port Herald (273 mi.) and connected via Sena and the Zambezi bridge (12,064 ft.) with Dondo in Portuguese East Africa. The railway was serviced by about 1,500 mi. of all-weather road (1938). On the lake was a regular service of ships, but river shipping on the Shiré lost its importance after the completion of the railway in 1935. Capital for the railway was acquired by involved series of loans (*c.* £5,000,000) which became the chief obstacle to the stabilization of Nyasaland's finances. Although the burden of the railway was largely shifted to the United Kingdom, the government insisted that the railway pay what it could, and therefore freight rates remained rather high, retarding the economic development.

(H. A. Wf.; X.)

**History.**—The first European who visited southern Nyasaland was Jasper Bocarro, who in 1616 carried samples of Zambezi silver from the vicinity of Tete to Malindi near Mombasa. During the next century Jesuit missionaries travelled through many sections of the country and brought back rumours of the existence of Lake Nyasa. The Lacerda expedition which penetrated as far as Lake Mweru in 1798 made the watershed of Lake Nyasa known, but the lake itself was not effectively discovered nor the country opened to Europeans until David Livingstone (*q.v.*) reached it on Sept. 16, 1859. In the following year the first attempt to establish missions was made, but it failed when a small group led by Bishop Mackenzie of the Universities Mission to Central Africa was decimated by fever and Yao hostility in the vicinity of Zomba. The region was, therefore, left to itself until the Livingstonia Free Church mission and the Church of Scotland mission were established in 1875–76. Since the missions found themselves unable to cope with the problems of supplying food and transport, the African Lakes corporation was formed in 1878. This corporation, nicknamed *mandala* (glass) by the natives because its founder, John Moir, wore spectacles, was the most important factor in opening Nyasaland.

The clashes between the missionaries and Arab slave traders brought the first British consuls into the country in 1883, and the African Lakes corporation enlisted volunteers in its unofficial war placed in 1888 under the command of Captain (later Lord) Lugard. At this time, the British government hesitated to interfere officially because Nyasaland was surrounded by Portuguese territory and remained inaccessible. A change in British attitude occurred in 1889, when D. J. Rankin discovered the navigable Chinde mouth of the Zambezi river, the status of which as an international waterway had been recognized in 1884. In the same year Cecil Rhodes' British South Africa company obtained a charter to develop Nyasaland. These developments inspired the British government to send Mr. (later Sir) H. H. Johnston into Nyasaland to negotiate treaties with the native chiefs and to thwart a Portuguese expedition under Major Serpa Pinto designed to link together the Portuguese territories of Mozambique and Angola. Between 1889 and 1891 British influence was consolidated, and as a result of the Anglo-German convention of 1890 and the Anglo-Portuguese convention of 1891, the Nyasaland Protectorate was established and was formally proclaimed in 1892. Johnston was put in charge of it as commissioner and consul-general responsible to the British Foreign Office. For five years he combined this post with that of administrator of the British South Africa company's trans-Zambezi territories which became Northern Rhodesia. With the aid of gunboats and Indian troops he suppressed slave raiding, forced Arabs and Yao into submission and subdued the Angoni, who had harassed the non-Angoni natives. The country was finally pacified in 1897. There

were then about 150 European settlers, nearly all in the vicinity of Blantyre and Zomba.

Sir Harry Johnston was succeeded as commissioner in 1897 by Sir Alfred Sharpe, whose intimate knowledge of the country was valuable in the work of development. The progress made was marked in 1904 by the transfer of the protectorate, up to that time under Foreign Office control, to the Colonial Office. In 1907 the title of the chief official was changed from commissioner to governor and in the same year executive and legislative councils were established. Called at first the Nyasaland Protectorate, the name was changed in 1893 to "The British Central Africa Protectorate," but in 1907 the old name was revived. When in 1910, Sir Alfred Sharpe retired, the urgent problems awaiting solution were economic; chief concern being over Nyasaland's communications with the sea, the river route having proved unsatisfactory. When World War I began, northern Nyasaland was invaded by Germans from East Africa. The governor, Mr. (later Sir) George Smith, was capable and energetic, and he received the full support of both Europeans and Africans.

There were 18,920 Africans recruited for service with the King's African Rifles, and 191,200 rendered seasonal service as carriers and noncombatants. The Germans were repelled, and later Nyasaland became a base for operations against them. There was, however, during the war, a disquieting incident. Among the natives were a number of professed Christians who claimed freedom from white control. One of these men, John Chelembwe, who had been educated in the United States, on his return built a church and preached the independence of Africans. With some 500 followers he rose in revolt in Jan. 1915. Three white settlers were murdered, one a Mr. Livingstone (a descendant of David Livingstone), and Chelembwe preached a sermon in his church with Mr. Livingstone's head placed on the pulpit. The revolt was speedily suppressed by a small force of British and natives, Chelembwe, who had taken to flight, and 20 of his followers were shot.

Following World War I, which brought German East Africa (renamed Tanganyika) within the British orbit, several attempts were made to amalgamate Nyasaland with adjacent British territories. While during the 1920s and 1930s Nyasaland's ties appeared to have been with Kenya and Tanganyika, after 1938 there was a movement to unite it to Northern Rhodesia. In 1939 the governor became a member of the East African Governor's conference as well as of the Inter-territorial conference at Salisbury, an assembly of the governors of Southern Rhodesia, Northern Rhodesia and Nyasaland. On Oct. 18, 1944 the British colonial office formally established a standing Central African committee to promote the closest contact and co-operation between the governments of the three territories. This council under the chairmanship of the governor of Southern Rhodesia held its first meeting in Salisbury, Southern Rhodesia, on April 24, 1945.

*See* S. S. Murray, *A Handbook of Nyasaland* (1932); *Annual Reports of the social and economic progress of the people of the Nyasaland Protectorate* (annually, British Colonial Office); *Yearbook and Guide of the Rhodesias and Nyasaland,* 1938–39 (1939).

(H. A. Wf.; F. R. C.)

**NYBORG,** a seaport of Denmark on the island of Fyn, in the *amt* (county) of Svendborg. Pop. (1940) 8,994. The town was founded in the 12th century and a castle erected on Knudshoved (Canute's Head). From the 13th to the 15th century Nyborg was one of the most important places in Denmark. In 1658 it was held by the Swedes for about a year. The fortress, built by Christian IV. and Frederick III., was dismantled in 1869, and the ruins of the castle are used as a prison.

**NYE, EDGAR WILSON** (1850–1896), American humorist, was born at Shirley, Me., on Aug. 25, 1850. His parents removed to a farm on the St. Croix river in northern Wisconsin in 1852, and young Nye was educated in Wisconsin at the academy at River Falls, where he studied law. In 1876 he was admitted to the bar at Laramie, Wyo., where he served as justice of the peace, superintendent of schools, member of the city council and postmaster. Here he began to contribute humorous articles under the pseudonym of "Bill Nye" to newspapers, especially the Cheyenne *Sun* and the Denver *Tribune.* In 1881 he founded at Laramie the *Boomerang,* and his reputation as a humorist was soon widespread. Later he became a successful lecturer, and in 1885, with James Whitcomb Riley, the poet, made an extended tour through the country, each reading from his own writings. Nye removed to New York city in 1886, and passed the later years of his life at Arden, a village in North Carolina, where he died on Feb. 22, 1896. His principal books are *Bill Nye and Boomerang* (1881); *Forty Liars and other Lies* (1882); *Nye and Riley's Railway Guide* (1886), with James Whitcomb Riley; and two comic histories, *Bill Nye's History of the United States* (1894) and *Bill Nye's History of England from the Druids to the Reign of Henry VIII.* (1896).

See *Bill Nye, His Own Life Story; continuity* by F. W. Nye (1926).

**NYIKA.** This Swahili word means "forest and thorn bush country" and is used by the Swahili to designate a set of Eastern Bantu tribes, who during the 16th century under pressure from the Galla migrated down the coast from the steppes on the left bank of the Tana river. It does not include the Taita, Pokomo, Segeju and Akamba, though these are ethnically connected with the tribes to whom it is applied. The nine tribes included in the term Nyika are the Giryama, now living about 3° south of the Equator, the Rabai, the Duruma and the Digo—all upper Nyika tribes and the most important of the group: the other five are the lower Nyika—the Kauwa, Chonyi, Dzihana, Kambe and the Rihe or Ribe.

Generally speaking they are tall, muscular, well set up and broad-headed. The Digo, however, though well built are slender and have refined oval faces. There are evident affinities with the Northern Hamites, and their general colour is dark brown, becoming paler the nearer Mt. Kilimanjaro is approached. Waist clothes are worn by the men, and women wear many-pleated kilts, but are nude from the waist up, though now the tendency is to dress like Swahili women.

The *kaya* or fortified village was fundamental to their clan organization, but now that war is no longer anticipated, and villages are built outside the fortification, it has lost some of its significance, though still used for the assemblies of elders. The *kaya* is always situated on a hill or in a dense forest and is strongly palisaded. The Pokomo build circular huts like the Galla, but this group generally is characterized by rectangular huts, with a ridge-pole and a thatched roof extending to the ground and thus dispensing with walls. The houses are either gable- or hip-ended.

The Nyika tribes are divided into exogamous clans, which observe certain prohibitions and avoidances and share a general veneration for the hyaena in which all the cognate tribes join except the Pokomo: but now at any rate there is no trace of totemism. The clans of the Digo and Duruma are matrilineal; the rest are patrilineal with the exception of the Rabai, who are in a transitional stage. The Rabai have two sets of clans, male and female, and every man inherits the clan of his father and of his mother, but for all practical purposes he is reckoned as a member of his father's clan; a woman, on the other hand, while she similarly inherits both clans, stresses the mother's. Every clan has its own clubhouse (*lwanda*) and there is also the *moro* or council house, which is the general inter-clan meeting place for men, and houses the friction drum used for convening the council.

The Digo, probably under Arab influence, have hereditary sultans, but otherwise there are no paramount chiefs. The government is in the hands of elders, who wear an ivory armlet as a badge of office. Every 13 years males have to be initiated at circumcision into an association analogous to Masai age-grades and after passing through the preliminary degrees they eventually reach the status of elders, among whom there is an inner circle called the Hyaena, which alone knows all the magical spells and consequently inspires great terror. From this circle are selected the "owners of the land," who carry on the government during the space of a *rika* or circumcision cycle.

The bow is the most usual weapon and the arrows are often poisoned. They also carry swords which are, however, as much implements as weapons. The Giryama have a parrying stick unique in the eastern area. Agriculture is carried on by women

who grow maize, millet, vegetables and sweet potatoes. They have sheep and goats but few cattle, and like most of the coastal tribes are careful not to take the cattle out till the heavy dew has dried from the grass, a precaution which does not seem to be necessary to the Bantu and Nilo-Hamitics living at higher altitudes.

The Nyika worship the typical Eastern Bantu deity *mulungu,* a vague abstraction of the sky combined with ancestor-worship with the main emphasis on the latter, the spirits of the dead (*koma*) surviving mortality and taking the world of the living under their charge. *Mulungu* is the dispenser and creator and from his union with the earth have sprung all things in the world including human beings, who are *mulungu's* hens and chickens. There are no professional rainmakers.

BIBLIOGRAPHY.—O. Baumann, *Usambara und seine Nachbargebiete* (1891); Sir Charles Eliot, *The East African Protectorate* (1905); W. W. A. Fitzgerald, *Travels in the Coastlands of British East Africa* (1898); J. L. Krapf, *Reisen in Ost Afrika* (1859); A. Werner, "The Bantu Coast Tribes of the East African Protectorate" (*J.R.A.I.,* xlv., 1915) and article "Nyika" in Hastings *E.R.E.* (J. H. D.)

**NYIREGYHAZA,** the capital of the county of Szabolcs, in Hungary, is situated on the sandy loess Nyirseg plateau. It is an agricultural centre, specializing in the intensive cultivation of fruit and vines. There are also small manufactures, *e.g.,* of soda, soap and agricultural machinery. Pop. (1939) 56,108.

**NYKÖPING,** a seaport of Sweden, chief town of the district (*län*) of Södermanland, 98 mi. S.W. of Stockholm by a branch from the Stockholm-Malmö railway. Pop. (1943) 14,299.

Nyköping (*i.e.,* New-Market, Latinized as *Nicopia*) begins to appear as a town early in the 13th century. Its castle was the seat of the kings of Södermanland, and after those of Stockholm and Kalmar was the strongest in Sweden. It was burned by Albert of Mecklenburg's party in 1389, by an accidental conflagration in 1665, and by the Russians in 1719. Nyköping lies at the head of the Byfjord, an inlet of the Baltic. The ruins of its once famous castle, the town hall (1662), and the district governor's residence, are notable buildings.

**NYMPH,** in zoology, is the name given to the immature stages through which all insects with incomplete metamorphosis pass after leaving the egg. At its last moult the nymph gives rise to the perfect insect. (*See* INSECTS.)

**NYMPHAEUM,** a monument consecrated to the nymphs (*q.v.*), especially those of springs. These monuments were originally natural grottoes, which were traditionally considered the habitations of the nymphs. They were arranged to furnish a supply of water. Subsequently, artificial grottoes took the place of natural. The nymphaea of the Roman period were borrowed from the Hellenistic east (*e.g.,* The Great Nymphaeum of Ephesus). The majority were rotundas, adorned with statues and paintings. They served the threefold purpose of sanctuaries, reservoirs and assembly-rooms. A special feature was their use for the celebration of marriages. Such nymphaea existed at Corinth, Antioch and Constantinople; the remains of some 20 have been found at Rome and of many in Asia Minor, Syria and Africa. The term nymphaeum was also applied to the fountain in the atrium of the Christian basilica. (*See* FOUNTAIN.)

**NYMPHS,** in Greek mythology, the generic name of a large number of female divinities of inferior rank. The word, the etymology of which is uncertain, seems to mean simply a marriageable woman; this is appropriate, as they are mostly associated with fertile, growing things (as trees), or with water. They are frequently associated with the superior divinities, as Artemis, Apollo, Dionysus, Pan and Hermes (*q.v.*).

The nymphs were distinguished according to the different spheres of nature with which they were connected. Sea nymphs were *Oceanids* or *Nereïds,* daughters of Oceanus or Nereus. *Naiades* (from Gr. *νάειν,* flow, cf. *νᾶμα,* stream) presided over springs, rivers and lakes. *Oreades* (*ὄρος,* mountain) were nymphs of mountains and grottoes, one of the most famous of whom was Echo. *Napaeae* (*νάπη,* dell) and *Alseïdes* (*ἄλσος,* grove) were nymphs of glens and groves. *Dryades* (*q.v.*) or *Hamadryades* were nymphs of forests and trees.

In Italy they tended to be identified with native divinities of springs and streams (Iuturna, Egeria, Carmentis, Fons), while the Lymphae (originally Lumpae), Italian water-goddesses, owing to the accidental similarity of name, were identified with the Greek Nymphae.

O This letter, the fourth vowel of the modern alphabet, corresponds to the Semitic *ayin*, which represented not a vowel but a breathing. The Greeks, or possibly their Asianic predecessors, in adapting the Semitic alphabet to their own use used this letter (*omicron*) to express the vowel O, as was the case also with the letters *aleph, he, cheth* and *yodh*. Vowels were not expressed alphabetically in Semitic. The form of the letter on the Moabite stone was small, ○, and this small form appears in early Greek inscriptions from Thera and Corinth. In Corinth and in the inscriptions from Abu-Simbel in Egypt there is a form ◇. A form with a dot in the centre occurs in Thera, ⊙, and this is paralleled in the large Etruscan Ⓞ. At Miletus a form ∩ occurs. The Latin form, taken from the Chalcidic or Etruscan, was O. The minuscule form retains the shape of the majuscule letter.

The Greeks used the letter to represent the short close vowel ŏ. For the long vowel they used a sign Ω (*omega*) probably adapted

| NAME OF FORM | APPROXIMATE DATE | FORM OF LETTER |
|---|---|---|
| PHOENICIAN | B.C. 1,200 | |
| CRETAN | 1,100-900 | |
| THERAEAN | 700-600 | |
| ARCHAIC LATIN | 700-500 | |
| ATTIC | 600 | |
| CORINTHIAN | 600 | |
| CHALCIDIAN | 600 | |
| IONIC | 403 | |
| ROMAN COLONIAL | PRE-CLASSICAL AND CLASSICAL TIMES | |
| URBAN ROMAN | | |
| FALISCAN | | |
| OSCAN | | |
| UMBRIAN | | |
| CLASSICAL LATIN AND ONWARDS | | |

THE DEVELOPMENT OF THE LETTER "O" FROM THE EARLIEST TIMES TO THE PRESENT DAY

from ○ to one of the forms of which in use at Miletus it closely approximates. The western dialects used Ω to represent the long vowel, whether open or close. In the east it was used only for the open vowel, *ov* being used for the long close vowel as well as for the true diphthong. In the Cyclades however a reversal of this process frequently took place, Ω being used for the close sound whether long or short, O for the open. In Latin the letter stood for the same vowel without distinction of length, and the sound has passed almost unchanged into the Romance languages.

In modern English the vowel has undergone changes. The long *ō* has become a diphthong (*ou*) as in the words *bone, rose*. Short *ŏ* has become more open and lower, as in *rob*. Before the consonant *r* the sound is rounded and pronounced very far back in the mouth, *e.g., glory, north*. In the word *do* the single letter is used where a more usual orthography would require its doubling. Again in the word *son* one would expect the vowel *u*. In words such as *word, work, world* the sound has been affected by the preceding bilabial. The short sound is the descendant of Middle English short *ŏ* in which both the close and open short *ŏ*, which were distinguished in Old English, met. The long *ō*, now a diphthong, descends from Middle English long *ō*, an open sound, which was derived from Old English long *ā*. In Middle English this was a rounded back vowel akin to the modern vowel in the words *shore, north*. Old English close long *ō* became in Middle English *oo* (*ū*). (B. F. C. A.)

**OAK,** the name given to trees and shrubs of the genus *Quercus* of the beech family (Fagaceae, *q.v.*), a large group which includes some of the world's most important timber trees. The oaks are widely distributed over the temperate parts of Europe, Asia, northern Africa and North America, and extend southward in mountains and highlands into the tropics. On the mountains of Europe and North America they grow only at moderate elevations and none approaches the arctic circle. The tendency of many species to vary in a marked degree and the existence of numerous hybrid forms make the determination of the exact number of species difficult, but it is estimated at from about 300 to upwards of 500.

The oaks are readily distinguished by their peculiar fruit, an acorn which consists of a nut partially or wholly enclosed in a cup composed of numerous involucral scales. The carpellate flower contains a single ovary, three-celled at first, but normally becoming one-celled and one-seeded by abortion. The staminate flowers are in small clusters on the usually slender and pendent stalk, forming an interrupted catkin. The alternate leaves are more or less deeply lobed or cut in many species, but in some of the deciduous and many of the evergreen forms are nearly or quite entire on the margin. The well-known *Q. robur*, one of the most valued of the oaks, and the most celebrated in history and myth, may be taken as a type for oaks with sinuated leaves. Though known in England, where it is the only indigenous species, as the English oak, it is a native of most of the milder parts of Europe and of the Caucasus mountains in Asia. More than 40 varieties are in cultivation in European nurseries and collections. The English oak is one of the larger trees of the genus, though old specimens are often more remarkable for the great size of the trunk and main boughs than for very lofty growth. The spreading branches have a tendency to assume a tortuous form, causing a zigzag development; to this peculiarity the picturesque aspect of ancient oaks is largely due. When standing in dense woods the trees are rather straight and formal in early growth, and the gnarled character traditionally assigned to the oak applies chiefly to its advanced age. The fruit matures in a single season. Vast oak forests still covered the greater part of England and central Europe in the earlier historic period. Many of the ancient oaks that remain in England may date from Saxon times; the growth of trees after the trunk has become hollow is extremely slow, and the age of such venerable giants is only a matter of vague surmise. The celebrated Newland oak in Gloucestershire, known for centuries as "the great oak," was 47½ ft. in girth at 5 ft. from the ground. The wood of the English oak, when grown in perfection, is one of the most valuable produced in temperate climates. The heartwood varies in colour from dark brown to pale yellowish-brown, is hard, close-grained and liable to split. The oak of Great Britain was formerly in great demand for the construction of merchant shipping. The fine-grained heartwood is sought by the

cabinetmaker for the manufacture of furniture, as are also the gnarled and knotted portions of slowly grown trees, which are sawn into veneers. Oak was formerly largely used by wood-carvers and was thus applied at a very early date; the shrine of Edward the Confessor, in the abbey at Westminster, was constructed of dark-coloured oak-wood.

The cultivation of this oak in Europe forms one of the most important branches of forestry. Its growth is slow, though it varies greatly in different trees; when grown for large timber oak can rarely be profitably felled until the first century of its growth is completed. It is often grown as an ornamental tree in the eastern United States, where, however, it is usually short-lived. In the southern parts of Australia and in New Zealand it seems to flourish as well as in its native home. An important product of oak woods is the bark, formerly the chief tanning material of Europe. The acorns of the oak possess a considerable economic importance as food for swine. In the Saxon period the "mast" seems to have been regarded as the most valuable product of an oak forest.

Of the European timber oaks, the next in importance to the English oak is *Q. cerris,* the Turkey oak of the nurserymen. This oak abounds all over the Turkish peninsula, on the Taurus ranges, and in many parts of southern Europe; it was introduced into England about 1735, and is common in parks and plantations.

The evergreen holly oak of southern Europe is *Q. ilex,* usually a small tree, frequently of rather shrub-like appearance, with abundant glossy dark-green leaves, more or less prickly at the margin. It abounds in all the Mediterranean countries. The bole sometimes grows 90 ft. in height, but it does not often reach a great size. In its native lands it attains a vast age; Pliny attributes to several trees then growing in Rome a greater antiquity than the city itself.

The cork oak, *Q. suber,* the bark of which yields cork (*q.v.*), is a native of the west Mediterranean area. In Spain the wood is of some value, being hard and close-grained, and the inner bark is used for tanning.

The valonia of commerce, one of the richest of tanning materials, is the acorn of *Q. macrolepis,* a fine species indigenous to Greece and the coasts of the Levant.

Some oaks are of indirect importance because of products formed by their insect enemies. Of these the Aleppo gall (*see* GALLS) is yielded by *Q. infectoria,* a native of Asia Minor and western Asia. *Q. coccifera,* a small bush growing in Spain and many countries around the Mediterranean, furnishes the kermes dye. (*See* KERMES.)

In North America the oaks are generously represented. They attain their greatest size and economic importance in the southern United States, especially in the lower Mississippi valley, and reach their maximum diversity as regards species in the highlands of Mexico, notably in the western Sierra Madre range, where they form vast forests. In *The American Oaks* (1925), W. Trelease enumerated 371 species, of which 253 occur in Mexico, 54 in Central America, 3 in Panamá, 4 in Colombia, and 1 in the Antilles (Cuba), while 84 are found in the United States, 10 extending into the southern border of Canada. These vary greatly in size from small, straggling or even creeping shrubs to magnificent forest trees, 150 ft. or more in height, with trunks exceeding 6 ft. in diameter. In addition, Trelease recognized more than 50 named hybrid oaks whose parent species are regarded as satisfactorily determined.

The American oaks fall into two main groups—the white oaks and the red or black oaks—about equal in number and comprising practically all the species. In the white oak group (*Leucobalanus*) the acorns ripen at the end of the first season, the shell of the nut is smooth inside, and the leaves or their lobes, which are usually rounded, are without bristle tips. In the black or red oak group (*Erythrobalanus*) the acorns ripen at the end of the second season, the shell of the nut is hairy inside, and the leaves or their lobes, which are usually sharp-pointed, are bristle-tipped.

Of the oaks found in the United States, upwards of 50 species attain the stature of trees, more than half of which are of economic value for timber or other useful purposes. Fully 20 species attain a height of 100 ft. or more, and 5 equal or exceed a height of 150 ft., with correspondingly massive trunks. These larger oaks constitute the chief supply of native hardwood lumber in North America. Three-fourths of them occur east of the Rocky mountains; the others are found in the Pacific states, chiefly in California, the quality of their timber in general being inferior to that of the eastern oaks.

Among the most valuable eastern white oaks are the typical white oak (*Q. alba*), 80 ft. to 100 ft. high, with a trunk 3 ft. to 4 ft. in diameter, one of the finest North American trees; the rugged and massive bur oak (*Q. macrocarpa*), sometimes 170 ft. high, with a trunk 6 ft. to 7 ft. in diameter; the chestnut oak (*Q. montana*), the post oak (*Q. stellata*), the overcup oak (*Q. lyrata*), and the swamp chestnut or basket oak (*Q. prinus*), all growing to a height of 100 ft. and highly valued for lumber. Noteworthy representatives of the eastern red or black oak group are the red oak (*Q. borealis*), sometimes 150 ft. high; the Shumard red oak (*Q. shumardi*), 120 ft. high; the black oak (*Q. velutina*), 150 ft. high; the somewhat smaller scarlet oak (*Q. coccinea*) and willow oak (*Q. phellos*), all important timber trees.

The oaks of the Rocky mountain region are mostly small trees, often becoming shrubby at the higher elevations. The Rocky mountain white oak (*Q. utahensis*), rarely 45 ft. high, is the largest Colorado oak, and the Arizona white oak (*Q. arizonica*), sometimes 60 ft. high, is the chief oak of New Mexico and Arizona.

In California some 15 species of oak occur. Among the deciduous forms are the valley oak (*Q. lobata*), often 100 ft. to 125 ft. high, sometimes with a massive trunk 10 ft. in diameter; the Oregon white oak (*Q. garryana*), 60 ft. to 100 ft. high, found from San Francisco bay to British Columbia, and the California black oak (*Q. kelloggii*), sometimes 100 ft. high, found also in Oregon. Among the evergreen species are the coast live oak (*Q. agrifolia*) and the interior live oak (*Q. wislizenii*), both medium-sized trees; the scrub oak (*Q. dumosa*), usually 2 ft. to 8 ft. high, abundant in the chaparral (*q.v.*), and the canyon live oak (*Q. chrysolepis*), sometimes growing erect to a height of 110 ft.

The only evergreen species of the eastern states is the live oak (*Q. virginiana*), found near the coast from Virginia to Texas; it grows to a height of 75 ft., usually branching near the buttressed base into a round-topped head, sometimes 130 ft. across. The very strong wood was formerly much used in shipbuilding.

The total cut of oak lumber in the United States in 1899 was 4,551,000,000 bd.ft., an all-time maximum. In 1940 the total cut was 1,467,000,000 bd.ft.; about one-third of this was cut in Virginia, Arkansas and Louisiana, the rest in 33 other states. Commercially, oak lumber is classified as white oak and red oak. White oak lumber is cut principally from the white, chestnut, post, bur, overcup and swamp chestnut oaks; red oak lumber is cut chiefly from the red, Shumard red, scarlet, black and willow oaks.

For world distribution *see* A. Engler and K. Prantl, *Die Natürlichen Pflanzenfamilien* (1887–1909); *see* also C. S. Sargent, *Manual of North American Trees* (2nd ed., 1922); W. Trelease, "The American Oaks," *Mem. Nat. Acad. Sci.* v, xx (1925); G. B. Sudworth, "Check List of the Forest Trees of the United States," *U.S. Dept. Agr. Mis. Cir. 92* (1927). (F. W. J.; X.)

**OAKDALE,** a city of Allen parish, Louisiana, U.S.A., in the southwestern part of the state, on the Calcasieu river, and served by the Santa Fe and the Missouri Pacific railways. Pop. 4,016 in 1920; in 1930, 3,188; 1940, 3,933. It has lumber mills and other industries. The city was incorporated in 1923.

**OAKHAM,** a market town, and the county town of Rutland, England, 90 mi. N. by W. of London by the L.M.S.R. Pop. urban district (1938) 3,280; area 3.5 sq.mi. All Saints' church is chiefly Perpendicular. Of Oakham castle, first mentioned in 1151, the Norman hall (built 1190–1200) is little changed, and is used as the county hall. A custom prevails by which every peer of the realm on first passing through Oakham has to give a horseshoe (or a sum to buy one) to be placed in the hall.

**OAKLAND,** a city of California, U.S.A., on the eastern shore of San Francisco bay and connected with San Francisco (5 mi. distant) by the 8.4 mi. San Francisco-Oakland bay bridge, and facing the Golden Gate; the county seat of Alameda county and

the third city of the state in size. It has a municipal airport of 825 ac., is a port of call for 50 steamship lines and is the western terminus of the Santa Fe, the Southern Pacific and the Western Pacific and is served by electric railways and by ferries and motor-coach lines. The population was 216,216 in 1920, of whom 49,895 were foreign-born, including 4,536 Chinese and Japanese; in 1940 it was 302,163. The business section of the city is built on a level, crescent-shaped plain along the bay, averaging 2.5 mi. in width, behind which gently sloping hills rise to an elevation of 1,500 ft., providing residential sections with magnificent views of the bay, with San Francisco and the Golden Gate directly opposite. The land area of the city is 52.8 sq.mi. Adjoining it on the north is Berkeley; to the south, across an arm of the bay, is Alameda. These three cities and the seven smaller municipalities of the metropolitan Oakland area (Richmond, Emeryville, Piedmont, San Leandro, Albany, El Cerrito and Hayward) had a population approximating 500,000 in 1940.

In the heart of the city, surrounded by a park equipped as a general recreation centre, is Lake Merritt, a 160-ac. body of salt water and the only salt water lake in the heart of any American city. One part of the lake is a federal refuge for birds, the regular winter resort of thousands of wild ducks. The city maintains 57 fully equipped playgrounds; public parks with an additional area of 628 ac.; and two municipal camps for week-end holidays and summer vacations, one in the high Sierras and the other on Feather river. There is a municipal auditorium and a city hall, both built before the United States entered the war of 1914–18. The public-school system includes 44 elementary, 15 junior high and 8 high schools. The University of California, in Berkeley, is only 4 mi. from the Oakland city hall. In Oakland, on a 60-ac. campus in the foothills, is Mills college for women, opened in 1871 by Dr. Cyrus T. Mills and Mrs. Mills. After 1931 the city operated under a council-manager form of government.

Oakland has 27 mi. of water front. A channel has been dredged, and 85 large docks, wharves and piers constructed. The railroads have built four solid filled moles and trestles, extending from the shore 1⅓ to 3 mi. The commerce of Oakland harbour (including the Alameda side of the inner harbour) was approximately 4,000,000 tons in 1940.

The industrial district lies just behind the water front and is traversed by 34 mi. of main-line railroad trackage. After World War I Oakland had a great industrial expansion. In 1940 the federal census of manufactures reported 1,403 establishments, with an aggregate output valued at $281,141,940. The motor vehicles, bodies and parts manufactured were nearly one-third the value of the total factory output. Next in importance were lumber and lumber products, electrical machinery, apparatus and supplies, canned and preserved fruits and vegetables and boats and ships. There are four large shipbuilding plants.

The site of Oakland was part of the holdings of Don Luis Maria Peralta, who received vast grants from the Spanish crown. In 1842 he divided his lands among his four sons, and the two to whom this region fell established themselves on their estates. From one of them in 1850 Moses Chase leased a tract, and he became the founder of the future city. In 1852 it was incorporated as a town and in 1854 it was chartered as a city. The name was suggested by the grove of oaks in which the first houses were built.

**OAKMONT,** a residential borough of Allegheny county, Pennsylvania, U.S.A., on the Allegheny river and the Pennsylvania railroad, 12 mi. N.E. of Pittsburgh. Pop. (1920) 4,512 (83% native white); (1940) 6,260.

**OAKMOSS,** a lichen (*Evernia prunastri*) containing an oleoresin valued in perfumery both for its own fragrance of heavy, oriental type, and as a fixative base. Another species (*E. furfuracea*) having similar properties, is often included under the same common name, which is a translation of the French *Mousse de chêne*. Oakmoss grows on the trunks and branches of trees, also on poles and rails, in mountainous country throughout much of the northern hemisphere, in pale, greenish gray tufts 2 or 3 in. long, extending or drooping, made up of flattened strands which fork repeatedly, ending in pointed tips. The upper or outer surface of these strands is minutely warty and dusted with pale gray soredia, particles which reproduce the plant in the absence of the rare, disk-shaped, sexual fruit bodies (apothecia). The under surface is whitish, channeled in a faint, net-like pattern. Other lichens of the genera Usnea, Ramalina, Parmelia, etc., which grow intermingled with the Evernia, frequently gathered with it in the commercial product, have little fragrance, but may contribute to the value of the oleoresin as a base. Chief sources of oakmoss from about 1900, when the perfume first came into general use, until 1940, were Yugoslavia and France, large quantities being shipped for distillation in northern Europe. After the disruption of trade by war conditions, investigation showed the lichens to exist in Canada and northern United States, and they have been distilled in America to a limited extent. Oakmoss was used in perfumery as early as the 16th century, later forgotten. Baskets filled with it have been found in the ancient royal tombs of Egypt, but whether intended for perfume or, as some suggest, for making bread, is not known. It contains a starchy substance undoubtedly edible.

OAKMOSS (EVERNIA PRUNASTRI). AFTER "THE LICHEN BOOK"

**OAK PARK,** a village of Cook county, Illinois, U.S.A., 9 mi. W. of Chicago's loop. It is served by the Chicago and North Western, the Chicago, Aurora and Elgin, Chicago Elevated lines and the Baltimore and Ohio Chicago Terminal railways. Pop. (1940) 66,015. The assessed valuation of property in 1939 was $43,265,633. The village was incorporated in 1901.

**OANNES** (also IANNES, EUAHANES), in Babylonian mythology, the name given by Berossus to a mythical being who taught mankind wisdom. He is identical with the god Ea (*q.v.*), although there may not be any direct connection between the two names. Berossus describes Oannes as having the body of a fish but underneath the figure of a man. He is described as dwelling in the Persian gulf (Erythraean sea) and rising out of the waters in the daytime and furnishing mankind instruction in writing, the arts and the various sciences. Other epithets of Oannes are Annēdotus, Odakōn, Euedokus, Eneugamos, Eneuboulos, Anēmentos. This antediluvian myth of a fish-like monster is based on the water god Enki of Eridu, patron of wisdom, symbolised as a "goat fish," and identified with Capricorn. (S. L.)

**OARFISH,** an oceanic fish, *Regalecus*, characterized by the long, compressed body, short head, large eye and long dorsal fin, forming a crest on the top of the head. The oarfish is distinguished from its allies, the deal-fishes (*q.v.*) by the long filamentous pelvic fins ending in a spatulate expansion (hence their name). These fish reach a length of nearly 40 ft.

**OASIS,** a fertile spot surrounded by desert (the Greek form is ἄνασις which is doubtfully referred to the Coptic word *ouahe*, a dwelling place). On the desert Libyan plateau immediately west of the Nile between Aswan and Cairo are areas where the water comes to the surface or is found in shallow wells, *e.g.*, Oases of Khârga, Dâkhla and Farâfra. The water may come to the surface in springs, upon the artesian principle, or it may collect and remain in mountain hollows. These areas vary considerably in extent; they are always intensively cultivated and support thick growths of date-palms; and all kinds of tropical vegetables, grains and small fruits are grown. Some oases have a large population with substantial dwellings, others are merely halting-places.

**OASTLER, RICHARD** (1789–1861), English reformer, was born at Leeds on Dec. 20, 1789, and in 1820 succeeded his father as steward of the Thornhills' extensive Fixby estates at Huddersfield, Yorkshire. In 1830 John Wood, a Bradford manufacturer, called Oastler's attention to the evils of child employment in the factories of the district. Oastler at once started a campaign against the existing labour conditions by a vigorous letter, under the title "Yorkshire Slavery," to the *Leeds Mercury*. After many years of agitation, in which Oastler played a leading part, the Ten

Hours bill and other Factory acts were passed, Oastler's energetic advocacy of the factory-workers' cause procuring him the title of "The Factory King." In 1838, however, owing to his opposition to the new poor law and his resistance of the commissioners, he had been dismissed from his stewardship at Fixby; and, in 1840, being unable to repay £2,000 which he owed his late employer, Thomas Thornhill, he was sent to the Fleet prison, where he remained for over three years. From prison he published the *Fleet Papers,* a weekly paper devoted to the discussion of factory and poor-law questions. In 1844 his friends raised a fund to pay his debt, and on his release he made a triumphant entry into Huddersfield. Oastler died on Aug. 22, 1861.

*See* W. R. Croft, *The History of the Factory Movement, or, Oastler and his Times* (1888).

**OATES, TITUS** (1649–1705), English conspirator, was the son of Samuel Oates (1610–1683), an Anabaptist preacher, chaplain to Pride, and afterwards rector of All Saints' church, Hastings. On leaving Cambridge he took Anglican orders, and officiated in several parishes, Hastings among them. Having brought malicious charges in which his evidence was rejected, he narrowly escaped prosecution for perjury. He next obtained a chaplaincy in the navy, from which he was speedily dismissed. He now applied for help to Dr. Israel Tonge, a rector who was obsessed with the idea of Roman Catholic plots; Oates was to help him in unravelling the plots. To this end it was decided that Oates should pose as a Catholic. He spent some time at the Jesuit colleges of Valladolid and St. Omer, being expelled from both.

Returning in June 1678 to Tonge, he forged a plot by piecing together things true and false, or true facts falsely interpreted, and by inventing treasonable letters and accounts of preparations for military action. The whole story was written by Oates in Greek characters, copied into English by Tonge, and finally told to one of Charles II's confidential servants named Kirkby. Kirkby having given the king his information, Oates was sent for. He gave details, in 43 articles, of the plot and the persons who had engaged to assassinate Charles. Charles at no time believed this incredible farrago. To bolster up the case a fresh packet of five forged letters was concocted; but the forgery was transparent, and even Sir William Jones, the attorney-general, though a violent upholder of the plot, dared not produce them as evidence.

Oates now made an affidavit before Sir Edmond Berry Godfrey (*q.v.*) to an improved edition of his story, in 81 articles. Among the persons named was Coleman, secretary to the duchess of York, whom Godfrey knew, and to whom he sent word of the charges. Coleman in turn informed the duke, who induced Charles to compel Oates to appear before the privy council. Here Oates was exposed by a few simple questions. But among the papers seized at Oates's request were Coleman's, and in them were found copies of letters written to Père la Chaise, suggesting that Louis should furnish him with money, which he would use in the French and Catholic interest among members of parliament. Among them, too, were these passages: "Success will give the greatest blow to the Protestant religion that it has received since its birth"; "we have here a mighty work upon our hands, no less than the conversion of three kingdoms, and by that perhaps the utter subduing of a pestilent heresy, which has so long domineered over great part of the northern world." The credit of Oates was thus, in the eyes of the people, re-established, and Coleman and others named were imprisoned.

On Oct. 12, occurred the murder of Godfrey. On Oct. 21, parliament met, and Oates was called before the house. A new witness was wanted to support Oates's story, and in November a man named William Bedloe came forward. At first he remembered little; by degrees he remembered everything that was wanted. Oates then accused the queen before Charles of high treason, and carried his tale before the house of commons. The commons voted for the queen's removal from court, but, the lords refusing to concur, the matter dropped. It was not, however, until 1679 that the slaughter of Jesuits and other Roman Catholics upon Oates's testimony and that of his accomplices was checked. Sir George Wakeman, the queen's physician, was accused of purposing to poison the king, and the queen was named as being concerned in the plot. Sir Philip Lloyd proved Oates to have perjured himself, and Wakeman was acquitted. On June 26, 1680, upon Oates's testimony, the duke of York was presented as a recusant at Westminster. But the panic had worn itself out, and Oates retired on a pension. Shortly before the death of Charles, James brought, and won, a civil action against Oates, with damages of £100,000; in default of payment Oates was taken to prison; while there he was indicted for perjury, and was tried in May 1685, soon after the accession of James II. He received a severe sentence with repeated floggings, which was expected to kill him, but to the astonishment of all he survived.

Oates was in prison for three and a half years. Finally he received a royal pardon, with a pension of £300 a year. The remainder of his life was spent in retirement, varied by sordid intrigue. In 1691 he became acquainted with William Fuller, whom he induced to forge another plot, though not with the success he had himself attained. In 1696 he dedicated to William III a book called *Eikon Basilike,* a tissue of invective against "the late king James." In 1698 he obtained admission as a member of the Baptist Church, and used to preach at Wapping; but in 1701, as the result of a financial scandal, he was formally expelled from the sect. He died on July 12, 1705.

BIBLIOGRAPHY.—Oates's, Dangerfield's and Bedloe's *Narratives; State Trials; Journals of Houses of Parliament;* North's *Examen;* the various memoirs and diaries of the period; Fuller's *Narrative;* Dryden's *Absalom and Achitophel;* Burnet's *History;* Narcissus Luttrell's *Relation.* Lingard's *History* gives an exhaustive and trustworthy account of the Popish terror and its victims; and the chief incidents in Oates's career are graphically described by Macaulay. On the question of the place of his education see *Notes and Queries* (Dec. 22, 1883). *See* also T. Seccombe's essay in *Twelve Bad Men* (1894, bibliography).

**OATH** (O.Eng. *âdh*), an asseveration or promise made under non-human penalty or sanction. The word is found throughout the Teutonic languages, but without ascertainable etymology.

**Retribution for Violation** (*see* DYNAMISM).—The harm or penalty consequent on perjury may be considered to result directly, without any spirit or deity being mentioned. Thus among the Nagas of Assam, two men will lay hold of a dog or a fowl by head and feet, which is then chopped in two with a single blow of the dao, this being emblematic of the fate expected to befall the perjurer. Or a man will take hold of the barrel of a gun, a spear-head or a tiger's tooth, and solemnly declare, "If I do not faithfully perform this my promise, may I fall by this!" (Butler in *Journ. Asiatic Soc., Bengal,* 1875, p. 316).

In Siberia, in lawsuits between Russians and the wild Ostiaks, it was usual to bring into court the head of a bear, the Ostiak making the gesture of eating, and calling on the bear to devour him in like manner if he does not tell the truth. Similar oaths are sworn on the head or skin of a tiger by the Santals and other indigenous tribes of India. Death by a tiger precludes reincarnation and therefore involves social and physical extinction. Both in the old and modern world oaths by rivers are most sacred. In earlier ages men swore inviolably by Styx or Tiber, and an oath on water of the Ganges is to the Hindu the most binding of pledges, for the goddess will take awful vengeance on the children of the perjurer. The Tungus brandishes a knife before the sun, saying, "If I lie may the sun plunge sickness into my entrails like this knife."

The transition to invoking gods conceived in human form is shown in the treaty-oath between the Macedonians and the Carthaginians recorded by Polybius (vii 9); here the sun and moon and earth, the rivers and meadows and waters, are invoked side by side with Zeus and Hera and Apollo, and the gods of the Carthaginians. The heaven-god, able to smite the perjurer with his lightning, was invoked by the Romans, when a hog was slain with the sacred flint representing the thunderbolt, with the invocation to Jove so to smite the Roman people if they broke the oath (Liv. i 24; Polyb. iii 25). But bears and tigers are as apt to kill truth-tellers as perjurers, and the lightning-flash falls without moral discrimination. In the *Clouds* of Aristophanes, the Socrates of the play points out that notorious perjurers go unharmed, while Zeus hurls his bolts at his own temple and the tall oaks, as if an oak-tree could perjure itself.

The doctrine of miraculous earthly retribution on the perjurer

lasted on in legend, as where Eusebius relates how three villains conspired to bring a false accusation against Narcissus, bishop of Jerusalem, which accusation they confirmed by solemn oath before the church, one wishing that if he swore falsely he might perish by fire, one that he might die of the pestilence, one that he might lose his eyes; a spark no man knew from whence burned to ashes the first perjurer's house and all within, the second was consumed by the plague from head to foot, whereupon the third confessed the crime with tears so copious that he lost his sight (Euseb. *Hist. Eccl.* vi 9). In general the supernatural retribution on perjury has been transferred to beyond the grave.

**International Forms.**—Gestures such as grasping hands, or putting one hand between the hands of another in token of homage, are not oaths, but ceremonies of compact. Even the covenant among many ancient and modern nations by the parties mixing their blood or drinking one another's is in itself only a solemn rite of union, not an oath proper.

The act of swearing by weapons may signify that the swearer if forsworn is to die by such a weapon; or the warrior may appeal to his weapon as a powerful or divine object (*see* Du Cange, *s.v.* "Juramenta super arma"; Grimm, *Deutsche Rechtsalterth.*, p. 896). Stretching forth the hands towards the object or deity is a natural gesture, used by Israelites (Gen. xiv 22; Deut. xxxii 40; *see* Dan. xii 7; Rev. x 5). In France a juror takes oath by raising his hand, saying, "Je jure!" The Scottish judicial oath is taken by the witness holding up his right hand uncovered, and repeating after the usher, "I swear by Almighty God, and as I shall answer to God at the great day of judgment, that I will," etc.

In the ancient world sacrifice (*q.v.*) often formed part of the ceremony of the oath; typical examples may be found in the Homeric poems. Details of the old Scandinavian oath have been preserved in Iceland in the Landnámabók (*Islendinga Sögur*, Copenhagen, 1843); a bracelet (baugr) of two rings or more was to be kept on the altar in every head court, which the godi or priest should wear at all law-things held by him, and should redden in the blood of the bullock sacrificed, the witness pronouncing the remarkable formula: "Name I to witness that I take oath by the ring, law-oath, so help me Frey, and Niörd, and almighty Thor" (hialpi mer svâ Freyr, ok Miördr, ok hinn almâttki Âss), etc. This was doubtless the great oath on the holy ring or bracelet which the Danes swore to King Alfred to quit his kingdom.

Under Christ's injunction, "Swear not at all" (Matt. v 34; also James v 12), many Christians have shrunk from taking oaths, *see* writings of the Fathers. In more modern times Anabaptists, Mennonites and Quakers have refused to take even judicial oaths. On the other hand, the laws of Christendom from early ages have been directed against such swearing as was considered profane or otherwise improper, and against perjury. Constantine's laws required every witness in a cause to take oath; this is confirmed in Justinian's code which even in some cases requires also the parties and advocates to be sworn (*Cod. Theod.* xi 39; *Justin. Cod.* iv 20, 59). Bishops and clergy were called upon to take oath in ordination, monastic vows, and other ecclesiastical matters (*see* details in Bingham, *Antiq. of Chr. Church,* xvi 7). The Reformation conformed to this principle in Art. xxxix of the church of England. The Christian oath on a copy of the Gospels seems derived from the late Jewish oath taken holding in the hand the scroll of the law (or the phylacteries), a ceremony itself possibly adapted from Roman custom (*see* treatise "Shebuoth" in *Gemara*). The practice of kissing the book, established in England, appears in the middle ages (J. E. Tyler, *Oaths,* pp. 119, 151). The book was often laid on the altar, or the swearer laid his hand on the altar itself, or looked towards it; or touched relics of saints on the altar. Other objects, as the cross, the bishop's crosier, etc., were sworn by (*see* Du Cange, *s.v.* "Jurare"). An oath ratified by contact or inspection of a sacred object was called a "corporal" or bodily oath, as distinguished from a merely spoken or written oath.

**Oath Formulas.**—Among the oath formulas used in Christendom, that taken by provincial governors under Justinian is typical of one class: "I swear by God Almighty, and His only begotten Son our Lord Jesus Christ, and the Holy Ghost, and the Most Holy Glorious Mother of God and ever Virgin Mary, and by the Four Gospels which I hold in my hand, and by the Holy Archangels Michael and Gabriel," etc. The famous oath of the kings Louis and Charles at Strassburg in A.D. 842 runs: "By God's love and the Christian people and our common salvation, as God shall give me knowledge and power," etc. In the oath of fealty in the capitularies of Charlemagne in 802 is found the familiar form "Sic me adjuvet Deus," corresponding to formulas of pre-Christian Rome. This became widely spread in Europe, appearing in Old French "Si m'ait Dex," German "So mir Gott helfe," English "So help me God." A remarkable point in its history is its occurrence in the "So help me Frey," etc., of the old Scandinavian ring-oath already described. William the Conqueror swore "by the splendour of God," Richard I "by God's legs," John "by God's teeth"; other phrases are given in Du Cange as "per omnes gentes," "per coronam," "par la sainte figure de Dieu," "par la mort Dieu," etc.

**Law.**—In England the coronation oath is administered by an archbishop or bishop in the presence of the people, who, on their parts, reciprocally take the oath of allegiance to the crown. *The archbishop or bishop shall say:* "Will you solemnly promise and swear to govern the people of this United Kingdom of Great Britain and Ireland and the dominions thereto belonging according to the statutes in parliament agreed on, and the respective laws and customs of the same?" *The king shall say:* "I solemnly promise so to do." *Archbishop or bishop:* "Will you to the utmost of your power cause law and justice, in mercy, to be executed in all your judgments?" *King:* "I will." *Archbishop or bishop:* "Will you to the utmost of your power, maintain the laws of God, the true profession of the Gospel, and the Protestant reformed religion established by law? And will you maintain and preserve inviolably the settlement of the Church of England and the doctrine, worship, discipline and government thereof, as by law established in England? And will you preserve unto the bishops and clergy of England, and to the churches therein all such rights and privileges as by law do or shall appertain to them, or any of them?" *King:* "All this I promise to do." *After this the king, laying his hand upon the holy Gospels, shall say:* "The things which I have here before promised I will perform and keep; so help me God," *and then shall kiss the book.* (*See* CORONATION.)

The chief officers of state take an "official" oath well and truly to serve his majesty. Special oaths are taken by privy councillors, archbishops and bishops, peers, baronets and knights, recruits and others. The old oath of allegiance, as administered (says Blackstone, *Commentaries,* book i chap. x) upwards of 600 years, was replaced in the reign of William III by a shorter form; and it now runs: "I . . . do swear that I will be faithful and bear true allegiance to His Majesty . . . , his heirs and successors, according to law." Statutes of Charles II and George I enacted that no member should vote or sit in either house of parliament without having taken the several oaths of allegiance, supremacy and abjuration. In modern times a single parliamentary oath was substituted for the three, and this was altered to enable Roman Catholics to take it; Jews were enabled to sit in parliament by being allowed to omit the words "on the true faith of a Christian." In its present form the parliamentary oath consists of an oath of allegiance and a promise to maintain the succession to the crown as limited and settled in the reign of William III. The right to affirm in lieu of taking the parliamentary oath was first raised in the case of Charles Bradlaugh (*q.v.*). The "judicial" oath taken by judges of the court of appeal or of the High Court of Justice, and by justices of the peace is "to do right to all manner of people after the laws and usages of this realm, without fear or favour, affection or ill-will." Jurors are sworn, whence indeed their name (*iuratores*); in felonies the oath administered is: "You shall well and truly try and true deliverance make between our sovereign lord the king and the prisoner at the bar whom you shall have in charge, and a true verdict give according to the evidence." (*See* PRACTICE AND PROCEDURE: *Juries.*) The oath of the jurors in the Scottish criminal courts is: "You [the jury collectively] swear in the name of Almighty God and as you shall answer to God at the great day of judgment that you will truth say and no truth conceal in so far as you are to pass upon this assize." In the ancient

custom of compurgation, once prevalent in Europe, the accused's oath was supported by the oaths of a number of helpers or compurgators who swore to their belief in its validity.

Witnesses in English law courts must give their evidence under the sanction of an oath, or of what is equivalent to an oath, and the ordinary form of oath adapted to Christians is: "The evidence you shall give . . . shall be the truth, the whole truth, and nothing but the truth. So help you God." Many alterations of the English law as to oaths have been made in relief of (1) those Christians who object on conscientious grounds to the taking of an oath, and (2) of those persons who refuse to admit the binding force of an oath. Special provision was first made for Quakers, Moravians and Separatists; then followed general enactments relating to civil and criminal proceedings respectively, till finally the law was embodied in the Oaths Act 1888, which enacted that "every person upon objecting to being sworn, and stating, as the ground of such objection, either that he has no religious belief, or that the taking of an oath is contrary to his religious belief, shall be permitted to make his solemn affirmation instead of taking an oath." . . . The form of affirmation prescribed by the Oaths Act was as follows: "I, *A. B.*, do solemnly, sincerely, and truly declare and affirm," etc. Under s. 5 of the same act a person might swear in the Scottish form, with uplifted hand (no book of any kind being used) and if he desired to do so "the oath shall be administered to him in such form and manner without question." With the desire of making universal the method of administering the oath the Oaths Act 1909 was passed. A Christian swears on the Gospels, holding a copy of the New Testament in his uplifted right hand, the hand being uncovered, and his head being also uncovered. A witness may elect to be sworn on any version of the Bible which he considers most binding on him, as a Roman Catholic on the Douai Testament or Bible. A Jew is sworn on the Pentateuch, holding a copy thereof in his right hand, the head being covered. A Mohammedan is sworn upon the Koran. He places his right hand flat upon the book and puts the other hand upon his forehead, bringing his head down to the book and in contact with it. He then looks at the book for some moments. Buddhists are sworn on the Buddhist doctrines, Sikhs upon the Granth, Parsees upon the Zend Avesta, Hindus upon the Vedas, or by touching the Brahmin's foot, and, according to caste custom, Indian witnesses sometimes insist upon the oath being administered by a Brahmin; but in India witnesses now generally affirm. Kafir witnesses swear by their own chief, and a Kafir chief by the king of England. When a Chinese witness is to be sworn, a saucer is handed to him which he takes and, kneeling down, breaks into fragments.

The administering or taking of unlawful oaths is criminal in English and Scots law. Statutes relating to the offense were passed in 1797, 1799, 1810 and 1812, and it is evident from the preamble of the latter act (Unlawful Oaths Act 1812) that they were aimed at those societies in the United Kingdom at the time of the French Revolution which required or permitted their members to take an unlawful oath. Supplementary statutes were passed in 1817 and 1837. Children of tender years, who, in the opinion of the court, have not sufficient intelligence to understand the nature of an oath, may give evidence without being sworn.

**United States.**—In the United States oaths required by way of qualification for public office or citizenship are generally prescribed by constitutions or statutes. At an early date provisions were made for simple affirmation for the benefit of those whose religious faith proscribed the taking of an oath. Witnesses in the law courts or before legal or administrative officials invested with the power of administering oaths must give their evidence under oath or by affirmation. Belief by the witness in a God and an appeal to Him as an avenger of falsehood are the essentials of the oath. Liberal allowances may thus be made for the taking of oaths by non-Christians, the witness being sworn in such fashion as he considers binding on his conscience. Professed atheists have on occasion been excluded from the witness stand, but generally the religious belief of a witness can only be used to impeach his credibility. No special form need accompany the administration of an oath, unless required by statute, provided that some formal act be done to impress the witness with the distinction between sworn statements and bare assertions.

BIBLIOGRAPHY.—Coke's *Institutes;* C. Ford, *Handbook on Oaths* (1876, ed. by F. H. Short, 1903); F. A. Stringer, *Oaths and Affirmations* (3rd ed., 1910); H. J. Stephen, *"Commentaries"* (18th ed., 1925). (*See* also articles AFFIDAVIT; EVIDENCE; WITNESS.)

**OATS.** The oat plant belongs to the genus *Avena* and is one of the more important cereal crops. The grain is used largely as feed for livestock, although some is processed directly into human food. The importance of the oat crop is exceeded in the cereal group by rice, wheat and corn.

The floral arrangement (inflorescence) is a terminal panicle that is usually lax or spreading. In some of the rarer types, the branches of the central axis are reduced so that in appearance the panicle approaches the spikes or heads of other small grains. The panicles may be either approximately symmetrical or with a preponderance of branches and their terminal spikelets hanging to one side, producing what is called a side oats. The inflorescence is a panicle made up of numerous branches and spikelets which are composed of florets. Each spikelet is enclosed by two papery glumes that are longer than the lemma or palea. The individual spikelet is attached to a branch of the panicle and usually contains a primary and a secondary floret. The secondary floret is attached to the primary floret by means of a short rachilla. The lemma is immediately inside the glume and is usually longer than the palea. In *Avena nuda,* a species not commonly grown, spikelets may have 8 to 10 florets, and 2 to 8 may be fertile.

The lemma and palea are usually without hairs for the most part in cultivated oats (*Avena sativa*). In a large number of the wild forms, however, the lemma is covered with numerous hairs. The lemma also bears a weak awn in many cultivated varieties and sometimes a large awn as in the case of the wild types. Between the lemma and the palea are three stamens. The fruit is called a caryopsis. Upon maturity, the caryopsis is maintained in the closely clasped lemma and palea except in hull-less oats where it is freed upon threshing. The lemma colour at maturity may vary considerably from yellow to white, black, brown or red. In some wild species of oats the glumes remain after the kernels of the spikelet have fallen to the ground. In cultivated species, however, most of the kernels remain in the spikelet until threshed. The basal articulation of the spikelet is important from the standpoints of classification and utilization of oats. Sometimes the secondary kernel is tightly clasped by the lemma of the primary kernel; this is known as doubling or bosom kernels. Sometimes the first flower may be sterile and yet not doubled. The caryopsis or groat weighs 2 to 3 times as much as the lemma and palea in cultivated oats. The oat panicle usually is from 4 to 12 in. long and may have as few as 8 or 10 kernels or as many as 200.

The leaves of the oat plant are thin, narrow and long. They are very prominent in the early phases of growth, but become less prominent upon maturity, at which time the culms are elongated and produce what is called the stalk or culm of the plant. There is no auricle at the base of the leaf blade and this is not true of the other small grains. The stems are usually hollow except at the nodes. Culms are from 2 to 5 ft. tall and the number per plant depends largely upon the rate of sowing, the fertility of the soil and growth conditions. Roots are fibrous and numerous, and penetrate the soil to various depths.

**Origin.**—Cultivated oats are thought to have been derived chiefly from two species, the common wild oat (*Avena fatua*) and the wild red oat (*A. sterilis*). The principal derivatives of *A. fatua* are the common oats with the spreading panicle and those with the spikelets preponderantly on one side. The common red oat (*A. byzantina*) is thought to have originated from the wild red oat (*A. sterilis*). The common wild form was first found growing in different regions of western Europe. Early writers mentioned the possibility that oats were found as a weed mixed with barley and therefore may have been distributed as a mixture in barley. From western Europe they spread to other temperate parts of the world and have been in production under a wide range of conditions. This crop is thought to be more ancient than other small grains, and may be the small grain which approaches intermediacy between monocots and dicots.

**Classification.**—The genus *Avena* is composed of polyploid series, as is true of *Triticum* and *Hordeum,* the haploid chromosomes numbering 7, 14 and 21. There are several recognized species in the seven

chromosome group, most of them being wild types. There are at least two species recognized as being in the 14 chromosome group. In the third group with 21 chromosomes are found the common white and yellow cultivated varieties, ordinary wild types, hull-less and *Avena byzantina,* the cultivated red oat. In addition, other wild forms are found in this series.

Classifications of the different species have been made by numerous workers, most of whom do not agree in detail.

The common wild oat, which is thought to be the progenitor of *Avena sativa,* is a weed in many sections of the world although in some areas it is cut for hay or grazed. Because the seeds may lie dormant for long periods of time it is difficult to eradicate this type of oat. Kernels mature more rapidly at the top of the panicle and drop to the ground as they ripen, even though the culm may still be green. The panicle of the wild oat is usually longer and more lax than that of the ordinary cultivated sorts.

Fatuoids or false wild oats have been observed in nearly all cultivated varieties. Fatuoid kernels also drop to the ground as in the case of wild oats. However, false wild types do not constitute a weed hazard.

The various common oats are grown in cooler and more temperate regions of the world. Side and late-maturing common oats occur in northwestern Europe and northern sections of the United States and Canada. The smaller kerneled yellow varieties occur in southwestern Russia and in the corn belt of the United States. Red oats are grown principally in the warmer climates including the southern sections of the United States and the Mediterranean regions of Europe and Africa. Australia also produces some of the common red oats. These are considerably more heat tolerant than are the common types. Hull-less forms are found in the highlands of Tibet, northern India, Turkestan and western China.

Some of the more important older agricultural varieties of oats in North America are Kherson, Silvermine, Victory, Fulghum, Red Rustproof, Markton, Gopher, Columbia, Cornellian, Patterson, Banner and O.A.C. selections. Some of the newer varieties are Vicland, Boone, Tama, Marion, Bridger, Desoto and Lega. Varieties from other sections of the world are as follows: Victory, Record, Golden Rain, Potato, Elder, Mansholt Binder, Petkus, Gelbhafer, B.S. No. 1, S.E.S. No. 52, Victoria, Algerian, Belar and Dun.

**Cultivation and Use.**—A large part of the oats produced in the United States is sown in the spring. There are three groups of spring sown oats: those that are of midseason to late in maturity, early white and yellow types, and the spring sown red types that are grown principally in the great plains of the United States. There is also a large area of fall-sown oats in the southern section of the United States. Seeding goes on in practically all months of the year in various areas of the world.

Oats are less exacting in their soil requirements than are other cereals with the exception of rye. They seem to be able to extract nutrients from the soil that would not be available for wheat and barley. In the presence of sufficient moisture, oats will do comparatively well on soils that are sandy and low in fertility and on soils high in acidity. Rye, however, as a rule will produce crops on soils that are too poor for satisfactory oat production. Oats are grown under a wide range of conditions as concerns soil, moisture and fertility, and they have rotational advantages not possessed by other cereal crops. In the corn belt this crop is grown widely in rotation with corn and forage crops. Oats are used as a nurse crop or a companion crop with grasses and legumes that are to be used later for forage purposes. Since oat culture is relatively simple, a good crop may be obtained by either disking or plowing in the fall or spring, followed by sowing seed with a grain drill or with a broadcast seeder. The rate of seeding is about 10 pecks to the acre. Production is usually greater when sown soon after frost has left the ground in the spring sown area. In the harvesting, various machinery may be used according to local conditions. One method is the use of a combine which can thresh the crop from the field, while another is the use of a binder followed by shocking the bundles and then threshing by means of a separator. In some areas harvesting is done by more primitive means.

The predominant usage of oats is for feed. While it has a particular value for horses, it is fed to all classes of livestock as grain in pure form or in mixtures of feed. Oats have long been a favourite source of breakfast foods. For this purpose the oat grain is used more than any other cereal in the United States. In 1939, about 530,000,000 lb. were processed for various breakfast foods. Rolled oats or oatmeal is used mostly for porridge, although other kinds of breakfast food are manufactured from the grain of the oat plant. It is also used for making cookies, breads and puddings.

The straw is used for animal feed and is excellent for animal bedding. In addition to the grain and bedding usages, oats are used for pasturing in various sections of the world, and the crop is also cut for hay.

The oat grain is known to be high in protein and fat content. It is also a very good source of vitamin $B_1$, and has an appreciable amount of vitamin E. The grain has as much riboflavin as other cereals, but much less niacin than has wheat. It is practically devoid of vitamins C and D. Leaves of growing young plants are high in a large number of nutritional elements including the "grass juice factor" which is in commercial usage.

The oat crop enters industrial usage to a small extent. Other than breakfast foods one of the principal industrial products is the liquid aldehyde called furfural. This product is made by the destructive distillation of the oat hulls in the presence of acid and steam under regulated conditions. Furfural is used in selective solvents for various purification purposes, in paint remover and in lacquer solvents, as well as for other purposes.

In most regions of the world, oat culture faces the hazards of rust, smut and other diseases which may greatly reduce yield and quality. Plant breeders strive to attain resistance to these major diseases and to lodging, for the enhancement of quality and yields. In certain areas drought resistance and the survival of fall sown varieties are much needed characteristics sought by the plant breeder. Inasmuch as oats are self-pollinated and breed true after pure lining, improvements are easily utilized in production increase. The development of new varieties by means of hybridization followed by purification and testing has commanded considerable attention from oat breeders the world over for many years.

One of the main problems in breeding is the selection in early generations of plant progenies that will resist disease and have high productive capacity. Specialized races of pathogenic fungi complicate the problem of breeding for disease resistance. The decade between 1930 and 1940 was one in which much progress was made in oat breeding in the United States. During those years hybridization and selection were used to develop smut and rust resistant varieties. In the years immediately following 1940 several varieties carrying resistance to the several major diseases were distributed in the United States.

**Production and Trade.**—The average annual world production is about 4,500,000,000 bu., averaging about 30 bu. per ac. The leading countries in oat production are as follows: United States, U.S.S.R., Germany, France, Poland, England and Wales, Sweden, Denmark and Argentina. Portugal and South Africa produce about 12–15 bu. per ac. while the Netherlands has the high average of about 70 bu. per ac. The United States production for 1942 was 1,350,000,000 bu., most of which came from the spring-sown area in this country. Average acre yield in the United States is about 30 bu. or close to the world average. Leading states in oat production are Iowa, Minnesota, Illinois and Wisconsin.

During the period 1920–40, trade between countries varied a good deal and was influenced by the depression that began in 1929. Oats are generally considered a bulky product and for this reason have not entered into world trade as much as other heavier cereals.

*International Trade in Oats, 1938*

| Country | Exports 1,000 bu. | Imports 1,000 bu. |
|---|---|---|
| Argentina | 26,324 | 61 |
| Canada | 10,843 | 8,663 |
| United States | 9,588 | 15 |
| United Kingdom | 298 | 9,199 |
| Germany | 1 | 12,968 |
| Switzerland | 6 | 14,116 |

Argentina, Canada and United States were three of the principal exporting countries while Switzerland, Germany and the United Kingdom were the principal importing countries. (H. L. Ss.)

**OAXACA** (wah-hah'ka) or **OAJACA** (officially OAXACA DE JUÁREZ), a southern state of Mexico, including the southern and larger part of the Isthmus of Tehuantepec. Pop. (1940) 1,192,794 a large majority of whom are Indians. The state has an area of 36,365 sq.mi., broken by mountain ranges into numerous broad fertile valleys, chiefly lying in the *tierra templada* region. The isthmus districts, however, have lower elevations and are distinctly tropical. The coast line is 329 mi. long; behind it is a narrow strip of lowlands lying within the *tierras calientes.* In places this strip nearly disappears, the sierras rising almost immediately from the seashore. The highest points are Zempoaltepetl (11,148 ft.), San Felipe del Agua (10,253 ft.), and the Cerro del Leone, the highest summit in the Sierra Madre del Sur. The only ports on the coast open to foreign trade are Salina Cruz and Coatzacoalcos (Puerto México)—the first the Pacific terminus of the Tehuantepec National railway, with a spacious artificial harbour, and the second a deep but narrow natural harbour, the Atlantic coast terminus of the railway. The greater part of the state has a subtropical climate, with high sun temperatures, moderate rainfall and mild, healthful conditions. The less healthful regions include the isthmus districts, the coastal zone on the Pacific and the low country near Veracruz. The chief products are Indian corn, wheat, coffee, sugar, rubber, cotton, cacao, tobacco, indigo and a great variety of tropical fruits. Among the manufactured products are cotton, woollen and "pita" fibre fabrics, sugar, rum, mescal, beer, furniture, pottery, soap, candles, leather, matches, chocolate, flour and cigarettes. Two important railway lines traverse the state—the Tehuantepec National (trans-isthmus) and the Mexican National line from Puebla to

south of Oaxaca. Two progressive Indian races, the Zapotecas and Mixtecas, descendants of those who built the remarkable cities of Mitla and Monte Alban (*see* CENTRAL AMERICA: *Archaeology*) form the greater part of the population.

**OAXACA** or **OAXACA DE JUÁREZ** (official title) (from Aztec *Huaxyacac*), capital of the Mexican state of Oaxaca. Pop. (1940) 29,306, largely Indians, most of whom are Mixtecas and Zapotecas. Oaxaca is connected with Puebla (211 mi.) by the Mexican National railway. The city lies in a broad, picturesque valley 5,085 ft. above sea-level, and has a mild temperate climate. It has a fine old cathedral in the Spanish Renaissance style and dating from 1553; rebuilt in 1702.

According to tradition the Aztec military post and town of Huaxyacac was founded in 1486. The date of the first Spanish settlement is uncertain, but it was probably between 1522 and 1528. The city suffered severely in the earthquakes of 1727 and 1787, the cathedral being greatly damaged in 1727. In war and revolution, it has been repeatedly captured.

**OB** or **OBI,** river of Asiatic Russia, known to the Ostiaks as the As, Yag, Kolta and Yema; to the Samoyedes as the Kolta or Kuay; and to the Tatars as the Omar or Umar. Its length is roughly 2,400 m.; the area of its basin is considerably more than a million sq.m. and the navigable waters in its basin total more than 17,000 m. Its source is in the Altai mountains and its course is through hilly country to the Kirghiz steppe and thence it flows to its delta in the gulf of Ob, an inlet of the Arctic ocean 600 m. in length. In its middle course, south of its junction with the Irtysh, and extending between the two streams, are the Vasuigan swamps, named from the Vasuiga, a left bank tributary of the Ob. They extend for 100,000 sq.m. and in summer are impassable marshes, with dense thickets of cedars, larches and pines. In spring they are flooded and are then known as the Vasuigan sea. In winter they become ice-bound and may be crossed. When drained the land proves fertile. North of the swamps the river flows through coniferous forest to Berezov, and passes Obdorsk, where there is a Veterinary Institute for the help of the reindeer breeders and to which small sea-going vessels can penetrate.

After receiving its largest tributary, the Irtysh, the Ob divides into more than one arm and is of little use for navigation except for barges bringing fish from the delta in the autumn. Above the junction of the Irtysh, steamers and barges ply upon the Ob and its tributaries the Irtysh, the Tobol, the Tavda and the Tura in summer. In 1915 there were 350 steamers and several hundred barges chiefly carrying corn, flour, salt and timber, in addition to passengers. The east-west river traffic is giving place to railway communication, but the north-south route is still very important. The river is frozen from November to May or June; floods, ice and floating timber impede navigation for some time after the thaw.

The fact that in its southern parts the Ob approaches so close to the Yenisei that short and easy portages link them, made the penetration of Siberia by the Cossacks an easy task. The Chulim, a tributary of the Ob, in its upper course is at one point only six m. from the Yenisei, but a canal link is impossible owing to the great difference in level, while the Ket river, another right bank tributary of the Ob has canal communication with the Kas, a tributary of the Yenisei.

The Irtysh, which is quite as important as the Ob, rises as the Black Irtysh, south of the Mongolian border, and flows through the Dzungarian gate into Russia, where it expands into Lake Zaisan, and then cuts its way across a spur of the Altai into the plains. There are lakes, many of which are salt and are rapidly drying; flourishing villages stand on the site of what in the early part of last century was Lake Chany.

**OBADIAH,** the fourth of the "minor prophets," the otherwise unknown author of the shortest book in the Old Testament, whose 21 verses, even, show evidence of the expansion or addition of which a manuscript, as distinct from a printed book, so easily admits. Whilst the first fourteen verses address Edom in the second person singular, with apparent reference to recent disasters that have befallen that people, the last six address Israel in the second person plural, promising judgment on the nations, including Edom, and proclaiming the eschatological "Day of Yahweh," when the lost territories shall be recovered. (The "join" is made in verse 15, of which *a* belongs to the latter, and *b* to the former, prophecy.) The Edomites (identified with "Esau," verse 6; *cf.* Gen. xxxvi. 1) occupied the mountainous country south of the Dead Sea, on both sides of the Arabah; hence the reference to their rock-dwellings (verse 3). The aid which they gave to the Babylonians against Jerusalem in 586 (Ps. cxxxvii. 7, etc.) was never forgiven, and its remembrance inspires the present prophecy (verses 11ff.). The actual disaster that befell the Edomites was probably some invasion by the neighbouring nomads, *e.g.*, the Nabatean Arabs (verse 7). The opening paragraph of Malachi may refer to the same event; if so, we may suppose the prophecy of Obadiah in its earlier part to belong to the first half of the fifth century B.C. The dominant thought of it is that at last Edom has received its deserts at the hand of Yahweh. We do not know at what date this earlier portion was continued and incorporated into the more general prophecy concerning the future vindication of Judah, with which the book now closes. The original prophecy has elsewhere been reproduced, as well as expanded. Its first five verses occur in almost the same form in Jer. xlix. 14–16 & 9 (*cf.* also Joel ii. 32), a passage probably later than Obadiah. *See* EDOM.

BIBLIOGRAPHY.—For commentaries *see* W. Nowack, *Handkommentar zum alten Test.* iii. 4 (1898, 1904); J. Wellhausen, *Die kleinen Propheten* (1898); G. A. Smith, *Book of Twelve Prophets,* vol. ii. (1898, 1927) *Expositors' Bible;* K. Marti, *Das Dodekapropheton* (1904); A. van Hoonacker, *Les douze petits prophètes* (1908); J. A. Bewer in *Internat. Crit. Commentary* (1912); H. Wheeler Robinson in *Peake's Commentary* (1919); E. Sellin, *Einleitung in das alte Testament* (3rd. ed., 1920) trans. W. Montgomery (1923). G. W. Wade in *Westminster Commentary* (1925). (H. W. R.)

**OBAN,** small burgh and seaport, Argyllshire, Scotland, 113 mi. N.W. of Glasgow by L.M.S., and about the same distance by water. Pop. (est. 1938) 5,794. Its bay is screened by the island of Kerrera and sheltered by hills to the north and east. The Roman Catholic pro-cathedral was erected by the 3rd marquis of Bute. Oban, a government fishing station in 1786, is now the centre of tourist traffic for western Argyllshire and the islands.

At the north end of the bay stands the ruin of Dunolly Castle, the old stronghold of the Macdougalls of Lorne, whose modern mansion adjoins it. In the grounds is a huge conglomerate rock called the Dog Stone (*Clach-a-choin*), from the legend that Fingal used to fasten his favourite dog Bran to it. About 3 m. N.E. are the ruins of Dunstaffnage Castle. It was here that the "Stone of Destiny," now contained in the base of the coronation chair at Westminster Abbey, was kept before its removal to Scone.

**OBBLIGATO** or **OBLIGATO,** in the modern sense, a musical term for an instrumental accompaniment to a musical composition which, while in one way independent, is included by the composer on purpose and in a prescribed form, instead of being left to the discretion (*ad libitum*) of a performer.

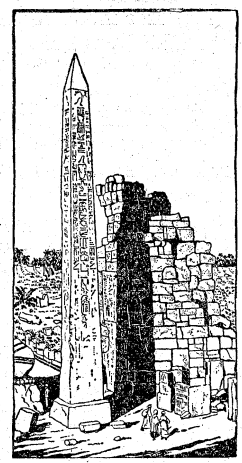
**OBEDIENT-PLANT** (*Physostegia virginiana*), a North American herb of the mint family (*Labiatae*), called also false dragon-head and lion's-heart, native to moist soil from Quebec to Ontario and Minnesota, and south to Florida and Texas. It is an erect, usually unbranched perennial, 1 to 4 ft. high, bearing oblong or lance-shaped, sharply-toothed, pointed leaves and dense terminal clusters (spikes) of pale-purple, rose-coloured or sometimes white flowers, about 1 in. long. The flower displays the peculiar characteristic of remaining temporarily at whatever angle it may be placed with reference to the stem.

**OBELISK,** a form of monumental pillar; and also the term for a bibliographical reference-mark in the form of a dagger. The typical Egyptian obelisk is an upright monolith of nearly square section, generally ten diameters in height, the sides slightly convex, tapering upwards very gradually and evenly, and terminated by a pyramidion whose faces are inclined at an angle of 60°. Obelisks were usually raised on pedestals of cubical form resting on one or two steps, and were set up in pairs in front of the entrance of temples. Small obelisks have been found in tombs of the Old Kingdom. The earliest temple obelisk still in position is that of

Senwosri I. of the XIIth Dynasty at Heliopolis (68 ft. high). A pair of Rameses II. (77 and 75 ft. high respectively) stood at Luxor until one was taken to Paris in 1831. Single ones of Tethmosis I. and Hatshepsut still stand at Karnak and remains of others exist there and elsewhere in Egypt. Colossal obelisks were erected by only a few kings, Senwosri I. in the Middle Kingdom and Tethmosis I., Hatshepsut, Tethmosis III. and Rameses II. of the Empire. Smaller obelisks were made in the Saïte period. The Romans admired them, and the emperors carried off some from their original sites and made others in imitation (*e.g.*, that for Antinous at Benevento); 12 are at Rome, one in Constantinople; two, originally set up by Tethmosis III. at Heliopolis, were taken by Augustus to adorn the Caesareum at Alexandria: one of these, "Cleopatra's Needle," was removed in 1877 to London, the other in 1879 to New York. The pyramidions were sheathed in bright metal, reflecting the sun's rays as if they were thrones of the sunlight. They were dedicated to solar deities, and were especially numerous at Heliopolis, where there was probably one of immemorial antiquity sacred to the sun. The principal part of the sun-temple at Abusir built by Neuserrē of the Vth Dynasty appears to have been in the shape of a stumpy obelisk on a vast scale; only the base now remains, but hieroglyphic pictures indicate this form. The hieroglyph of some other early sun-temples shows a disc on the pyramidion . The material employed for the great obelisks was a pink granite from Syene, and in these quarries there still remains, partially detached, an example 70 to 80 ft. long. The largest obelisk known is that in the piazza of St. John Lateran at Rome, set up by Tethmosis III. at Heliopolis in the 15th century B.C. and brought from Egypt by Constantine the Great and erected in the Circus Maximus, being ultimately re-erected in 1552 by Pope Sixtus V. It was 105 ft. 9 in. high, including the pyramidion, and its sides measured 9 ft. 10 in. and 9 ft. 8 in. respectively. On the base of the obelisk of Hatshepsut at Karnak, 97 ft. 6 in. high, there is an inscription stating that it and its fellow were made within the short space of seven months.

There was another form of obelisk, also tapering, but more squat than the usual type, with two of the sides narrow and terminating in a rounded top. One such of Senwosri I., covered with sculpture and inscriptions, lies at Ebgīg in the Fayum.

In Abyssinia, at Axum and elsewhere, there is a marvellous series of obelisk-like monuments, probably sepulchral. They range from rude menhirs a few feet high to elaborately sculptured monoliths of 100 feet. The loftiest of those still standing at Axum is about 60 ft. high, 8 ft. 7 in. wide, and about 18 in. thick, and is terminated by a rounded apex united by a necking to the shaft. The back of the obelisk is plain, but the front and sides are subdivided into storeys by a series of bands and plates, each storey having panels sunk into it which seem to represent windows with mullions and transom. These architectural decorations are derived from a style of building as found by a German expedition extant in an ancient church; courses of stone here alternate in the walls (both inside and out) with beams of wood held by circular clamps. In front of the best-preserved obelisk is a raised altar with holes sunk in it apparently to receive the blood of the sacrifice to the ancestors. Most of these must date before the adoption of Christianity as the State religion in the 6th century.



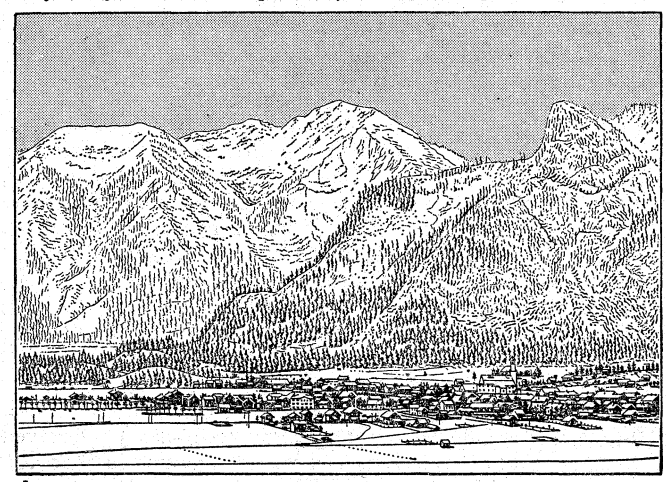
OBELISK (KARNAK)

*See* G. Maspero, *L'Archéologie égyptienne* (new ed., 1907); H. H. Gorringe, *Egyptian Obelisks* (New York, 1882; London, 1885, etc.); F. W. von Bissing and L. Borchardt, *Das Re-Heiligtum des Königs Ne-woser-Re* (1905); on the ancient method of raising obelisks, L. Borchardt, "Zur Baugeschichte des Amonstempel von Karnak," in Sethe's *Untersuchungen zur Geschichte und Altertumskunde Aegyptens*, vol. xv. For the Abyssinian obelisks *see* especially E. Littmann and D. Krencker, *Vorbericht der deutschen Aksum Expedition* (1906). (F. Ll. G.)

**OBERAMMERGAU,** a village of Bavaria, Germany, situated among the foot-hills of Kofel mountains, a range of the Alps, in the Ammer valley, 64 m. S.S.W. of Munich. Pop. about 1,700. The outside walls of many of the houses are decorated with fresco paintings, reproductions of famous biblical masterpieces. The villagers make toys and pottery, and carve wooden crucifixes, rosaries and images of saints. These carvings are shipped to all parts of the world and are found in many churches.

### THE OBERAMMERGAU PASSION PLAY

The village is famous for its performance of a Passion play every ten years. This is probably the most important survival of



A VIEW OF THE VILLAGE OF OBERAMMERGAU, SITUATED IN THE MOUNTAINS OF BAVARIA

the miracle plays so popular from the 13th to the 16th century. Contrary to popular belief, this production is not a portrayal of the life of Christ, but only of the events of his last few days on earth, known as Passion week.

In 1633 the village was stricken with the scourge of the Black Death. As an expression of gratitude for the cessation of the scourge the inhabitants vowed to enact the Passion and death of Christ every ten years. The first performance was given in 1634 and repeated every ten years until 1674, after which the dates were changed so as to fall on decimal years. This now has been faithfully kept with the exception of 1870, when the Franco-Prussian War interfered. The earliest extant text of the play was written in 1662, probably by the monks of Ettal, a monastery situated a few miles from Oberammergau. The text is slightly revised every ten years. The music was composed by Rochus Dedler, a schoolmaster of the parish, in 1814. The initial performance of the play is given the first Sunday in May, and is repeated every Sunday, with two or three extra performances each week. On account of the unsettled conditions resulting from the World War the 1920 production was postponed until 1922, during which year it was played 61 times. It starts at eight o'clock in the morning and continues for eight hours, with a short intermission at noon. The characters are chosen by a committee made up of the village priest, burgomaster, village council and members selected by popular vote. No one may participate in the spectacle unless he is a native of the village and is of unimpeachable moral character and dramatically qualified to enact the rôle for which he is chosen. Over 700 characters participate in the play. This includes the orchestra of 50 members and the chorus of 46. It is estimated that more than 300,000 witness the production each season. The proceeds are divided into four equal parts: one for the preparation of the play, one for the furnishing of homes for the visitors, one for the church and one for the players.

The play is enacted on a large open-air platform, the audience occupying an auditorium with a capacity of about 6,000, viewing the play through an immense oval opening in front of the auditorium. The play consists of 18 acts and a number of tableaux. Each act is prefaced by an orchestral selection and a choral anthem giving the motif of the act. This, in turn, is followed by

a tableau based on the Old Testament prefiguring the theme of the act. For instance, the scene depicting the Crucifixion is preceded by a tableau representing the offering of Isaac as a sacrifice by Abraham. The chief characters are the Christus, the Twelve Disciples, Mary the mother of Jesus, Mary Magdalene and Martha. Anton Lang (1875–1938) held the distinction of portraying the part of the Christus for three decades, 1900, 1910 and 1922. The participants regard their rôles with religious devotion and enact their parts with the deepest reverence. In the years between the representations of the play, performances are given of many classics for the purpose of training the prospective players for the Passion play, in enunciation, stage bearing and all other requirements of dramatizing. No wigs or facial make-up are permitted. The costumes, however, are of the biblical period and are of the very best material. The participants train their hair and beards and study to assume the general appearance of the characters for which they are candidates. (W. E. V.)

**OBERHAUSEN,** a town in the Prussian Rhine province, Germany, 5 mi. east of the Rhine, 20 mi. N.E. of Düsseldorf, on the main railway line to Hanover and Berlin, and at the centre of an important network of lines radiating hence into the Westphalian coal and iron fields. Pop. (1939) 191,305. The first houses of Oberhausen were built in 1845, and it received its municipal character in 1874. The town has large iron-works, coal-mines, rolling-mills, zinc smelting-works, dye-works, railway workshops and manufactures of wire-rope, glass, chemicals, sugar, porcelain and soap. It was bombed in World War II.

**OBERLIN,** a village of Lorain county, Ohio, U.S.A., 34 mi. W.S.W. of Cleveland, on federal highway 20 (by-pass) and served by the New York Central lines and bus. Population in 1940 was 4,305. It is a pleasant residential village, the seat of Oberlin college. Since 1926 it has had a manager form of government. Oberlin college was founded in 1833 by the Rev. John J. Shipherd (1802–44) and Philo P. Stewart (1798–1868), and was named after John Frederick Oberlin (d. 1826), the Alsatian pastor and philanthropist. Its educational plant is valued (1940) at about $5,000,000; its endowment funds aggregate $19,500,000; the library has about 400,000 bound volumes; and the student body numbers 1,900. Oberlin college includes the college of arts and sciences, the graduate school of theology and the conservatory of music.

The "Oberlin Theology" (not now identified with the college) centred in the teachings of President Finney, a powerful preacher and teacher, who carried on remarkable revival services in eastern cities of America and in England and Scotland. The modern theological position of the college is reflected in the writings of President Henry C. King (1858–1934) and of Dean Edward I. Bosworth of the theological seminary (1861–1927). Oberlin was the first American college to adopt coeducation, and in Aug. 1841, three women were regularly graduated from the classical course —the first women in America to receive the degree of bachelor of arts on conditions like those prevailing in the best men's colleges of the time. Oberlin was also a pioneer (1835) in refusing to debar students on account of race. A substantial proportion of the students earn part of their expenses.

Oberlin was a "station" on the Underground railroad. The attic of President Finney's home frequently sheltered slaves who were escaping to Canada. In 1858 a runaway slave, John Price, was captured in Oberlin by a U.S. marshal, and was rescued at Wellington (10 mi. S.) by a band of Oberlin professors and others, in consequence of which 30 professors were arrested and imprisoned. This was a famous fugitive slave case. The village was founded as a home for the college, and was incorporated in 1846.

**OBERON,** king of the elves. In the legendary history of the Merovingian dynasty he is a magician, brother of Merowech (Mérovée). In the *Nibelungenlied* he guarded the treasure of the Nibelungen. In the German mediaeval poem of *Ortnit,* the hero is aided in his wooing by his father Alberich, the king of the dwarfs. As Oberon, king of the fairies, he fills a similar rôle in *Huon of Bordeaux* (*q.v.*). Shakespeare used the fairy element in *A Midsummer Night's Dream,* and Wieland in his epic *Oberon* (1780). Ben Jonson wrote a masque of *Oberon, or the Fairy Prince* (*Works,* 1616). Weber's opera, *Oberon,* to the words of J. R. Planché, was first produced at Covent Garden in 1826.

*See* also C. Voretzsch, *Epische Studien. Die Kompositionen des Huon von Bordeaux* (Halle, 1900).

**OBITER DICTUM,** that which is said by the way; specifically, in law, an opinion expressed by a judge incidentally in the course of a case, on a point of law not material to the issue or to the grounds of the decision; such *obiter dicta* have no binding authority.

**OBJECT** and **SUBJECT,** in philosophy, the terms used to denote respectively the external world and consciousness. The term "object" is used generally in philosophy for that in which an activity of the mind ends, or towards which it is directed. With these may be compared the ordinary uses of the term for "thing" simply, or for that after which one strives, or at which one aims. "Subject," is originally the material or content of a discussion or thought, but in philosophy is used for the thought or the thinking person. The relation between the thinking subject and the object thought is analogous to the grammatical antithesis of the same terms: the "subject" of a verb is the person or thing from which the action proceeds, while the "object," direct or indirect, is the person or thing affected. The true relation between mind or thought (subject) and matter or extension (object) is the chief problem of philosophy, and may be investigated from various standpoints (*see* PSYCHOLOGY and METAPHYSICS).

**OBJECTIVISM,** in philosophy, a term used, in contradistinction to SUBJECTIVISM, for any theory of knowledge which to a greater or less extent attributes reality (as the source and necessary pre-requisite of knowledge) to the external world. The distinction is based upon the philosophical antithesis of the terms Object and Subject, and their respective adjectival forms "objective" and "subjective." In common use these terms are opposed as synonymous respectively with "real" and "imaginary," "practical" and "theoretical," "physical" and "psychic." A man "sees" an apparition; was there any physical manifestation, or was it merely a creation of his mind? If the latter the phenomenon is described as purely subjective. Subjectivism in its extreme form denies that mind can know more than its own states. Objects, *i.e.,* things-in-themselves, may or may not exist: the mind knows only its own sensations, perceptions, ideal constructions and so forth. In a modified form "subjectivism" is the philosophic theory which attaches special importance to the part played by the mind in the accumulation of experience. *See* PSYCHOLOGY and related articles.

**OBLATE,** an ecclesiastical term for persons not professed monks, friars or nuns, who have devoted themselves or have been devoted as children by their parents to a religious life. "Oblate" is more familiar in the Roman Church as the name of a religious congregation of secular priests, the Oblate Fathers of St. Charles. This congregation was founded in 1578 under the name of Oblates of the Blessed Virgin and St. Ambrose by St. Charles Borromeo, archbishop of Milan (*see* BORROMEO, CARLO). There is a similar congregation of secular priests, the Oblates of Mary the Immaculate, founded at Marseilles in 1815. *See* the *Catholic Encyclopaedia, s.v.* "Oblate."

**OBLATION,** an offering, a term, particularly in ecclesiastical usage, for a solemn offering or presentation to God. It is thus applied to certain parts of the Eucharistic service in the Roman Church. There are "two oblations," the "lesser oblation," in which the bread and wine yet unconsecrated are presented after the offertory, and the "greater oblation," the "oblation" proper, forming the latter part of the prayer of consecration, when the "Body and Blood" are ceremonially presented. *See* the *Catholic Encyclopaedia, s.v.* "Oblation."

**OBLIGATION,** in law, a term derived from the Roman law, in which *obligatio* signified a tie of law (*vinculum iuris*), whereby one person is bound to perform or forbear some act for another. The *obligatio* of Roman law arose either from voluntary acts or from circumstances to which legal consequences were annexed. In the former case it was said to arise from contract, in the latter

from tort, or from acts or omissions to which the law practically attached the same results as it did to contract or tort. *Obligatio* was used to denote either end of the legal chain that bound the parties, the right of the party who could compel fulfilment of the *obligatio,* the *creditor,* or the duty of the party who could be compelled to fulfilment, the *debitor.* In English law obligation has only the latter sense. Creditor and debtor have also lost their Roman law signification; they have been narrowed to mean the parties where the obligation is the payment of a sum of money. But in legal systems, chiefly founded on Roman law, the original meanings remain. In English law obligation is used in at least four senses—(1) any duty imposed by law; (2) the special duty created by a *vinculum juris*; (3) not the duty, but the evidence of the duty—that is to say, an instrument under seal, otherwise called a bond; (4) the operative part of a bond. The third and fourth uses of the word are chiefly confined to the older writers. The party bound is still called the obligor, the party in whose favour the bond is made the obligee. The word "bond" is, of course, a mere translation of *obligatio.* Obligations may be either perfect or imperfect. A perfect obligation is one which is directly enforceable by legal proceedings; an imperfect or moral obligation (the *naturalis obligatio* of Roman Law) is one in which the *vinculum juris* is in some respects incomplete, so that it cannot be directly enforced, though it is not entirely destitute of legal effect.

American law is in general agreement with English. The term obligation is important in the U.S.A. from its use in art. i. s. 10 of the constitution, "No state . . . shall pass any . . . law . . . impairing the obligation of contracts." This does not affect the power of Congress to pass such a law.

**OBOE** or **HAUTBOY.** The treble member of the class of wood-wind instruments having a conical bore and a double reed mouthpiece, the oboe consists of a conical wooden tube, composed of three joints, upper, middle and bell, and of a short metal tube to which are bound by many turns of waxed silk the two thin pieces of cane that form the mouthpiece. These pieces of cane are so bevelled and thinned at the end which is taken into the mouth that the gentlest stream of compressed air suffices to set them vibrating and thereby to set up the rhythmical series of pulses which generate the sound waves in the stationary column of air within the main tube of the instrument.

The compass of the oboe is from B flat below the treble stave to F in alt, or even a note or two higher, with all chromatic semitones. Its quality of tone is thin, penetrating and even somewhat nasal. It is possible to play on it diatonic and chromatic scale and arpeggio passages, legato and staccato; leaps; cantabile passages; sustained notes, crescendo and diminuendo, grace notes and shakes (with reservations).

The first appearance of the instrument in a musical work occurs in Sebastian Virdung's *Musica getutscht und aussgezogen* (1511). It there bears the name of *Schalmey,* and is already associated with an instrument of similar construction called *Bombardt.* There exists, however, much earlier evidence, in the illuminated mss. and in the romances of the Middle Ages, of the great popularity of the instrument in all parts of Europe. The oboe was known during the early Middle Ages as *Calamus, Chalumeau* (France), *Schalmei* (Germany) and *Shawm* (England), while after the Renaissance we find instruments of this type ranged in complete families from the soprano to the bass and known respectively as the little Schalmey; the discant Schalmey; the alto Pommer; the tenor Pommer; the bass Pommer; and the great double quint Pommer.

BY COURTESY OF CARL FISCHER, INC., NEW YORK

THE OBOE IN ITS MODERN FORM

The 17th century brought no great changes in the construction of the four smaller instruments of the family. Extensively used in France, they were there called "haulx bois" or "hault-bois," to distinguish them from the two larger instruments which were designated by the words "gros bois." Haultbois became hautbois in French, and oboe in English, German and Italian; and this word is now used to distinguish the smallest instrument of the family still in use.

The reform in the construction of the flute due to Theobald Boehm of Munich about 1840, a reform which principally consisted in the rational division of the tube by the position of the lateral holes, prompted Triebert to try to adapt the innovation to the oboes and bassoons; but he failed, because the application of the system denaturalized the timbre of the instruments, which it was necessary, before all things, to preserve. Further improvements, however, made upon the same lines by Barret and later by Rudall Carte, have transformed the oboe into the most delicate and perfect of reed instruments, as which it constitutes one of the most valuable and indispensable members of the modern orchestra.

**OBOK,** a seaport on the north shore of the Gulf of Tajura, N.E. Africa, acquired by France in 1862. It gave its name to the colony of Obok (now French Somali coast protectorate). (*See* SOMALILAND: *French.*) The port is separated from the open sea by coral reefs, but is only partially sheltered from the winds. The French in 1896 transferred to Jibuti, on the opposite shore of the Gulf, the seat of government of the colony. Obok is connected with Aden and Jibuti by submarine cables. It is only a native village with a population of about 300.

**OBRECHT, JACOB** (also HOLBRECHT) (*c.* 1430–*c.* 1500), Dutch composer, was born probably at Utrecht about 1430. About 1474 Erasmus was under him as a choir boy at Utrecht, where he was chapel master, and in the same year Obrecht seems to have held an appointment at Ferrara. He was afterwards director of the Cambrai school of singing, and at some time lived in Florence, where his name is associated with Josquin, Isaac and Africola, and the musicians who clustered round Lorenzo's court. The principal records of his later years are found in Antwerp Cathedral, where he was chapel master from 1491 until his death. That he possessed immense contrapuntal skill and was considered one of the greatest masters of the age there is evidence in the praise of his contemporaries and successors, the honours bestowed upon him, and the visits received by him at Antwerp. The finest of his eight masses, *Fortuna Desperata,* was published in Amsterdam (1870) and appears in 1880 in the *Maatschappij tot Bevordering der Toonkunst* (*No. ix.*). He also wrote chansons and motets. The finest of the motets is *Salve crux arbor vitae.* Great interest attaches to his *Passion,* in which the chorus impersonates all the characters in the story and the narrative is given to the tenor in recitative.

A definitive edition of his works has been published by Johannes Wolf (*Werke van Jacob Obrecht,* Amsterdam and Leipzig).

**OBREGÓN, ALVARO** (1880–1928), Mexican soldier and president, was born in the district of Alamos, Sonora, on Feb. 17, 1880. During his early life as a planter he became an advocate of land reforms to better the condition of the peons and Indians, and in 1912 he entered the services of Madero, a man of similar ideals. With Indian troops which he recruited, Obregon aided in suppressing the revolt of Orozco against Madero, and later he again took the field against Felix Diaz whose successful revolt led to the downfall of Madero and the establishment of Huerta as provisional president. Obregon then joined the counter-revolution of Carranza who had remained true to Madero. After a string of victories culminating in the successful storming of Sinaloa and Culiacan and the capture of Guadalajara, the way to Mexico City was opened, and on Aug. 15, 1914, Obregon led the Carranza troops into the capital. Huerta fled.

In the struggle which arose between Carranza and Zapata and Villa, Obregon remained loyal to Carranza. He defeated Zapata finally at Pueblo in Jan. 1915. In April he conducted a campaign against Villa for the control of central Mexico and by winning the battles of Celaya and Leon forced Villa back to his mountain fastnesses. As leader of the radical wing of Carranza's followers and chief of the army, Obregon possessed power enough to force into the new Constitution of 1917, against Carranza's wishes, the

famous article 27 which provided for the restoration of communal lands to the Indian villages, limited the size of individual land holdings, deprived religious organizations of the right to hold lands and reserved to the Government the ownership of all mineral and petroleum resources. The new Constitution also provided that no president should succeed himself, but in 1920 Carranza took steps to have himself retained in power, one of these steps being an order for the arrest of Obregon. Obregon escaped to Sonora where a revolt against Carranza was already in progress and put himself at the head of the troops. In a short time he was master of the situation and on Dec. 1, 1920, was elected president. He immediately adopted a friendly tone toward the United States and other foreign countries, and in 1923 the United States recognized his Government. His administration was made notable by many labour and agrarian reforms and by a sincere effort to carry the provisions of the 1917 Constitution into force. In 1924 he supported Calles, his minister of the Interior, for president. His opponents under de la Huerta charged fraud in the election and started a revolution. Obregon once more took the field, defeated the rebels and drove de la Huerta into exile. Obregon was again elected president on July 1, 1928, but on July 17 before taking office he was assassinated.

He wrote *Ochomil kilómetros en Campaña* (1917). *See* also J. A. Tamayo, *El Gral, Obregón y la guerra* (1922); E. J. Dillon, *President Obregón, a World Reformer* (1922); H. I. Priestly, "Calles and Obregón," *California University Chronicle,* vol. xxx. (1928).

**OBRENOVIĆ,** the name of a dynasty which supplied several rulers of Serbia in the 19th century. *See* MILOŠ OBRENOVIĆ I; MICHAEL OBRENOVIĆ III; MILAN OBRENOVIĆ IV; and ALEXANDER (ALEXANDER OBRENOVICH).

**O'BRIEN, WILLIAM** (1852–1928), Irish patriot, was born at Mallow, Co. Cork, on Oct. 2, 1852, son of James O'Brien, a solicitor's clerk. He was educated at the Cloyne diocesan college and at Queen's college, Cork, and began journalism in 1869 on the *Cork Daily Herald.* In 1875 he joined the staff of the *Freeman's Journal.* In 1880 he founded his own paper, *United Ireland,* conducted with amazing vigour. Forster, on reading the first number, is said to have exclaimed, "Who is this new madman?" O'Brien's paper was suppressed for the time being, and he was shut up in Kilmainham jail, with Parnell and others. There O'Brien drew up the famous "No Rent" manifesto, which was smuggled out of Kilmainham, read at a Land League meeting in Dublin, and led to the proclamation of the league as an illegal association.

After Forster's recall from Ireland, O'Brien resumed his campaign in *United Ireland.* In 1887, under the Balfour régime in Ireland, O'Brien started the slogan of "no reduction, no rent." Parnell was much out of Ireland, and though he eventually disavowed the "plan," O'Brien had stirred up a fierce agitation, met by the British government with the Coercion Act of 1887. Under this act O'Brien was sent to Tullamore jail. He had been elected M.P. for Mallow in 1883, and on his release he appeared in the house of commons to renew his obstructive tactics there.

After the Parnell divorce case he tried to mediate between the Parnellites and the anti-Parnellites. He advised the retirement of Parnell until the storm should have blown over. Finally in 1900 he reunited the party. In 1903 O'Brien, who had begun his career as a land agitator, thought that the Wyndham Land Act of 1903 offered a bridge between the Nationalists and the southern Unionists. He wanted an "act for Ireland" party which should include men of all creeds and of various opinions. He split the Irish Party, and in the general election of 1918 his followers retired, leaving a clear fight at the polls between the Nationalists and the Sinn Feiners. Thus the man who had sought conciliation with southern Unionists in 1903 was fated, though he had no faith in Sinn Fein methods, to secure the Sinn Fein victory.

O'Brien married a French woman, Sophie Raffalovich, the daughter of a Paris banker. He died on Feb. 26, 1928.

**O'BRIEN, WILLIAM SMITH** (1803–1864), Irish revolutionary, was born in Co. Clare on Oct. 17, 1803, and educated at Harrow and at Cambridge. He took the additional name of Smith on inheriting his maternal grandfather's estates in Limerick. He entered parliament in 1828 as member for Ennis, and from 1835 to 1848 represented the county of Limerick. Although he spoke in 1828 in favour of Catholic emancipation, he differed on other points from the general policy of O'Connell. But he opposed the Irish Arms act of 1843, and became an active member of the Repeal association. In July 1846 the "Young Ireland" party, with Smith O'Brien and Gavan Duffy at their head, left the Repeal association, and in the beginning of 1847 established the Irish Confederation. In May 1848 he was tried at Dublin for sedition, but the jury disagreed. In the following July he established a war directory, and attempted to make a rising among the peasantry of Ballingarry, but the movement lacked cohesion, and the crowd dispersed before the approach of the dragoons. O'Brien was arrested at Thurles, tried and sentenced to death. The sentence was, however, commuted to transportation to Tasmania for life. In May 1856 he obtained a full pardon, and returned to Ireland. He died at Bangor, North Wales, on June 18, 1864.

**OBSCENITY.** By English common law it is an indictable misdemeanour to give an obscene exhibition or to publish any obscene matter, whether it be in writing or by pictures, effigy or otherwise. But the test of criminality as accepted in England is whether the exhibition or matter complained of tends to deprave and corrupt those whose minds are open to immoral influences and who are likely to visit the exhibition, or to see the matter published. If the exhibition or publication is calculated to have this effect, the motive of the publisher or exhibitor is immaterial. Even in the case of judicial proceedings, newspapers are not privileged to publish evidence which falls within the definition.

Besides the remedy by indictment there are statutory provisions for punishing as vagabonds persons who expose to public view in public streets or adjacent premises obscene prints, pictures or other indecent exhibitions. These are supplemented by the Indecent Advertisements Act 1889. By the Obscene Publications Act 1857 powers are given for searching premises on which obscene books, etc., are kept for sale, distribution, etc., and for ordering their destruction, and the post office authorities have power to seize postal packets containing such matter and to prosecute the sender under the Post-Office Act.

The use of obscene or indecent language in public places is punishable as a misdemeanour at common law, but it is usually dealt with summarily, under the Metropolitan Police Act 1839, or the Town Police Clauses Act 1847, or under local by-laws.

In the United States, the different States provide punishment for obscene libel, the exhibition of obscene pictures and the display or use of obscene language in public. The Federal Government penalizes sending of obscene matter through the mails.

Under the tariff act of 1930 (U.S. Code § 1305) the U.S. may ban the import of "any obscene book." "Obscene" is legally defined in the courts as "tending to stir the sex impulses or to lead to sexually impure thoughts." In a decision of the U.S. district court (1933) by Judge John M. Woolsey, the ban was lifted on James Joyce's modern classic *Ulysses.* Legal precedent was established in the opinion, which describes an investigation of a work of art on literary as well as juridical grounds, from the point of view of both intent and results.

Indecent acts committed with intent to insult females are punishable under the Vagrancy act 1824 as amended by sect. 42 of the Criminal Justice act 1925, and if committed otherwise under the acts of 1839 and 1847. (W. DE B. H.; X.)

**OBSERVATORY (ASTRONOMICAL).** The erection of special buildings for astronomical research is a practice of long standing. It is said by Diodorus that the great temple of Belus at Babylon was built for astronomical purposes, and, since there is indication in the Chinese records that the gnomon was used for measuring the height of the sun in the reign of the emperor Yao (2300 B.C.) it may be said that the beginning of practical astronomy was contemporaneous in eastern and western Asia. There is no evidence of the existence of an observatory of Greek or Alexandrine origin until the time of Ptolemy Soter, who, about 300 B.C., built one at Alexandria. The earliest records from an observatory known to be extant are those of Hipparchus (*c.* 140 B.C.) who has left a catalogue of stars from observations made at the island of Rhodes, repeating those made earlier at Alexandria.

Three hundred years later, Ptolemy (A.D. 150) compiled a star catalogue, but it is doubtful whether this was from his own observation and, therefore, whether he had an observatory beyond that at Alexandria.

The art of astronomical observation was revived several hundred years later in western Asia when observatories were established at Damascus and Baghdad and one at Mokatta by Caliph Hakim about A.D. 1000. A splendid observatory was built at Maragha in northwest Persia by Hulagu Khan about A.D. 1260, but the most productive was that of the Persian Prince Ulugha Beigh, grandson of the great Tamerlane, who, at Samarcand with his assistants, made a catalogue of stars from observations with a large quadrant in the first half of the 15th century. Later in that century, about 1471, John Müller of Königsberg, better known as Regiomontanus, set up an observatory at Nuremberg, with the help of Bernard Walther of that city, furnished with instruments of his own design, and after his death in 1476, clocks, then a recent invention, were added to the equipment. The first observatory, however, that may be considered a prototype of modern national observatories was that of Tycho Brahe on the island of Hveen. To the building commenced on Aug. 8, 1576, he gave the appropriate name Uranibourg.

**Tycho Brahe's Observatory.**—This building was of some magnificence and large enough to house Tycho and several young men who lived with him as students or observers. It was furnished with a large quadrant attached to a wall in the plane of the meridian, for to this astronomer is due the credit of appreciating the advantage of size in instruments of this type, and of the principle which is embodied in the mural circle. Here Tycho Brahe with his assistants, one of whom was Longomontanus, a name well known in the science, observed the heavens and produced a catalogue of the positions of more than 1,000 stars. On the death of his patron, Frederick II in 1588, Tycho was deprived of royal favour and income. In 1597 Tycho left Denmark, the observatory at Hveen having been already dismantled.

The invention of the telescope in 1609 opens a new chapter in the history of observatories, and the building at Padua in which Galileo discovered and made the first observations of Jupiter's satellites on Jan. 8, 1610, may be regarded as the first of a new class. Others were created as additions to universities or similar institutions during the 17th century. In 1637, King Christian IV of Denmark established a permanent observatory at Copenhagen, which was completed 20 years later and then placed under the direction of Longomontanus.

John Hevel, or Hevelius, a member of a noble family of Danzig, built an observatory in 1641 in his own house and furnished it with an azimuthal quadrant of 5-ft. radius and a sextant of 6 ft., with which he measured the meridian altitudes of stars, sun, moon and planets, and their distances from one another in the manner of Tycho—that is, with plain sights, believing this to be superior to the newly adopted telescopic method.

**Paris, Greenwich and Others.**—Hevelius died early in 1687 and his work was not carried on, but by that date there had come into existence the two national observatories at Paris and Greenwich. The former was built in the years 1667–71, according to the plans of Claude Perrault, as an architectural monument. Under the Cassinis and others, it has done much for astronomy. The Royal observatory, Greenwich, was founded in 1675 for the definite purpose of the improvement of navigation. Architectural pride again entered into the design, for Sir Christopher Wren wrote of it to Bishop Fell of Christ Church, Oxford, as built "a little for pomp" referring to the main building. The essential instruments were housed apart, and at the present time, Wren's beautiful creation is merely a small item in its extensive domain.

Few establishments of the kind were erected during the next half century. Mainly because of the occurrence of the transit of Venus in 1769, George III built and furnished the King's observatory at Kew. The improvement in reflecting telescopes by James Short and the invention of the achromatic object glass in the latter part of the 18th century marked the beginning of many observatories that have since become famous. The Radcliffe observatory at Oxford was erected 1771–74 from funds bequeathed by Dr. Radcliffe, a court physician "for charitable purposes," the words being interpreted somewhat widely. Provost Andrews bequeathed a substantial sum for building and endowing an astronomical observatory for the University of Dublin, which was built at Dunsink in 1783, but not furnished with instruments until many years later. An observatory was established and endowed at Armagh in Ulster in 1793, in charge of Primate Robinson, while the most prolific British observatory of the period was that of William Herschel at Bath, Datchet and Slough, successively.

**Early Continental Observatories.**—Continental observatories established during this period were those of Mannheim (1775), which was transferred to Karlsruhe in 1880, and again to Heidelberg in 1896; Lilienthal founded by Schroter in 1779, and furnished with a reflector made by Herschel; Leipzig where a small observatory existed on the tower of the university in the years 1787–90; Breslau (1790); also one at Seeberg near Gotha, founded by Duke Ernest II in 1788 that was made famous by Zach and Encke. The observatory at Palermo, Sicily, where Piazzi made his famous catalogue of stars, was founded in 1790; and at about the same time Lalande and his assistants were observing transits of stars from an observatory in l'École Militaire, Paris.

## THE NINETEENTH CENTURY

**British Observatories.**—A full list of observatories, public and private, founded in Great Britain during this next 100 years would be large. An observatory on Calton hill, founded by a private association, the Edinburgh Astronomical institution, in 1818, was taken over by the crown as a royal observatory in 1834, and transferred to its present site on Blackford hill in the years 1889–96. Cambridge university observatory was founded in 1820 and under its noted directors, George Biddell Airy, James Challis, John Couch Adams, Robert Stawell Ball and Arthur Stanley Eddington has done valuable work, and now well equipped with instruments, has a solar and astrophysical observatory. The Radcliffe observatory at Oxford was originally in the charge of the Savilian professor of astronomy but this arrangement lapsed and the offices of professor and Radcliffe observer became distinct about 1839. In 1875 the University observatory came into existence largely through the liberality of Warren de la Rue, for the use of the Savilian professor. The work of this observatory has been largely photographic. An observatory was established at Liverpool mainly for the time service of the port in 1838, and at Glasgow a small observatory attached to the university, of which Dr. Alexander Wilson had been the first director about 1760, was enlarged and transferred to a new site in 1836.

Among private observatories the reflecting telescope with 6-ft. mirror made by Lord Rosse and set up at his seat, Parsonstown, Ireland, in 1845, is famous, and scarcely less so are the smaller instruments of the same type made by William Lassell, and used by him at Liverpool 1844–52.

Observatories established in England in the second half of the 19th century were those of De la Rue, a pioneer in astronomical photography, at Cranford in Middlesex; of George Knott at Cuckfield, Sussex; of William Huggins, the famous spectroscopist, at Tulse hill, the private observatory of Norman Lockyer, who afterwards developed spectroscopic research at a state-supported establishment at South Kensington. Those of Edward Crossley at Halifax, Yorkshire, and Thomas Espin at Towlaw, Durham, have reputations based on double-star observations.

**Colonial Observatories.**—A feature of the 19th century was the establishment of British Colonial observatories. Acting on the proposal of the Board of Longitude in 1820, the Lords Commissioners of the Admiralty resolved to establish an observatory at the Cape of Good Hope for the improvement of practical astronomy, which came into being in the year 1829, and has adequately fulfilled its purpose as a government observatory under the directorship of Frank Maclear, Edward James Stone, David Gill, George Washington Hough and Harold Spencer Jones of the present day. This observatory has a reversible transit circle of the latest type, and a heliometer and an equatorially-mounted twin telescope with objectives 24 in. and 18 in. in aperture for photo-

graphic and spectroscopic work—gifts of Frank Maclear.

The first observatory on Australian soil was one on Dawes point, the headland on which stands the present Sydney observatory, established in 1786. In 1853 Robert L. Ellery was appointed to superintend an astronomical observatory at Williamstown which was removed to Melbourne in 1861–63. With the observatories of Sydney and Perth, Melbourne has taken a share in the international work of charting the heavens by photography, and in addition meridian observing, magnetism, seismology, meteorology and time service form its activities. The Adelaide observatory was not completed until 1861. The observatory of Western Australia at Perth was established 30 years later. The aim of a small observatory established at Wellington, New Zealand, under Sir James Hector in 1869 for time service was later enlarged and the institution is now called the Dominion observatory.

**Continental Observatories.**—During this period many observatories were established on the continent of Europe, two of which were made famous by the labours of Wilhelm Struve. The University of Dorpat, Livonia, Russia, possessed in 1809 an observatory of small dimensions, scantily equipped, of which Struve, a student of astronomy in the university, was given charge in the year 1813. His successful work attracted the attention of the Russian government, and soon the observatory was furnished with such instruments and pecuniary means as to raise it to the rank of a first-class establishment, where Struve, almost single-handed, produced results of a very high standard. Attracted by Struve's work the Emperor Nicholas in 1833 resolved to erect a central observatory for the empire of Russia, and, largely to Struve's design, an observatory was completed in 1839, at Pulkowa near St. Petersburg, which was considered to be the finest and best equipped of the time. Another observatory of the first half of the 19th century, though not on the magnificent scale of Pulkowa, but associated with the name of a distinguished astronomer, was that of Königsberg, established by the king of Prussia in 1813 and put in the charge of F. W. Bessel who had already made a reputation at the observatory at Lilienthal. The observatory at Altona near Hamburg, completed in 1823, was made famous because of its association with Heinrich Christian Schumacher, to whose personality is ascribed the encouragement given to astronomy by the Danish government. In 1874, this observatory was transferred to Kiel, which had then become the chief German naval station, and formed the international central bureau for distribution of astronomical information until World War I, when this useful work was transferred to Copenhagen.

The Royal observatory at Berlin had its origin in the year 1705. It was with the 9-in. refractor of this observatory that the planet Neptune was first seen. The establishment of an observatory at the University of Bonn was decided on by the king of Prussia, in 1836, and Friedrich Wilhelm Argelander, who had been director of the Abo observatory, Finland, transferred to Helsingfors in 1837, was chosen as director. Although the instruments of this observatory are not large, the stupendous work of Argelander, carried on by his successors, in star cataloguing, indicates its principal branch of activity. The University of Strasbourg has an observatory attached to it completed by the German government in 1881, consisting of three magnificent buildings placed in a large open garden. Its largest telescope, the great equatorial, a refractor with object glass of 20-in. aperture, is said to have been the largest in Germany at the time of its erection. The University observatory, Vienna, built on a new site in the years 1874–80 to replace one that dated from the middle of the 18th century, is a large structure standing in grounds of 14 acres in extent, with an imposing façade and surmounted by four domes designed on the model of the Berlin observatory. Basle (1874), Bordeaux (1879), Breslau (1790), Budapest (1856), Cracow (1791), Kazan, Leipzig (1790, remodelled in 1861) are other universities of Europe that have observatories attached to them. At Heidelberg (Königstuhl), a private observatory founded by Dr. Max Wolf in 1877, was merged with Grand-Ducal institute, established in 1898, which combined two sections; one an astrometric observatory that had existed successively at Schoetzingen, Mannheim and Karlsruhe since 1762 (*v. supra* Mannheim), and an astrophysical observatory under the direction of Dr. Wolf.

Among the notable observatories in northern Europe established two or more centuries ago but greatly expanded in later years is the Stockholm observatory, founded in 1748, and now equipped with a large double equatorial telescope, a 40-in. reflecting telescope and many modern auxiliary instruments; the observatory of the University of Upsala founded in 1739; the Royal observatory of Lund, first established in 1670; and the University observatory of Copenhagen originally built about 1650 on the summit of the famous "round tower."

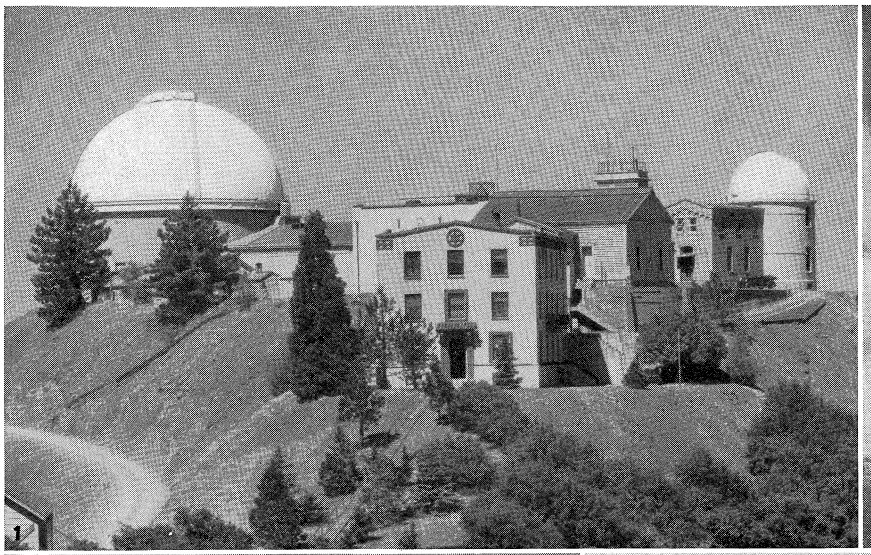
Before World War I there were ten French national observatories under the control of a consultative committee that reported annually to the government. The Paris observatory of the 17th century has been mentioned. Some that were resuscitated or created in the ten years after the war of 1870–71, have history behind them. An observatory at Marseilles, founded by the order of Jesuits about the year 1700, was taken over in 1749, after the expulsion of the Order, as the Royal Naval observatory and made famous by Jean Louis Pons, Pons Joseph Bernard, Adolphe Gambart, Jean Valz and Jean Chacornac. A new observatory was built in 1862 with which the older one was incorporated and the names of Jean Stephan, Jérome Coggia and Alphonse Louis Nicolas Borrelly recall many discoveries of minor planets and comets made with its instruments. The observatory at Toulouse had a predecessor as early as 1718, but the existing establishment dates from about 1840 when it was erected and supplied with excellent instruments at the public expense, but with an inadequate staff, so that it was devoted for many years solely to meteors and meteorology.

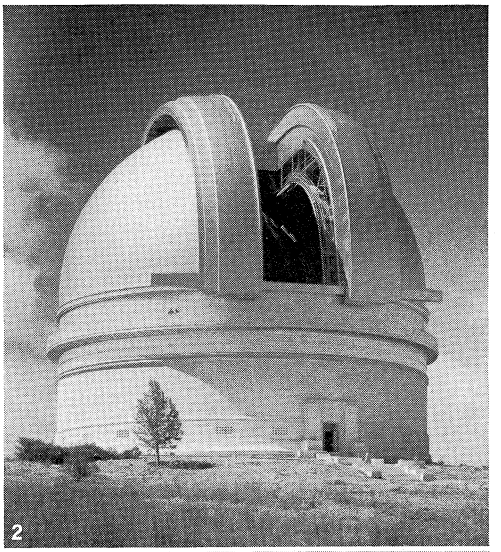
The observatory at Bordeaux, together with those at Paris, Toulouse and Algiers, has taken a share in the international work of charting the heavens by photography. The Algiers observatory, about half a century old, is an imposing group of buildings set up on a hill at Boudzareah, near Algiers. The two observatories that complete the ten are the solar physical observatory at Meudon near Versailles and the observatory at Nice, bequeathed by the founder to the University of Paris in 1899 and now ranking as a national institution.

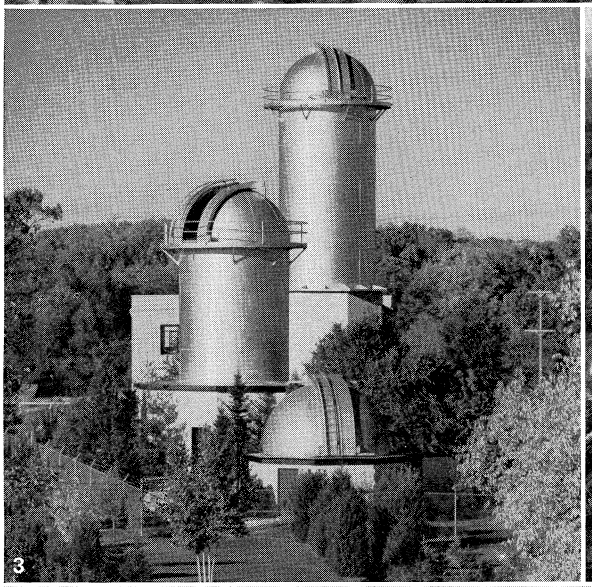
**American Observatories.**—The first American observatory is said to have been erected at Chapel Hill, N.C., in 1831–32. It was destroyed by fire in 1838. Projects for observatories were set on foot at Williams college, Mass., in 1836; at Hudson, O., 1836–37; and for the National observatory at Washington which was actually established by Lieut. J. M. Gilliss of the U.S. navy in 1843–44. The movement was encouraged and in many cases observatories were created by collective financial help. By the efforts of Prof. D. M. Mitchel money was raised for shares in a public company to build an observatory at Cincinnati. The first meeting of stockholders was held on May 23, 1842, and an object glass 11 in. in diameter, which was quite large for that epoch, was procured during the summer. The Litchfield observatory of Hamilton college, New York, was founded by public subscription in 1852. An observatory attached to the University of Missouri in 1853 was afterwards improved by a gift from Dr. S. S. Laws. In 1856, the Dudley observatory, Albany, was established by gifts from citizens of that city, and took its name from the largest donor, Mrs. Blandina Dudley. The Allegheny observatory was founded as an annex to the university in 1860, and was completed in 1867 through the liberality of W. Shand. The Dearborn observatory of the University of Chicago was built in 1864. The Halsted observatory, attached to Princeton university, came into existence in 1866. The Leander McCormick observatory of the University of Virginia (1883), Washburn observatory of the University of Wisconsin (1878), Michigan University observatory, Ann Arbor (1855), and other university observatories are used both for purposes of education and for astronomical research.

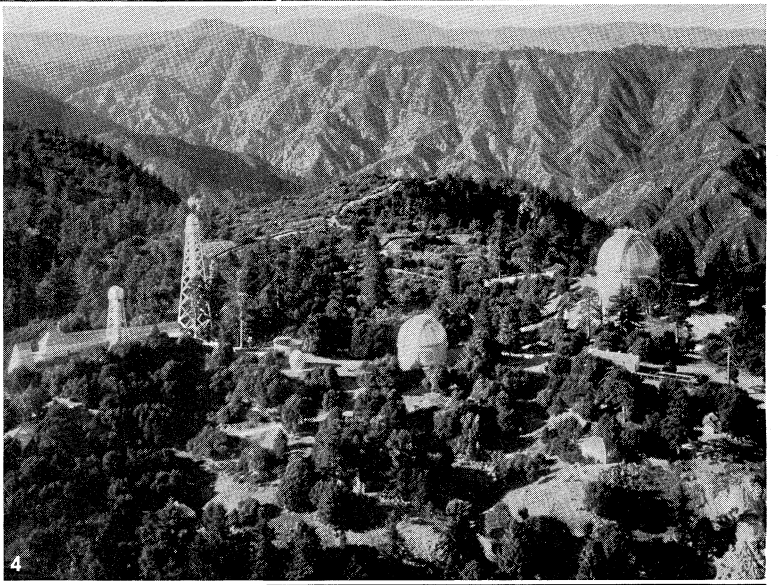
The U.S. Naval observatory at Washington is somewhat akin to Greenwich, since it is a nationally-supported institution for the purposes of the navy. Chronometers and compasses are tested, and the staple astronomical work has been the making of star catalogues and astronomical calculations. One of the most famous of these observatories of the 19th century is that of Harvard college, Cambridge, Mass., whose origin is associated with the

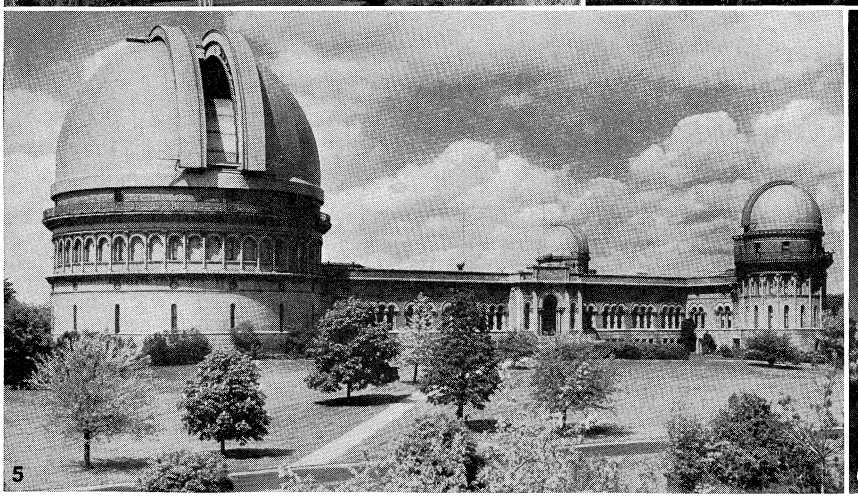
# OBSERVATORY (ASTRONOMICAL)

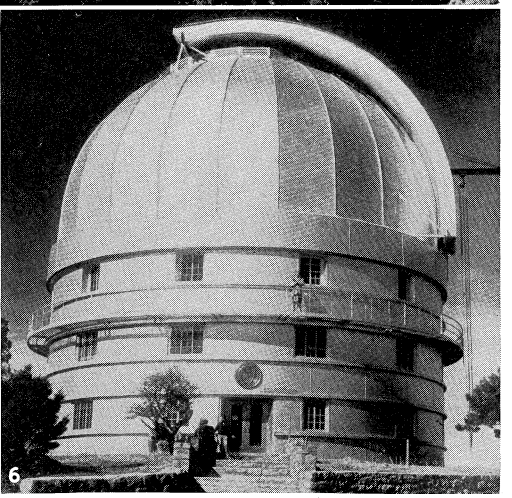










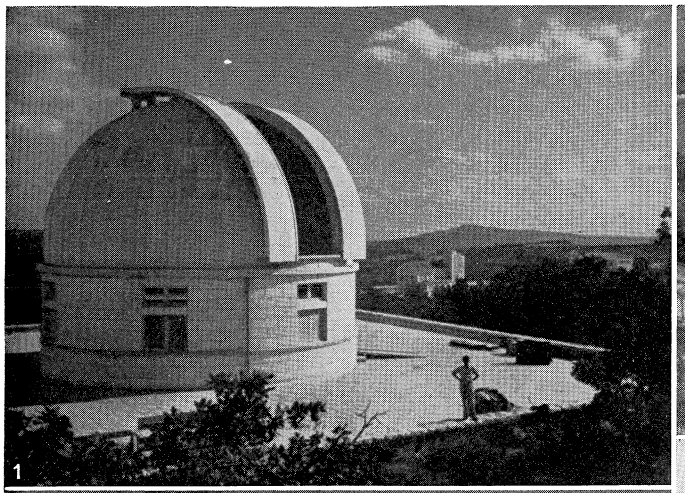


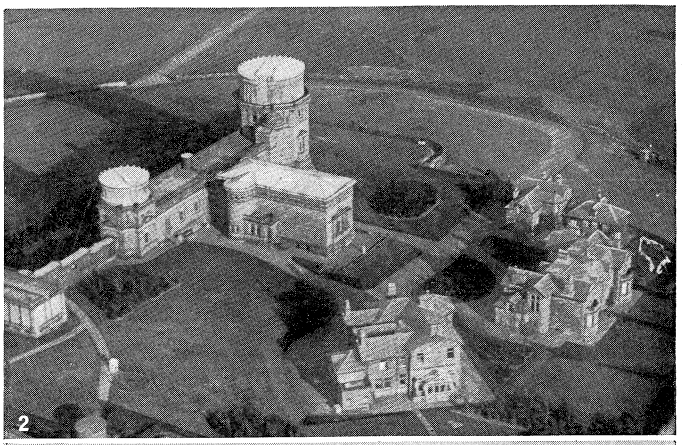
BY COURTESY OF (1) LICK OBSERVATORY, (2) EDISON R. HOGE, (3) THE DIRECTOR, MC MATH-HULBERT OBSERVATORY, (4) FAIRCHILD AERIAL SURVEYS, (5) YERKES OBSERVATORY (6) ELWOOD M. PAYNE

## AMERICAN OBSERVATORIES

1. The Lick observatory on Mt. Hamilton, Calif., completed in 1887–88. The domes on main buildings covering the 36-in. and 12-in. refractors are shown
2. Mt. Palomar observatory in California. Installation of the observatory's 200-in. reflecting telescope was postponed for the duration of World War II
3. The McMath-Hulbert observatory of the University of Michigan. Located near Pontiac, Michigan, and devoted to solar work. The smallest dome houses a 24-in. reflecting telescope. The middle tower contains a coelostat and the tower-type solar telescope with a 30-ft. spectrograph. The highest tower also houses a coelostat and tower-type solar telescope
4. Mt. Wilson observatory, near Pasadena, Calif., established in 1904–05. Its largest reflecting telescope, completed in 1917, has a mirror 100 in. in diameter
5. Yerkes observatory of the University of Chicago, at Williams Bay, Wisconsin, completed in 1897. View from the southwest
6. The W. J. McDonald observatory. Dome of the 82-in. reflecting telescope at Mount Locke, Texas. Founded in 1939 jointly by the University of Texas and the University of Chicago

# OBSERVATORY (ASTRONOMICAL)





BY COURTESY OF (1), (3), (4) YERKES OBSERVATORY, (2) THE ASTRONOMER ROYAL FOR SCOTLAND, (5) THE DIRECTOR, LA PLATA OBSERVATORY

## OBSERVATORIES OVER THE WORLD

1. Dome of the 48-in. reflecting telescope of the Astrophysical observatory near St. Michel, 60 mi. northeast of Marseille, France
2. Royal observatory, Edinburgh, Scotland. On Blackford hill. Established in 1896 in place of an observatory on Calton hill, Edinburgh
3. Office building of the Astrophysical observatory near St. Michel, France
4. General view of the historic building of the Pulkowa observatory in the U.S.S.R., destroyed during the siege of Leningrad in World War II. The Russian government planned to reconstruct the building on the original plans
5. General view of the La Plata observatory at La Plata, Argentina

personality of William Cranch Bond, a member of a Cornish family that emigrated in 1786 and settled in Portland, Me., where he was born in 1789. Bond had great aptitude for scientific research, especially astronomy, and when, in 1837, it was decided to build an observatory for Harvard college, he, though engaged in a profitable manufacturing business, accepted the invitation to take charge. No salary was attached to the office until the year 1846. The original Harvard observatory (Dana House, 1839) and the new observatory (1843–47) were established by public subscription. Under the direction of Prof. E. C. Pickering, the work of this observatory was mainly photometric and spectroscopic. Harvard had no telescope of size, until the new observatory was furnished with a 15-in. equatorial telescope, one of the two largest made up to that time. Later a refracting telescope of 24-in. aperture was added, the gift of Miss Catherine Bruce. It had a branch observatory in Arequipa, Peru, at a high elevation in the Andes, built and largely supported by a sum of money bequeathed for the purpose by Uriah Boyden, but this branch was in 1928 transferred to South Africa. Yale university has an observatory, founded in 1882, which is known for its work on the determination of stellar parallaxes and theoretical astronomy. The private observatory of Percival Lowell at Flagstaff, Arizona, has attracted attention because of the observations of the surfaces of the planets made there, for which it was founded in 1894.

In South America, there had been an observatory at Buenos Aires in 1822, whose period of activity was short, so that the National observatory at Santiago, Chile, may be regarded as the first permanently founded (1856) on this continent. The National observatory of the Argentine republic, established at Cordoba in 1870, has done good service in cataloguing the stars of the southern hemisphere. It now has a 60-in. reflecting telescope. There are other observatories in South America.

The last quarter of the 19th century may be said to have seen the beginning of the era of the large telescope, though the large specula of Parsonstown (6 ft.) and Melbourne (4 ft.) were earlier. The 26-in. refractor at Washington dates from 1873, but a few years later, a telescope was made on a considerably larger scale through the benevolence of James Lick, who died in San Francisco on Oct. 1, 1876. This telescope, with object glass 36 in. in diameter, is set up in an observatory on Mt. Hamilton, Calif. In 1895 a reflector with a silver-on-glass mirror of 36-in. diameter, that had been used by Dr. Common, was presented by Edward Crossley of Halifax, England, and with these two instruments and others, the Lick observatory, dedicated to the University of California, has done much photographic and spectroscopic observation. The size of the larger instrument was surpassed ten years later when, in Oct. 1897, through the efforts of Dr. George Ellery Hale, C. T. Yerkes presented a refracting telescope with object glass of 40-in. aperture, together with a large observatory building containing it on the shore of Lake Geneva, Wis., to the University of Chicago. From that date the Yerkes observatory has been a centre of astronomical activity. The program has been, to a great extent, spectroscopic and astrophysical but micrometrical work on double stars, planets and satellites, has had a place, together with work in connection with the discovery and observation of comets.

## TWENTIETH CENTURY

**Modern Observatories.**—The names and locations of active and inactive observatories are printed yearly in the *American Ephemeris and Nautical Almanac*. The progress of astronomy and the changes in the aim of celestial research have brought changes in the characteristics of observatories. At the beginning of the 19th century the equipment of an observatory may be said to have consisted of a meridian instrument with an equatorial as subsidiary; today the latter is generally the more important instrument, and usually is supplemented by photographic equipment and numerous auxiliary instruments. The routine determination of the positions of sun, moon, the planets and stars, however, still continues as standard work at Greenwich, Washington and other national observatories, since such records are necessary for the maintenance of fundamental astronomy.

Outstanding facts of the 20th century have been the making of large telescopes, in some cases of novel design for special researches, and the establishment of branches to existing observatories in places considered more suitable meteorologically than those of their parents. One important example is the observatory set up in 1904–05 on Mt. Wilson, 5,700 ft. above sea level, near Pasadena, Calif. This observatory was established by Dr. George Ellery Hale as a department of the Carnegie Institution of Washington, D.C. The telescopes are on Mt. Wilson where the observations are made. The library, laboratory, administrative offices, and machine shop are in the valley below. For solar observations two tower telescopes—one 150 ft. high and one 60 ft. high—are used. A revolving mirror known as a coelostat and a fixed mirror on the top of the tower reflect the sun's light through an object glass downwards. In each of the towers the spectrograph is mounted in a well under the tower, the depth of the well being one-half the height of the tower. With these instruments a continuous photographic record of the sun's surface is maintained day after day. This observatory has two large reflecting telescopes, one having a mirror 60 in. in diameter and one with a mirror 100 in. in diameter, the latter being the largest (in 1945) in use in the world. The 100-in. mirror is carried on an equatorial mounting and has an interferometer for measuring the diameters of stars. Optical arrangements for both telescopes provide for the use of different focal lengths in the Newtonian, Cassegrain, or coudé form. Further equipment includes a horizontal solar telescope, a 50-ft. interferometer, a 20-in. reflector, and a 10-in. and a 5-in. photographic refractor.

Another large American observatory is the McDonald observatory of the University of Texas. Established in 1939 on Mount Locke, 6,828 ft. above sea level, in the Davis mountains of Texas, it was organized under a co-operative agreement between two universities, in which the University of Texas built the observatory and the University of Chicago provided the scientific staff. The mirror is 82 in. in diameter and is mounted in a telescope of the cross-axis type, with the tube situated on the side of the polar axis. There is a prime-focus camera used for direct photography at the focus of the 82-in. mirror, without other reflections such as are common in a Newtonian telescope. A second camera provides for direct photography at the Cassegrain focus. Spectrographic equipment includes a slitless spectrograph for low-dispersion, spectra, a spectrograph for use at the Cassegrain focus and a coudé focus spectrograph for high-dispersion spectra. The program at McDonald is mainly spectrographic.

**Mount Palomar Observatory.**—This observatory, which had not yet (in mid-1945) been formally named, was established by the California Institute of Technology to which the International Education board of the Rockefeller foundation made a grant in 1929 for the construction of a 200-in. reflecting telescope. Its operation is under a joint co-operative plan between the California institute and the Mount Wilson observatory of the Carnegie institution. Its location is on Palomar mountain in southern California about 100 mi. distant from Pasadena and Mount Wilson, at an elevation of 5,600 ft.

The dome and building for the great telescope were erected in 1938. The dome, which is 137 ft. high and of about the same diameter, is insulated throughout to protect the telescope from change of temperature when not in operation. The building which supports the dome has three floor levels on which are offices, photographic rooms, air-conditioning units, electrical switchboards and motors, and a large vacuum chamber for aluminizing the 200-in. mirror.

In the centre of the building, rising to the height of the third or operating floor, is the heavy structural steel framework which supports the two pedestals carrying the telescope. The frame or yoke in which the tube rests is rectangular in shape with tubular side members 10 ft. in diameter. A unique feature is the horseshoe-like form of the north member of the yoke which permits the telescope to be turned northward as far as the north pole. The lower surface of this member is accurately faced and serves as the north-bearing surface of the telescope mounting. The tube and frame, weighing a total of about 500 tons, are carried on a system of bearings employing high-pressure oil pads which nearly

eliminate friction and provide remarkable ease of motion.

The tube, 22 ft. in diameter, is designed to avoid angular deflections at its ends and thus to reduce injurious effects of flexure. Uniform driving of the telescope is accomplished by a synchronous motor fed by current generated by a vibrating string standard and suitably amplified. The major portions of the mounting including the oil-bearing system have been erected and tested.

The disk for the 200-in. mirror is a single block of "pyrex" glass cast by the Corning Glass works. It consists of a surface plate about 6 in. thick supported by a network of deep ribs. An opening 40 in. in diameter is cast in the centre of the disk. The mirror, which will weigh about 16 tons when completed, was brought to a spherical form in 1938, more than 5 tons of glass being removed in the process. The slow and difficult work of parabolizing the surface was then commenced but was interrupted by the outbreak of World War II. It was estimated that about one year would be required to complete the parabolization and to figure the auxiliary mirrors to be used in conjunction with it. The finished telescope may be used in any one of three forms: Newtonian or primary focus with a focal length of 55 ft.; Cassegrainian combination, equivalent focal length 267 ft.; coudé combination, equivalent focal length 500 ft.

In addition to the 200-in. telescope under construction, the Palomar observatory has in operation an 18-in. telescope of the Schmidt type and several smaller instruments. A 48-in. Schmidt telescope working at ratio F/2.5 and utilizing a 72-in. concave mirror is also being built. The mirror for this powerful telescope has been completed and the dome erected.

**Other Observatories.**—Canada has a 72-in. reflector at the Dominion Astrophysical observatory established in 1916 at Victoria, B.C., as a branch of the Dominion observatory at Ottawa, which itself had grown from a modest establishment used by the survey department. The telescope has been devoted chiefly to astrophysical work. In 1935 this size was surpassed by the 74-in. pyrex mirror at the David Dunlap observatory of the University of Toronto. In spite of a rigorous climate this reflector has performed admirably.

In the eastern hemisphere an observatory specially adapted for solar investigation was established at Canberra by the federal government of Australia as a link in the chain of such institutions round the world, of which the Solar Physics observatory at Cambridge, England (removed from South Kensington in 1911), and that at Kodaikanal, southern India (which was established as a government institution about 1900 and replaces, in part, the observatory of the government of Madras founded in 1792) are others. A site has been chosen in southwest Africa under the auspices of the Smithsonian institution of Washington for a station for the special study of solar radiation. The Harvard southern station has been transferred from Arequipa in Peru to Mazelspoort, 14 mi. from Bloemfontein, Orange Free State, Union of South Africa. At this station is one of the two 60-in. telescopes in the southern hemisphere. The second is at the National observatory, Cordoba, Argentina. Yale University observatory has set up a southern branch at Johannesburg; and the Detroit observatory of the University of Michigan has done the same at Bloemfontein through the aid of a generous donor. The principal instrument is a refractor of 27-in. aperture, which is used mainly for observing double stars. In the same connection it may be noted that the observatory of the Union of South Africa at Johannesburg which dates under its present name from 1912 (having previously been known as the Transvaal observatory, when it was mainly a meteorological station) has a 26-in. refracting telescope. The observatory at Durban, in charge of the colonial government of Natal, was closed in 1912. The dome and mounting for a 74-in. reflecting telescope of the Radcliffe observatory, Oxford, have been erected at Pretoria, South Africa, but completion of the mirror in England was delayed by war conditions. In 1942 the New National Astrophysical observatory in Tonanzintla, Mexico, was dedicated. Its principal instrument is a 22-in. reflecting telescope of the Schmidt type.

Some notable additions were made to the observatories of Europe in the first quarter of the 20th century. As the climate of Pulkowa was considered to be unfavourable for observation, through the influence of Oscar Backlund, who was its director for 21 years, branch establishments were founded—one at Odessa in 1898 for the astronomy of position; another at Nicolaieff, 75 mi. from Odessa, in 1912, for a similar purpose; and a third at Simeis in the Crimea. Backlund died in 1916, but in the last few years of his life the Russian government sanctioned the expenditure of large sums of money for the purpose of procuring astrophysical and astrophotographic equipment for the new observatories, and during 1926 a reflecting telescope with a mirror one metre in diameter and a photographic refractor with an objective of 41-in. aperture were supplied to the Simeis observatory by a British firm. The observatory of Geneva, which is of very early foundation (1772), now possesses a reflector with mirror, one metre in diameter, the gift of a member of the staff. The Astrophysical observatory at Potsdam, which dates from the year 1878, was enriched by the addition of a 32-in. photographic refractor in the year 1899, and in 1921 a tower telescope was erected in its grounds as a tribute to Prof. Albert Einstein. The building is modern and original.

A tower telescope has been set up at the Royal Astrophysical observatory at Arcetri (Florence) designed for solar observation. A new object glass was supplied to this institution in 1925 by the German government, by way of war reparation. The Italian Royal observatory at Milan, with which the name of Giovanni Virginio Schiaparelli is associated, has been removed and improved by the help of resources similarly supplied. The observatory at Bergedorf, Germany, five miles south of Hamburg, developed out of a local school of navigation in the city of Hamburg. Contributions by the citizens for instruments enabled the school to grow into the Hamburg municipal observatory. In 1906 it was transferred to Bergedorf and the new establishment was completed in 1909. This observatory continues to do star-cataloguing work and supplies a time service for the city, but it is well equipped for astronomical observations of other kinds. It has a reflector, one metre in aperture, and a large twin telescope for photography. This observatory has been specially successful in the discovery of comets.

In Great Britain, the Norman Lockyer observatory, originally the Hill observatory, is on the top of Salcombe hill near Sidmouth, Devon. This observatory, at a height of 560 ft., contains instruments from the observatory of the late Dr. Frank McClean at Rusthall, near Tunbridge Wells, and others used at the government establishment formerly at South Kensington. The spectroscopic classification of stars and the determination of their parallaxes from examination of their spectra, are items in its program.

An observatory of an unusual type was established in France in 1930 by Bernard Ferdinand Lyot of Meudon, who set up his apparatus on the Pic du Midi in the Pyrenees mountains at an elevation of 9,300 ft. Here, with a special refracting telescope and optical system of his own design, he obtained remarkable results in the photography of the solar corona, prominences and spectrum of the corona in full sunlight. Using a cinematograph, he was able to record the movements of the prominences by means of motion pictures. A station of the Harvard College observatory using equipment of a type similar to that of Lyot was established at Climax, Colo., in 1940.

The effect of World War II upon observatories was twofold; in some cases invasion and physical damage ended all scientific work at least temporarily; in other cases reduction in operating staffs and transfer of research to war problems limited normal activity. Many observatories in continental Europe and some in England were damaged, and two great Russian observatories, Pulkowa and Simeis, were almost totally destroyed. The condition of numerous others was still (in 1945) unknown. Plans were initiated, however, for the construction of several new observatories and the expansion of others at the close of the war, especially in eastern and western Europe and some parts of the United States.

BIBLIOGRAPHY.—Dreyer, *Tycho Brahe* (1890). *See* also *Mem. Roy. Ast. Soc.* vol. XIII (1943); Winterhalter, *Washington Observations* (1885); Appendix 1; E. S. Holden, *The Lick Observatory* (1888);

Stroobant and others, *Les Observatoires Astronomiques* (Brussels, 1907); Annual Notes in the *Mon. Not.* R.A.S., and in the *Observatory Magazine.* (H. P. H.; W. S. As.)

**OBSERVER CORPS IN AIR DEFENCE.** At the beginning of world war hostilities in 1914 the necessity of an air raid warning service was hardly envisioned, but it was not long before the importance and desirability of such an observer system became evident in the British Isles to transmit intelligence of enemy aircraft activity. Flash warnings, it was obvious, would prove invaluable for air defence as well as to centres about to be attacked.

At first in Great Britain the defences were limited to telephone reports from police within 60 mi. of London to the admiralty. In 1915 the system was extended to cover England and Wales, with reports telegraphed by local chief constables to the admiralty, which then informed the war office.

In 1916 the war office took charge, a more efficient system of observers was introduced with cordons of 30 mi. outside vulnerable areas, while London was provided with two cordons and coastal posts were established. In the autumn of 1917 the London air defences were reorganized under General Ashmore. The aeroplane patrol improved steadily, but information from the observers as to enemy aircraft operations was not yet quick enough or reliable enough to aid the defensive pilots. German activity early in 1918 being confined to London and its south and east, a new system was devised: the attacked areas were covered with the various units of the defence, coastal posts, squadrons, guns, searchlights and balloon aprons. These units reported activity of the enemy aircraft, the information filtered through certain centres, and thence to a big **map** in headquarters. All report message lines were open during operations and no connections were necessary. Extensive telephone construction work was not completed until after May 19, 1918, the date of the last air raid.

Air defence revival early in 1924 found large vulnerable areas without observers; despite the simplicity of demands by the service, intelligence reports would be lacking on enemy aircraft movements over Great Britain. Therefore the country was covered by watchers in series of observation posts, six to eight miles apart, equipped with complete telephone service. The year 1924 saw the first experimental operation around Cranbrook, the reporting centre. It proved the system feasible, and valuable experience was gained.

In 1925 the system was extended to two zones covering the whole of Kent and Sussex, each zone consisting of a network of observer posts with lines to a local centre, thence to the headquarters of the air defence. Chief constables and special constables manned the equipment and the R.A.F. tested the layout by day and night operations. As a result the organization received the official sanction of the home office and the war office, and by 1927 the system embraced Hampshire, Sussex, part of Surrey, Kent, Essex and half of Suffolk. Observers, without pay, were efficient and alert.

It should be noted that, as of May 1941, observers were being paid at a rate of so many shillings per hour. About 25 posts communicated directly with a centre. In the centre was a large table map, around which sat plotters with telephone receivers open, three posts to each plotter. Incoming reports were plotted on the map while an independent recorder kept a record. Overlooking the control map was a teller who reported to air defence headquarters as the courses appeared and were plotted. Thereafter periodic exercises were held in which bombing and fighting planes sought to reach vital centres. The warning system proved most valuable, transmitting the courses of invaders with certainty and great rapidity.

**United States.**—In the United States no effort toward creating aircraft warning systems had been made until about 1933. Following the great earthquake in Long Beach, Calif., in 1933, when the sheriff of Los Angeles county, Eugene W. Biscailuz, found he was without communications to the stricken area 20 mi. away, an organization for communications in event of disaster was formed. From this evolved the civilian aircraft warning service, utilizing networks of observations and detection of possible enemy aircraft over areas 250 mi. from a central point. These points are known as information centres.

The war beginning in Europe in 1939 intensified the study of this subject in the United States. In total war any object in enemy territory is a military target. The army air corps and allied services conducted several black-outs and enemy air raids, simulating as nearly as possible actual warfare.

These exercises were carried out from 1937 to Jan. 1941. The locations covered were southern California, North Carolina, Alabama and the New England area including the metropolitan area of New York. The first air warning exercise to be conducted in the United States was over 9,000 sq.mi. in southern California and central California in 1937; utilizing the Los Angeles county plan, the tests were carried out by the First Wing G.H.Q. air force and the 63rd antiaircraft artillery for two weeks. March field, corps area headquarters, was the theoretical objective of the enemy.

The information centre for southern California is equipped with every means of communication, including telephone, telegraph, county forestry circuit, Edison power and light telephone circuit, teletypewriter circuits, Santa Fe railroad and Southern Pacific railroad telephone and telegraph circuits, commercial radio and amateur wave lengths in addition to the county short-wave, two-way portable radios under control of the sheriff's office and the army radio network.

A second exercise covering 80,000 sq.mi., comparable to the area of the British Isles and Ireland, was held in 1938. In 1939 the most extensive effort of this type ever attempted in practice involved the entire Pacific coast. Four information centres were set up, two in California, one in Oregon and one in Washington. Army intelligence reported briefly that the service "worked."

From this trial came opportunity to expand further the service. The civil advisory system was inaugurated, operating directly out of the centres, by which information about approaching enemy aircraft was sent directly from communications centre by the sheriff's office to defence industries, aircraft plants, oil, electric and water systems. During exercises, every vital industry within a radius of 250 mi. was given the warning within a few minutes.

In collaboration with the U.S. army, the Los Angeles county system, known as the aircraft warning system, proved so efficient that it was adopted, with slight modifications, by other large concentrations of population in the United States.

For a large scale national emergency, the nation has been divided into four general areas, with communication centres as follows: northeast, Mitchel field, N.Y.; southeast, Tampa, Fla.; southwest, Los Angeles and March field, Calif.; northwest, Spokane, Wash. Into these centres will flow the intelligence from observation post spotters, after first having been directed through filtering stations in each local area.

Under the general plan of the aircraft warning service, the southern California sector information centre was established at Alhambra, a suburb of Los Angeles, with all incoming circuits terminating at this point. There were four outgoing channels of communication, two radio, one telephone and one teletypewriter circuit from Alhambra to March field, U.S. air corps defence headquarters. To inform all officers in the Alhambra information centre simultaneously of the contents of a received "flash message," a translux projector was employed, projecting each message on a moving tape which in turn was reflected on a screen above the operating map. The map itself is a relief scale map horizontally placed and surrounded by a gallery for personnel. It is operated by a control board of 300 individual push buttons for lighting up the courses of invading aircraft.

The purposes of the test were to co-ordinate the communication systems of the various agencies comprising the aircraft warning service; to train the observers in the proper procedure for transmission of messages, identification of aircraft, and to increase the speed of transmission; to attempt to utilize the railroad communication systems; to test the area alert control; to determine the feasibility of the use of the statewide teletype system for the purpose of warning centres of population; to train per-

sonnel in the information centre for increased efficiency in evaluating the messages received and the transmitting of information to proper authorities; and to test the system for exchange of information with the northern California sector.

Two hundred and seventy-seven observer stations were established for the exercises. A printed pamphlet covering essential instructions with blank message forms had previously been forwarded to each observer by mail.

The four outgoing circuits to March field were army radio, Edison radio, Santa Fe railroad telephone and the joint Edison-Nevada-California-Los Angeles county forestry teletype. The telephone circuit was not used during the exercise, all traffic being dispatched over the teletype or radio circuits. To these has been added a circuit direct from the sheriff's office in downtown Los Angeles to the vulnerable industrial plants.

A complete duplication of the Alhambra information centre has been installed in the sheriff's office so that all messages from all agencies reaching Alhambra are simultaneously received in downtown Los Angeles. In addition, all voice messages are recorded on wax cylinders, that they may be immediately checked.

The southern California sector map, 8x12 ft., utilized a red light for each observation post, a green light for the location of each sheriff's deputy office in southern California. The control board was equipped with 300 two-way keys, one side for eight volts, and the other for four volts. Potential for the lights was furnished by a transformer of 110/8/4 volts.

The alert control plan was designed for the specific function of alerting observation posts upon the determination by the operations officer of the probable course to be followed by the attacking planes.

In this plan the southern California sector was divided into subsectors, each designated numerically. This subdivision was carried out to correspond with the arrangement of the communication systems involved in the exercise. Certain control points were established and given instructions on alert procedure. The alert signal of · · · · · · (interval) · · · — · · · (interval) · · · — · · · was transmitted over the various communication circuits by the control point. The observer upon receipt of the alert signal was not required to acknowledge, but was requested to be on the alert for the succeeding 15 minutes.

Prior to the 1939 exercises, a communication test was held, the purpose of which was to check the various methods of communication of the observers in the field. A type flash message was furnished each observer with the instructions mailed to him, and he was requested to report this message to the information centre at a certain specified time on a certain date. In general the reports were received on time and the communications net functioned in an efficient manner.

Incoming messages from the various observation posts, coming over telephone, teletype or the radio, were duplicated, and then stamped in the time clock. One copy was then given to the operator of the visual teletype machine; the other copy given to the dispatcher who evaluated the contents. If important, the station number was sent to the electrical map operator for plotting, and then relayed to March field.

The civil advisory circuits are those communication circuits to be utilized primarily in transmitting a warning from the message centre to the civil authorities, on the approach and possibility of an air raid by hostile aircraft. The system is formulated on the premise that the civil authorities will be responsible for all precautionary measures to be taken in event of an air raid insofar as the civilian population is concerned, such as blacking-out, light diversity, traffic regulation, audible signals, fire suppression, evacuation, etc.

Six areas in the state of California are large centres of population. It is these which are of primary concern in the transmitting of a warning in adequate time, to reduce the possible civilian casualties. For this purpose are commandeered the existing communication facilities now operated by the law enforcement agencies. These circuits are teletype, and are operated by the following organizations: state of California, department of penology, division of criminal identification, county of Los Angeles, sheriff's office; county of Riverside, sheriff's office, the latter being operated by the Bell (telephone) teletypewriter service. The state of California teletype system comprises 11 circuits, with three control points: Los Angeles, San Francisco and Sacramento, state capital.

This system is looped through the sheriff's office, police department and department of motor vehicles. On this system any one city may be notified singly or a number simultaneously, thus simplifying the problem of transmitting intelligence.

Sheriff's office teletype circuit links 23 cities, and thus interposes an excellent civil advisory circuit, inasmuch as the sheriff of each county is the senior law enforcement officer of both the incorporated cities and the unincorporated area of the county which he represents. Furthermore, 12 major cities in the state are served direct to their respective police departments by the state teletype system, while four widespread offices of the department of motor vehicles are connected by the same circuit.

In Los Angeles county, in addition, the sheriff's office has a separate teletype system over leased wires to 12 substations located within the county of Los Angeles, and this is also interconnected with the police departments of many incorporated cities within the county. This system is operated independently of the state system, and notification may be transmitted to any one city separately, or group of stations simultaneously.

It has been found that the high speed transmission of the teletype and the flexibility of interconnection, as well as the ability to transmit to an individual or a group of cities simultaneously, constitutes an ideal intelligence system between the message centre of the aircraft warning service and the law enforcement agencies.

Thus the army is required to contact only one point upon determination of the possible objective, in order to warn civil authorities.

In the Los Angeles area, centre of the great aeroplane manufacturing plants, it is highly desirable to warn the factories of the approach of enemy aircraft. These widely scattered plants are served by short-wave radio, as are the many airports in the vicinity.

To effect a quick, efficient warning service, the sheriff's office has organized the "Sheriff's Los Angeles County Communication reserve," a volunteer organization operating two-way radio on a frequency of 29·900 kilocycles and including the Civil Aeronautics administration, with its air-traffic communication facilities, covering several airports and commercial air liners in flight. This communication is handled direct from the aircraft warning service information centre, utilizing portable transmitter equipment, and results in sending warnings in an average elapsed time of 30 sec., which is practically instantaneous.

It is intended to mobilize and organize a substantial number of power and pleasure craft along the coast, equipped with suitable short-wave transmitters for extending observation and warning service some distance at sea, and already (1941) the preliminary work has been accomplished.

The fire department of the city of Los Angeles has established an air raid alert signal. This signal, with an all-clear signal, was transmitted to the various fire houses over the independent fire alarm system, from the central fire alarm bureau in 1939, probably the first time such a system has been utilized for the purpose in the United States.

An aircraft warning experiment was held in the New York-New England region from Jan. 21 to 24, 1941 under the direction of the GHQ air force. A corps of civilian observers, organized under the auspices of the American Legion, worked with the army. The communications network was operated by the American Telephone and Telegraph company and its affiliated companies.

The test was excellently co-ordinated and proved the feasibility of the plan which the army was formulating. As a result of the test an orientation and indoctrination course was held at Mitchel field, L.I., from March 25 to April 13, 1941, during which all knowledge on the subject was weighed and explored with

a view to setting up a fixed and standardized aircraft warning service.

On April 17, 1941 the bureau of public relations of the war department by press release gave out further information on the subject of an aircraft warning service:

Five hundred thousand civilians will be enrolled as volunteer observers to constitute a nationwide force of minutemen to co-operate the four air forces of the army air corps in warning of the approach of enemy aircraft. This move to systematize the air warning defences of the nation is another step in real preparedness for a possible emergency. It is being taken now in recognition of the fact that the active co-operation and collaboration of the general public are essential in the air phase of defence. Modern air defence is divided basically into active and passive phases. Included in the active phase is the "defensive" attack, carried out by fighter planes. It embraces also the network of civilians giving the warnings of enemy aircraft.

To obtain information of the movements of hostile air threats, to attack these threats in the air, to provide simultaneous protection of all sensitive home areas, will be the objectives of these agencies of active defence. Co-operating in a combined effort, they will make possible a positive, aggressive and co-ordinated counterblow to sweep enemy fighters and bombers from the skies. Close liaison will be maintained with the agencies engaged in passive defence. To them, also, warnings of approaching enemy aircraft are vital. They will warn the civilian population and industry, warn home guards, police, fire departments, antigas and medical workers to stay on the alert at their stations. They will enforce black-outs of lighting and radio broadcasting which might guide enemy aircraft to their targets.

To know where the attacking air force is poised, where it strikes and where it may be expected to strike, is essential in hitting back. That is where the average man and his wife come in. Organized in their home communities and manning posts for watching and listening, they will be minutemen who will call "army flash" into their telephones. That warning, as well as the information brought back by friendly observation planes, will send fighter commands, anti-aircraft artillery and balloon barrage squadrons into action.

Patriotic organizations like the American Legion and their women's auxiliaries, various elements of federal and state governments, coast guard, forest fire wardens, weather observers and the civilian conservation corps will be included in the organizations that will cover the nation in grid fashion. In time of attack they would stand watch on the roofs of their homes, in the towers of churches and skyscrapers, on prairies, farms and fields and beaches.

They would watch for the speck—at night they would listen for the hum of a motor—that may be an enemy plane. The "army flash" would go to the interceptor commands whose commanders would fling their fighting planes into aerial combat. The flash would go also to the antiaircraft artillery, the balloon barrage men, to the air raid precaution workers and to the civil authorities.

Public utilities—telegraph, telephone, railway and light and power systems will play an enormous part in the warning system, for it is over their communications that observers will send their flashes.

The American Legion manifested a deep interest in the subject of aircraft warning. This organization has furnished personnel and funds to co-operate in nearly all of the tests which have thus far been held by the army air corps. Early in 1941, the American Legion sent a delegation of three of its members to London, England, to study at first hand the aircraft warning system now in use by the British. As a result of this visit the American Legion was prepared to compile a manual on this subject for general circulation, but suspended such project when requested to do so by the war department.

On May 20, 1941, an executive order was issued by the president of the United States creating the office of civilian defence. This body will function as a centre for the co-ordination of federal civilian defence activities which involve relationships between the federal governments, territories, insular possessions, the district of Columbia and their respective defence agencies.

Within this office will be set up a board for civilian protection to be composed of the director of the office of civilian defence and a representative of the war department, navy, justice, federal security agency and such others as the president may designate. The council of the state governments, the American Municipal association and the United States conference of mayors are each invited to nominate a member for the board. The director of the office of civilian defence, with the assistance of the board for civilian protection, will study and plan measures designed to afford adequate protection of life and property in the event of emergency, and sponsor and carry out such civil defence programs, including the recruitment and training of civilian auxiliaries and disseminate to appropriate officials of the federal government and state and local governments such information concerning civil defence measures as may be necessary to meet emergency needs. (H. E. Hy.)

**OBSIDIAN,** a glassy volcanic rock of acid composition. Rhyolitic lavas frequently are vitreous, and when the glassy matter greatly predominates and the crystals are few and inconspicuous the rock becomes an obsidian; the chemical composition is essentially the same as that of granite; the difference in the physical condition of the two rocks is due to the fact that one consolidated at the surface, rapidly and under low pressures, while the other cooled slowly at great depths and under such pressures that the escape of the steam and other gases it contained was greatly impeded.

Only a few obsidians are entirely vitreous; usually they have small crystals of felspar, quartz or a ferromagnesian mineral, and when these are numerous the rock is called a porphyritic obsidian.

These crystals have, as a rule, good crystalline form, but the quartz and felspar are often filled with enclosures of glass.

All obsidians have a low specific gravity (about 2·4) both because they are acid rocks and because they are noncrystalline. Their lustre is vitreous except when they contain many minute crystals; they are then velvety or even resinous in appearance. Black, gray, yellow and brown are the prevalent colours of these rocks.

In hand specimens they often show a well marked banding which is sometimes flat and parallel, but may be sinuous and occasionally is very irregular, resembling the pattern of damascened steel.

When crystals are present they generally have their long axes parallel to the fluxion.

Even when conspicuous and well formed crystals are not visible in the rock there is nearly always an abundance of minute imperfect crystallizations (microlites, etc.). They are often so small that high magnifications may be necessary to ascertain their presence. Some are globular and others are rod shaped; they may be grouped in clusters, stars, rosettes, rows, chains or swarms of indefinite shape. In banded obsidians these microlites may be numerous in some parts but few or absent in others. The larger ones polarize light, have angular outlines like those of crystals, and may even show twinning and definite optical properties by which they can be identified as belonging to felspar, augite or some other rock-forming mineral.

These microlites or crystallites (*q.v.*) show that the glassy rock has a tendency to crystallize, which is inhibited only by the very viscous state of the glass and the rapidity with which it was cooled. Another type of incipient crystallization which is excessively common in obsidian is spherulites (*q.v.*), or small rounded bodies which have a radiating fibrous structure. They are of globular shape, less frequently irregular or branching, and may be elongated and cylindrical (axiolites). In some obsidians from Teneriffe and Lipari the whole rock consists of them, so closely packed together that they assume polygonal shapes like the cells of a honeycomb. In polarized light they show a weak gray colour with a black cross, the arms of which are parallel to the crosswires in the eyepiece of the microscope and remain stationary when the section is rotated.

Often bands of spherulites alternate with bands of pure glass, a fact which seems to indicate that the growth of these bodies took place before the rock ceased to flow.

As cooling progresses the glassy rock contracts and strain phenomena appear in consequence. Porphyritic crystals often contract less than the surrounding glass, which accordingly becomes strained, and in polarized light may show a weak double refraction in a limited area surrounding the crystal. Minute cracks are sometimes produced by the contraction; they are often more or less straight, but in other cases a very perfect system of rounded fissures arises. These surround little spherules of glass which are detached when the rock is struck with a hammer. There may be concentric series of cracks one within another. The minute globular bodies have occasionally a sub-pearly lustre, and glassy rocks

which possess this structure have been called perlites (*q.v.*).

Although rocks wholly or in large part vitreous are known from very ancient geological systems, such as the Devonian, they are certainly most frequent in recent volcanic countries. Yet among the older rocks there are many which, though finely crystalline, have the chemical composition of modern obsidians and possess structures, such as the perlitic and spherulitic, which are very characteristic of vitreous rocks. By many lines of evidence we are led to believe that obsidians in course of time suffer devitrification, in other words they pass from the vitreous into a crystalline state, but as the changes take place in a solid mass they require a very long time for their achievement, and the crystals produced are only of extremely small size. A dull stony-looking rock results, the vitreous lustre having entirely disappeared, and in microscopic section this exhibits a cryptocrystalline structure, being made up of exceedingly minute grains principally of quartz and felspar. Often this felsitic devitrified glass is so fine-grained that its constituents cannot be directly determined even with the aid of the microscope, but chemical analysis leaves little doubt as to the real nature of the minerals which have been formed. Many vitreous rocks show alteration of this type in certain parts where either the glass has been of unstable nature or where agencies of change such as percolating water have had easiest access (as along joints, perlitic cracks and the margins of dikes and sills). Obsidians from Lipari often have felsitic bands alternating with others which are purely glassy. In Arran there are pitchstone dikes, some of which are very completely vitreous, while others are changed to spherulitic felsites more or less silicified.

Obsidians occur in many parts of the world along with rhyolites and pumice. In Europe the best-known localities for them are the Lipari Islands, Pantellaria, Iceland and Hungary. Very fine obsidians are also obtained in Mexico, at the Yellowstone Park, in New Zealand, Ascension and in the Caucasus. Included in this group are some rocks which are more properly to be regarded as vitreous forms of trachyte than as glassy rhyolites (Iceland), but except by chemical analyses they cannot be separated. It is certain, however, that most obsidians are very acid or rhyolitic. The dark, semi-opaque glassy forms of the basic igneous rocks are known as tachylytes. The typical obsidians exhibit the chemical peculiarities of the acid igneous rocks (viz., high percentage of silica, low iron, lime and magnesia, and a considerable amount of potash and soda) as shown in the following table.

| | I. Yellowstone Park | II. Iceland | III. Mexico |
|---|---|---|---|
| $SiO_2$ | 74·70 | 75·28 | 73·63 |
| $A_2O_3$ | 13·72 | 10·22 | 14·25 |
| FeO | 0·62 | .. | 1·80 |
| $Fe_2O_3$ | 1·01 | 4·24 | .. |
| CaO | 0·78 | 1·81 | tr. |
| MgO | 0·14 | 0·25 | 1·42 |
| $K_2O$ | 4·02 | 2·44 | 4·39 |
| $Na_2O$ | 3·90 | 5·53 | 4·61 |
| $H_2O$ | 0·62 | 0·23 | .. |

(J. S. F.)

**OBSTETRICS** (Midwifery). Obstetrics, together with Gynaecology (*q.v.*) and Paediatrics cover the greater part of the reproductive cycle (*i.e.*, from the parents of one generation to those of the next), the portion falling strictly within the sphere of Obstetrics being from conception through pregnancy, labour and lying-in up to the time of the return of the mother to her ordinary duties. The start may be made even before conception for the obstetrician may be called on to advise as to the marriageability of a woman, *i.e.*, of her capacity to be a wife and mother, because of some disease or deformity of the genital organs or bony pelvis, or general disease, as of the heart, lungs or elsewhere, on which his experience of the effects in pregnancy and labour will be required. Midwifery is associated in the minds of the public with attendance at a confinement, and the woman who engages a doctor thinks of his duties as seeing her safely through the crisis of childbirth and relieving her, so far as the resources of medicine will allow, of the pains associated therewith.

**Labour.**—Labour comes on about 280 days after the first day of the last menstrual period and is divided into three stages. The first and longest is occupied by the opening up of the mouth of the womb; the second stage, lasting usually two hours or less, represents the time from full dilatation to the expulsion of the child; the third stage, half an hour or less, covers the period of the expulsion of the afterbirth. The motive power in all stages of labour is the contractions of the strong muscular wall of the womb, aided in the last two stages by the bearing down efforts of the abdominal muscles. The "pains of labour" are caused by the powerful colic-like contractions of the womb with, towards the end, the stretching of the passages as the child is being born.

The first stage may last even to days without harm to mother or child so long as the waters are unbroken, as the water-bag is an efficient protection to both, but danger to the child especially may result in those cases of premature breaking of the waters in which the presenting part does not come down and block the escape of all the water. The "dry" labour in which the water is lost is always a difficult one.

To be normal the head of the child, and the top of the head (vertex) should come first, that is, present, and does so in over 95 per cent. of cases and its position should be such that the hind part of the head is born before the forehead. The labour is often longer and more difficult when the back of the child is backwards in the womb.

The chief difficulties arise from other presentations than those of the top of the head,—sometimes the face presents (once in 300 cases) and may cause a long and difficult labour, and more rarely the brow (1 in 1,200), a still more difficult presentation, as the passage of a full-time child is not possible until the presentation is altered to a face or a vertex. The most frequent abnormal presentation is a breech, when the buttocks come first and the head last, as it occurs about 1 in 40 cases. It, however, is not more serious to the mother than a vertex presentation, but the child is more likely to be still-born, being suffocated owing to the head coming last. Another, and happily rare, malpresentation is the cross-birth (1 in 250) in which the child lies across the passage, as if not changed, it completely obstructs the birth. Twins occur about once in 80 births, and add slightly to the risks, because the children are often small and the labour premature and slow with the first child. The second child is usually born easily because the passages are already dilated. A single unduly large child is much more likely to give rise to difficulty; it is always unfortunate if the child weighs over 10lb.,—the more desirable weight is one of 6 to 7lb.

**Complications.**—Among the more serious complications are those giving rise to (1) haemorrhage during birth (commonly due to misplacement of the after-birth which is in front of the child and to early separation of the placenta), (2) convulsions (eclampsia), occurring usually in women with kidney disease and (3) labour obstructed by deformity of the pelvic bones narrowing the bony canal through which the child must pass or by tumours blocking the canal. In the marked degrees of pelvic deformity the only chance of obtaining a living child is by Caesarean Section (*q.v.*). Delivery by the natural passages in such cases may be possible only by destroying the child and the risk of injury to, and death of, the mother in these destructive operations may be as great as the Caesarean operation.

Much the most common cause of failure of the woman to deliver herself is due to relative or absolute weakness of the uterine contractions (pains). Relative, if in a first confinement the soft passages, and especially the outlet, are rigid, or in any confinement in which owing to the size of the child or its position or the narrowness of the passages, some extra effort on the part of the womb is required and is not forthcoming. Absolute weakness is present in those cases in which no additional effort is called for and yet there is insufficient power to expel the child without great prolongation of labour.

Feeble action of the womb may be due to loss of the stimulus of the dilating bag by early breaking of the waters; if the presenting part comes down to take the place of the bag, all will go well,

but if it does not there is nothing to prevent all the waters dribbling away and a dry labour of this kind is always difficult, and the child may be stillborn. A loaded bowel or a full bladder also interferes with uterine action and these viscera must be kept empty. Fatigue is a very important factor in this regard for the womb of the tired out woman will not function efficiently. Anxiety, lack of confidence in her own powers and long continued pain act in the same way and hasten the production of fatigue. The relief of pain, the obtaining of rest and general management of the patient is, therefore, a most important part of the medical attendant's duties. The problem is not an easy one because sedatives, anaesthetics and means of relieving pain also tend to lessen, at any rate, for a time, the muscular activity of the uterus.

**Lying-in Period.**—During the lying-in period, rest and quiet are essential, particularly for highly-strung women, but rest to mind more than to body. The patient should sit up in bed and move about so as to promote free escape of the discharges. She is not an ill woman and is kept in bed to allow time for healing and the return of the enlarged and relaxed structures to their pre-pregnancy state. It is useless to say how long the woman should remain in bed or in her room; every case must be decided as an individual problem;—a longer stay being required by those who have had complications, who are worn out and require rest, sleep badly or are of a nervous and over-anxious temperament; a shorter by those in whose cases everything has been straightforward, who sleep well and are of an easy-going nature and do not worry. Much can be done in the way of massage and bed exercises and after rising by Swedish exercises to restore the abdominal and pelvic muscles,—a most important measure in preserving the figure and lessening the chances of dropping of the abdominal viscera and womb. The chief danger during the lying-in period is that of puerperal fever (*q.v.*) and its sequelae.

**Preventive Obstetrics.**—In the last 20 years a striking change has occurred in the science of obstetrics and its practice, chiefly as the result of its invigoration by the spirit of preventive medicine.

The term "preventive medicine" (*q.v.*) does not connote any special creed or peculiar doctrine in medicine. Its first object is to seek out the causes of disordered function and remove them before they can become operative and, in the second place, when these causes are unknown, to detect the early signs of deviation from normality and restore the normal before trouble arises. The maintenance of natural function in all bodily systems is its aim.

If obstetrics is regarded from this point of view the difference between the new and the old practice will become obvious. Its immediate purpose will be to secure normal reproduction by detecting and removing all known causes of disorder of function and by observing the healthy pregnant woman from conception onwards to discover any sign of departure from the normal. Though a physiological state, pregnancy imposes a strain on the efficient working of every system of the body, and the thorough examination of the state of health of mind and body of the woman early in her pregnancy and further observation to see how she is standing the test seem but reasonable precautions. Apart from those who have some organic weakness and may break down under the strain, there are disorders of function that may develop in those previously of sound physique. A special strain falls on the excretory organs, and the kidneys and the liver may be affected and lead to acute or chronic disease. Hence the need for the routine and repeated examination of the urine. The good health of the mother throughout childbearing increases her resistance to infection (*e.g.*, puerperal fever) and her efficiency in the rearing of her family.

The care of the pregnancy itself is likewise a matter of greater concern than in the older obstetrics, not only because of the loss of prospective life, but because miscarriage is a prolific cause of operative interference, during or after its occurrence, and of infective and other diseased conditions of the reproductive tract and thus of subsequent disability. Premature labour results in the birth of weakly infants difficult to rear and is a prominent factor in the persistent high mortality among new-born infants. Another important object of the supervision of the pregnant woman, that of foreseeing and avoiding difficulties and complications during labour, provides the simplest illustration of the changed outlook in obstetrics.

The usual custom of a generation ago was for the woman to retain her doctor for attendance on her confinement and for the doctor to do little more than note the expected date on which his services might be required. Unless consulted by the patient because of some disturbance of health, he might not see her again until summoned at the onset of labour. He then made a thorough investigation to see if all was straightforward or if there was any malpresentation or other difficulty, and was prepared to do his best to remedy any untoward condition that might be present or arise later, often being exceedingly ingenious and resourceful in so doing. His obstetric training as a student had been directed largely toward teaching him the management of normal labour, the emergency treatment of abnormal presentations and obstructions to the passage of the foetus through the birth canal and other complications during labour, and his reputation as an accoucheur was largely determined by his capacity to cope with emergencies.

**Modern Methods.**—The training of the modern student is conducted on other lines, and whenever a complication occurs the first question discussed is, "Could this have been foreseen?" and if so, the next question is, "What should then have been done?" and a comparison of the case as he has seen it with what it might have been had the emergency been anticipated is used to impress on him that the sole criterion of sound obstetrics is the securing of natural parturition and the prevention of unexpected difficulties and complications so far as the present state of our knowledge allows.

To avoid difficulties in labour, examination is begun about six weeks before the expected date of confinement in order to determine that the child is presenting normally and that there is sufficient accommodation in the bony pelvic canal to allow of its easy passage. This examination is repeated two or three times to make sure that no change has occurred in the presentation and position and that the child does not become unduly large to pass readily. For the most part these matters can be determined with a fair degree of accuracy by the ordinary methods of obstetric examination, but in difficult and special cases examination under anaesthesia and by X-rays may be required. Should it be discovered that even at six weeks before full time there will be difficulty in the child being born by the natural passages, because of rickety or other deformity of the pelvic bones, the question arises whether it is better to resign all hope of the delivery of a living child by the natural passages and perform Caesarean section or to induce labour and learn if the natural powers can effect the delivery of a small and premature infant.

If there does not appear to be any obstruction at the time of the first examination but at a later one there is evidence of a tight fit, labour should be brought on then to avoid the risk of the child becoming too large to be born without difficulty. By eliminating difficulties due to disproportion in size between the child and the mother's pelvic canal and such malpresentations as those previously mentioned most of the serious difficulties in labour can be obviated in some way or other. The change in presentation and position of the child can be effected by manipulation through the abdomen, if done before the child is too large to be moved readily, and in favourable cases and under anaesthesia sometimes even up to and after the onset of labour, but if left until the waters have broken or labour is advanced, requires internal operative procedures with their additional risks of injury and infection.

In these instances the cause of difficulty can be anticipated and removed before labour begins, but there are also many conditions of which the cause is unknown so that the obstetrician must fall back on the second line of defence, that of discovering the earliest signs of disturbance, taking them as a warning of danger ahead and making the best possible dispositions. Premature detachment of the after-birth commonly shows itself by haemorrhage and all pregnant women whilst under supervision are warned to report at once any bleeding, so that immediate measures may be taken to

lessen the chances of serious consequences. Albuminuria, discovered by frequent examination of the urine, convulsions (eclampsia), excessive vomiting and visual disturbances are warnings of dropsy.

Pre-maternity supervision is in its infancy, but with experience of its working much more will be possible in the way of prevention. Many of its problems have scarcely begun to be worked out and an example of one of the most outstanding of them is worth a little consideration as an example of the problems that obstetrics has to face.

**A Widened Outlook.**—When these wider questions are looked into, there is little ground for complacency among those responsible for the obstetric practice of the country. There has been no reduction in maternal mortality equivalent to the drop in the general death-rate or to the remarkable fall in the infantile mortality, which has been halved since the beginning of this century. Further analysis of the registrar-general's figures in England and Wales shows that septicaemia, a form of blood-poisoning practically eliminated from general surgery by the antiseptic and aseptic technique, is still too prevalent and still causes (as puerperal sepsis) about a third of the deaths in childbearing. The annual rate of maternal deaths per 1,000 live births registered in England and Wales is a little under four. In the bad years immediately after the War, the rate was over four per 1,000. In the United States (1920) the rate was 7·99 per thousand. This may not appear large but means that about 3,000 women in the prime of life die in childbearing with the loss of their maternal care to many more young children, and of these mothers over 1,000 die from puerperal sepsis, a preventable disease. Its prevention is a more complicated matter than, and a somewhat different problem from, that of surgical sepsis, because septic organisms may be present in the lower genital tract and spread upwards and into the blood stream, apart from any question of failure of aseptic technique on the part of the attendant.

The statistics of all maternity hospitals show that fever in childbed increases with all complications and difficulties calling for internal manipulation, all of which tend to the introduction or upward spread of infective organisms. The more prolonged and the higher up the tract the manipulation, the greater is the incidence of fever. By far the commonest operative interference is delivery by the forceps because it is advocated by many merely in order to shorten the patient's suffering. Instead of trying to secure natural delivery in cases of weak uterine action, a substitute for the uterine power is adopted in the shape of the muscular power of the attendant exerted through the obstetric forceps. The causes of weak uterine power are difficult to determine and often impossible to foresee, but here is a direction in which investigation is necessary.

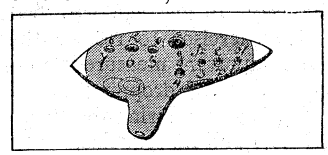
Particularly calling for solution are the questions, how far modern social conditions have lessened the power of the woman of to-day to stand the hardship, fatigue and mental and physical strain of child-birth and rendered her less capable of completing the expulsion of the child naturally than the mothers in the days before anaesthesia and frequent forceps delivery; what are the factors tending to produce this lessened capacity; and, how far are they removable?

The obstetrical centre of gravity has thus been shifted backwards from the care of labour to the supervision of pregnancy and a wider outlook over the reproductive cycle is taken so that the part played by obstetrics is seen as but part of the wider subject that is concerned with securing the health of the new generation at the minimum of cost to the old. The pre-maternity supervision looks forward to the nursing of the child and the rearing of the family. It anticipates the natural feeding of the infant by removing all causes that may interfere with breast feeding. It has an educational side and endeavours to inculcate sound principles of hygiene in the preparation for, and the care of, the babe when born, because success in this direction will mean a better start for the new generation. The observation of the developing child falls to paediatrics and the two subjects, as maternity and child welfare, have become a duty and charge to local health authorities, and as such are well known to the public.

In conclusion a tribute should be paid to the late Dr. Ballantyne of Edinburgh, as the advocate of pre-maternity supervision and the pioneer of the antenatal clinic, which more than anything else has served to further the permeation of obstetrics by the spirit of preventive medicine. *See* J. S. Fairbairn, *Gynaecology with Obstetrics* (1926). (J. S. Fa.)

**OCALA,** a city in the interior of Florida, U.S.A., 100 mi. S.W. of Jacksonville; the county seat of Marion county. It is on federal highway 441; has a city-county airport; and is served by the Atlantic Coast Line and the Seaboard Air Line railways. Pop. (1940) 8,986. The city is the centre of mineral deposits: lime, phosphate, fuller's earth, kaolin and chert. There are also a crate-box-hamper factory, an excelsior mill, lumber yards, creamery, meat and fruit packing plants and building material plants. Five miles east is Silver spring (so called from the remarkable transparency and refractive powers of its waters) which has a circular basin 300 ft. in diameter and 65 ft. deep, and discharges over 300,000 gal. a minute, its outflow forming a navigable stream 9 mi. long, emptying into the Oklawaha river. Ocala was settled in 1845 and chartered as a city in 1868. It has a council-manager form of government. The name is Seminole, meaning fertile soil.

**OCAÑA,** a town of central Spain, in the province of Toledo; on the extreme north of the tableland known as the Mesa de Ocaña, with a station on the railway from Aranjuez to Cuenca. Pop. (1940) 9,806 (mun., 9,953). Ocaña is the Vicus Cuminarius of the Romans, and was the dowry that El Motamid of Seville gave his daughter Zaida on her marriage with Alphonso VI of Castile (1072–1109).



BY COURTESY OF CARL FISCHER, INC., N.Y.
THE OCARINA, A WIND INSTRUMENT POPULAR AMONG STREET PLAYERS

**OCARINA,** a wind instrument invented in Italy, which must be classed with musical toys or freaks. It consists of an earthenware vessel in the shape of an egg with a pointed base and perforated with holes and a tube like a spout in the side, which contains the mouthpiece. In America, it is sometimes called a "sweet potato."

**O'CAROLAN** (or CAROLAN), **TURLOGH** (1670–1738), Irish bard, son of John O'Carolan, a farmer, was born at Newtown, near Nobber, Co. Meath. At eighteen he became blind from smallpox. He received special instruction in music, and used to wander with his harp round the houses of the surrounding gentry, mainly in Connaught. The number of Carolan's musical pieces, to nearly all of which he composed verses, is said to exceed two hundred. He died on March 25, 1738, and was buried at Kilronan.

His poetical *Remains* in the original Irish, with English metrical translations by Thomas Furlong, were printed in Hardiman's *Irish Minstrelsy* (1831). Many of his songs were preserved among the Irish MSS. in the British Museum.

**OCCAM, WILLIAM OF** (*c.* 1300–1349), English schoolman, known as *Doctor invincibilis* and *Venerabilis inceptor,* was born at Ockham, Surrey, and after joining the Franciscans, studied from 1312 to 1318 at Merton college, Oxford, where he taught until 1324, when he was summoned to Avignon to account for some of his doctrines. While he was confined to his convent, in 1326, John XXII. ordered various theses from his works to be examined by the masters of theology, but his works were not actually condemned. Two years later his championship of the Spirituals brought him into a further conflict with the pope, and as a result, he and Michael of Cesena, general of the order, joined the emperor Louis of Bavaria who was at that time in contest with the papal curia. It was for Occam's share in this controversy that he was best known in his lifetime. Michael of Cesena died in 1342, and Occam, who had received from him the official seal of the order, was recognized as general by his party. He probably died at Munich in 1349, having tried to be reconciled with the Church after the death of the emperor.

Occam was one of the most interesting figures in the great contest between pope and emperor, which laid the foundation of modern theories of government, in the disintegration of scholasti-

cism and in the rise of theological scepticism. In the *Opus nonaginta dierum* (1330) (written in reply to John XXII.'s libellus against Michael of Cesena), and in its successors, the *Tractatus de dogmatibus Johannis XXII. papae* (1333–34), the *Compendium errorum Johannis XXII. papae* (1335–38) and in the *Defensorium contra errores Johannis XXII. papae* (1335–39), Occam only incidentally expounds his views as a publicist, the *Compendium* being of special interest because it selects four papal constitutions which involved a declaration against evangelical poverty, and insists that they are full of heresy. The *Super potestate summi pontificis octo quaestionum decisiones* (1339–42) attacks the temporal supremacy of the pope, insists on the independence of kingly authority, which he maintains is as much an ordinance of God as is spiritual rule, and discusses what is meant by the State. His views on the independence of civil rule were even more decidedly expressed in the *Tractatus de jurisdictione imperatoris in causis matrimonialibus,* in which he contends that it belongs to the civil power to decide cases of affinity and to state the prohibited degrees. By 1343 his great work the *Dialogus* (*see* Goldast ii. 398–957), in which he attempted to summarize his views, was in circulation. His last work, *De Electione Caroli IV.*, restates his opinions upon temporal authority.

In philosophy, Occam's most significant doctrines fall within the departments of psychology, metaphysics and theology. In the first, he contends that since singulars alone exist, the universal, which is a kind of mental label, has an objective value only inasmuch as it is thought; that the *intellectus agens* and the *species intelligibiles* are superfluous because abstraction follows naturally upon perceptions or intuition, the fundamental form of human knowledge; that will and not intellect is the primary faculty of the soul, and that both faculties, like memory, are identical with the substance of the soul; and that a *forma corporeitatis* must be admitted if the independence of the soul is to be preserved. In metaphysics, Occam teaches that matter has its own essence apart from form; that accidents are only aspects of substance; that the problem of individuation is meaningless because each thing is singular in itself, and that between essence and existence there is no real distinction. The famous dictum—*Essentia non sunt multiplicanda praeter necessitatem*—has become known as "Occam's Razor," but it was already stressed by Duns Scotus. In theology, Occam's scepticism is especially noticeable in his assertion that the existence of God and His attributes, including His unity and infinity, are not strictly provable. According to Occam, the most characteristic activity of God is willing, and moral laws are good only because God wills them and not in their own right.

BIBLIOGRAPHY.—Occam's political works were edited by Goldast (Frankfurt, 1614) and further mss. by R. Scholz (Rome, 1914). The *Dialogus* appeared separately in 1495, the *Defensorium contra Joannem XXII.* in 1513, and the *De Imperatorum et pontificum potestate* in 1927 (edit. C. K. Brampton). Of the non-political works, the *Commentary on the Sentences* appeared in 1483 and 1495, the *Quodlibet* in 1487 and 1491 and the logical treatises fairly frequently in the 15th and 16th centuries.

*See* Prantl, *Geschichte der Logik* (1855–70); Riezler, *Die literarischen Widersacher der Päpste zur Zeit Ludwig des Baiers* (1874); A. J. Little, *Grey Friars in Oxford* (1892); F. Bruckmüller, *Die gotteslehre W. v. Ockham* (Munich, 1911); L. Kugler, *Der Begriff d. Erkenntniss bei W. v. Ockham* (Breslau, 1913); J. Hofer, "Biographische Studien über W. von Ockham" in *Arch. Fran. Hist.* (1913); R. L. Poole, *Illustrations in Mediaeval Thought* (2nd ed., 1920); A. Pelzer, "Les 51 articles de G. d'Occam censurés à Avignon en 1326" in *R. Hist. eccles.* (1922); F. Federhofer, "Ein Beitrag zur Bibliographie und Biographie des W. v. Ockham" in *Philos. Jahrb.* (1925), and "Die Psych . . . W. v. Ockham," in *Philos. Jahrb.* (1926). Full bibliography in Überweg, *Gesch. der Philosophie* (ed. 2, 1928).

**OCCASIONALISM,** in philosophy, a term applied to that theory of the relation between matter and mind which postulates the intervention of God to bring about in the one a change which corresponds to a similar change in the other. The theory thus denies any direct interaction between matter and mind. It was expounded by Geulincx and Malebranche to avoid Descartes's dualism of thought and extension, and to explain causation.

**OCCLEVE** (or HOCCLEVE), **THOMAS** (1368–1450?), English poet, was born probably in 1368/9. What is known of Occleve's life has to be gathered mainly from his works. At eighteen or nineteen he obtained a clerkship in the Privy Seal Office, which he retained on and off, in spite of much grumbling, for about thirty-five years. In 1399 he received a small annuity, which was not always paid as regularly as he would have wished. "The Letter to Cupid," his first poem to which we can affix a date, was translated from *L'Epistre au Dieu d'Amours* of Christine de Pisan in 1402, evidently as a sort of antidote to the moral of *Troilus and Cressida,* to some mss. of which we find it attached. About 1410 he settled down to married life, and the composition of moral and religious poems. His longest work, *The Regement of Princes* or *De Regimine Principum,* written for Prince Hal shortly before his accession, is a tedious homily on the virtues and vices, imitated from Aegidius de Colonna's work of the same name, from the supposititious epistle of Aristotle, known as the *Secreta secretorum* and the work of Jacques de Cessoles (*fl.* 1300) rendered into English later by Caxton as *The Game and Playe of Chesse.*

On the accession of Henry V. Occleve turned his muse to the service of orthodoxy and the Church, and one of his poems is a remonstrance addressed to Oldcastle, calling upon him to "rise up, a manly knight, out of the slough of heresy." Then a long illness was followed for a time, as he tells us, by insanity. His "Dialog with a Friend," written after his recovery, gives a naïve and pathetic picture of the poor poet, now fifty-three, with sight and mind impaired, but with hopes still left of writing a tale he owes his good patron, Humphrey of Gloucester, and of translating a small Latin treatise, *Scite Mori,* before he dies. His hopes were fulfilled in his moralized tales of "Jereslaus' Wife" and of "Jonathas," both from the *Gesta Romanorum,* which, with his "Learn to die," belong to his old age. After finally retiring from his privy seal clerkship, he was granted in 1424 sustenance for life in the priory of Southwick, Hants, on which, with his former annuity, he appears to have lived till about the middle of the century. A "Balade to my gracious Lord of Yorke" probably dates from 1448 or later.

The main interest for us in Occleve's poems is that they are characteristic of his time. They illustrate the blight that had fallen upon poetry on the death of Chaucer. The nearest approach to the realistic touch of his master is to be found in his "Male Regle," which, written about 1406, gives some interesting glimpses of his "misruly youth." But these pictures of 15th-century London are without even the occasional flash of humour that lightens up Lydgate's *London Lackpenny.*

A poem, "Ad beatam Virginem," generally known as the "Mother of God," and once attributed to Chaucer, is copied among Occleve's works in ms. Phillipps 8151 (Cheltenham), and may thus be regarded as his work. Occleve found an admirer in the 17th century in William Browne, who included his "Jonathas" in the *Shepheards Pipe* (1614). Browne added a eulogy of the old poet, whose works he intended to publish in their entirety (*Works,* ed. W. C. Hazlitt, 1869, ii. 196–198). In 1796 George Mason printed six *Poems by Thomas Hoccleve never before printed . . .*; "De Regimine Principum" was printed for the Roxburghe Club in 1860, and by the Early English Text Society in 1897. *See* Dr. F. J. Furnivall's introduction to *Hoccleve's Works; The Minor Poems, in the Phillipps MS. 8151, and the Durham MS. III.* 9, ed. F. J. Furnival; ii. *The Minor Poems in the Ashburnham MS. Addit. 133,* ed. Israel Gollancz; iii. *The Regement of Princes A.D. 1411–12, and fourteen of Hoccleve's minor poems,* ed. F. J. Furnivall (Early English Text Society, 3 vols., 1892–1925).

**OCCULTATION,** in astronomy, the hiding of one celestial body by another passing in front of it; commonly the passage of the moon or of a planet between the observer and a star or another planet.

**OCCULTISM:** *see* MAGIC.

**OCEAN AND OCEANOGRAPHY.** "Ocean" is the name applied to the great connected sheet of water which covers the greater part of the surface of the earth. But the ocean is less than the hydrosphere in so far as the latter term includes also the water lying on or flowing over the surface of the land. The conception of an encompassing ocean bounding the habitable world is found in the creation myths of the most ancient civilizations. The Babylonians looked on the world as a vast round mountain rising from the midst of a universal sheet of water. In the Hebrew scriptures the waters were gathered together in one place at the word of God, and the dry land appeared. The Ionian geographers looked on the circular disc of the habitable world

as surrounded by a mighty stream named Oceanus, the name of the primeval god, father of gods and men, and thus the bond of union between heaven and earth.

Since the Pythagorean school of philosophy upheld the spherical as against the disc-shaped world, some of the ancient geographers, including Eratosthenes and Strabo, looked upon the hydrosphere as forming two belts at right angles to each other, one belt of ocean following the equator, the other surrounding the earth from pole to pole as in the *terra quadrifida* of Macrobius; while others, including Aristotle and Ptolemy, looked upon the inhabited land, or *oikoumene*, as occupying the greater part of the earth's surface. Until the discovery of America and of the Pacific ocean the belief was general that the land surface was greater than the water surface. (*See* MAP.) Only in our own days has the existence of the southern continent been demonstrated within the limits of Antarctica.

Oceanography is the science which deals with the ocean. Of recent years the use of "hydrography" as the equivalent of physical oceanography has acquired a certain currency, but as the word is also used with more than one other meaning (*see* SURVEYING) it ought not to be used for oceanography. This article is restricted to general oceanography in its physical aspects and deals with phenomena common to the whole ocean.

**History of Research and Organization.**—Research in oceanography began in recent times, especially since the rapid increase in the study of the exact sciences during the 19th century. Observations at sea with accurate instruments became common, and the ships' logs of to-day are provided with headings for entering daily observations of the phenomena of the sea-surface. The contents of the sailors' scientific logs were brought together by the American enthusiast in the study of the sea, Matthew Fontaine Maury (1806–73), whose methods and plans were adopted at international congresses. Many millions of observations are recorded in ships' logs; this firsthand material is preserved in appropriate offices of various nations. The contents of these logs, it is true, refer more to maritime meteorology than to oceanography properly so-called.

This material for the study of the surface phenomena of the ocean has been supplemented in relation to the study of the depths of the ocean, by the records of numerous scientific expeditions and latterly by publications embodying systematic observations on a permanent basis. Valuable observations were made in oceanography during the expeditions of Captain James Cook and the polar explorers, especially those of Sir John Ross in the north and Sir James Ross in the south. The period of deep sea investigation began about 1850 when it became possible to measure ocean depths with precision. (*See* SOUNDING.) At this time, an exact knowledge of the depths of the ocean assumed an unlooked-for practical importance for the laying of telegraph cables at the bottom of the sea. Another stimulus came from the biologists, who began to realize the importance of a more detailed investigation of the life conditions of organisms at great depths in the sea.

These preliminary trips of scientific marine investigation were followed by the greatest purely scientific expedition ever undertaken, the voyage of H.M.S. "Challenger" round the world under the scientific direction of Sir Wyville Thomson and the naval command of Sir George Nares. This epoch-making expedition lasted from Christmas 1872 to the end of May 1876, and gave the first wide and general view of the physical and biological conditions of the ocean as a whole. Almost simultaneously with the "Challenger," a German expedition in S.M.S. "Gazelle" conducted observations in the south Atlantic, Indian and south Pacific oceans; and the U.S.S. "Tuscarora" made a cruise in the north Pacific, sounding out lines for a projected Pacific cable. Since that time investigation has been carried out by ships of all nations, on a scale too extensive for detailed record.

In 1902 at Stockholm was founded the International Council for the study of the sea, whose headquarters are in Copenhagen. At present (1928) all the north-east and north-west European States, with the exception of Russia, are represented there. The idea is to help and control the fisheries in the Baltic, the North sea, the Norway sea and Barents sea, as well as in British and Irish waters. Portugal, Spain and Italy have also become members of this union, which has done much to improve the instruments and methods of oceanography. Generally, each Government has built or fitted out a research steamer for the work. The United States of America, Canada and Japan also take part.

**Extent of the Ocean.**—The hydrosphere covers nearly three-quarters of the earth's surface as a single and continuous expanse of water surrounding four great insular land-masses known as the continents. Water predominates in the unexplored north polar area, and it is very unlikely that new land of any great extent exists there. On the other hand, recent antarctic exploration makes it certain that a great continent surrounds the south pole with a total area of about 14,000,000 sq.km. Thus there is a total land area of 148,892,000 sq.km., and a total water area of 361,059,000 sq.km., 29% of land and 71% of water, or a ratio of 1:2·43.

**Divisions of the Ocean.**—The arrangement of the water surface on the globe is far from uniform, the ocean forming 61% of the total area of the Northern and 81% of that of the Southern Hemisphere. Of the whole ocean only 43% (154·7 million sq.km.) lies in the Northern Hemisphere and 57% (206·4 million sq.km.) in the Southern. A great circle can be drawn upon a globe in such a way as to divide it into two hemispheres, one of which contains the greatest amount of land and the other the greatest amount of sea of any possible hemispheres. The centre of the so-called land hemisphere lies near the mouth of the Loire ($47\frac{1}{2}°$ N. and $2\frac{1}{2}°$ W.), while the centre of the so-called water hemisphere lies to the south-east of New Zealand and eastward of Antipodes island. Even in the land hemisphere the water area (135·6 million sq.km.) is in excess of the land area (119·4 million sq.km.), while in the water hemisphere the amount of land is quite insignificant, 29·6 million sq.km. compared with 225·4 million sq.km. of water.

The outline of the water surface depends on the outline of the basins in which it is contained. The four great continental masses, therefore, give the ocean a distinctly tripartite form, the three great divisions being known as the Atlantic, the Indian and the Pacific oceans, all three running together into one around Antarctica. Thus the connecting belt of water is narrow as compared with the extent of the oceans from north to south. The proportions are not readily grasped from a map of the world on Mercator's projection and must be studied on a globe.

Each of the three meridional oceans has an Antarctic facies in the southern part. Some authors prefer to consider these southern parts as a Great Southern ocean. Only the Atlantic possesses a really Arctic facies north from the narrowest part of Davis strait, north of Denmark strait and north of a line running from Iceland to Jan Mayen and Spitzbergen.

Where the ocean touches the continents the margin is in places deeply indented by peninsulas and islands marking off portions of the water surface which from all antiquity have been known as "seas." These seas are more or less dependent on the ocean for their régime, being filled with ocean water. These seas may be classified according to their form either as "enclosed" or as "partially enclosed" (or "fringing"). Enclosed seas extend deeply into the land and originate either by the breaking through of the ocean or by the overflowing of a subsiding area. They are connected with the ocean by narrow straits, the salinity of the water contained in them differs in a marked degree from that of the ocean, and the tidal waves are of small amplitude. Four great intercontinental enclosed seas are included between adjacent continents—the Arctic sea, the Central American or West Indian sea, the Australo-Asiatic or Malay sea and the Mediterranean sea. There are also four smaller continental enclosed seas each with a single channel of communication with the ocean, viz., the Baltic sea and Hudson bay with very low salinity, the Red sea and Persian gulf with very high salinity.

The fringing or partially enclosed seas adjoin the great land masses and are only separated from the oceans by islands or peninsulas. Hence their tidal conditions are quite oceanic, though their salinity is usually rather lower than that of ocean water. The four fringing seas of eastern Asia parallel the main lines of dis-

location in the neighbouring land masses, as do the Andaman sea and the Gulf of California. On the contrary, the North sea, the British fringing seas, and the Gulf of St. Lawrence cross the main lines of dislocation.

In addition to these seas notice must be taken of the subordinate marginal features, such as gulfs and straits. Gulfs may be classified according to their origin as due to fractures of the crust or overflowing of depressed lands. The former are either the extensions of oceanic depressions, *e.g.*, the Arabian sea, or such caldron-depressions as the gulf of Genoa or rift-depressions like the Gulf of Aden. Compound gulfs are formed seawards by fracture and landwards by the overflowing of depressed land, *e.g.*, the Bay of Biscay, Gulf of Alaska and Gulf of the Lion. Gulfs formed by the overflowing of depressed lands lie upon the continental shelf, *e.g.*, the Gulf of Maine, Bay of Fundy.

Straits have been formed (1) by fracture across isthmuses, longitudinally as in the Strait of Bab-el-Mandeb, or transversely as in the Strait of Gibraltar; (2) by erosion, *e.g.*, the Strait of Dover; (3) by overflowing subsided land, as in the straits of Bering, Torres and Formosa.

**Surface of the Ocean.**—If the whole globe were covered with a uniformly deep ocean and if it were of uniform density, the surface would form a perfect ellipsoid of revolution. At any point a sounding line would hang in the line of the radius of curvature of the water surface. But the water surface is broken by land, and the mean density of the substance of the land is 2·6 times as great as that of sea-water, so that the gravitational attraction of the land must necessarily cause a heaping up of the sea around the coasts, forming what has been called the continental wave, and leaving the sea-level lower in mid-ocean. Hence the geoid or figure of the sea surface is not part of an ellipsoid of rotation but irregular. The differences of level between different parts of the geoid have been greatly overestimated in the past; F. G. Helmert has shown that they cannot exceed 200 metres and are probably much less. Recent pendulum observations have shown great local differences in density in the earth's crust, a marked deficiency of mass under high mountains and excess under the bed of the ocean. There is thus a condition of isostasy or equilibrium between them as a general rule. The intensity of gravity at the surface of the sea far from land has been measured on several occasions. The inequalities of the geoid are not over 100 metres. Distortion of the ocean surface may also arise from meteorological causes and be periodic or unperiodic in its occurrence, but it does not amount to more than 1 or 2 metres. Atmospheric precipitation poured into the sea by the great rivers must necessarily create a permanent rise of the sea-level at their mouths, and from this cause the level round the coasts of rainy lands must be higher than in mid-ocean. The level of the Skagerak should be about 0·6 metre higher than that of the open Norwegian sea between Jan Mayen and the Lofoten islands, the level of the Gulf of Finland at Kronstadt and of the Gulf of Bothnia at Haparanda should similarly be 0·4 metre higher than that of the Skagerak. The level of the Mediterranean has also been determined by exact measurements to be from 0·4 to 0·6 metre lower than that of the Atlantic on account of evaporation. The atmosphere affects sea-level also by its varying pressure, the difference in level of the sea surface from this cause between two given points being 13 times as great as the difference between the corresponding readings of the mercurial barometer. In the north tropical belt of high pressure south of the Azores the atmospheric pressure in January is 22mm. higher than in the Irminger sea; hence the sea-level near the Azores is almost 0·3 metre lower than in the northern sea. The Baltic is fuller in the time of the summer rains than in winter, when the rivers and lakes are frozen and most of the precipitation on the land is snow. A similar range occurs on the Dutch coast in the North sea, where the maximum level is reached in October, the month of highest rainfall, and there is a range of 200mm. to the minimum level at the time of least rainfall in early spring.

In the monsoon regions the half-yearly change from on-shore to off-shore winds produces noticeable differences in level, the total range being 237mm. The influence of wind on water-level is most remarkable in heavy storms on the flat coasts of the North sea and Baltic, when the rise may amount to very many feet. In the region of tropical hurricanes the converging wind system of a circular storm causes a heaping up of water capable of devastating the low coral islands of the Pacific. The old speculations as to a great difference of level between the Mediterranean and the Red sea, and on the two sides of the Isthmus of Panama, have been proved by precision levelling to be totally erroneous.

**Deep-sea Soundings.**—The hand-lead attached to a line divided into fathoms was a well-known aid to navigation even in high antiquity, and its use is mentioned in Herodotus (ii. 5) and Acts (xxvii. 29). The earliest deep-sea sounding on record is that of Capt. Phipps on Sept. 4, 1773, in the Norwegian sea, in 65° N. 3° E., on his return from his expedition to Spitsbergen. He spliced together all the sounding-lines on board, and with a weight of 150lb. attached he found bottom in 683 fathoms and secured a sample of fine soft blue mud. He detected the moment of the lead touching the bottom by the sudden slackening in the rate at which the line ran out. The honour of first sounding really oceanic depths belongs to Sir James Clark Ross, who made some excellent measurements in very deep water using expensive kilometre-long stout hemp lines. Captain Matthew Fontaine Maury, U.S.N., introduced a ball of strong twine attached to a cannon shot, which ran it out rapidly; when the bottom was reached the twine was cut and the depth deduced from the length of string left in the ball on board. The time of touching bottom was judged by timing each 100-fathom mark and noting the sudden increase in the time interval when the shot reached the bottom. In 1854, J. M. Brooke, a midshipman of the United States Navy, invented a method of sounding by means of an automatically released heavy weight.

Modern surveying ships sound with steel piano wire not more than 0·6 to 0·9mm. in diameter and a detachable lead seldom weighing more than 70lb. (*See* SOUNDING.)

Since 1920 the acoustic method has been used to measure the ocean depths. The first results are satisfactory and the so-called "echo-data" are increasing rapidly in number and value. When the sound wave is engendered in the water, one must measure the time (in seconds) which the wave takes to reach the sea bottom and the time the echo takes to get back from there to the ship. The speed of the sound increases with the temperature, with the salt content and with the pressure, and varies between 1,400 and 1,620 metres per second. Generally the results of echo-observations and wire loosening are in fairly close agreement; but formerly one was not sure whether the wire dropped vertically or whether it was deflected by currents and thus registered too great a depth.

**Relief of the Ocean Floor.**—Recent soundings have shown that the floor of the ocean on the whole lies some 3 or 4 km. beneath the surface and E. Kossinna has, 1921, calculated the mean depth to be 3,800 metres, while the mean elevation of the surface of the continents above sea-level is only 840 metres. Viewed from the floor of the ocean the continental block would thus appear as a great plateau rising to a height of 4,640 metres. The greatest depths of the ocean below sea-level and the greatest heights of the land above it are not of the same order of magnitude, the summit of Mt. Everest rising to 8,800 metres above the sea-level, while the Philippine Trench near Mindanao sinks to 10,800 metres (5,900 fathoms) below sea-level. Of course the area at great heights is very much less than the area at corresponding depths. According to Kossinna's calculation the areas of the ocean beyond various depths are as follows:—

| Metres | Millions sq.km. | % of 509·95 million sq. km. |
|---|---|---|
| More than | | |
| 200 . . . | 333·5 | 65·3 |
| 1,000 . . . | 318 | 62·3 |
| 2,000 . . . | 303 | 59·4 |
| 3,000 . . . | 278·5 | 54·6 |
| 4,000 . . . | 207·5 | 40·7 |
| 5,000 . . . | 88·5 | 17·4 |
| 6,000 . . . | 4·5 | 0·9 |

Considering these areas and those of continental lands of various elevations, it is possible to classify the whole into three groups, (1) the area of the continents and their shelves down to the 200 metre submarine contour, this makes up 34·7% of the earth's surface; (2) The area between the 200 metre and 3,000 metre submarine contour, 10·7% of the earth's surface; (3) The area below the 3,000 metre submarine contour, 54·6% of the earth's

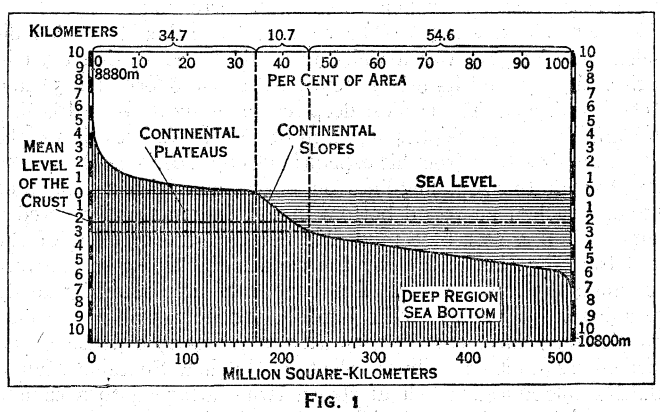



FIG. 1

surface. (Fig. 1.) If land and water were evenly balanced on the earth the most widespread depth figure for the ocean should be about 2,400 metres, but the actual facts are surprisingly different. Several students, including A. Wegener, interpret matters by supposing that the continental masses are of material different from that of the deep-sea floor. The first, which they call sial, rich in silica, has a specific gravity of 2·6. The second, which they call sima, is formed of basic material and has a specific gravity of 2·9. They think that the continental masses float in the deep-sea floor rocks, much as icebergs float in the sea. This interpretation makes the deep-sea floor something quite different from the continents and is, at any rate, a useful working hypothesis. On the whole the floor of the ocean is not so smooth in its contours as had been believed until recently. According to the new "echo data" the apparent great flat stretches show marked variations of relief. Modern orometry has introduced the calculation of the mean angle of the slope of a given uneven surface provided that maps can be prepared showing equidistant contour lines. If the distance between the contour lines is $h$ and the length of the individual contour lines $l$, the sum of their lengths $\Sigma\ (l)$, and A the area of the surface under investigation, then the mean angle of slope is obtained from the equation

$$\alpha = \frac{h\ \Sigma\ (l)}{\mathrm{A}}.$$

Calculating from sheets of the prince of Monaco's *Atlas of Ocean Depths,* Krümmel obtained a mean angle of slope of 0° 27′ 44″ or an average fall of 1 in 124 for the north Atlantic between 0° and 47° N., the enclosed seas being left out of account. Large angles of slope may, however, occur on the flanks of oceanic islands and the continental borders. On the submarine slopes leading up to isolated volcanic islands, angles of 15° to 20° are not uncommon, at St. Helena the slopes run up to 38½° and even 40°, at Tristan d'Acunha to 33½°. E. Hull found a mean angle of slope of 13° to 14° for the edge of the continental shelf off the west coast of Europe, and off Cape Toriñana (43° 4′ N.) as much as 34°. Where the French telegraph cable between Brest and New York passes from the continental shelf of the Bay of Biscay to the depths of the Atlantic the angle of slope is from 30° to 41°. Such gradients are of a truly mountainous character; the angle of slope from the Eibsee to the Zugspitze is 30°. Particularly steep slopes are found in the case of submarine domes, usually incomplete volcanic cones, and there have been cases in which after such a dome has been discovered by the soundings of a surveying ship it could not be found again as its whole area was so small and the deep floor of the ocean from which it rose so flat than an error of 4 or 5 km. in the position of the ship would prevent any irregularity of the bottom from appearing.

In spite of the increase of deep-sea soundings in the last few decades, they are still very irregularly distributed in the open ocean, and the isobaths (lines of equal depth) on a chart of the world include wide generalizations. Bearing this caution in mind, the existing bathymetrical charts, amongst which that of the prince of Monaco stands first, give a very fair idea of the great features of the bed of the oceans. (*Carte générale bathymétrique des océans dressée par ordre de S.A.S. le Prince Albert de Monaco,* 24 sheets [Paris, 1904]; 2nd edition, Paris, 1913 *seq.*) A definite terminology for the larger forms of sub-oceanic relief was put forward by the International Geographical Congress at Berlin in 1899 and adopted by that at Washington in 1904. Equivalent terms, which are not necessarily identical or literal translations, were adopted for English, French and German.

The larger forms designated by special generic terms include the following: The *continental shelf* is the gentle slope which extends from the edge of the land to a depth usually about 100 fathoms or 200 metres, though in some cases as much as 300 fathoms or about 600 metres, and is there demarcated by an abrupt increase in the steepness of the slope to ocean depths. In the deep sea two types of feature are recognized under the general names of *depression* and *elevation.* The depression is distinguished according to form and slope as (1) a *basin* when of a roughly round outline, (2) a *trough* when wide and elongated, or (3) a *trench* when narrow and elongated lying along the edge of a continent. The extension of a basin or trough stretching towards the continent is termed an *embayment* when relatively wide and a *gully* when narrow. The elevation includes (1) the gently swelling *rise* which separates troughs and basins in the middle of the ocean, (2) the steeply sloping *ridge* which interposes a narrower barrier between two depressions, and (3) the *plateau* or wide elevation rising steeply on all sides from a depression. The deepest part of a depression is termed a *deep,* and the highest part of an elevation when not reaching the surface a *height.* In addition to these larger forms a few minor forms must be recognized. Amongst these are the *dome,* an isolated elevation rising steeply but not coming within 100 fathoms (200 metres) of the surface; the *bank,* an elevation coming nearer the surface than 100 fathoms, but not so near as 6 fathoms (10–11 metres); and finally the *shoal* or *reef,* which comes within 6 fathoms of the surface, and so may constitute a danger to shipping. Similarly we may note the *caldron* or small steep depression of a round outline, and the *furrow* or long narrow groove in the continental shelf.

According to the resolutions of the International Geographical Congress the larger individual forms which have been described by generic terms shall have specific names of a purely geographical character; but in the case of the minor forms the names of ships and persons are considered applicable. In 1899 A. Supan published a chart of the oceans with a suggested nomenclature based on these principles; and the larger forms in the prince of Monaco's great chart also are named in accordance with the rule. This system is not yet general. Sir John Murray considers that only deeps exceeding 3,000 fathoms in depth should be named.

**The Continental Shelves.**—The continental shelves are those parts of the continental blocks which have been covered by the sea in comparatively recent times, and their surface consequently presents many similarities to that of the land, modified of course by the destructive and constructive work of the waters. Waves and tidal currents produce their full effects in that region, and in high latitudes the effect of transport of materials by ice is very important; while in the warm water of the tropics the reef-building animals and plants (corals and calcareous algae) carry on their work most effectively there. The continental shelves include not only the oceanic border of the continents but also great areas of the enclosed seas and particularly of the fringing seas, the origin of which through secular subsidence is often very clearly apparent, as for instance in the North sea and the tract lying off the mouth of the English channel. A closer investigation of the numerous long narrow banks which lie off the Flemish coast and the Thames estuary shows that they are composed of fragments of rock abraded and transported by tidal currents and

storms. Numerous old river valleys and furrows entrenched in the continental shelf bear witness to its land origin. Such valleys are very clearly indicated in the belts of the western Baltic, the Cape Breton deep, the Hudson Furrow, the so-called Congo Cañon, the Swatch of No Ground off the Ganges delta, and numerous similar furrows.

The seaward edge of the continental shelf often falls steeply to the greatest depths of the ocean, and not infrequently forms the slope of a *trench,* a form of depression which has usually a steep slope towards a continent or an island-bearing rise on one side and a gentler slope towards the general level of the ocean on the other. Soundings exceeding 7,000 metres occur in trenches; there are few trenches known (on west coast of Central America) in which the maximum depth is less than 5,000 metres. Most trenches are narrow, but of considerable length, and their steeper side is believed to be due, not to a fracture, but to a folding of the earth's crust, because these trenches are only found parallel to young fold mountains like the Cordillera of North and South America. The deep trenches are distributed chiefly around the Pacific near to the shore or near the limits of former lands (Mindanao, 10,800m.). Outside the Pacific we find a trench (8,526m.) north of Porto Rico, and another north of the south Sandwich Islands in the south Atlantic. In the Indian ocean there is a trench (7,450m.) west and south of Sumatra-Java, where a double-folding occurs. On a coast with old block mountains, as around Africa and the Deccan, these trenches are absent. The region of these depressions is also specially subject to great earthquakes. These submarine trenches occupy only 1% of the area of the oceans. There are also numerous "fossil" trenches, filled with various deposits, at the foot of fold mountains, as, for example, the Ganges valley.

### TABULAR VIEW OF OCEANS AND SEAS

The following table gives the average depth, the area, and the volume of the oceans, seas and the hydrosphere according to the 1921 computations of E. Kossinna:—

*Mean Depth, Area and Volume of Oceans and Seas.*

| Name | Depth | | Area | Volume |
|---|---|---|---|---|
| | Metres | Fathoms | Sq.km. | Cu.km. |
| Atlantic ocean | 3,926 | 2,147 | 82,441,500 | 323,613,000 |
| Indian ocean | 3,963 | 2,167 | 73,442,700 | 291,030,000 |
| Pacific ocean | 4,282 | 2,342 | 165,246,200 | 707,555,000 |
| I. Oceans | 4,117 | 2,251 | 321,130,400 | 1,322,198,000 |
| Arctic sea | 1,205 | 659 | 14,090,100 | 16,980,000 |
| Malay sea | 1,212 | 663 | 8,143,100 | 9,873,000 |
| Central American sea | 2,216 | 1,212 | 4,319,500 | 9,573,000 |
| Mediterranean sea | 1,429 | 782 | 2,965,900 | 4,238,000 |
| Inter-continental seas | 1,378 | 754 | 29,518,600 | 40,664,000 |
| Baltic sea | 55 | 30 | 422,300 | 23,000 |
| Hudson bay | 128 | 70 | 1,232,300 | 158,000 |
| Red sea | 491 | 269 | 437,900 | 215,000 |
| Persian gulf | 25 | 14 | 238,800 | 6,000 |
| Smaller enclosed seas | 172 | 94 | 2,331,300 | 402,000 |
| II. Enclosed seas | 1,289 | 705 | 31,849,900 | 41,066,000 |
| Bering sea | 1,437 | 786 | 2,268,200 | 3,259,000 |
| Okhotsk sea | 838 | 458 | 1,527,600 | 1,279,000 |
| Japan sea | 1,350 | 738 | 1,007,700 | 1,361,000 |
| East China sea | 188 | 103 | 1,249,200 | 235,000 |
| Andaman sea | 870 | 476 | 797,600 | 694,000 |
| Californian gulf | 813 | 445 | 162,200 | 132,000 |
| North sea | 94 | 52 | 575,300 | 54,000 |
| English channel and Irish sea | 58 | 32 | 178,500 | 10,000 |
| Laurentian sea | 127 | 70 | 237,800 | 30,000 |
| Bass sea | 70 | 39 | 74,800 | 5,000 |
| III. Fringing seas | 874 | 478 | 8,078,900 | 7,059,000 |
| Seas (enclosed and fringing) | 1,205 | 659 | 39,928,800 | 48,125,000 |
| Hydrosphere | 3,795 | 2,075 | 361,059,200 | 1,370,323,000 |

**Oceanic Deposits.**—It has long been known that the deposits which carpet the floor of the ocean differ in different places, and coasting sailors have been accustomed from time immemorial to use the lead not only to ascertain the depth of the water but also to obtain samples of the bottom, the appearance of which is often characteristic of the locality. Various devices have been attached to leads intended to catch and hold the material when soft enough to be penetrated. One of the most effective early forms was the snapper or "deep-sea clamm" of Sir John Ross, a pair of powerful spring jaws held apart by an arrangement which, when released on striking the bottom, allowed the jaws to close, biting out and holding securely a substantial portion of the ground. A simpler form of collector, now almost universally used, is a plain brass tube, which is driven into the bottom of the sea by the weight of the sounding lead, and in which the deposit may be retained by a valve or other contrivance, though in many cases friction alone suffices to hold the punched-out core. Larger quantities of deposit may be conveniently collected by means of the Monaco snapper or of the dredge, which can be worked in any depth and brings up large stones, concretionary nodules or fossils, which a sounding-tube could not collect.

The voyage of the "Challenger" supplied for the first time the nucleus of a collection of deep-sea deposits sufficient to serve as the basis for comprehensive classification and mapping. The "Challenger" collections supplemented by those of other expeditions and of many telegraphic and surveying-ships were studied in detail by Sir John Murray and Prof. A. Renard, whose monograph (*"Challenger" Reports,* "Deep Sea Deposits"), published in 1891, laid the foundations and reared the greater part of the structure of our present knowledge on the subject. The classification adopted was a double one, thus:—

| | | |
|---|---|---|
| I. Deep sea deposits (beyond 100 fathoms or 200 metres) | 1. Red clay<br>2. Radiolarian ooze<br>3. Diatom ooze<br>4. Globigerina ooze<br>5. Pteropod ooze | A. Pelagic deposits (formed in deep water remote from land) |
| | 6. Blue mud<br>7. Red mud<br>8. Green mud<br>9. Volcanic mud<br>10. Coral mud | B. Terrigenous deposits (formed in deep or shallow water close to land) |
| II. Shallow water deposits (in less than 100 fathoms) | Sands, gravels, muds, etc. | |
| III. Littoral deposits (between high and low-water marks) | Sands, gravels, muds, etc. | |

Krümmel preferred, 1907, to simplify this by grouping the deposits in a single category arranged according to position:

(*a*) *Littoral* (including Murray and Renard's littoral and shallow water deposits [II. and III.]).

(*b*) *Hemipelagic* (including Nos. 6–10 of deep sea deposits).

(*c*) *Eupelagic* (including Nos. 1–5 of deep sea deposits).

As so defined the hemipelagic deposits are those which occur in general on the slope from the continental shelves to the ocean depths and in the deep sea basins of enclosed and fringing seas. K. Andrée (*Geologie des Meeresbodens,* 1920) adopts this.

**Littoral and Shore Deposits.**—The littoral deposits include those of the actual shore on the wash of the waves and of the surface of the continental shelf. Shore deposits are the product of the waste of the land arranged and bedded by the action of currents or tidal streams. On the rocky coasts of high latitudes blocks of stone detached by frost fall on the beach, and becoming embedded in ice during winter, are often drifted out to sea and so carry the shore deposits to some distance from the land. Where the force of the waves on the beach produces its full effect the coarser material gets worn down to gravel, sand and silt, the finest particles remaining long suspended in the water, to be finally deposited as mud in quiet bays. A particularly fine-grained mud is formed on the low coasts of the eastern border of the North sea by a mixture of the finest sediment carried down by the slow-running rivers with the calcareous or siliceous remains of plankton. Pure calcareous sand and calcareous mud are formed by

wave action on the shores of coral islands where the only material available is coral and the accompanying calcareous algae, crustacea, molluscs and other organisms secreting carbonate of lime. Recent limestones are being produced in this way and also in some places by the precipitation of calcium carbonate by sodium or ammonium carbonate which has been carried into the sea or formed by organisms. The precipitated carbonate may agglomerate on mineral or organic grains which serve as nuclei, or it may form a sheet of hard deposit on the bottom, as occurs in the Red sea, off Florida, and round many coral islands in the Pacific. The very finest sediment is kept in a state of movement until it drops into the gulleys or furrows of the shelf, where it can come to rest together with the finer fragments of the remains of littoral or bank vegetation. Thus are formed the "mud-holes" of the Hudson Furrow. Sand may be taken as the predominating deposit on the continental shelves, often with a large admixture of remains of calcareous organisms, for instance the deposits of *maërl* made up of nullipores off the coasts of Brittany and near Belle Isle. Amongst the most widely-distributed of the deposits actually formed on the continental shelf are phosphatic nodules; these are especially abundant on the east coast of the United States and on the Agulhas bank, where the amount of calcium phosphate in the nodules is as much as 50%. Sir John Murray finds the source of the phosphoric acid to be the decomposition of large quantities of animal matter.

**Hemipelagic Deposits.**—These are a mixture of deposits of terrigenous and pelagic origin. The most abundant of the terrigenous materials are the finest particles of clay and calcium carbonate as well as fragments derived from land vegetation, of which twigs, leaves, etc., may form a perceptible proportion as far as 350 to 400 km. from land. Blue mud, according to Murray and Renard, is usually of a blue or slatey or grey-green colour when fresh, the upper surface having, however, a reddish tint. The proportion of calcium carbonate varies greatly according to the amount of foraminifera and other calcareous organisms it contains. Blue mud prevails in large areas of the Pacific ocean, the Indian ocean, and the Atlantic. As a glacial-marine mud it occurs round the whole of the Antarctic shelf, down to depths of 4,500 metres. A blue and brown mud is the chief deposit of the North Polar basin and of the Norwegian sea also. Max Weber states that blue mud occurs in the deep basins of the eastern Malay sea.

Red mud may be classed as a variety of blue mud, from which it differs on account of the larger proportion of ochreous substance. This variety surrounds the tropical parts of the continental shelves of South America, South Africa and eastern China.

Green mud differs to a greater extent from the blue mud, and owes its characteristic nature and colour to the presence of glauconite, the spines of echini and the spicules of sponges. It occurs in such abundance in certain geological formations as to give rise to the name of green-sand. Green mud abounds off Cape Hatteras, the north of Cuba, and off the coast of California. The "Challenger" expedition found it on the Agulhas bank, on the eastern coasts of Australia, Japan, South America and on the west coast of Portugal. When the proportion of calcium carbonate in the blue mud is considerable a calcareous ooze results. The floors of the Caribbean, Cayman and Mexican basins in the Central American sea are covered with a white calcareous ooze with calcareous concretions. Similar formations are found in the Mediterranean, where a dark mud predominates in the western part, passing into a grey, marly slime in the Tyrrhenian basin and replaced by a calcareous ooze in the Eastern basin. The bottom of the Black sea is covered by a stiff blue mud. Sir John Murray found pyrites make up nearly 50% of the deposit. In the Red sea the "Pola" expedition discovered a calcareous ooze similar to that of the Mediterranean, and the formation of stony crust by precipitation of calcium and magnesium carbonates may be recognized as giving origin to a recent dolomite.

The terrigenous ingredients in the deposits become less and less abundant as one goes farther into the deep ocean. Finely-divided colloidal clay is found in all parts of the ocean, however remote from land, in very small amount, and there is less in tropical than in cooler waters. There is present in sea-water far from land a different clay derived from the decomposition of volcanic materials. To this very slowly-growing deposit of inorganic material over the ocean floor there is added an overwhelmingly more rapid contribution of the remains of calcareous and siliceous planktonic and benthonic organisms, which tend to bury the slower accumulating material under a blanket of globigerina, pteropod, diatom or radiolarian ooze. When those deposits of organic origin are wanting or have been removed, the red clay composed of the mineral constituents is found alone. It is a remarkable geographical fact that on the rises and in the basins of moderate depth of the open ocean the organic oozes preponderate, but in the abysmal depressions below 5,000 metres there is found only the red clay, with a minimum of calcium carbonate, though sometimes with a considerable admixture of the siliceous remains of radiolarians.

**Eupelagic Deposits.**—Globigerina ooze was recognized as an important deposit as soon as the first successful deep-sea soundings had been made in the Atlantic. Murray and Renard define globigerina ooze as containing at least 30% of calcium carbonate, in which the remains of pelagic (not benthonic) foraminifera predominate. In many parts of the Atlantic, as Lohmann points out, 70% of the globigerina ooze consists of coccoliths (minute calcareous algae). The striking absence of mineral constituents distinguishes the eupelagic globigerina ooze from the hemipelagic calcareous mud. Out of 118 samples of globigerina ooze by the "Challenger" expedition, 84 came from depths of 3,000 to 4,500 metres, and only 16 from depths greater than 4,500 metres. Viewed as a whole, this deposit may be taken as a partial precipitation of the plankton living in the upper waters of the open sea. Globigerina ooze is the characteristic deposit of the Atlantic ocean, where it covers not less than 48,500,000 sq. kilometres. In the Indian ocean the area covered is 31,000,000 sq.km., and in the huge Pacific ocean only 30,000,000 sq. kilometres.

**Pteropod Ooze.**—This is merely a local variety of globigerina ooze in which the comparatively large but very delicate spindle-shaped shells of pteropods happen to abound. These shells do not retain their individuality at depths greater than 3,000 metres, and, in fact, pteropod ooze is only found in small patches on the ridges.

**Diatom Ooze.**—This was recognized by Sir John Murray as the characteristic deposit in high latitudes in the Indian ocean, and later it was found to be characteristic also of the corresponding parts of the Atlantic and Pacific, covering a total area of about 23,000,000 sq. kilometres. It is in these latitudes not seldom combined with marine glacial deposits. It has been found sporadically near the Aleutian islands, between the Philippines and Marianne islands and to the south of the Galapagos group. It is made up to a large extent of the siliceous frustules of diatoms. It is usually yellowish-grey and often straw-coloured when wet, though when dried it becomes white and mealy.

**Red Clay.**—This was discovered and named by Sir Wyville Thomson on the "Challenger" in 1873 when sounding in depths of 5,000 metres and more on the way from the Canary islands to St. Thomas. The reddish colour comes from the presence of oxides of iron, and particles of manganese also occur in it, especially in the Pacific region, where the colour is more that of chocolate; but when it is mixed with globigerina ooze it is grey. Red clay is the deposit peculiar to the abysmal area; 70 carefully investigated samples collected by the "Challenger" came from an average depth of 5,000 metres. Red clay has not yet been found in depths less than 3,500 metres. The main ingredient of the deposit is a stiff clay which is plastic when fresh, but dries to a stony hardness. Isolated gritty fragments of minerals may be felt in the generally fine-grained homogeneous mass. The dredge often brings up large numbers of nodules formed upon sharks' teeth, the ear-bones of whales or turtles, or small fragments of pumice or other volcanic ejecta, and all more or less incrusted with manganese oxide until the nodules vary in size from that of a potato to that of a man's head. A very interesting feature is the small proportion of calcium carbonate, the amount present being usually less as the depth is greater; red clay from depths exceeding 5,500 metres does not contain so much as 1% of calcareous matter. The

red clay is the characteristic deposit of the Pacific ocean, where about 101,000,000 sq.km. are covered with it, while only 15,000,000 sq.km. of the Indian ocean and 14,000,000 sq.km. of the Atlantic are occupied by this deposit; it is, indeed, the dominant submarine deposit of the water-hemisphere, just as globigerina ooze is the dominant submarine deposit of the land-hemisphere.

**Radiolarian Ooze.**—This was recognized as a distinct deposit and named by Sir John Murray on the "Challenger" expedition, but it may be viewed as red clay with an exceptionally large proportion of siliceous organic remains, especially those of the radiolarians which form part of the pelagic plankton. It does not occur in the Atlantic ocean at all, and in the Indian ocean it is only known round Cocos and Christmas islands; but it is abundant in the Pacific.

Murray and Renard recognized a progressive diminution of carbonate of lime with increase of depth as a characteristic of all eupelagic deposits. The whole collection of 231 specimens of deep sea deposits brought back by the "Challenger" shows the following general relationship:—

*Proportion of Calcium Carbonate in Deep Sea Deposits*

68 samples from less than 2,000 fathoms (3,600 metres) = 60–80%
68 samples from 2,000–2,500 fathoms (3,600–4,600 metres) = 46·7%
65 samples from 2,500–3,000 fathoms (4,600–5,500 metres) = 17·4%
8 samples from more than 3,000 fathoms (5,500 metres) = 0·9%

New studies of the "Meteor" expedition show that near the great depths the configuration of the floor plays an important part. Where, as a result of an elevation of the ocean floor, the water in a basin is stagnant or moves only slowly, *e.g.*, in the Congo deep, north of the Walfisch ridge, the diminution of the calcium carbonate with increasing depth is much less marked than where the ground currents bring a continuous inflow of new water. Thus we find in the floor deposits at about 5,000 metres depth west of the mid-Atlantic ridge in the Brazil deep only 2% of calcium carbonate, while eastward in the Congo deep we have 46%.

Opinions are still varied as to the time necessary for the formation of 1 cm. or 1 ft. of deep sea deposit. It is generally believed that the red clay accumulates extremely slowly because sharks' teeth and whales' ear-bones which serve as nuclei in it belong, in some cases, to extinct species and are not found in the globigerina ooze, although there is no reason to suppose that at any one time they were unequally distributed over the ocean floor. Cable engineers report that a layer of globigerina ooze 2 cm. thick can be formed in ten years. For 2 cm. of coccolith ooze to be formed, however, it is computed that 4,000 years are necessary.

The frequently observed stratification within a sample is also important. All samples are not homogeneous, one of 50 cm. depth can include very varied deposits. In some samples sand which can be deposited only near a coast is found under a layer of globigerina ooze, whence it is evident that the study of marine deposits is of great importance in connection with investigations of geomorphological evolution.

**Permanence of the Ocean Beds.**—There are no known sedimentary rocks that appear to have been deposited at the bottoms of oceans comparable in depths with those we know—that is, there are no formations known that resemble, for instance, the globigerina ooze now being deposited on the Atlantic floor. On the other hand, the geographical distribution of many species of plants and animals points very decidedly towards the existence in the past of land connections between the various continents, and this evidence cannot be put aside. It was therefore given as another theory by Neumayer, Frech and others (1885, 1902) that, in the north and south Atlantic, in the central part of the Indian ocean, and possibly in the central part of the Pacific, there were, during the Mesozoic period, extensive land regions that have now subsided. Thus there are indications that large regions of continental land have been depressed to form the floors of deep oceans, but there are no clear indications that deep ocean beds have ever been elevated to form dry land.

A third hypothesis set out by A. Wegener in 1915, suggests that the great continental land elevations actually slip on the plastic layer beneath. The Atlantic basin has been formed by the slipping westward of the Americas. The coastal mountain ranges on the Pacific margin of the Americas were formed by the crumpling of the crust under the westward drift of the American continents, and so on. The hypothesis requires that there should be evidence of progressive change of longitude. Observed changes are doubted. It also requires some stress-difference under which the continental land masses yield and shift place relative to the earth-axis. All these three very different theories—that of permanence, that of bridge continents and that of slipping continents—have their difficulties and objections. It follows that there can be no agreement as to the age of the oceans.

## AGE OF THE OCEANS

According to Wegener the Atlantic is the youngest, the Indian older, and the Pacific the oldest of the oceans. Certainly the Atlantic, in the zone stretching from the West Indies to the Mediterranean, has experienced great changes since Tertiary times. Other investigators suggest that the Atlantic, with the exception of the West Indian region, is the oldest ocean, and that the Pacific is still, so to speak, in the making. As proofs of this are mentioned the many deep trenches or geosynclines around its borders and the numerous earthquakes which point to the continuation of the folding and subsidence. Some data now exist for the formation of estimates of the age of the oceans. The evidence comes partly from the study of radioactivity (*q.v.*); it is known that helium and lead are the end-products of radioactive disintegration of certain minerals, and from the ratios of these materials to their parent substances it is believed that a period of several thousands of millions of years must have elapsed since the first solid and cool earth-crust was formed. Some cosmographic investigations (due mainly to Jeans and Jeffreys) suggest that at least about 1,300,000,000 years have elapsed since the first oceans were formed.

**Salts of Sea Water.**—Common salt, Epsom salts, gypsum and magnesium chloride were early recognized amongst the constituents of sea water. Modern analyses reveal the existence of 32 out of the 80 known elements as dissolved in sea water. Copper, lead, zinc, nickel, cobalt and manganese have been found only in the substance of sea weeds and corals. Silver and gold also exist in solution in sea water. E. Sonnstadt detected first, in 1870, gold by means of a colour test, Haber's analyses 1926–27 give 4 ($10^{-6}$) grains of gold per kgm. of sea water, making any ideas of recovery hopeless.

The elements in addition to oxygen which exist in largest amount in sea salt are chlorine, bromine, sulphur, potassium, sodium, calcium and magnesium. Since the earliest quantitative analyses of sea water were made by Lavoisier in 1772 the view has been held that the salts are present in sea water in the form in which they are deposited when the water is evaporated. The most numerous analyses have been carried out by Forchhammer, who dealt with 150 samples, and Dittmar, who made complete analyses of 77 samples obtained on the "Challenger" expedition. Dittmar found the following average proportions of the salts in ocean water:—

*The Salts in Ocean Water*

| | Per 1,000 parts water | % Total salts | Per 100 molecules $MgBr_2$ |
|---|---|---|---|
| Common salt, sodium chloride (NaCl) | 27·213 | 77·758 | 112,793 |
| Magnesium chloride ($MgCl_2$) | 3·807 | 10·878 | 9,690 |
| Magnesium sulphate ($MgSO_4$) | 1·658 | 4·737 | 3,338 |
| Gypsum, calcium sulphate ($CaSO_4$) | 1·260 | 3·600 | 2,239 |
| Potassium sulphate ($K_2SO_4$) | 0·863 | 2·465 | 1,200 |
| Calcium carbonate ($CaCO_3$) and residue | 0·123 | 0·345 | 298 |
| Magnesium bromide ($MgBr_2$) | 0·076 | 0·217 | 100 |
| | 35·000 | 100·000 | |

The variations in the proportion of individual salts to the total salts are very small; all analyses since Dittmar's have confirmed this result. Although the salts have been grouped in the above table it is not to be supposed that a dilute solution like sea water contains all the ingredients thus arbitrarily combined. There must be considerable dissociation of molecules and as a first approximation it may be taken that of ten molecules of most of the components about nine (or in the case of magnesium sulphate five) have been separated into their ions, and that it is only during slow concentration as in a natural *saline* that the ions combine to produce the various salts in the proportions set out in the above table. One can look on sea water as a mixture of very dilute solutions of particular salts, each one of which after the lapse of sufficient time fills the whole space as if the other constituents did not exist, and this inter-diffusion accounts easily for the uniformity of composition in the sea water throughout the whole ocean, the only appreciable difference from point to point being the salinity or degree of concentration of the mixed solutions.

The origin of the salt of the sea was attributed by some authorities entirely to the washing out of salts from the land by rain and rivers and the gradual concentration by evaporation in the oceans. This hypothesis, however, does not accord with the theory of the development of the earth from the state of a sphere of molten rock, surrounded by an atmosphere of gaseous metals, by which the first-formed clouds of aqueous vapour must have been absorbed. The great similarity between the salts of the ocean and the gaseous products of volcanic eruptions at the present time, rich in chlorides and sulphates of all kinds, is a strong argument for the ocean having been salt from the beginning. Two other facts are totally opposed to the origin of all the salinity of the oceans from the concentration of the washings of the land. The proportions of the salts of river and sea water are quite different, as Julius Roth shows thus:—

| | Carbonates | Sulphates | Chlorides |
|---|---|---|---|
| River water . . . | 80 | 13 | 7 |
| Sea water . . . . | 0·2 | 10 | 89 |

The salt of salt lakes which have been formed in the areas of internal drainage in the hearts of the continents by the evaporation of river water are entirely different in composition from those of the sea, as the existence of the numerous natron and bitter lakes shows. Magnesium sulphate amounts to 4·7% of the total salts of sea water according to Dittmar, but to 23·6% of the salts of the Caspian according to Lebedinzeff; in the ocean magnesium chloride amounts to 10·9% of the total salts, in the Caspian only to 4·5%; on the other hand calcium sulphate in the ocean amounts to 3·6%; in the Caspian to 6·9%. These two disparities make it extremely difficult, if not impossible, to view ocean water as merely an extract of the salts in the rocks.

The determination of salinity was formerly carried out by evaporating a weighed quantity of sea water to dryness and weighing the residue. This method was inexact. Sörensen and Knudsen after a careful investigation abandoned the old definition of salinity as the sum of all the dissolved solids in sea water and substituted the weight of the dissolved solids in 1,000 parts by weight of sea water on the assumption that all the bromine is replaced by its equivalent of chlorine, all the carbonate converted into oxide and the organic matter burnt. The advantage of the new definition lies in the fact that the estimation of the chlorine (or rather of the total halogen expressed as chlorine) is sufficient to determine the salinity. According to Knudsen the salinity is given in weight per thousand parts by the expression $S = 0.030 + 1.8050\ Cl$, where S is the salinity and Cl the amount of total halogen in a sample. This definition was adopted by the International Council for the Study of the Sea in 1902.

Besides the determination of salinity by titration of the chlorides, the method of determination by the specific gravity of the sea water is still used. In the laboratory the specific gravity is determined in a pyknometer by actual weighing, and on board ship by the use of an areometer or hydrometer. In all areometer work it is necessary to ascertain the temperature of the water sample under examination with great exactness, as the volume of the areometer as well as the specific gravity of the water varies with temperature. All determinations must accordingly be reduced to a standard temperature for comparison. Following the practice of J. Y. Buchanan on the "Challenger," it has been usual for British investigators to calculate specific gravities for sea water at 60° F compared with pure water at the maximum density point (39·2°) as unity. On the continent of Europe it has been more usual to take both at 17·5° C (63·5° F), which is expressed as

$$\frac{\text{"S17.5"}}{17.5}.$$

A careful investigation of the relation between the amount of chlorine, the total salinity and the specific gravity of sea water of different strengths including an entirely new determination of the thermal expansion of sea water was made by M. Knudsen, 1899; the results are published in his *Hydrographical Tables* in a convenient form for use (1901).

The temperature of maximum density of sea water of any specific gravity was determined by Knudsen, the temperature of maximum density is lower as the concentration of the sea water is greater, as is shown in the following table:—

*Maximum Density Point of Sea Water of Different Salinities*

| Salinity per mille | 0 | 10 | 20 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|
| Temperature $\theta$° C | 3·95° | 1·86° | −0·31° | −2·47° | −3·52° | −4·54° |
| Density $\sigma\theta$. . | 1·00000 | 1·00818 | 1·01607 | 1·02415 | 1·02822 | 1·03232 |

In this table density $\sigma\theta$ signifies the specific gravity of the sea water in question at $\theta$ temperature.

**Further Physical Properties of Sea Water.**—The laws of physical chemistry relating to complex dilute solutions apply to sea water, and hence there is a definite relation between the osmotic pressure, freezing-point, vapour tension and boiling-point by which when one of these constants is given the others can be calculated.

| Salinity per mille . . | 10 | 20 | 30 | 35 | 40 |
|---|---|---|---|---|---|
| Freezing-point (C) . . | −0·53 | −1·07 | −1·63 | −1·91 | −2·20 |
| Osmotic pressure (atmospheres) . . . | 6·4 | 13·0 | 19·7 | 23·1 | 26·6 |
| Elevation of boiling-point (C) . . . | 0·16 | 0·31 | 0·47 | 0·56 | 0·64 |
| Reduction of vapour pressure (mm.) . . | 4·2 | 8·5 | 13·0 | 15·2 | 17·6 |

The biologic importance of the osmotic pressure of sea water will be easily understood from the fact that a frog placed in sea water loses water by exosmosis and soon becomes 20% lighter than its original weight, while a true salt water fish suddenly transferred to fresh water gains water by endosmosis, swells up and quickly succumbs. The elevation of the boiling-point is of little practical importance, but the reduction of vapour pressure means that sea water evaporates more slowly than fresh water, and the more slowly the higher the salinity. The fact that sea water does evaporate more slowly than fresh water has been proved by the observations of Mazelle at Trieste and of Okada in Azino (Japan). Their experiments show that in similar conditions the evaporation of sea water amounts to from 70 to 91% of the evaporation of fresh water. G. Wüst calculates that in one year on an average 0·82 metre of water is evaporated over all the seas of the world; in the trade wind zone something like 1·10 metres and in high latitudes only 0·5 metre or less.

**Transparency and Colour of Sea Water.**—The optical properties of sea water are of direct importance in biology, as they affect the penetration of sunlight into the depths. The transparency of sea water has frequently been measured at sea by the simple experiment of sinking white-painted discs and noting the depth at which they become invisible. In the North sea north of the Dogger bank, for instance, the disc is visible in calm weather to a depth of from 20 to 30 metres, but in rough weather only to 10 metres. The greatest transparency hitherto reported is in the Sargasso sea, where Krümmel observed a 2 metre disc to depths of 66 metres, but in the cold currents of the north Atlantic and also in the equatorial current the depth of visibility was only from

20 to 30 metres. In the tropical Indian and Pacific oceans the depth of visibility increases to from 40 to 50 metres.

Spindler and Wrangell in the Black sea studied transparency by sinking an electric lamp; experiments have also been made by using photographic plates to find the greatest depths to which light penetrates. Fol and Sarasin detected the last traces of sunlight in the western Mediterranean at a depth of 370 metres, and Murray and Hjort observed that photographic plates, after an exposure of two hours at a depth of 1,500 metres in mid-Atlantic, had become dark. The chief cause of the different transparency is the varying quantity of mineral particles in suspension or of plankton. Schott gives the following as the result of measurements of transparency by means of a white disc at 23 stations in the deep ocean, where quantitative observations of the plankton under 1 square metre of surface were made at the same time.

| | Volume of plankton | Depth of visibility | Colour |
|---|---|---|---|
| | ccm. | metres | |
| Mean of 11 stations poor in plankton . . . | 85 | 26 | Blue |
| Mean of 12 stations rich in plankton . . . | 530 | 16 | Green |

The colour of ocean water far from land is an almost pure blue, and all the variations of tint towards green are the result of local disturbances, the usual cause being turbidity of some kind, and this in the high seas is almost always due to swarms of plankton. The colour of sea water as it is seen on board ship is most readily determined by comparison with the tints of Forel's xanthometer which consists of a series of glass tubes filled with a mixture of blue and yellow liquids in varying proportions. Observations with the xanthometer have shown that the purest blue (0–1 on Forel's scale) is found in the Sargasso sea, in the north Atlantic and in similarly situated tropical or subtropical regions in the Indian and Pacific oceans. The northern seas have an increasing tendency towards green, the Irminger sea showing 5–9 Forel, while in the North sea the water is usually a pure green (10–14 Forel), the western Mediterranean shows 5–9 Forel, but the eastern is as blue as the open ocean (0–2 Forel). A pure blue colour has been observed in the cold southern region, where the "Valdivia" found 0–2 Forel in 55° S. between 10° and 31° E., and even the water of the North sea has been observed at times to be intensely blue. Over shallows even the water of the tropical oceans is always green. There is no relationship between colour or transparency on the one side and the temperature or salinity on the other, but a distinct relationship between colour, transparency and plankton or mineral particles in suspension in the ocean. The most transparent water which is the most free from plankton is always the purest blue, while an increasing turbidity is usually associated with an increasing tint of green. The physical explanation for these facts, according to the investigations of K. Grien near Capri, is the selective absorption of light in water. In the following table the originally existing amount of light is supposed to equal 1,000.

| Colours of the spectrum | Red | Yellow | Green | Blue | Violet |
|---|---|---|---|---|---|
| Wave lengths in $\mu\mu$ | 650 | 600 | 550 | 450 | 410 |
| Depth 5 metres | 3·7 | 2·5 | 250 | 450 | 866 |
| „ 20 „ | 0·03 | 1·2 | 5·8 | 277 | 666 |
| „ 50 „ | 0·002 | 0·03 | 2·2 | 201 | 200 |
| „ 100 „ | .. | 0·001 | 0·03 | 5·5 | 10 |
| „ 200 „ | .. | .. | 0·004 | 0·04 | 1 |

At a depth of 50 metres red and yellow are wholly absorbed, while $\frac{200}{1,000}$ of the blue and violet rays of the original amount of light still exist. Blue is the natural colour of water over the greater depths and the colour seen by divers. Clear sea water looks blue from the surface because some of the non-absorbed rays are reflected, but if the water contains mineral substances or plankton the red and yellow rays may also be reflected and the colour of the water is green. Discoloration is always due to foreign substances. Brown or even blood-red stripes have been observed in the north Atlantic when swarms of the copepod *Calanus finmarchicus* were present; the brown alga *Trichodesmium erythraeum*, as its name suggests, can change the blue of the tropical seas to red; swarms of diatoms may produce olive-green patches in the ocean, while some other forms of minute life have at times been observed to give the colour of milk to large stretches of the ocean surface.

**Other Properties.**—On account of its salinity, sea water has a smaller capacity for heat than pure water. The specific heat diminishes as salinity increases, so that for 10 per mille salinity it is 0·968, for 35 per mille it is only 0·932, that of pure water being taken as unity. The internal friction or viscosity of sea water has been shown by E. Ruppin to increase with the salinity. Thus at 0° C the viscosity of sea water of 35 per mille salinity is 5·2% greater and at 25° C 4% greater than that of pure water at the same temperatures; in absolute units the viscosity of sea water at 25° C is only half as great as it is at 0° C.

The compressibility of sea water increases with decreasing temperature, salt content and pressure. The difficult calculation of the amount of compressibility has recently been carried out by W. Ekman, Bjerknes and Sandström. The following series from the Philippine trench shows the variations.

| Depth (metres) | Temperature °F | Salinity ‰ | Specific gravity | |
|---|---|---|---|---|
| | | | Without compression | With compression |
| 0. . | 80·8 | 34·32 | 1·02220 | 1·02220 |
| 100. . | 76·6 | 34·86 | 1·02331 | 1·02376 |
| 1,000. . | 40·1 | 34·53 | 1·02739 | 1·03215 |
| 5,000. . | 34·7 | 34·68 | 1·02777 | 1·05107 |
| 10,000. . | 36·7 | 34·68 | 1·02768 | 1·07123 |

One litre of water at this last depth therefore weighs not 1027·68 grams but actually 1071·23 grams. If the whole mass of water in the ocean were relieved from pressure its volume would expand from 1,369 million cub. km. to 1,381 million cub. km., which, for a surface of 361 million sq. km., means an increased depth of 32 metres.

## THE GASES OF SEA WATER

The water of the ocean, like any other liquid, absorbs a certain amount of the gases with which it is in contact, and thus sea water contains dissolved oxygen ($O_2$), nitrogen ($N_2$), and carbonic acid ($CO_2$) absorbed from the atmosphere. Great quantities of $CO_2$ are, in addition, present in carbonates. It is important for the sea organisms, particularly for fish which breathe through gills, that the absorbed air, although the amount is very small, contains more oxygen per cent than that of the atmosphere. At the surface one litre of sea water of 35‰ salinity and at a temperature of 50° F contains normally 18·7 c.c. of gas, consisting of 6·4 c.c. of oxygen, 12·0 c.c. of nitrogen and 0·3 c.c. of carbonic acid gas. These 6·4 c.c. of oxygen are 34% of the whole absorbed air, while oxygen forms only 21% of the atmosphere. The quantity of oxygen usually increases with decreasing temperature and decreasing salt content; it is also greater at the surface than in the depths, where the oxygen is consumed by the breathing of organisms and cannot be directly replaced.

In the last 20 or 30 years the distribution of oxygen in time and place, in the Atlantic and European enclosed seas, at least, has been fairly thoroughly examined. It has been found that in the Tropics, between 20° S. and 20° N., the water between 100 and 1,000 metres deep is very poor in oxygen, having generally only 2 or 3 c.c. per litre, but in the high polar latitudes the water contains 7 or 8 c.c. of oxygen per litre at the surface and even in the depths. In these high latitudes the water evidently sinks at times from the surface to the sea floor and maintains the oxygen at the bottom. This polar ground water flows away towards the Equator and so the water at the bottom of tropical seas has enough oxygen to enable organisms to exist. Where this vertical sinking of the surface water does not occur, as in the Baltic, the bottom water is very poor in oxygen; often oxygen is absent, *e.g.*, north of

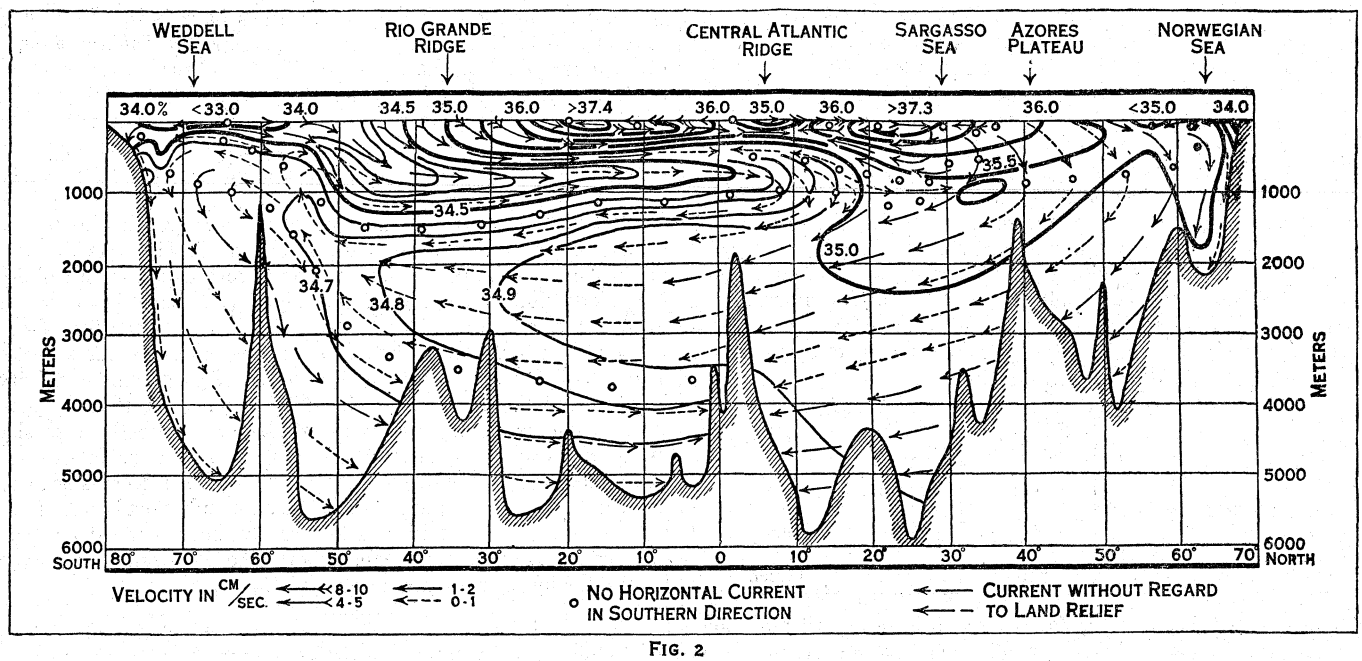



FIG. 2

Gothland, and animal life is then limited. In the Black sea the deep water is always and everywhere free from oxygen, and organisms are quite absent. On the other hand, one observes in the upper, sun-penetrated layers an abundance of oxygen, when in spring the plankton plants develop and produce oxygen through the so-called assimilation process. Where oxygen is scarce or absent there is generally a marked increase of $CO_2$, *e.g.*, on the floor of some Baltic hollows. This increase in the amount of $CO_2$ up to 12 times the normal amount, is caused by slow accumulation in the absence of renewal of the water and by the breathing of the sea animals; the water in these hollows is thus in the end poisoned. In contrast with the Baltic the North sea depths are sufficiently supplied with oxygen, and there is no marked increase in carbonic acid. For these reasons conditions are much more favourable for fish in the North sea than in the Baltic.

The gaseous, absorbed nitrogen plays no part here; its significance arises from the fact that nitrogen compounds have a nutritive value for plants, as on dry land. It has already been pointed out that in addition to carbonic acid gas, there is a large amount of $CO_2$ present in the dissolved carbonates. The greater part of the $CO_2$ occurs as carbonate and bicarbonate.

In the open ocean the alkali proportion of the salt content is set out in the formula

$$A\ (\text{alkalinity}) = 0{\cdot}77\ S.\ (\text{salinity})$$

where S is in ‰ and A in c.c. per litre. In this case, where the salt content is 35‰ the average alkalinity is 27 c.c. But great deviations appear, especially a great increase near coasts, where rivers bring down a large amount of carbonate.

Since 1851 it has been known that all sea water has an alkaline reaction. Absolutely pure water, which does not exist naturally, is neutral, it contains an equal amount of hydrogen ions and hydroxyl ions; it does not conduct an electric current and is neither alkaline nor acid. In sea water a considerable part of the water is resolved into the two components, (1) the positive hydrogen ion (H), and (2) the negative hydroxyl ion ($OH^1$), because weak acids, such as carbonic acid, and their salts in aqueous solution are subject to hydrolitic dissociation. The estimation of the hydrogen ions is used as a means of measuring the alkaline reaction of sea water, which depends both on the amount of free $CO_2$ and on the alkalinity discussed above. This hydrogen ion concentration of the sea varies around $10^{-8}$ grams per litre. All these factors have fixed relations to one another.

## DISTRIBUTION OF SALINITY

In each of the three oceans there are two maxima of salinity of the surface water—one in the north, the other in the south tropical belt, separated by a zone of minimum salinity in the equatorial region, and giving place poleward to regions of still lower salinity. The three oceans differ somewhat between themselves. The north Atlantic maximum is the highest with water of 37·9 per mille salinity; the maximum in the south Atlantic is 37·4; in the north Indian ocean, 36·7; the south Indian ocean, 36·4; the south Pacific, 36·9; and the north Pacific has the lowest maximum of all, only 35·7. The comparatively fresh equatorial belt of water has a salinity of 35·0 to 34·0 in the Atlantic and in the Indian ocean, 34·5 in the western and 33·5 in the eastern Pacific. Taking each of the oceans as a whole, the Atlantic has the highest general surface salinity with 35·37.

The salinity of enclosed seas naturally varies much more than that of the open ocean. The saltiest include the eastern Mediterranean with 39·5 per mille, the Red sea with 41 to 42 per mille in the Gulf of Suez, and the Persian gulf with 40 near Bushire. The fresher enclosed seas include the Malay and the East Asiatic fringing seas with 30 to 34·5 per mille, the Gulf of St. Lawrence with 30 to 31, the North sea with 35 north of the Dogger bank, diminishing to 32 further south, and the Baltic, which freshens rapidly from between 25 to 31 in the Skagerak to 7 or 8 eastward of Bornholm and to practically fresh water at the heads of the Gulfs of Bothnia and Finland. The Arctic sea presents a great contrast between the salinity of the surface of the ice-free Norwegian sea with 35 to 35·4, and that of the central Polar basin, which is dominated by river water and melted ice, and has a salinity less than 25 per mille in most parts.

The causes of difference of surface salinity are mainly meteorological. The belt of equatorial minimum salinity corresponds with the excessively rainy belt of calms and of the equatorial countercurrent, the salinity diminishing towards the east. The tropical maxima of salinity on the poleward side of the trade-winds coincide with the regions of minimum rainfall, high temperature, strong trade-winds and consequently of maximum evaporation. Evaporation is naturally greatest in the enclosed seas of the nearly rainless subtropical zone such as the Mediterranean and Red sea. Where the evaporation is at a minimum, the inflow of rivers from a large continental area and the precipitation from the atmosphere at a maximum, there is necessarily the greatest dilution of the sea water, the Baltic and the Arctic seas being conspicuous examples.

The salt content of the sea water in the depths of the oceans has been investigated with certainty only during the last 10 or 20 years. While the variation at the surface is somewhere between 30 and 40‰, the variation at depths of more than 200 metres lies only between 35·5‰ and 34·5‰. These variations are there occa-

sioned not by meteorological phenomena, but by the currents of the deep sea. If we study the Atlantic, which is best known (fig. 2), we see that there is a great difference between the part in the northern hemisphere and that in the southern. In north latitudes the salt content diminishes steadily with the depth from 37 to 34·8‰ but in south latitudes the diminution proceeds only to a depth of 800 or 1,000 metres, where a first minimum of 34·3‰ is reached. From 800 metres or 1,000 metres to 2,000 or 3,000 metres the salt content increases to 34·9‰ in order to decrease from this layer again down to the sea floor, where a second minimum of 34·6‰ is observed. The particulars of the course of the isohalsines or lines of equal salinity are explained best through looking at the deep currents along the arrow lines in the figure. In high south latitudes the heavy water, poor in salt, sinks from the surface into the depths and moves northward right over the Equator into the northern hemisphere at a moderate depth of from 600–1,000 metres as the so-called Intermediate Current or *Zwischenstrom*. In the northern mid-latitudes the salty, heavy water sinks from the surface into the depths and moves, at a depth between 1,000 and 3,000 metres, towards the southern hemisphere as the Depth current or *Tiefenstrom*. Finally at a still deeper level, on the ocean floor, the water moves from the southern to the northern hemisphere (the Floor current or *Bodenstrom*). Thus one finds currents with very different origins and varying salt content moving in various directions resulting from a combination of both vertical and horizontal movements. This scheme of the divisions of salt content and movement of water applies also to the Indian sea depths, and, fundamentally at least, to the Pacific. Most important for the origin of these movements is the fact that round the earth in the neighbourhood of Antarctica are present immense masses of water of high specific gravity which flow away northward at the surface of the sea and which then, somewhere around Lat. 50° S., sink towards the depths as the Intermediate current or *Zwischenstrom*. Without this immense south polar sea the properties of the deep sea water would be very different; the north polar seas, shut off from the south by ridges, can send forth no such great streams.

In general, the salt content of the depths of the great oceans is less than that of the surface; it is only the manner and rate of the decrease that is different in northern and in southern latitudes. In addition the polar seas have another factor of vertical distribution of salt content. In the icy seas, down to a depth of 100 or 200 metres, as a result of freezing, the water is very cold but poor in salt; under this, from 200 to 1,000 metres, is a layer of warmer, saltier water; from there to the bottom the temperature diminishes, but only a very little, and the salt content remains almost unaltered (fig. 2). The following table combines the latest figures for salt-content and temperature at five latitudes along meridian 30° W.

| *Salinity ‰* | | | | | |
|---|---|---|---|---|---|
| | South | | | North | |
| Depths (metres) | 60° | 30° | 0° | 30° | 60° |
| 0 | 33·96 | 36·07 | 35·29 | 36·82 | 35·30 |
| 100 | 34·42 | 36·03 | 35·65 | 36·75 | 35·29 |
| 200 | 34·60 | 35·56 | 35·27 | 36·39 | 35·28 |
| 500 | 34·66 | 34·90 | 34·72 | 35·78 | 35·25 |
| 1,000 | 34·69 | 34·26 | 34·64 | 35·45 | 35·05 |
| 1,500 | .. | 34·53 | 34·94 | 35·39 | 34·98 |
| 2,000 | 34·65 | 34·94 | 34·92 | 35·17 | 34·97 |
| 3,000 | .. | 34·96 | .. | 34·97 | .. |
| 4,000 | 34·67 | 34·76 | 34·86 | 34·94 | .. |
| *Temperature* (° F) | | | | | |
| 0 | 29·5 | 68·9 | 79·2 | 70·7 | 46·4 |
| 100 | 29·5 | 65·8 | 62·6 | 66·7 | 45·9 |
| 200 | 31·5 | 60·6 | 54·7 | 63·7 | 45·5 |
| 500 | 32·9 | 50·0 | 44·6 | 55·6 | 43·5 |
| 1,000 | 32·4 | 38·3 | 39·6 | 47·5 | 40·3 |
| 1,500 | 32·0 | 37·2 | 39·2 | 42·6 | 39·2 |
| 2,000 | 31·6 | 37·6 | 37·9 | 39·6 | 37·4 |
| 3,000 | 31·3 | 36·0 | 37·0 | 37·4 | .. |
| 4,000 | 31·3 | 34·2 | 34·7 | 36·7 | .. |

In a few enclosed seas—differing from the ocean—the salt content increases with the depth, *e.g.*, in the Baltic and Black seas, because salty water flows into the seas along the floor from the North and Mediterranean seas respectively; the result is that in the middle of the Baltic, near Gothland, the salt content at the surface is only 6 or 7‰ while from a depth of 100 metres it rises to 11 or 13‰.

**Temperature of the Oceans.**—The temperature of the surface of the sea is obtained from samples dipped by a bucket. The measurement of temperature in the depths involves stopping the ship and employing thermometers of special construction. The best instrument and the one in general use to-day is the outflow or reversing thermometer, first introduced by Aimé in the Mediterranean in 1841–45, but greatly improved and simplified by Negretti and Zambra, London, and Richter Wiese, Berlin. The principle is to have a constriction in the tube above the bulb so proportioned that when the instrument is upright it acts in every way as an ordinary mercurial thermometer but when it is inverted the thread of mercury breaks at the constriction. Magnaghi introduced a convenient method of inverting the thermometer by means of a propeller actuated on beginning to heave in the line; greater precision and certainty are obtained by using a lever actuated by a weight slipped down the line to cause the reversal. All thermometers sunk into deep water must be protected against the enormous pressure to which they are exposed.

The warming of the ocean is due practically to solar radiation alone; such heat as may be received from the interior of the earth can only produce a small effect and is fairly uniformly distributed. On account of the high specific heat and of the turbulence of sea-water the diurnal range of temperature at the surface is very small. According to A. Buchan's discussion of the two-hourly observations on the "Challenger" the total range between the daily maximum and minimum in the warmer seas is between 0·7° and 0·8° F, and for the colder seas still less (0·2° F), compared with 3·2° F in the overlying air. The maximum usually occurs between 1 and 2.30 P.M., the minimum shortly before sunrise. The temperature of the surface water is generally a little higher than that of the overlying air, the daily average difference being about 0·6° F, varying from 0·9° lower at 1 P.M. to 1·6° higher at 1 A.M. There are few observations available for ascertaining the depth to which warmth from the sun penetrates in the ocean. The investigations of Aimé in 1845 and Hensen in 1889 indicate that the amount of cloud has a great effect. Aimé showed that on a calm, bright day in the Mediterranean the temperature rose 0·1° C between the early morning and noon at a depth of about 20 metres. The penetration of warmth from the surface is effected by direct radiation, by convection by particles rendered dense by evaporation increasing salinity, and through the turbulence of movement in the upper layers. After a storm the whole of the water in the North sea assumes a homothermic condition, *i.e.*, the temperature is the same from surface to bottom, and this occurs not only south of the Dogger bank, where the condition is normal, but also, though less frequently, in the deeper water farther north. Similar effects are produced in narrow waters by the action of tidal currents, and the influence of a steady wind blowing on or off-shore has a powerful effect in mixing the water.

The warmest parts of the Indian ocean and Western Pacific have a mean annual temperature of 82° to 84° F, but such high temperatures are seldom found in the tropical Atlantic. In the Indian ocean between 15° N and 5° S. the surface temperature in May averages 84° to 86° F, and in the Bay of Bengal the temperature is 86°, and no part of the Atlantic has so high a monthly mean temperature at any season. G. Schott's investigations show that the annual range of surface temperature in the open ocean is greatest in 40° N., with 18·4° F, and in 30° S., with 9·2° F; on the contrary, near the equator it is less, only 4° F in 10° N., and in high latitudes it is also small, 5·2° F in 50° S. The figures quoted above are differences between the average surface temperatures of the warmest and of the coldest month. As to the absolute extremes of surface temperature, Sir John Murray points out that 90° F frequently occurs in the western part of

the tropical Pacific, while among seas the Persian gulf in summer months reaches 96° F, only 2° under blood-heat, and the Red sea follows closely with a maximum of 94°. The greatest change of temperature at any place has been recorded to the north-east of Japan with a minimum of 27° F and a maximum of 83°. In those localities, however, it is not the same water which varies in temperature with the season, but the water of different warm and cold currents which periodically occupy the same locality as they advance and retreat. The zones of surface temperature are arranged roughly parallel to the equator, especially in the southern hemisphere. Between 40° N. and 40° S. the currents produce a considerable rearrangement of this order. The arrangement of the isotherms thus affords a basis for valuable deductions as to the direction of ocean currents.

Krümmel's calculation gives the proportional areas at a high temperature as follows:—

*Percentage of Ocean Surface*

| With temperature | Atlantic | Indian | Pacific |
|---|---|---|---|
| Over 77° F (25° C). . | 22·4 | 38·0 | 40·1 |
| Over 68° F (20° C). . | 50·1 | 51·7 | 58·4 |

The vertical distribution of temperature in the open ocean is better known than that of salinity. Such information has already been given above (p. 689) in the table of salinity. The regional differences of temperature at like depths become less as the depth increases. Thus at 300 fathoms or roughly 500 metres greater differences than 22° F hardly ever occur between 60° N. and 60° S., in 800 fathoms or 1,500 metres the differences are less than 15°, and in 1,500 fathoms or 3,000 metres less than 7°. Even in the tropics the high temperature of the surface is confined to a very shallow layer; thus in the Central Pacific where the surface temperature is 82° F the temperature at 200 metres is only 52° F. The whole ocean must thus form but a cold dwelling-place for the organisms of the deep sea. Sir John Murray calculates that at least 80% of the water in the ocean has a temperature always less than 40° F, and a recent calculation by Krümmel gave in fact a mean temperature of 39° F for the whole ocean.

The vertical distribution of temperature in mid-ocean in the greater depths, *i.e.*, depths of more than 200 metres or 100 fathoms, shows first a peculiar situation under the equator and secondly a great difference between the same latitudes north and south. If we use the above table of five points in the Atlantic we find that the water, from a depth of 100 metres to one of at least 600 metres, is colder under the equator than at lat. 30° S. and lat. 30° N., *e.g.*, the water, 200 metres down at the equator, is 9° F colder than at the Bermudas (54·7° and 63·7° respectively). One gathers from this that even at these moderate depths much water in the equatorial zone is rising from the underlying depths, while in mid-latitudes it is sinking. Particularly is this the case in the Sargasso sea between the Azores and the Bermudas. This region shows relatively the highest temperature even down to depths of 2,000 or 3,000 metres; it is considered as the starting point of the North Hemisphere Depth Current or *Tiefenstrom.* (*See* fig. 2.) The North Atlantic is on the whole much warmer than the South Atlantic; this is seen by a comparison of the temperatures at equal depths at 30° lat. N. or S., and still more at 60° lat. In the region 60° N. and 30° W., south of Iceland, one does not find polar or arctic temperatures in the depths, but at 60° S. and 30° W., near South Georgia, they are well marked. Similarly in the Indian and Pacific oceans, the water at a depth of from 100 to 600 metres, near the equator is colder than that north and south of it; and in both these oceans the water at greater depths in middle latitudes is colder in the Southern than in the Northern hemispheres, depth for depth. Everywhere, as in the case of salt content, one finds the northward-reaching influence of the huge, cold, antarctic body of water. The Indian ocean has no connection with the north polar region, the Pacific has ice in quantity only in the Sea of Okhotsk and parts of the Bering sea, and it is separated from the Arctic basin by the narrow Bering strait. But in the depths the Atlantic is also well sheltered from the north polar water by great submarine ridges. Thus it happens that the world ocean is much colder in southern than in northern latitudes.

Generally, the temperature, like the salt content, decreases with the depth. In polar waters this is not the case; here the temperature increases below the surface layers, which had been cooled by ice and cold air to 29·5° F, until at 1,000 metres it is somewhere around 32° or 33° F, and diminishes slowly thence to the bottom. Therefore the arrangement of the temperature is usually *anatherm* (*ἀνά* above *θερμὸς* warm) but in the polar seas it is *katatherm* (*κατά* under) or *dichotherm* (*δίχα* apart). There are also deep regions described as *homotherm,* where from the level of the barrier to the bottom, the temperature remains uniform. Thus south-west of Cape Province (S. Africa) in the Cape Trough, the temperature decreases continuously until it reaches 33·3° F in the greatest depths, while north of the Walfisch ridge and east of the south Atlantic rise in the so-called Congo Deep the temperature remains uniform at 36·4° F from 3,500 metres down to the bottom. Thus in the Central American sea below 1,700 metres, the depth on the bar, no water is found at a temperature lower than that prevailing in the open ocean at that depth, viz., 39·6° F, not even at the bottom of the great Bartlett Deep in 6,290 metres. Such homothermic masses of water are characteristic of all deep enclosed seas. Thus in the Malay sea the various basins are homothermic below the depth of the rim, at the temperature prevailing at that depth in the open ocean. In other enclosed seas shut off from the ocean by a very shallow sill the rule holds good that the homothermic water below the level of the sill is at the lowest temperature reached by the surface water in the coldest season of the year, provided always that the stratification of salinity is such as to permit of convection being set up. To this group belongs the Arctic sea. The Mediterranean sea also belongs to this group; its various deep basins are nearly homothermic (at the winter surface temperature) below the level of their respective sills.

An undercurrent flows out from the Red sea through the Strait of Bab-el-Mandeb, and from the Mediterranean through the Strait of Gibraltar, raising the salinity as well as the temperature of the part of the ocean outside the gates of the respective seas. The action of the Red sea water affects the whole of the Gulf of Aden and Arabian sea, raising the temperature at the depth of 1,000 metres to 52° or 53° F or 9° F higher than the water of the Bay of Bengal at the same depth. The effect of the Mediterranean water in the North Atlantic does not require such large figures to express it, but is extraordinarily far-reaching. There are clear traces of the warm and salty Mediterranean water northward as far as Ireland, westward as far as the Azores and southward as far as the Canaries, at a depth of from 1,000 to 1,600 metres. In shallow seas as the North sea and the British fringing seas, where tidal currents run strong, there is a general mixing together of the surface and deeper water, thus making the arrangement of vertical temperature anathermic in summer and katathermic in winter, while at the transitional periods in spring and autumn it is practically homothermic. Thus at Station $E_2$ of the international series at the mouth of the English channel in 49° 27′ N., 4° 42′ W., the following distribution of temperature F has been observed by Matthews:—

| | Aug., 1904 | Nov., 1904 | Feb., 1905 | May, 1905 |
|---|---|---|---|---|
| Surface | 63·7° | 56·2° | 50·7° | 51·3° |
| 30 metres | 55·5 | 56·5 | 50·8 | 50·5 |
| 100 metres | 55·4 | 56·5 | 50·8 | 50·5 |

It is noticeable that there is a marked vertical temperature gradient only at the end of summer when a warm surface layer is formed, though in Aug. 1904 that was only 14 metres thick. The heat content of the water column, at Station $E_2$ and other places where investigations have occurred in great detail, has been shown by Harvey to vary greatly from year to year.

**Sea Ice.**—The freezing-point of sea water is lower as the salinity increases and normal sea water of 35 per mille salinity freezes at 28·6° F. Experience shows that sea water can be cooled

considerably below the freezing-point without freezing if there is no ice or snow in contact with it. The dissolved salts are excluded in the process in a regular order according to temperature. As very low air temperatures seldom occur, freshly formed sea ice always has a salt content of from 12 to 18‰ if the original salt content of the water was 34‰, and the sea ice is therefore not suitable as a source of drinking water. In general the salt is returned to the lower unfrozen water, but during a continued hard frost it may appear as crystals on the surface; these crystals are known to polar explorers by the Siberian name of *rassol*. Ice is a very poor conductor of heat and accordingly protects the surface of the water beneath from rapid cooling; hence new-formed pancake ice does not increase excessively in thickness in one winter, and even in the centre of the Arctic basin the ice-covering only amounts to 2 or at most 3 metres in the course of a year, while in the Antarctic regions the season's growth is only half as great; in the latter also the accumulated snow is an important factor in the thickness of the ice, and snow is an even worse conductor of heat. The influence of wind and tide breaks up the frozen surface of the sea, and sheets yielding to the pressures slide over or under one another and are worked together into a hummocky ice-pack, the irregularities on the surface of which, caused by repeated fractures and collisions, may be from 3 to 7 metres high. Such formations termed *toross* by the Russians, may extend under water, according to Makaroff's investigations, to at least an equal depth. Such old sea ice, when prevented from escaping, forms the palaeocrystic sea of Nares; but, as a rule, it is carried southward in the East Greenland and Labrador currents, and melted in the warmer seas of lower latitudes. In the Southern Hemisphere the ice-pack forms a nearly continuous fence around the Antarctic continent. Pack ice forms regularly in the inner part of the Baltic every winter, but not in the Norwegian fjords. Even in the Mediterranean, sea ice is formed annually, in the northern part of the Black sea, and more rarely in the Gulf of Salonika and at the head of the Adriatic off Trieste. Hudson bay is blocked by ice for the greater part of the year, and the Gulf of St. Lawrence is blocked every winter. Ice also clothes the continental shores of the northern fringing seas of eastern Asia. In addition to sea ice, icebergs which are of land origin occur at sea. In the north, icebergs break off, as a rule, from the ends of the great glaciers of Greenland, and in the far south from the edge of the great Antarctic ice-barriers. The latter often give birth to prodigious icebergs and ice islands, which are carried northward by ocean currents nearly as far as the tropical zone, before they melt. The Antarctic icebergs are of tabular form and much larger than those of Greenland, but in either case an iceberg rising to 70 metres above sea-level is uncommon and one exceeding 100 metres is very rare. The Greenland icebergs are carried by the Labrador current across the great banks of Newfoundland, where they are often very numerous in the months from March to August, when they constitute a danger to shipping as far south as 40° N. No icebergs occur in the North Pacific and none has ever been reported nearer the coasts of Europe than off the Orkney islands, and there only once in 1836.

**Oceanic Circulation.**—Although observations on marine currents were made near land or between islands even in antiquity, accurate observations on the high seas have only been possible since chronometers furnished a practicable method of determining longitude, *i.e.*, from the time of Cook, the circumnavigator. The difference between the position as determined astronomically and by dead-reckoning gives an excellent idea of the general direction and velocity of the surface-currents. The first comprehensive study of the currents of the Atlantic was that carried out by James Rennell (1790–1830), and since that time Findlay in his *Directories*, Heinrich Berghaus, Maury and the officials of the various hydrographic departments have produced increasingly accurate descriptions of the currents of the whole ocean. Direct observations of currents in the open deep sea are difficult, but Americans have measured directly from anchored ships the Gulf Stream currents in the Caribbean sea. Similarly, for the whole South Atlantic region, the German survey ship "Meteor" (1925–27) was anchored to measure the currents at all depths with Ekman's current-meter. One of the indirect methods of investigating currents is by taking account of the initial temperature of the current and following it by the thermometer throughout its course. Benjamin Franklin (1775) and Charles Blagden (1781), by means of numerous observations of temperature made on board the packets plying on the Atlantic passage, determined the boundaries and seasonal variations of Gulf Stream and Labrador current. In the northern European seas, salinity often proves a sharper criterion of the boundaries than temperature. Evidence drawn from driftwood, wrecks or special drift bottles is less distinct but still interesting and often useful. Icebergs and plankton also serve as indicators of the trend of currents.

Ocean surface-currents depend in general on the prevailing winds, the configuration of the coast and its submarine approaches. The trade-wind regions correspond pretty closely with westward-flowing currents, while in the equatorial calm belts there are eastward-running counter-currents. In a similar manner the Brazil, the Agulhas and the East Australian currents originate from the drift of the south-east trades, and the Japan current arises from the north-east trade drift. In the region of the westerly winds on the poleward side of 40° N. and S. the currents again flow generally eastward.

The general accordance of wind and surface-currents is so obvious that it was fully recognized by seafaring men in the time of the first circumnavigators. Modern investigations have shown, however, that the relationship is by no means simple. We must remember that the ocean is a continuous sheet of water of a certain depth; if a single water particle is set in motion, the whole ocean must respond, as Varenius pointed out in 1650. Only a complete system of circulation can exist in the ocean, and horizontal and vertical movements of water are definitely related to one another. Modern oceanographic investigations of temperature and salt content in the depths, as well as dynamic analyses show that surface water where two surface-currents come together, sinks into the depths (fig. 3), but that where two surface-currents diverge water from the depths rises (fig. 4). The Sargasso sea is an important convergence region. A divergence region lies southward of the Cape Verde islands. Many hitherto enigmatic phenomena are explained by such convergence and divergence lines; *e.g.*, long ribbons of foam, drifting bodies in long lines, ripples, and small patches of cold water in the midst of warm water.

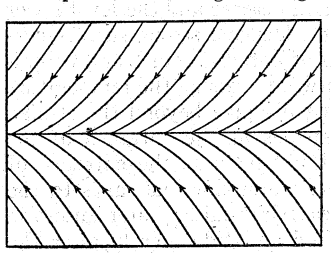


FIG. 3

We also know that the surface-currents have only a very small depth in consequence of the combined action of earth rotation and eddying friction. Following a suggestion by F. Nansen, W. Ekman in 1906 pointed out that current at the absolute surface is deflected 45° to the right (Northern Hemisphere), or 45° to the left (Southern Hemisphere) of the wind direction; the north-east trades therefore produce not a south-westerly but a westerly current, a fact established by observation. Analogous deflections are characteristic for all depths, and already at a depth of 100–150–200 metres the direction is generally opposite to that at the surface as fig. 5 shows. The depth at which the current practically ends is called the friction-depth; it is dependent on the velocity at the surface and on the latitude. The eddying friction which reduces the velocity of water below the surface, on the other hand causes surface movements to become rapidly movements beneath the surface.

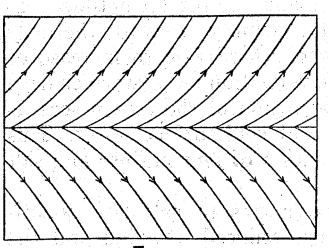


FIG. 4

W. Ekman showed further that a pure wind-drift current when towards the coast, causes a heaping up of the water, and if away from the land, a welling up of deep water. The latter phenomenon is most clearly shown by the stripes of cold water along coasts of

north-west and south-west Africa and the west coasts of North and South America. Upwelling coastal water is coldest close to the shore. The heaping up of surface water upon the coast, gives rise in the depths to a counter-current from the coast. This bottom counter-current maintains its level, is also subject to deflection on account of the rotation of the earth, and has a large share in securing vertical circulation and ventilation of the ocean.

There are also currents produced by variations in the density of water (p. 688). Ekman calls these convection streams; they depend ultimately on the varying rates of cooling, warming or evaporation of water at various places. The consequent variations in density produce variations in pressure at one and the same depth; the heavier water endeavours to flow under the lighter, and the lighter strives to spread itself out over the heavier. The great horizontal compensatory ocean streams between the Northern and Southern Hemispheres are to be explained most probably by differences of pressure; but we have also density or convection streams on the surface of the ocean, associated with or separate from the wind or drift currents. The so-called "Atlantic Current" on the west coast of Europe—a so-called continuation of the Gulf Stream—is only in small part a wind drift. It is principally the result of a density current, for in the Norway sea the density is very high while between lat. 40° and 50° it is low. In particular cases, in straits linking seas of differently constituted water, the density or convection currents develop in such a way that a surface-current goes in one direction, then appears a boundary zone, where the velocity is zero, and under this there is a deep current flowing in a direction contrary to that of the surface-current.

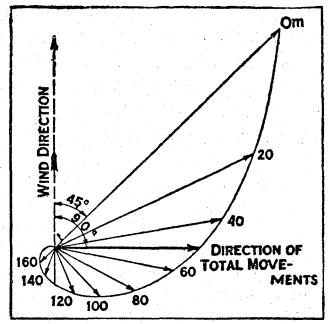


FIG. 5

The very dense water of the Red sea and the Mediterranean makes the column of water salter and heavier and the level lower than in the ocean beyond the straits. Hence a strong surface-current sets inwards through the straits of Bab-el-Mandeb and Gibraltar, while an undercurrent flows outwards, raising the temperature and salinity of the ocean for a long distance beyond the straits. Through the Bosporus and Dardanelles at the entrance of the Black sea, and through the sound and belts at the entrance of the Baltic, streams of fresh surface water flow outwards to the salter Mediterranean and North sea, while salter water enters in each case as an undercurrent. Wind and tide greatly alter the strength of these currents.

Strongly marked differences in density are produced by the melting of sea ice. O. Pettersson has made a careful study of ice melting as a motive power in oceanic circulation, and points out that it acts in two ways; on the surface it produces dilution of the water, forming a fresh layer and causing an outflow seaward of surface water with very low salinity; towards the deep water it produces a strong cooling effect, leading to increase of density and sinking of the chilled layers. Similarly, warmer deep water is attracted polewards to the region of the frozen seas as a result of the flowing away thence of cold surface water. This helps to explain the peculiar distribution of temperature and salt content around the poles.

Modern oceanography has found means to calculate quantitatively the circulatory movements produced by wind and the distribution of temperature and salinity, not only at the surface but in deep water. The methods, first suggested by H. Mohn and subsequently elaborated by V. Bjerknes, Sandstrom, Helland-Hansen and others, have been very usefully applied in many cases by means of so-called dynamical sections, but they should be supplemented by direct observations of currents and of the fundamental processes and conditions underlying them. The determination of the exact relationship of cause and effect in the origin of ocean currents is a matter of great practical importance. The researches of Pettersson, Meinardus, H. N. Dickson and others leave no doubt, for example, that the variations in the intensity of the Gulf Stream, whether these be measured by the change in the strength of the current or in the heat stored in the water, produce great variations in the character of the weather of northern Europe.

The connection between variations of current strength and the conditions of existence and distribution of plankton are no less important, especially as they act directly or indirectly on the life-conditions of food fishes.

BIBLIOGRAPHY.—General: M. F. Maury, *The Physical Geography of the Sea and its Meteorology* (1860); C. D. Sigsbee, *Deep-sea Sounding and Dredging* (Washington, 1880); O. Krümmel, *Handbuch der Ozeanographie* (2 vols., Stuttgart, 1907 and 1911); J. Thoulet, *Océanographie* (2 vols.), vol. i. *Statique* (1890), vol. ii. *Dynamique* (1896); Luigi Hugues, *Oceanografia* (Turin, 1904); Sir J. Prestwich, "Tables of Temperatures of the Sea at Different Depths . . . made between the years 1749 and 1868," *Phil. Trans.* clxv. (1876), 639–670; A. Buchan, "Specific Gravities and Oceanic Circulation," *Trans. Roy. Soc. Edinburgh,* xxxiv. (1896), 317–342; M. Knudsen, *Hydrographical Tables* (Copenhagen, 1901); Sir John Murray, "Deep Sea Deposits and their Distribution in the Pacific Ocean," *Geogr. Journal* (1902) 19, pp. 691–711, chart; Sir J. Murray and J. Hjort, *The Depths of the Ocean* (1912); J. Thoulet, *Précis d'analyse des fonds sous-marins actuels et anciens* (1907); T. Richard, *L'Océanographie* (1907); *Lists of Oceanic Depths and Serial Temperature Observations, received at the Admiralty in the year 1888 (et seq.) from H. M. Surveying Ships, Indian Marine Survey and British Submarine Telegraph Companies* (Official); K. Andrée, *Geologie des Meeresbodens* (Leipzig, 1920); T. Johnstone, *Introduction to Oceanography* (Liverpool, 1923); G. Schott, *Physische Meereskunde* (3rd ed., 1924); W. Ekman, *Meeresströmungen Handbuch der Mechanik* (Leipzig, 1927); K. W. Harvey, *Chemistry and Physics of Sea Water* (Cambridge, 1928); W. A. Herdman, *Founders of Oceanography and Their Work* (1923).

Important current and temperature charts of the ocean and occasional memoirs are published by the Hydrographic office (Admiralty), by the Meteorological office in London, by the U.S. Hydrographic office in Washington, the Deutsche Seewarte in Hamburg, by the Institut für Meereskunde in Berlin and elsewhere. *Pilot Charts* of the Atlantic, of the Indian and Pacific oceans are issued by the U.S. Hydrographic office, of the North Atlantic and of the Indian ocean by the British Meteorological office, of the North and South Atlantic and of the Indian ocean by the Deutsche Seewarte, Hamburg, all these charts giving a conspectus of the normal conditions of weather and sea.

Reports of Important Expeditions:—Sir C. Wyville Thomson, *The Depths of the Sea* (cruises of "Porcupine" and "Lightning") (1873); Sir John Murray, *Report of the Scientific Results of the Voyage of H.M.S. "Challenger" in the years 1872–1876* (50 vols., 1880–95); A. Agassiz, *Three Cruises of the U.S. Coast and Geodetic Survey Steamer "Blake," . . . from 1877 to 1880* (2 vols., Boston, Mass., 1888); *Die Forschungsreise S.M.S. "Gazelle" in den Jahren 1874 bis 1876* (5 vols., Berlin, 1889–90); S. Makaroff, *Le "Vitiaz" et l'Océan Pacifique, 1886–1889* (St. Petersburg [Leningrad], 1894); *The Norwegian North Atlantic Expedition (on the "Vöringen"), 1876–1878* (Christiania [Oslo], 1880–1900); *Expéditions Scientifiques du "Travailleur" et du "Talisman," 1880–1883* (1891 *et seq.*); *Die Ergebnisse der Plankton-Expedition, 1889* (Kiel, 1892, *et seq.*); *Résultats des campagnes scientifiques accomplies sur son yacht par Albert 1er Prince de Monaco* (Monaco, from 1889); *The Danish "Ingolf" Expedition, 1806* (Copenhagen, 1900); Prof. Luksch, *Expeditionen S. M. Schiff "Pola" in das Mittelmeer und in das Rote Meer,* Kais. Akad. Wissenschaften (Vienna, 1891–1904); *Die Deutsche "Valdivia" Tief-See Expedition, 1898–1899* (1900, and Jena, 1902 *seq.*); M. Weber, *Siboga Expeditië* (Leyden, 1902 *et seq.*); F. Nansen, *The Norwegian North Polar Expedition, 1893–1896* (1900); Joh. Schmidt, *Danish Oceanographical Expeditions to the Mediterranean ("Thor")* (Copenhagen, 1912); W. Brennecke, *Deutsche antarktische Expedition, 1911–1912; Ozeanographie* (Hamburg, 1921); "'Meteor' Expedition, 1925–27," in *Zeitschrift Gesellsch. f. Erdkunde* (Berlin, 1926–28); "The Percy Sladen Trust Expedition to the Indian Ocean," *Transact. Linnean Soc.* (1926); *Bulletin des résultats acquis pendant les courses périodiques; Publications de circonstance, Journal du Conseil, Procès verbaux et Rapports* (Conseil permanent international pour l'exploration de la mer) (Copenhagen, 1902 *seq.*); William Beebe, *Beneath Tropic Seas* (1928); E. J. Allen, *The Science of the Sea* (1929); F. S. Russell and C. M. Yonge, *The Seas* (1928).

Reports of many minor expeditions and researches have appeared in the *Reports* of the Fishery Board for Scotland; the Marine Biological association at Plymouth; the Kiel Commission for the Investigation of the Baltic; the Berlin Institut für Meereskunde; the bluebooks of the Hydrographic department; the *Bulletin du musée océanographique de Monaco* (1903 *seq.*); the *Scottish Geographical Magazine;* the *Geographical Journal; Petermanns Mitteilungen;* Wagner's *Geographisches Jahrbuch;* the *Proceedings* and *Transactions* of the Royal Societies of London and Edinburgh; the *Annalen der Hydrographie; Revue Internationale für Hydrobiologie und Hydrographie,* and the publications of the Swedish Academy of Sciences.

**OCEAN GROVE,** a summer resort of Monmouth county, New Jersey, U.S.A., on the Atlantic coast, adjoining Asbury Park on the south. It is served by the Central of New Jersey, the New York and Long Branch and the Pennsylvania railways and motor-coach lines. The resident population of the resort in 1940 was 3,888. There are many hotels, private cottages and a mile of "board walk" along the sea front. Ocean Grove was founded in 1869 by the Ocean Grove Camp-Meeting Association of the Methodist Episcopal Church, as a place for religious worship, rest and recreation, free from all kinds of undesirable amusements, and it keeps much of its original character. It is governed under a corporation charter which authorizes restrictions in the leases.

**OCEANIA,** a geographical area extending from Australia, in the west, to the most easterly islands of Polynesia, in the east, and from New Zealand, in the south, to Micronesia and the Sandwich islands, in the north. Ethnologically the area is divisible into six principal regions (*q.v.*): Australia; Tasmania; Melanesia, a group of islands extending from Fiji, in the south-east, to New Guinea, in the west; New Guinea, which, however, is a geographical rather than an ethnological unit, for the eastern and north-eastern coastal regions are Melanesian, while the west really falls under Indonesia; Polynesia, an island area of considerable racial and cultural uniformity, comprising the greater part of the Pacific; Micronesia, an island area comprising that part of the Pacific which lies between New Guinea, Polynesia and the Philippines.

**Racial History.**—There is little doubt that man first entered this area from the west, and subsequent migrations have all had an easterly, or, in the case of Australia, a southerly trend. The problem of dissecting out the racial components of the peoples on the eastern and southern periphery is, therefore, comparatively simple. Furthermore, the uniformity, both of physical type and culture, and evidence of a more or less historical kind, show that the Polynesian area is of comparatively recent occupation, even allowing for more than one principal set of migrations. But in New Guinea and Melanesia, the principal gateways into Oceania, conditions are more complex, and the racial history of this area has been only tentatively elucidated. Australia, again, shows considerable physical and cultural uniformity with many variations, but the existence of varieties of the Papuan type of man in Tasmania, with a very primitive culture, suggests that man entered and crossed the length of Australia at an extremely early date.

**Principal Groups.**—The six principal divisions of this region, Australia, Tasmania, Melanesia, New Guinea, Polynesia and Micronesia, can be fairly readily distinguished from one another, both racially and culturally, though, in the case of New Guinea, there is not that racial and cultural uniformity which characterizes each of the other areas. Apart from New Guinea, with its great diversity of race and culture, some general characterization of culture as well as race can be made of each of the other areas. Language, for example, will readily separate Australia, and in all probability Tasmania, from the group Melanesia, Polynesia and Micronesia. The speech of these three areas, together with the Melanesian and Indonesian part of New Guinea, is clearly referable to one family, the Austronesian (*q.v.*), extending from part of India and Burma, through Malaya and Indonesia to the extremities of Polynesia. But while the Polynesian languages may be described as dialects of one language, there is considerably more diversity within the Melanesian sub-division of this family.

This Austronesian speech is associated with a distinctly higher culture, particularly in Polynesia and Micronesia, the Melanesians being in some respects intermediate between these groups and the Papuans of New Guinea, though among Papuans there is great variety of culture, the result, no doubt, of various degrees of blending of immigrant cultures with perhaps more than one indigenous culture brought into New Guinea and Melanesia by the original Papuans.

The Australians, culturally as well as physically, betray a marked contrast, not only with the Austronesian-speaking peoples of Oceania, but also with the Papuans of New Guinea. Horticulture, well-developed throughout the rest of the area, excepting Tasmania, is entirely absent, and the economic life is, consequently, of a very low order. Nevertheless, an elaborate social organization and ceremonial life and considerable variation in such stable aspects of culture as the disposal of the dead, survive in Australia.

**Mode of Life.**—The Australians and Tasmanians, being hunters and collectors, are necessarily nomadic, though within more or less well-developed tribal areas. Their most important possessions are their hunting weapons, spears, boomerangs and tools rudely chipped out of stone. The aridity of most of Australia during the greater part of the year, and the very short period during which nature provides abundant food, cause most of the non-economic activities of the Australians to be concentrated in the brief period of spring, when magico-religious rites with the object of increasing the food supply are performed, initiations are conducted, and, in fact, most of the tribal, in contrast with family, activities take place.

In the rest of the area, with its basis of horticulture, the economic struggle is not so keen, and the population is a settled one, except for a few nomadic or semi-nomadic peoples in New Guinea. Diet is mainly vegetarian, taro, yams, bread-fruit, sweet potato, coco-nuts, sago and bananas being the principal foods. In island and coastal regions fish is largely consumed, and almost everywhere pigs are reared and reserved for consumption on occasions of importance, such as marriage festivals and mortuary feasts. Although cannibalism is common, the eating of human flesh is usually a ceremonial act of revenge, or associated with mortuary or other rites. Canoes capable of long sea voyages are constructed, principally in the island areas. Double canoes, and outrigger canoes of various patterns and, formerly, double canoes which only survive at the present day in a limited part of New Guinea, are the commonest, the larger ones being provided with sails. While intercommunication is much hampered by warfare, goods are traded over considerable distances, and in many areas well-developed systems of currency occur.

**Social Organization.**—One feature of social organization appears to be common to the whole of this area, namely, the systematic non-genealogical use of relationship terms, generally known as the classificatory system. If we select any person in a village and enquire as to his relationship to others in the village, he will rarely be at a loss, for everyone is likely to be a mother, or a brother, an uncle or a father-in-law, etc., in this classificatory sense, and such relationships will be found to hold to a large number of persons in other more distant villages. Moreover, these classificatory relationships are important determinants of conduct, many rights and duties being dependent on relationship, though when the relationship is very distant in the classificatory sense they are hardly distinguishable. One of the most important functions of this relationship system lies in the regulation of marriage, those lying in certain relationships being prohibited from marriage, while in some cases only those persons who can establish a given relationship between themselves are allowed to marry. Marriage, however, is generally regulated, at least in part, by the clan (*q.v.*) which is usually, throughout this area, the most important social unit. Particularly in Australia, Melanesia and New Guinea, and to a slightly less extent in Polynesia, is the clan a fundamental unit of the social structure. Membership of the clan is determined by descent through the father or the mother, both varieties being common, and marriage is prohibited within the clan. As a rule, the clan is also totemic (*see* TOTEMISM), this totemic aspect being peculiarly important in Australia, where totemic rites form a large part of the ceremonial life of the natives. In parts of the area, especially Australia and Melanesia, the clans are grouped into two exogamous moieties (*see* DUAL ORGANIZATION), and there is some evidence which suggests that a dual organization once extended over most of the area or occurred among their ancestors before their migrations into Oceania.

**Political Organization.**—In Australia and parts of Melanesia, age appears to be an important qualification of leadership, councils of elders deciding matters of tribal importance. In parts of Melanesia there is little vested authority, a more or less communistic system prevailing, while in other parts, authority depends on the acquirement of prestige derived from the holding of feasts, or the acquisition of wealth. Hereditary chieftainship is

common in Polynesia, where a considerable social gulf may exist between nobles and commoners.

**Initiation.**—Ceremonies of initiation into manhood occur amongst Australians and many Papuans, and are found amongst some Melanesians, mainly in connection with secret societies (*q.v.*), which in some cases dominate the social organization.

**Religion.**—The belief in spirits of the dead is general throughout this area, and some degree of cult of the dead is present everywhere. In some cases, mortuary ceremonial reaches a very high degree of elaboration, particularly in the case of chiefs. Violent orgies of mutilation on the occasion of a death are reported from Australia, and in extreme form from Polynesia. But the existence of an elaborate mortuary ceremonial is not necessarily associated with anything that can be called a worship of the dead, which is probably confined to Polynesia, parts of Melanesia and Micronesia. Between spirits of the dead, or ghosts, and spirits or gods not definitely associated with some ancestor, there is no sharp line of demarcation, but sometimes there are separate words for these two kinds of beings, and a different cult is associated with each, a practice common in Melanesia. Certain ghosts or spirits may be of sufficient importance to rank as gods, who are able to affect more or less the destinies of man, or who are credited with having performed certain acts of creation, or to have introduced important foods or new customs. An elaborate mythology centres around these culture heroes throughout the area, and provide us with suggestive hints as to culture movements and culture contacts in the past.

There is, perhaps, more uniformity throughout the area in the realm of magic (*q.v.*) than in that of religion, in so far as it is possible to separate the two, for there is a transparent sympathetic basis of almost all the magical practices. In addition to direct sympathetic magic without the aid of ghosts or spirits, we also find, particularly in Melanesia, the coercion of both ghosts and spirits for the attainment of what are usually anti-social ends. Divination of sorcerers is also common, which, together with fantastic beliefs concerning the powers of sorcery, accounts for a good deal of the strain to which social relations between individuals, and between groups is subjected in this part of the world. One of the commonest causes of murder is revenge for supposed sorcery.

BIBLIOGRAPHY.—The separate articles, AUSTRALIA, etc., should be consulted for the bibliography of this region. For the racial history, *see* A. C. Haddon, *The Races of Man* (Cambridge, 1924). In Sir J. G. Frazer, *The Belief in Immortality* vols. i.–iii. (London, 1913–22–24), there is a good account of the chief features of social organization and religion of the principal groups within Oceania.

(W. E. A.)

## ARCHAEOLOGY

From permanent contact with European settlers in the latter part of the 18th century the transition from the Stone to the steel age was rapid. Previously writing was unknown in the area, if we except the pictographic "script," as yet imperfectly explained, of Easter island (*q.v.*).

Although it is improbable that any of the more important monuments have entirely escaped observation and record, the greater part of the area has never been properly surveyed in an archaeological sense, and the published records available for many islands are meagre and of unequal value. The only islands of which anything like detailed surveys have been published are Easter, the Australs, the Marquesas, Hawaii (some islands), the Carolines (Ponape, and Kusaie) and, in part, New Zealand and the Chathams (*see* Bibliography). Surveys of Tonga, Tahiti, Necker I., Rapa-iti, and some smaller islands (Fanning, Malden, Christmas, etc.) are now in preparation by the Bishop Museum, Honolulu.

**Absence of Palaeolithic Culture.**—In the moist climate, perishable objects were quickly destroyed, and pottery being absent in Polynesia (except Fijian vases introduced into Tonga), the materials for archaeological study are practically limited to stone tools and monuments. No evidence of a Palaeolithic culture has been found in any part of Oceania. The prevailing tools are everywhere axes or adzes of stone (occasionally also of shell), polished wholly or in part, although flaked obsidian was also used in certain islands where it occurred (*e.g.* Easter, New Zealand, New Britain), and roughly flaked quarrying tools bearing a superficial resemblance to palaeolithic hand-axes are found in Easter island. Judged by its tools, the prehistoric culture of the area belongs entirely to the neolithic phase.

The ethnographical division into Melanesia and Polynesia holds good, in the main, for archaeology. In the former region adzes are of the "celt" type and rounded or sublenticular in section; in the latter they are predominantly straight-edged and angular in section, and further subdivided into a tanged and tangless type, characteristic of east and west Polynesia respectively. The distribution of monuments is in substantial agreement with that of the tools, and the elaborate structures of masonry characteristic of Polynesia scarcely occur west of Fiji, where the few stone monuments found are crude and megalithic in character. Exceptions in the Solomon and Banks islands may be regarded as relics of Polynesian migrations eastwards, or as due to later reflex movements.

**Absence of Stratified Sites.**—No stratified sites showing culture sequence, except in a minor degree in New Zealand, have been found. The habit of making funerary offerings seems to have been little developed, and grave-goods, where discovered, do not differ markedly from artifacts of recent date. Only in parts of Melanesia has the occurrence of deposits distinct in character from the products of the historic inhabitants been observed.

### POLYNESIA

In Polynesia there is at present little archaeological evidence of a succession of cultures; monuments and implements represent at most an earlier and, in some cases, a higher phase of the culture that continued into historic times. Exceptions do occur, however; adzes of distinctively Melanesian type, found in Tahiti, and the carvings of bird-headed men in Easter island suggest the possibility of a pre-Polynesian occupation of parts of eastern Oceania by the negroid race. The evidence is too scanty to be entirely convincing, and the presence of a strong negroid strain in the inhabitants of eastern Polynesia is more probably due to racial intermixture during the Polynesian migrations through Melanesia than to a fusion in the islands in which it is found.

**Eastern Polynesia.**—In all the island groups east of Tonga and Samoa, without a single important exception, occur the remains, now more or less ruined, of megalithic structures, the sacred places or *marae* of the Polynesians. These consist typically of paved rectangular enclosures, surrounded by stone walls, and containing one or more rectangular stone platforms, sometimes, as in Tahiti, of stepped pyramidal form. The elements were variously combined, and differ in details of construction, contour and size. Thus in the Marquesas the walls are low or absent, in the Australs the platforms are generally lacking, while in Tahiti and Hawaii all features are generally present. The platforms were faced with large boulders or hewn blocks of stone or coral, sometimes weighing many tons, and often neatly fitted in regular courses, although mortar was never employed. The core consisted of earth or rubble, and sometimes contained burial pits or vaults. Platforms served also as substructures for sacred houses built of perishable material, for the exposure of the dead, as sacrificial altars, etc.; and the question whether they were intended primarily as tombs has yet to be settled by excavation. Many of them were originally surmounted by large figures of wood or stone in conventionalized human form. Such stone figures, some still *in situ,* are found in Hawaii (Necker), Easter island, Pitcairn, Tahiti, and the Australs (Raivavai), and in the Marquesas, where they exactly resemble those carved in wood. In the Marquesas, platforms, which always had vertical sides, were also much used for secular purposes, both in public assembly places (*tohua*) as seats for the spectators of dances, and as foundations for the ordinary dwelling-houses. The extreme development of terraces and platforms in the latter islands is due to the scarcity of level ground in the steep and narrow valleys, and to the abundance of suitably shaped boulders and easily worked volcanic stone. The largest recorded platform, that of Oborea, in Tahiti, now almost destroyed, measured 90 by 29yd. at the base, and rose in 10 or 11 steps to a height of about 50ft.;

but in general these structures did not exceed 12ft. in height. The antiquity of particular structures cannot be determined from internal evidence, but they were presumably built by ancestors of the historical Polynesians, who on traditional evidence did not reach the area earlier than the 7th century A.D. The fact that they occur in similar form in all groups, including Tahiti and Hawaii, which remained without intercommunication after the great voyages of the 13th and 14th centuries, as well as on intermediate islands, afterwards uninhabited, like Malden and Fanning, shows that the type must have been fully developed by the time of these voyages. Many were still in use when discovered, and some were even constructed in the historic period.

In Pitcairn island, which was uninhabited when occupied by the mutineers of the "Bounty" in 1789, are found many traces of a former Polynesian settlement. The *maraes* and stone figures are said to resemble those of Easter; but a number of large stone chisels and broad-edged axes dug up in the soil are quite exceptional in type. Other small islands, uninhabited at the time of their discovery, but bearing evidence of former Polynesian settlement, include Palmerston, Flint, Malden, Christmas, Fanning, Necker (Hawaii).

**Western Polynesia.**—In Samoa and Tonga typical walled *maraes* are not found, but in the former island there are numerous flat-topped mounds and platforms of considerable antiquity. Some of these were substructures for temples; others were used for burial. But certain earth and stone mounds of exceptionally large size, in Upolu and Savaii, appear to have been constructed for defensive purposes. One of these, near Apia, measures approximately 100yd. square at the base and is 35ft. high; it is traditionally supposed to have served as a platform for the houses of Tongan chiefs. In the mountainous interior of Upolu (Samoa) is a group of upright basalt slabs on a paved floor (*O Le Fale-o-le-Fe'e*), evidently the supports of a former house or temple, while in Savaii there are remains of roads and raised causeways elaborately engineered but long disused, and partly destroyed by an overflow of lava.

The most striking example of a true megalithic monument is the trilithon (Haamonga) on Tongatabu; it consists of two uprights and a lintel stone mortised into them, 15ft. high, and is stated by tradition to have been erected in the 13th century by Tui-ta-Tui in connection with a Kava feast. Not far distant are a large upright slab and two stone-faced house platforms. On the north coast of Tongatabu are the equally remarkable "tombs of the kings" (*langi*), formerly reserved for the burial of sacred chiefs called "Tooitongas"; these are stepped or terraced platforms containing burial vaults and are faced with hewn coral blocks measuring up to 22ft. in length. The earliest of these also probably date from the 13th century, but the construction of similar tombs continued down to the middle of the 19th century. Some of them are merely enclosures of rough stones.

Stone fortifications occur on many islands, and reach their highest development in the terraced entrenchments and solid stone towers on the mountains of Rapa-iti. Of the petroglyphs, representing stylized human and animal figures, concentric circles, etc., which are found abundantly in Hawaii and the Marquesas, some by their situation seem to have had religious significance, while others are only "travellers' marks"; many are of recent date.

**New Zealand and Chatham Islands.**—The final settlement of New Zealand by Polynesian immigrants from Rarotonga in the 14th century was preceded by an earlier branch of the same race, possibly also by people of Melanesian affinities, though this is disputed. Archaeology throws little light on this question, except in so far as no adzes of Melanesian type have been found in the older deposits. Only one properly stratified site has been excavated, viz.: Moa-bone Point Cave, near Christchurch, Otago, where the remains found in the lowest stratum prove the early inhabitants to have hunted the extinct moa. Although accurate dating is impossible, considerable antiquity is suggested by the fact that the coast has sunk several feet since the deposits were formed. The rock-paintings and the implements, which include knives, saws, drills, spear-points and finely "retouched" scrapers, of quartzite, obsidian, chalcedony and chert, indicate that the culture of the moa-hunters did not differ essentially, except in its higher standard of craftsmanship, from that of the historical Otago Maori.

The earthwork and stone fortifications belong for the most part to Maori (*q.v.*) culture, as do probably the pit dwellings and terraces of the Pelorus and Auckland districts and the artificial caves and figures carved in the soft tuff of Rotorua. Curious figures incised in a sandstone pit in Auckland and rock-carvings in the Kaingaroa plains representing canoes of modified Maori type are among the more interesting recent discoveries. The Chatham Islands appear to have been colonized by pure Polynesians, the extinct Moriori (*q.v.*), coming from the South island of New Zealand in about the 12th century. Their stone implements resemble Maori types, with the exception of tanged obsidian blades; tree-carvings and much weathered bird figures incised on cliffs have been reported.

## MICRONESIA

The most important monuments of Micronesia are found in the Caroline islands, where both on Ponape and Kusaie extensive groups of buildings intersected by canals were constructed on artificially enlarged reefs protected by sea-walls. They take the form of rectangular paved courtyards, frequently in contiguous clusters, constructed by laying natural columnar blocks of basalt lengthwise and crosswise in alternate layers. These walls rise in places to a height of more than 20ft., but were not roofed. The enclosures formerly contained houses of perishable material, traces of which remain; also platforms, terraced or pyramidal, in which were sepulchral vaults roofed with coral or basalt slabs. The most striking and best preserved of these structures is the royal cemetery of Nan Tauach at Matolenim (Ponape), which stands in a double enclosure and contains four burial chambers. Enclosed burial platforms of a somewhat similar type occur farther west in Yap and the Bunaj islands. They have certain elements in common with the *marae* of Polynesia, to which they are possibly related either directly or as collateral branches from the same cultural stem. Although the date at which these "sacred cities" of the Carolines were begun is not clear, they were still inhabited at the time of their discovery, and the tradition of how they were constructed by means of inclined planes of tree trunks survives. The stone pounders, and shell and other objects found in the tombs, do not suggest a high antiquity.

In several of the Marianne islands occur groups of conical pillars called *Lat'te,* of square-cut coral, surmounted by large hemispherical capitals, and constructed either of monoliths or layers of coral cemented together. These are always arranged regularly in two parallel rows, and the most probable explanation is that they were supports for the floors of raised temples or houses, since destroyed. Remains of a burial have been found in a cavity in one of the capitals, but this was presumably only a secondary usage. The largest, in Tinian, are 15ft. in height with capitals 6 or 7ft. in diameter; those of Guam and other islands are much smaller. Associated with these monuments, and suggestive of some ceremonial purpose, are remains of burials, pottery, stone mortars and other artifacts.

## MELANESIA

In various parts of Melanesia, from New Guinea to Fiji, are found relics of a prehistoric culture or cultures, which cannot as yet be dated or correlated satisfactorily. An important region covers the east end of New Guinea, New Britain and the adjacent archipelago, where the remains found include ornamented pottery (somewhat similar to that of prehistoric Japan), engraved skulls, obsidian implements and stone pestles and mortars, some of which occur at a considerable depth in river gravels and all of which are quite distinct from the products of recent inhabitants. In the same region, but within a more limited area, are low stone circles, lines and heaps of stones, now used as squatting places and, in part at least, of recent origin. Rock paintings and engravings are numerous in the district behind Port Moresby, some of them coated with a film of calcium carbonate, indicating a certain antiquity. Megaliths are widely distributed and irrigation terraces are found throughout Melanesia. In the Solomon islands (Bou-

gainville and San Cristoval) upright stones occur singly and in groups; in San Cristoval some villages are bordered with stone walls or platforms, and numerous stone-faced and earth mounds, containing shafts leading to burial chambers, and sometimes surmounted by stone statues, small dolmens or upright stones, are still in use. They may be related to Polynesian burial platforms. Their form and the mortuary customs associated with them have led to a comparison with early Egyptian mastabas; attention has also been called to a supposed resemblance of certain pig-tail figures to Egyptian royal statues, but this seems too remote to justify the emphasis laid upon it by some authorities. In the New Hebrides the antiquities include menhirs, stone sacrificial "tables" or dolmens, walls and high platforms, and obsolete types of pottery ornamented in a great variety of styles. There is an exceptional development of stone walls and buildings in the Banks islands, some, however, of recent construction. In general, chronological evidence is almost entirely lacking for these monuments, and the difficulties of distinguishing between ancient and modern are increased by the fact that parts of Melanesia are still living in a "megalithic period." In New Caledonia stone statues (in caves in Lifu) and a few "dolmens or trilithons" have been reported. Petroglyphs are common to all these groups, and particularly numerous in New Caledonia, where they take the form of human and animal figures, spirals and other patterns. Some of the better structures may be attributed either to late waves of Indonesian immigrants, or to reflex Polynesian influence, which has affected many of these islands in comparatively recent times; the *nanga* of Fiji so closely resemble Polynesian *marae* as to leave no doubt of their common origin.

**Migrations and Hypotheses.**—There is general agreement, on the evidence of oral traditions supported by physical, linguistic and botanical evidence, that the ancestors of the Polynesians—a composite stock including Caucasian, Mongolian and Negroid elements—must have come originally in a series of migratory waves from the Asiatic continent. Their starting-point cannot be definitely fixed; hypotheses vary as between India (Ganges or Chota Nagpur), Assam, and the Cambodia-Siam region of Indo-China. In favour of the latter view is the fact that a people speaking an allied language (Mon-Khmer) and having physical affinities with the Polynesians is still living there. They had probably settled in the Indonesian archipelago by the latter part of the first millennium B.C., whence they proceeded in at least two main streams of migration by way of Melanesia or Micronesia to Fiji, which they reached in about the 5th century A.D. Thence eastern Polynesia and New Zealand were settled in successive voyages during the 7th to 14th centuries. Hawaii seems to have been reached first by a direct migration from Indonesia and subsequently by a branch of the main wave from south-eastern Polynesia; this conclusion is supported by archaeological study which recognizes two distinct types of *heiau* (*marae*), the later of which corresponds more closely with the Tahiti-Marquesas type.

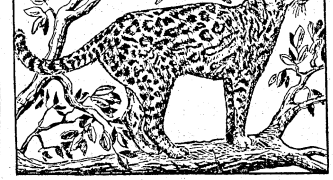
The hypothesis that Oceania served as a highway for the diffusion of an "archaic civilization," originating in Egypt in the 3rd millennium B.C., and including the practices of sun worship, mummification and the building of megalithic structures; and that the stone monuments of Oceania are attributable to the bearers of this culture-complex, has been a subject of considerable controversy. If tradition is right in asserting that Polynesian migrations did not reach the eastern Pacific before the 6th or 7th centuries A.D., and if, as appears probable, these people were the builders of the monuments in that area, it is evident that the older civilizations of America cannot have been inspired by them. On the other hand, since they were in contact with Asia till a relatively late period, they can hardly have escaped the influence of old-world culture or have failed to carry some of its elements with them into the Pacific. The view that Oceania was peopled by migration from America finds little support at the present time. But the theory has recently been advanced that the monuments and culture of eastern Oceania may owe something to the influence of Central and South America, the coasts of which were quite probably visited by the intrepid Polynesian navigators. The absence of pottery has been used by others as an argument for the very early isolation of the Polynesians; the loss of this art was, however, an inevitable result of prolonged wanderings among coral islands, where the material with which to practise it was not available.

BIBLIOGRAPHY.—Capt. James Cook, *Voyages;* W. Ellis, *Polynesian Researches* (1832–34); F. W. Christian, *The Caroline Islands* (1899); R. Parkinson, *Dreissig Jahre in der Sudsee* (1907); G. Thilenius, *Ergebnisse der Sudsee-Expedition,* vol. 2, B. 4 "Kusae" (1908–10); W. H. R. Rivers, *The History of Melanesian Society* (1914); S. Routledge, *The Mystery of Easter Island* (1919); S. P. Smith, *Hawaiki, Polynesian Traditions* (Auckland, N.Z., 1921); W. J. Perry, *The Children of the Sun,* with extensive bibliography (1923); F. Speiser, *Ethnographische Materialien aus den Neuen Hebriden* (1923); C. E. Fox, *The Threshold of the Pacific,* Solomons (1924); *see* also J. S. Kubary, "Die Ruinen auf der Insel Ponape," *Jour. Mus. Godeffroy,* vol. 3, parts 6 and 8 (Hamburg, 1873, etc.); *Internationales Archiv. für Ethnographie,* vol. 2, "Fiji" (1889), vol. 10, "Tahiti" (1897); *Journal of the Polynesian Society,* New Zealand, vol. 1–6 (1892–97), 12 (1903), 15–20 (1906–11), 30–37 (1921–28); *Journal (Royal) Anthropological Institute,* vol. 28 "Ponape" (1898), 30 "Pitcairn" (1900), 32 "Tonga" (1902), 42 and 49 "New Guinea" (1912 and 1919), 50 "Easter" (1920), 51 "Tahiti, Australs" (1921); Mans, "New Guinea" (1904, 1908, 1915, 1922–4, 1926–27, 1927–29, *Figi*) "New Caledonia" (1916); *Anthropos* "New Britain," vol. 4–6 (1909–11), 9–11 (1914–16); G. Fowke, "Hawaii," *Bureau of American Ethnology,* Bull. 76 (1921–22); *Bishop Museum, Honolulu,* publications, Bull. 12. K. P. Emory, "Lanai" (1924); Bull. 23, R. Linton, "Marquesas" (1925); *Occas. Papers,* vol. 7 No. 11; K. P. Emory, "Haleakala" (1921), and "Memoirs," vol. 9; H. D. Skinner, "Chatham Islands" (1923); E. Best, "Maori Stone Implements," *Dominion Museum Bull.* iv. Wellington, N.Z. (1921); *Bulletin de la Soc. des Etudes Oceaniennes,* No. 12, K. P. Emory, "Society Islands" (1926). (H. J. BR.)

**OCEANUS,** in Greek mythology, the river which encircles the earth (conceived as flat) (Gr. Ὠκεανός). Beyond it, to the west, are the land of the Cimmerians, where the sun never shines, the country of dreams, and the entrance of the underworld. Oceanus is in Hesiod (*Theog.* 133, 337–370) the son of Uranus and Ge, the husband of Tethys, father of 3,000 streams and 4,000 ocean nymphs. In Homer he is the origin of the gods. Herodotus and Euripides use the word in practically the modern sense of *ocean; see* OCEAN.

**OCELLUS LUCANUS,** a Pythagorean philosopher, born in Lucania in the 5th century B.C., perhaps a pupil of Pythagoras himself. Stobaeus (*Ecl. Phys.* i. 13) has preserved a fragment of his Περὶ νόμου (if he was really the author) in the Doric dialect but the only one of his alleged works which is extant is a short and unauthentic treatise *On the Nature of the Universe.*

Editions of the Περὶ τῆς τοῦ παντὸς φύσεως, by A. F. Rudolph (1801, with commentary), and by F. W. Mullach in *Fragmenta philosophorum graecorum,* i. (1860); H. Diels, *Die Fragmente der Vorsokratiker* (4th ed., 1922); Eng. trans. (1831) by Thomas Taylor. *See* also Überweg, *Grundriss der Gesch. der Philosophie,* Bd. i. (1926).



REDRAWN FROM A PHOTOGRAPH, N.Y. ZOOLOGICAL SOCIETY

OCELOT (FELIS PARDALIS)

**OCELOT,** a wild cat (*Felis pardalis*), ranging from Texas to Paraguay. The short smooth fur is ochraceous brown above, marked with numerous black-bordered blotches which tend to form oblique bands. The underside and feet are white. Ocelots reach a length of about 3½ ft., while the tail is 18 in. They live in forests and are ready climbers. Cranially, the ocelot resembles the larger cats, with flattened profile and a strong sagittal crest. (*See* CARNIVORA.) (J. E. HL.)

**OCHINO, BERNARDINO** (1487–1564), Italian Reformer, was born at Siena. He entered the order of Observantine Friars, the strictest sect of the Franciscans, and rose to be its general, but, craving a yet stricter rule, transferred himself in 1534 to the newly founded order of Capuchins, of which in 1538 he was elected vicar-general. In 1539 he delivered at Venice a remarkable course of sermons, showing a tendency to the doctrine of justification by faith, which is more marked in his *Dialogi VII.* published soon after. He was suspected and denounced, and when the Inquisition was established at Rome, Ochino was at once cited, but was deterred from presenting himself at Rome by the warnings of Peter Martyr and of Cardinal Contarini. After some hesitation he escaped across the Alps to Geneva. He was cordially received by Calvin, and within two years published six volumes of

*Prediche* (Eng. trans., Ipswich, 1548), tracts rather than sermons, explaining and vindicating his change of religion. He was minister of the Italian Protestant congregation at Augsburg from 1545 until 1547, when the city was occupied by the imperial forces in the Schmalkaldic War. Escaping by way of Strasbourg he found an asylum in England, where he was made a prebendary of Canterbury, received a pension from Edward VI.'s privy purse, and composed his chief work, *A Trajedy or Dialogue of the unjust usurped Primacy of the Bishop of Rome* (1549), originally written in Latin, but extant only in the translation of John Ponet, bishop of Winchester. The conception of the *Trajedy* bears a remarkable resemblance to that of *Paradise Lost;* and it is almost certain that Milton, whose sympathies with the Italian Reformation were so strong, must have been acquainted with it, and with some of Ochino's later works. In the *Labyrinth* (dedicated to Queen Elizabeth), he assailed the Calvinistic doctrine of predestination.

The accession of Mary in 1553 drove him from England, and he became pastor of the Italian congregation at Zürich. In 1563 the publication of his *Thirty Dialogues,* in one of which his adversaries maintained that he had justified polygamy under colour of a pretended refutation, led to his banishment. He found refuge in Poland until the edict of the 6th of August, 1564, banished all foreign dissidents. He died at Schlakau in Moravia, about the end of 1564.

See *Life* by B. O. Benrath (2nd ed., Brunswick, 1892; Eng. trans. by Helen Zimmern, 1876).

**OCHRES,** which vary in colour from pale yellow to deep red, brown and violet, and are native earths coloured with hydrated iron oxide, are of two kinds—one having a clayey basis, while the other is a chalky earth; the former variety is in general the richer and purer in colour of the two. Both kinds are widely distributed in beds or pockets, mainly in stratified rocks and rubble and rarely as extensive deposits. Some ochres require only grinding, whereas other varieties require calcination whereby the original colour is modified. In this process the associated earth exercises a marked influence, clayey ochres developing red and violet tints, while chalky varieties take brownish-red and dark brown hues. The well-known ochre, Terra di Siena, which in its native state is a dull-coloured earth, assumes when burnt a fine warm mahogany-brown hue highly valued by artists. Ochres containing much organic matter are sometimes calcined to improve their drying properties in varnish or oil. Ochres are also artificially prepared in large quantities—Mars yellow is either a pure hydrated ferric oxide or an intimate mixture of that substance with an argillaceous or calcareous base, and such compounds by careful calcination can be transformed into Mars orange, violet or red, all reliable pigments. *See* PAINTS, CHEMISTRY OF.

**OCHRIDA** (Serbo-Croatian *Ohrid*), a city of South Serbia, Yugoslavia, on Lake Ochrida, occupied by axis troops in 1941. Pop. (1931), 9,776, mainly Albanians, with some Serbs and Bulgars. The lake, 2,260 ft. above sea level, with an area of 107 sq.mi. and a maximum depth of 938 ft., lies amid magnificent scenery and is famous for its salmon trout. Malaria is prevalent. Ochrida occupies the site of the ancient *Lychnidos,* which was added to the Macedonian empire by Philip II. (382–336 B.C.) and destroyed by the Bulgars in A.D. 861. The Bulgarian tsar, Samuel, made Ochrida his capital, but was expelled, and in 1014 his empire was conquered by the Greek emperor Basil II. The see of Ochrida was founded by St. Clement in 916, and during the Bulgarian occupation their patriarchate was established here. In 1459 the Serbian patriarchate being suppressed, the administration of the Church was transferred to Ochrida. In 1890 a Bulgarian bishop was appointed to the see, which then became a centre of Bulgarian propaganda.

*See* Gelzer, *Der Patriarchat von Achrida* (Leipzig, 1902); Dr. Jovan Cvijić, "Researches in Macedonia," etc., *Geog. Journal,* vol. xvi. (1900); T. R. Georgevitch, *Macedonia* (1918).

**OCHS, ADOLPH SIMON** (1858–1935), American newspaper publisher, was born in Cincinnati, O., on March 12, 1858, of well educated Jewish parents who had emigrated in their youth to the United States from Bavaria. The father, Julius Ochs, was an officer of the United States forces in the Mexican War of 1848, and the Civil War, 1861–65. In 1865 the family settled in Knoxville, Tenn., where Adolph while still a boy attending primary schools delivered newspapers. At the age of 14, he became a printer's devil on the *Knoxville Chronicle.* In 1875–76 he was employed as a compositor by the Louisville, Kentucky, *Courier-Journal.* In 1877 he assisted in establishing the *Chattanooga Dispatch,* and in 1878, at the age of 20, with little or no capital, he gained control of the *Chattanooga Times,* at that time a decrepit newspaper. Assuming at the same time the duties of publisher, editor and business manager, he soon placed the *Chattanooga Times* on a firm basis, and brought it to a leading position among newspapers throughout the South.

In 1896 he acquired the controlling ownership of the *New York Times,* which had long been one of the leading newspapers in the United States, but was then in financial difficulties after 30 years of prosperity. Mr. Ochs then formed the New York Times Company. With a ripe experience in all departments of newspaper making, he steadily strengthened the paper's journalistic and financial position, and resuscitated it from a bankrupt newspaper with less than 10,000 bona fide circulation, to a newspaper with national reputation, a net paid sale (1934) of 466,000 copies on weekdays and 730,000 on Sundays, and from 2,000,000 to 20,000,000 agate lines of advertising annually. Times Square, New York, was named after the Times Building, which was erected in 1905.

Meantime, in 1901, Ochs became proprietor of the *Philadelphia Times,* which he merged with the *Public Ledger* and sold to Cyrus H. K. Curtis in 1912. He was a founder of the Southern Associated Press and later an organizer of the Publishers' Association of the City of New York. From 1900 to his death in 1935 he was a director of the Associated Press.

The influence of Ochs upon newspaper publishing in the United States has been very marked and highly beneficial. Entering New York publishing when the so-called "yellow journalism" was at its height, and in competition with half a dozen of the richest and most powerful newspapers in America, he boldly adopted the slogan, "All the News That's Fit To Print," and devoted his paper not to sensations, but to giving intelligent readers a daily news report, trustworthy, complete, non-partisan and decent.

In a few years Ochs made *The Times* the outstanding example of enterprise in news gathering and ultimately the most widely read newspaper in the United States. In its reporting of the news *The Times* identified itself with pioneers and explorers in various fields—Marconi, Peary, Lindbergh, Byrd (North and South Pole and trans-Atlantic flights), Amundsen, Ellsworth, Scott, Shackleton and others. In its expression of opinion, *The Times* was and remains essentially independent, its editorial position being best described by Ochs himself as intended "to reflect the best informed thought of the country, honest in every line, more than courteous and fair to those who may sincerely differ from its views."

Steadily withstanding the temptation to print a "comic" section and other features detached from the news of the day, Ochs was a pioneer in many newspaper innovations, among which were the introduction in newspapers of rotogravure printing of news pictures, a book review supplement and an open forum for letters to the editor, with the widest latitude for the presentation of opinions in conflict with the editorial views of *The Times.* He was also a pioneer in the adoption of standards to improve newspaper advertising typography, and of standards of advertising designed to exclude all false and misleading material.

Following these principles, he made *The New York Times* "the newspaper of record," publishing the only complete American newspaper index and printing an edition on rag paper for libraries, offices, institutions and those who preserve records. His interest in making accurate source material available to the public was shown in another manner when, with The New York Times Company, he underwrote in 1925, at a cost of over $500,000, the preparation of the manuscript of the *Dictionary of American Biography* by the Learned Societies of America.

In 1918 the trustees of Columbia University in New York awarded *The Times* the first Pulitzer Gold Medal in Journalism

for Meritorious Public Service. In 1922 Ochs was made an honorary Master of Arts by Yale university.

In subsequent years he received honorary doctorates from Columbia university, New York university, Dartmouth and Lincoln university.

He was also awarded the French Legion of Honour and in 1927 received the gold medal of the National Institute of Social Sciences for his services in promoting and maintaining high standards of journalism.

No honour gratified Ochs, however, more than that which came to him in 1928.

In that year of 1928, the community in which he had made his humble start conferred on him the title of "Citizen Emeritus of Chattanooga."

For the story of *The New York Times* see *History of The New York Times* by Elmer Davis (1921) and *Seventy-fifth Anniversary Supplement of The New York Times,* published Sept. 18, 1926. For the history of the *Chattanooga Times* see *Chattanooga Times Jubilee Issue,* July 1, 1928. (L. Wi.)

**OCHTERLONY, SIR DAVID,** Bart. (1758–1825), British general, was born at Boston, Mass., U.S.A., on Feb. 12, 1758, and went to India as a cadet in 1777. He served under Lord Lake in the battles of Koil, Aligarh and Delhi, and was appointed resident at Delhi in 1803. In 1804, having been promoted to the rank of major-general, he defended the city with a very inadequate force against an attack by Holkar. He served in the Nepal War (1814–15), which he brought to a successful conclusion. Afterward he obtained the signature of the treaty of Segauli (1816), which dictated the subsequent relations of the British with Nepal. For this success Ochterlony was created G.C.B., the first time that honour had been conferred on an officer of the Indian army. In the Pindari War (1817–18) he was equally successful. He was appointed resident in Rajputana in 1818, with which the residency at Delhi was subsequently combined. When Durjan Sal revolted in 1825 against Balwant Singh, the infant Raja of Bharatpur, Ochterlony, acting on his own responsibility, supported the raja by proclamation and ordered out a force to support him. Lord Amherst, however, repudiated these proceedings. Ochterlony, who was bitterly chagrined by this rebuff, resigned his office and retired to Delhi. He died at Meerut on July 15, 1825. The Ochterlony column at Calcutta commemorates his death.

*See* Major Ross of Bladensburg, *The Marquess of Hastings* ("Rulers of India" series) (1893).

**OCHTMANN, LEONARD** (1854–1934), American painter, was born in Zonnemaire, Zeeland, the Netherlands, on Oct. 21, 1854. His family removed to Albany, N.Y., in 1866. In 1882 he began to exhibit landscapes at the National academy, and he became a National Academician in 1904. His most characteristic pictures, which recall the work of Inness, are scenes on Long Island sound and on the Mianus river.

**OCKLEY, SIMON** (1678–1720), English orientalist, was born at Exeter in 1678. He was educated at Queen's college, Cambridge, became fellow of Jesus college and vicar of Swavesey, and in 1711 was made professor of Arabic at Cambridge. The pecuniary embarrassments of his later days form the subject of a chapter in D'Israeli's *Calamities of Authors.* The preface to the second volume of his *History of the Saracens* is dated from Cambridge castle, where he was imprisoned for debt. Ockley maintained that a knowledge of oriental literature was essential to the proper study of theology, and in the preface to his first book, the *Introductio ad linguas orientales* (1706), he urges the importance of the study. In 1707 he published a translation of Leon Modena's *History of the Present Jews throughout the World;* and in 1708 *The Improvement of Human Reason, exhibited in the Life of Hai Ebn Yokdhan.* His chief work is *The History of the Saracens* (1708–18), of which a third volume was published posthumously in 1757. Unfortunately Ockley took as his main authority a ms. in the Bodleian of the pseudo-Wakidi's *Futuh al-Sham,* which is rather historical romance than history. He also translated from the Arabic the *Second Book of Esdras* and the *Sentences of Ali.* Ockley died at Swavesey, Aug. 9, 1720.

**O'CLERY, MICHAEL** (1575–1643), Irish chronicler, grandson of a chief of the sept of O'Clery in Donegal, was born at Kilbarrow on Donegal bay, and was baptized Tadhg (or "poet"), but took the name of Michael when he became a Franciscan friar. He had already gained a reputation as a student of Irish history and literature, when he entered the Irish college of St. Anthony at Louvain. In 1620, through the initiative of Hugh Boy Macanward (1580–1635), warden of the college, and himself a famous Irish historian and poet, and one of an old family of hereditary bards in Tyrconnell, he began to collect Irish manuscripts and to transcribe everything he could find of historical importance; he was assisted by other Irish scholars, and the results were his *Reim Rioghroidhe* (Royal List) in 1630, *Leabhar Gabhala* (Book of Invasions) in 1631, and his most famous work, called by John Colgan (d. 1659), the Irish biographer, the "Annals of the Four Masters" (1636). Subsequently he produced his *Martyrologium* of Irish saints, based on various ancient manuscripts, an Irish glossary and other works. He lived in poverty, and died at Louvain.

**O'CONNELL, DANIEL** (1775–1847), Irish statesman, known as "the Liberator," was born on Aug. 6, 1775, near Cahirciveen, a small town in Kerry. He was sprung from a race the heads of which had been Celtic chiefs, had lost their lands in the wars of Ireland, and had felt the full weight of the harsh penal code which long held the Catholic Irish down. His ancestors in the 18th century had sent recruits to the famous brigade of Irish exiles in the service of France, and those who remained at home either lived as tenants on the possessions of which they had once been lords, or gradually made money by smuggling. While a boy he was adopted by his uncle, Maurice O'Connell of Derrynane, and sent to a school at Queenstown, and then to the colleges of St. Omer and Douai in France.

In 1798 O'Connell was called to the bar of Ireland, where he came rapidly to the front. In examining witnesses, he had no rival at the Irish bar. He was, however, a thorough lawyer besides, inferior in scientific learning to two or three of his most conspicuous rivals, but well read in every department of law, and especially a master in all that relates to criminal and constitutional jurisprudence; as an advocate, too, he stood in the very highest rank.

From early manhood O'Connell had turned his mind to the condition of Ireland and the mass of her people. The worst severities of the penal code had been, in a certain measure, relaxed, but the Catholics were still in a state of vassalage, and they were still pariahs compared with the Protestants. The rebellion of 1798 and the union had dashed the hopes of the Catholic leaders, and their prospects of success seemed very remote when, in the first years of the 19th century, the still unknown lawyer took up their cause. Up to this juncture the question had been in the hands of Grattan and other Protestants, and of a small knot of Catholic nobles and prelates; but they aimed only at a kind of compromise, which, while conceding their principal claims, would have placed their church in subjection to the state. O'Connell gave the Catholic movement an energy it had not before possessed. He formed the bold design of combining the Irish Catholic millions, under the superintendence of the native priesthood, into a vast league against the existing order, and of wresting the concession of the Catholic claims from every opposing party in the state by continuous agitation, embracing almost the whole of the people, but maintained within constitutional limits, though menacing and shaking the frame of society. The Catholic Association, at first small, but slowly assuming larger proportions, was formed; attempts of the government and of the local authorities to put its branches down were skilfully baffled by legal devices of many kinds; and at last, after a conflict of years, all Catholic Ireland was arrayed in a powerful organization. O'Connell stood at the head of this great national movement which, controlled from first to last by himself and the priesthood, was essentially conservative in character. His election for Clare in 1828 proved the forerunner of the inevitable change, and the Catholic claims were granted the next year.

O'Connell joined the Whigs on entering parliament, and gave effective aid to the cause of reform. The agitation, however, on the Catholic question had quickened the sense of the wrongs of

Ireland, and the Irish Catholics were engaged ere long in a crusade against tithes and the established church, the most offensive symbols of their inferiority in the state. It may be questioned whether O'Connell was not rather led than a leader in this; the movement, at least, passed beyond his control, and the country for many months was terrorized. Lord Grey proposed measures of repression which O'Connell opposed with extreme vehemence. This caused a breach between him and the Whigs; but he gradually returned to his allegiance to them when they practically abolished Irish tithes, cut down the revenues of the established church and endeavoured to secularize the surplus. In the British House of Commons O'Connell stood in the front rank as a debater; and his oratory, massive and strong in argument, made a powerful impression. O'Connell steadily supported Lord Melbourne's government, gave it valuable aid in its general measures, and repeatedly expressed his cordial approval of its policy in advancing Irish Catholics to places of trust and power in the state, though personally he refused a high judicial office. He sincerely advocated the rights of conscience, the emancipation of the slave and freedom of trade. But his rooted aversion to the democratic theories imported from France grew stronger with advancing age. His conservatism was most apparent in his tenacious regard for the claims of property. He actually opposed the Irish Poor Law, as encouraging a communistic spirit; he declared a movement against rent a crime, though he advocated a reform of the precarious tenure enjoyed by the Irish peasant.

O'Connell changed his policy as regards Ireland when Peel became minister in 1841. He declared that a Tory régime in his country was incompatible with good government, and he began an agitation for the repeal of the union. He had denounced the union in early manhood as an obstacle to the Catholic cause; he had spoken against the measure in parliament; he believed that the claims of Ireland were set aside or slighted in what he deemed an alien assembly; and, though he had ceased for some years to demand repeal, and regarded it as rather a means than an end, he was throughout life an avowed repealer. In his judgment the repeal of the union would not weaken the real bond between Great Britain and Ireland. The Catholic Association of 1828–29 was recreated for the new project. Enormous meetings convened by the priesthood, and directed or controlled by O'Connell, assembled in 1842–1843, and probably nine-tenths of the Irish Catholics were unanimous in the cry for repeal. O'Connell seems to have thought success certain; but he had not perceived the essential difference between his earlier agitation and this. The enlightened opinion of the three kingdoms for the most part approved the Catholic claims, and as certainly it condemned repeal. After some hesitation Peel resolved to put down the repeal movement. A vast intended meeting was proclaimed unlawful, and in October 1843 O'Connell was arrested and held to bail, with ten or twelve of his principal followers. He was convicted (February 1844) after the trials that followed, but the judges were biassed, and the sentence of imprisonment for a year and a fine of £2,000 was reversed on a writ of error by the House of Lords (September 1844), and he and his colleagues were again free. The spell, however, of O'Connell's power had vanished; his health had suffered much from a short confinement; he was verging upon his seventieth year; and he was disturbed by the growth of a party in the repeal ranks who scoffed at his views, and advocated the revolutionary doctrines which he had always feared and abhorred. Before long famine had fallen on the land, and under this visitation the repeal movement, already paralysed, collapsed. O'Connell died on May 15, 1847, at Genoa, whilst on his way to Rome. His body was brought back to Dublin and buried in Glasnevin cemetery.

Catholic Ireland calls O'Connell her "Liberator" still; he possessed the wisdom, the caution and the tact of a real statesman. But the battle in which he fought was not to be won in his generation. O'Connell married in 1802 his cousin Mary O'Connell, by whom he had three daughters and four sons, Maurice, Morgan, John (1810–1858), known as the "Young Liberator," and Daniel, who all sat in parliament.

*See* his son, John's, *Life* (1846) and *Recollections and Experiences* (1849), the biographies by W. Fagan (1847), M. F. Cusack (1872), J. O'Rourke and O'Keefe (1875), and J. A. Hamilton (1888); also R. Dunlop, *Daniel O'Connell and the Revival of National Life in Ireland* (1900), R. Houston, *Daniel O'Connell: his Early Life and Journal, 1795–1802* (1906), and A. Zimmermann, *Daniel O'Connell der Befreier und seine politische Bedeutung für Irland und England* (Paderborn, 1909).

**O'CONNOR, FEARGUS EDWARD** (1794–1855), Chartist leader, was the son of the Irish Nationalist politician Roger O'Connor. He entered parliament as M.P. for Cork and a follower of O'Connell in 1832; but three years later the "Liberator" had him unseated, by petition, for his indiscipline. He then turned to Radical agitation in England and on the publication of the Charter in 1838 became one of the best known Chartist leaders. Owing to his rough humour, his energy and his invective he became their most popular speaker, and the circulation of his journal, the *Northern Star,* outstripped all others. He advocated physical force, generally, however, with the proviso that moral force must be tried first, and at the Chartist convention of 1839 acquiesced on William Lovett's "moral force" leadership. Although not concerned in the insurrection of 1839 he was imprisoned for a year upon another charge. In 1841 he reorganized the movement by the foundation of the National Charter Association, and attained a position of such power that he was able practically to expel or silence Lovett and all others who advocated compromise with the middle class. But though he raised Chartism to its greatest power he was unable to direct it to victory. He permitted the general strike of 1842; in the midst of it his fears overcame him and he condemned it, securing its immediate defeat. After this fiasco he diverted Chartist energies to the support of his land company scheme for settling town workers on small holdings. For a while this appeared successful, and a first settlement, named O'Connorville, was opened at Herringsgate, Bucks. He was also elected M.P. for Nottingham in 1847. Next year, however, the company was found to be bankrupt, and the ignominious collapse of the revolutionary agitation of that year, to which he had pinned his hopes, made O'Connor's behaviour, already eccentric, plainly maniacal. He was, very belatedly, declared insane in 1852 and died in 1855. His funeral procession, 50,000 strong to Kensal Green, may be regarded as the last Chartist demonstration.

O'Connor was a tall, loud-voiced, handsome man, of unlimited devotion and energy and great oratorical powers; he was, however, vacillating, excessively vain, jealous and of small intellectual powers. (*See* CHARTISM.) (R. W. P.)

**OCONOMOWOC,** a city of Waukesha county, Wisconsin, U.S.A., on federal highway 16; 33 mi. W. of Milwaukee; served by the Chicago, Milwaukee, St. Paul and Pacific and the Milwaukee Electric railways. Pop. (1940) 4,562. It is a popular summer resort in a region of lakes. The city was founded about 1837 and incorporated in 1875. Its name is an Indian word said to mean "home of the beaver."

**O'CONOR, CHARLES** (1804–1884), American lawyer, was born in the City of New York on January 22, 1804. He was admitted to the bar in 1824. From 1853 to 1854 he was United States district attorney for New York. After the Civil War he became senior counsel for Jefferson Davis on his indictment for treason, and was one of his bondsmen. He took a prominent part in the prosecution of William M. Tweed and members of the "Tweed Ring" and published *Peculation Triumphant, Being the Record of a Five Years' Campaign against Official Malversation, A.D. 1871–1875* (1875). He removed to Nantucket, Mass., in 1881, and died there on May 12, 1884.

**OCONTO,** a city of north-eastern Wisconsin, U.S.A., on the W. shore of Green bay (Lake Michigan) at the mouth of the Oconto river; the county seat of Oconto county. It is on Federal highway 41, and is served by the Chicago and North Western and the Chicago, Milwaukee, St. Paul and Pacific railways. Pop. (1940) 5,362. It has a large fishing industry and several manufacturing plants. It was founded in 1846 and chartered in 1882.

**OCORONAN,** a small group of tribes of South American Indians, provisionally regarded as constituting an independent linguistic stock. The Ocoronas live or lived in eastern Bolivia along the upper Mamore river, at the missions of San Ignacio,

San Martin and Santa Rosa de Moxos. Apart from brief references to them by the early missionaries, little is known concerning their culture. Rivet believes that the Ocoronas are merely a sub-group of the Chapacuran (*q.v.*) stock.

*See* G. de Crequi-Montfort and P. Rivet, "La Famille linguistique Capakura" (*J. Soc. Américanistes de Paris* [n.s.] vol. x., pp. 119–173).

**OCOTILLO** (*Fouquieria splendens*), a North American shrub of the candle-wood family (Fouquieriaceae), called also coach-whip, Jacob's-staff and vine-cactus. It is a characteristic shrub of rocky deserts from western Texas to southern California and southward in Mexico. Near the base the stem divides into several slender, erect, furrowed, intensely spiny branches, usually from 8 to 20 ft. high. It bears small rounded leaves, the midribs of which harden into the spines, and showy bright-scarlet flowers in terminal clusters. The ocotillo is sometimes grown as a hedge plant; in Mexico the branches are woven into fences.

**OCTAHEDRON:** *see* SOLIDS, GEOMETRIC.

**OCTAVE,** a period or series of eight members. In ecclesiastical usage the octave is the eighth day after a particular church festival, the feast day itself and the "octave" being counted. The octave thus always falls on the same day of the week as the festival, and any event occurring during the period is said to be "in the octave." In music, an octave is the eighth full tone above or below any given note. It is produced by double or half the number of vibrations corresponding to the given note. In the interval between a note and its octave is contained the full scale, the octave of a note forming the starting-point of another scale of similar intervals to the first. The interval between a note and its octave is also called an octave. The name is also applied to an open metal stop in an organ, and to a flute (more usually known as the piccolo) one octave higher in pitch than the regular flute. It is also a term for a "parade" in fencing. The "law of octaves" was a term applied in 1865 to a relationship among the chemical elements enunciated by J. A. R. Newlands.

In literature an octave is a form of verse consisting of eight iambic lines, and complete in itself. From its use by the poets of Sicily, the form is usually called the Sicilian octave. It is distinguished from a single stanza of *ottava rima* by having only two rhymes, arranged *abababab*. In German literature the octave has been used not infrequently since 1820, when Ruckert published "Sicilianen," as they are called in German, for the first time. The word is often used to describe the eight opening lines of a sonnet.

**OCTAVIA,** the name of two princesses of the Augustan house. (1) Octavia, daughter of Gaius Octavius and sister of the emperor Augustus, was the wife of Gaius Marcellus, one of the bitterest enemies of Julius Caesar. In 41 B.C. her husband died, and she was married to Marcus Antonius, with the idea of bringing about a reconciliation between him and her brother. Her efforts were at first successful, but in 36 Antony left for the Parthian War and renewed his intrigue with Cleopatra. Though Octavia took out troops and money to him (35), he refused to see her and formally divorced her in 32. (2) OCTAVIA, daughter of the emperor Claudius, was the wife of Nero, by whom she was put to death. A Latin tragedy on her fate is attributed, though wrongly, to Seneca.

**OCTOBER,** the eighth month of the old Roman year, which began in March. In the Julian calendar, while retaining its old name, it became the tenth month, and had 31 days assigned to it. Several attempts were made to rename the month in honour of the emperors. Thus it was in succession temporarily known as Germanicus, Antoninus, and Herculeus, the last a surname of Commodus. The senate's attempt to christen it Faustinus in honour of Faustina, wife of Antoninus, was equally unsuccessful. By the Slavs it is called "yellow month," from the fading of the leaf; to the Anglo-Saxons it was known as Winterfylleth, because at this full moon (*fylleth*) winter was supposed to begin.

**OCTOPUS,** the name given in zoology to a single genus of eight-armed Cephalopoda (*q.v.*), one of whose distinguishing characters is the presence of two rows of suckers on each arm. As a less strictly defined term the name may be given to all the eight-armed Cephalopoda, of which some 36 genera have been described (*e.g., Eledone, Cirroteuthis, Argonauta*). The genus *Octopus* is a large one containing upwards of 140 species. Its representatives occur in nearly all seas (though it is poorly represented in Arctic and Antarctic waters) and some are found at great depths. *Octopus vulgaris* is found on British coasts (principally in the south), but it has a limited distribution in these waters, and is not often taken, the allied *Eledone cirrosa* being more common.

The sucker-bearing arms, strong jaws and sinister appearance of these animals have conferred on them a name for ferocity which is not undeserved. The stories of their attacks on man are sufficiently well attested, though they are often exaggerated.

The octopus moves about by means of its arms on the sea bottom, and is not habitually free-swimming, though like other Cephalopods, it can propel itself through the water by means of the funnel (*see* CEPHALOPODA). *Octopus* and the related genus *Eledone* live on the sea-bottom and are mainly found in shallow coastal water. According to Lo Bianco the common octopus in the Gulf of Naples prefers rocky situations for its lair during its early years. Certain forms (*e.g., Benthoctopus*) are found in very deep water, the greatest depth from which a member of the genus *Octopus* has been obtained being 1,875 fathoms. Other Octopods, however, are inhabitants of the open sea and are found swimming or floating at the surface (*Argonauta*) or at greater depths (*Eledonella, Cirroteuthis*). A species of *Eledonella* has been taken at a depth of 2,900 fathoms. Those which live permanently in very deep water are usually highly modified, having gelatinous tissues, large medusiform webs and reduced gills and dentition.

The common octopus feeds principally on crabs. Lo Bianco has shown that before killing its victims it paralyses them with a poison secreted by its salivary glands. The same observer has recorded that the common octopus in captivity will devour its own arms even if it is amply supplied with its normal food. Certain species of octopus attain a considerable size. The common octopus, *O. vulgaris*, sometimes spans over six feet with its arms and the giant *O. apollyon* of the western coast of the United States has been known to have a diameter of 28 feet.

Most species of this genus lay eggs in grapelike clusters. Lee states that the female *O. vulgaris* broods over the clusters, holding them in the membranous expansion of its arms and syringing them with jets of water from its funnel (*see* CEPHALOPODA).

Octopods are eaten fresh or dried by the natives of many parts of the world. The flesh of young *O. vulgaris* is still considered a delicacy in Naples.

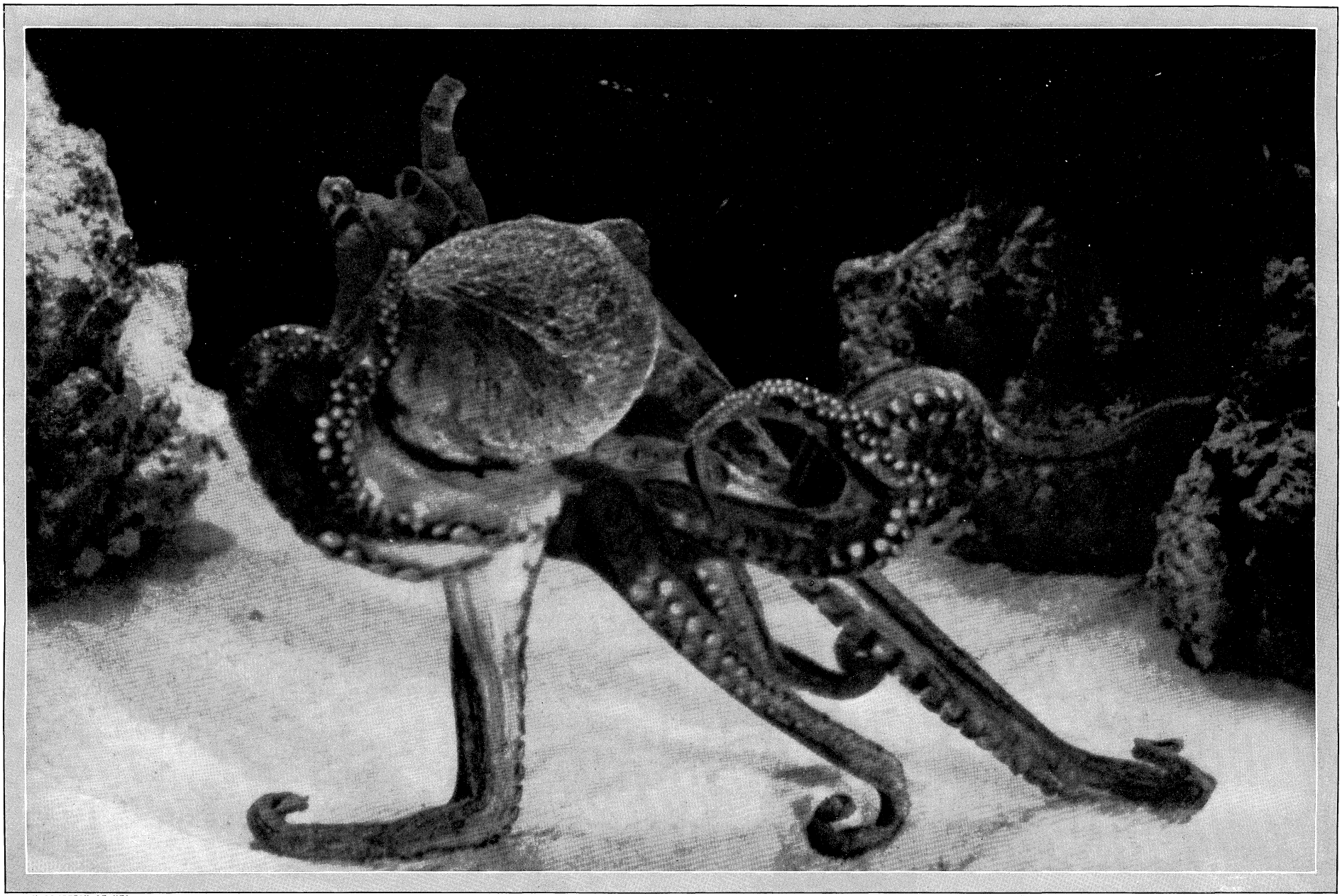
It has been mentioned above that the true octopus (*Octopus vulgaris*) is usually rare on the English coast. In 1899 and 1900, however, they became so abundant on the south coast as to attract general notice, and to constitute a veritable plague.

BIBLIOGRAPHY.—*See* CEPHALOPODA; also H. Lee, *The Octopus, or the Devil-fish of Fact and Fiction;* G. C. Robson, "The Deep Sea Octopoda," *Proc. Zool. Soc.* (London, 1926) and S. Lo Bianco "Notizie Biologiche . . . animali del Golfo di Napoli," *Mitth. Zool. Station von Neapel* (1909). (G. C. R.)

**OCTOSTYLE,** in architecture, a portico with eight columns in front.

**OCTROI,** a local tax collected on various articles brought into a district for consumption (O. Fr. *octroyer,* to grant, authorize; Lat. *auctor*).

The prescribed groups of commodities, upon which these indirect taxes were levied in 1927 by 1,092 local authorities in France (for the Alsace-Lorraine *octroi* is still governed by the pre-war German regulations) upon their entry for consumption into their area, are six, namely (1) liquids (artificial gaseous drinks, non-alcoholic beverages; vinegar; vegetable oils); (2) foods (meats, poultry, game, fish, butter, eggs, cheese, jams, fruits, etc.); (3) fuel (wood, coal, coke, candles, mineral oils, etc.); (4) fodder (fresh oil-cakes, dog biscuits, etc.); (5) building materials (plaster, lime, stone, bricks, slates, metals, sanitary appliances, woods, glass, etc.); and (6) miscellaneous (soaps, polishes, varnishes, paints, etc.). By presidential decree maximum *octroi* tariff rates for the whole of France must be published officially for all the separate classes within the above groups, particular scales being



BY COURTESY OF UFA

## OCTOPUS OR DEVIL FISH

This underwater photograph of an octopus shows the animal crawling on the bottom supported by three of its eight arms. The arms are sucker bearing and are used in capturing crustaceans, the animal's chief food, which have been previously paralyzed with a poison secreted by its salivary glands. Octopods also feed on bivalve molluscs and fishes

fixed according to the six population grades of localities. (Thus in the general tariff of July 1927, the rate on beef is 15 francs per cwt. in the grade under 1,000 inhabitants, 20 francs per cwt. in those from 1 to 10 thousand and 33 francs in those with over 100,000; that on butter per kilogramme ranges from 15 to 40 centimes, on coal per cwt. from 30 centimes to one franc, on petrol per 2 cwt. from 15 to 40 francs.) By a law of Feb. 1918 all *octroi* duties on alcoholic beverages, except on wine in bottle, were abolished. The general regulation of the system was profoundly altered by the law of Aug. 13, 1926, which gave greater freedom of action to the local and prefectoral authorities, within the framework of the general tariff, to modify rates or introduce new taxes, and permitted the central government to establish general regulations for the working of the system.

In 1926, out of a total of 1,042 *octrois* (apart from 18 in Alsace-Lorraine), 833 were collected directly, 116 were farmed out, one only (and it was the first instance for a long period of years) being under the farming out with participation system, and 92 employed the revenue authority mentioned. The total population subject to the *octroi* in these 1,042 localities was 14,370,500. The number of *octrois* in France has much diminished since 1918 when the total was 1,491; and for 1927 or Jan. 1928 several noteworthy towns decided to abandon the system (*e.g.*, Bordeaux, Perpignan, Troyes, Clermont-Ferrand, Chalons, St. Mihiel). There is a fairly strong abolition movement on foot which receives the vigorous support of the large body of motorists; the great difficulty is the provision of acceptable substitute local taxes especially in Paris. Lyons discarded it many years ago, and in her department (Rhone) there are only two *octrois*. They appear most numerous in the south-west and Provençal departments, where in some are found over 40 *octrois*.

In Belgium *octroi* duties were abolished in 1870, being replaced by an increase in customs and excise duties; and in 1903 those in Egypt were also abolished. *Octroi* duties exist in Italy, Spain, Portugal and in some of the towns of Austria.

BIBLIOGRAPHY.—A. Guignard, *De la suppression des octrois* (Paris); Saint Julien and Bienaimé, *Histoire des droits d'octroi à Paris;* M. Tardit and A. Ripert, *Traité des octrois municipaux* (Paris, 1904); L. Hourcade, *Manuel encyclopédique des contributions indirectes et des octrois* (Poitiers, 1925); *Bulletin de Statistique et de Législation Comparée,* Ministre des Finances, Paris. The abolition of the Belgian octrois produced a voluminous official report: *Abolition des octrois communaux en Belgique: documents et discussions parlementaires.*

**O'CURRY, EUGENE** (1796–1862), Irish scholar, was born at Dunaha, county Clare, in 1796, the son of a farmer who was a man of unusual intelligence. After being employed for some time in the topographical and historical section of the Irish ordnance survey, O'Curry earned his living by translating and copying Irish manuscripts. The catalogue of Irish manuscripts in the British Museum was compiled by him. On the founding of the Roman Catholic University of Ireland (1854) he was appointed professor of Irish history and archaeology. His lectures were published by the university in 1860. Three other volumes of lectures were published posthumously, under the title *On the Manners and Customs of the Ancient Irish* (1873). His voluminous transcripts, notably eight huge volumes of ancient Irish law, testify to his unremitting industry. He died in Dublin in 1862.

**ODAENATHUS** or ODENATUS (Gr. Ὀδαίναθος, Palm, אחינר = "little ear"), the Latinized form of ODAINATH, the name of a famous prince of Palmyra, in the second half of the 3rd century A.D., who succeeded in recovering the Roman East from the Persians and restoring it to the Empire. He belonged to the leading family of Palmyra, which bore, in token of Roman citizenship, the *gentilicium* of Septimius; hence his full name was Septimius Odainath (Vogüé, *Syrie centrale,* Nos. 23, 28= Cooke, *North-Semitic Inscrr.* Nos. 126, 130). It is practically certain that he was the son of Septimius Ḥairān the "senator and chief of Tadmor," the son of Septimius Odainath "the senator" (*N.S.I.* p. 285). The year when he became chief of Palmyra is not known, but already in an inscription dated A.D. 258 he is styled "the illustrious consul our lord" (*N.S.I.* No. 126). He possessed the characteristic vigour and astuteness of the old Arab stock from which he sprang; and in his wife, the renowned Zenobia (*q.v.*), he found an able supporter of his policy. The defeat and captivity of the emperor Valerian (A.D. 260) left the eastern provinces largely at the mercy of the Persians; the prospect of Persian supremacy was not one which Palmyra or its prince had any reason to desire. At first, it seems, Odainath attempted to propitiate the Parthian monarch Shāpūr (Sapor) I.; but when his gifts were contemptuously rejected (Petr. Patricius, § 10) he decided to throw in his lot with the cause of Rome. The neutrality which had made Palmyra's fortune was abandoned for an active military policy which, while it added to Odainath's fame, in a short time brought his native city to its ruin. He fell upon the victorious Persians returning home after the sack of Antioch, and before they could cross the Euphrates inflicted upon them a considerable defeat.

Then, when two usurping emperors were proclaimed in the East (A.D. 261), Odainath took the side of Gallienus the son and successor of Valerian, attacked and put to death the usurper Quietus at Emesa (Ḥöms), and was rewarded for his loyalty by the grant of an exceptional position (A.D. 262). He may have assumed the title of king before; but he now became "totius Orientis imperator," not indeed joint-ruler, nor Augustus, but "independent lieutenant of the emperor for the East" (Mommsen, *Provinces,* ii. p. 103)[1]. In a series of rapid and successful campaigns, during which he left Palmyra under the charge of Septimius Worod his deputy (*N.S.I.* Nos. 127–129), he crossed the Euphrates and relieved Edessa, recovered Nisībis and Carrhae, and even took the offensive against the power of Persia, and twice invested Ctesiphon itself, the capital; probably also he brought back Armenia into the Empire. These brilliant successes restored the Roman rule in the East; and Gallienus did not disdain to hold a triumph with the captives and trophies which Odainath had won (A.D. 264).

While observing all due formalities towards his overlord, there can be little doubt that Odainath aimed at independent empire; but during his lifetime no breach with Rome occurred. He was about to start for Cappadocia against the Goths when he was assassinated, together with Herōdes his eldest son, by his nephew Maconius; there is no reason to suppose that this deed of violence was instigated from Rome. After his death (A.D. 266–267) Zenobia succeeded to his position, and practically governed Palmyra on behalf of her young son Wahab-allath or Athenodorus. (*See* PALMYRA.) (G. A. C.)

**ODDFELLOWS, ORDER OF,** a secret benevolent and social society and subsequently a friendly benefit society also, having mystic signs of recognition, initiatory rites and ceremonies, and various grades of dignity and honour. Great antiquity has been claimed for the order of Oddfellows, but the members themselves now generally admit that the institution cannot be traced back beyond the first half of the 18th century, and explain the name as adopted at a time when the severance into sects and classes was so wide that persons aiming at social union and mutual help were a marked exception to the general rule. Mention is made by Defoe of the society of Oddfellows, but the oldest lodge of which the name has been handed down is the Loyal Aristarcus, No. 9, which met in 1745 "at the Oakley Arms, Borough of Southwark; Globe Tavern, Hatton Garden; or the Boar's Head in Smithfield, as the noble master may direct." The earliest lodges were supported by each member and visitor paying a penny to the secretary on entering the lodge, and special sums were voted to any brother in need. If out of work he was supplied with a card and funds to reach the next lodge, and he went from lodge to lodge until he found employment. The lodges gradually adopted a definite common ritual and became confederated under the name of the Patriotic Order. Towards the end of the century many of the lodges were broken up by State prosecutions on the suspicion that

[1]The late Roman chronicler Trebellius Pollio goes further and asserts "Odenatus rex Palmyrenorum optinuit totius Orientis imperium. . . . Gallienus Odenatum participato imperio Augustum vocavit," *Hist. Aug.* xxiii. 10 and 12. This is not borne out by the evidence. The highest rank claimed for him by his own people is recorded in an inscription dated 271 (*N.S.I.* No. 130) set up by the two generals of the Palmyrene army; Odainath is styled "king of kings and restorer of the whole city"; but this does not mean that he ever held the title of Augustus, and the inscription was set up after his death and during the revolt of Palmyra.

their purposes were "seditious," but the society continued to exist as the Union Order of Oddfellows until 1809. In 1813, at a convention in Manchester, was formed the Independent Order of Oddfellows, Manchester Unity, which now overshadows all the minor societies in England. Oddfellowship was introduced into the United States from the Manchester Unity in 1819, and the grand lodge of Maryland and the United States was constituted on Feb. 22, 1821. It now rivals in membership and influence the Manchester Unity, from which it severed its connection in 1842. In 1843 it issued a dispensation for opening the Prince of Wales Lodge No. 1, at Montreal, Canada. The American society, including Canada and the United States, has its headquarters at Baltimore. Organizations connected either with the United States or England have been founded in France, Germany, Switzerland, Denmark, The Netherlands, Norway, Sweden, Poland, Czechoslovakia, the British dominions and elsewhere.

The most complete and trustworthy account of the institution is that in *The Complete Manual of Oddfellowship, its History, Principles, Ceremonies and Symbolism,* privately printed (1879). (*See* also FRIENDLY SOCIETIES.)

**ODE,** a form of stately and elaborate lyrical verse. The original signification of an ode was a chant, a poem arranged to be sung to an instrumental accompaniment. There were two great divisions of the Greek *melos* or song. One of them, in the hands of Alcaeus, Anacreon and Sappho, came close to what modern criticism knows as lyric. On the other hand, the choir-song, in which the poet spoke for himself, but always supported, or interpreted, by a chorus, led up to what is known as ode proper. It was Alcman who first gave to his poems a strophic arrangement, and the strophe (*q.v.*) has come to be essential to an ode. Stesichorus, Ibycus and Simonides of Ceos led the way to the two great masters of ode among the ancients, Pindar and Bacchylides. The form and verse-arrangement of Pindar's great lyrics have regulated the type of the heroic ode. It is now perceived that they are consciously composed in very elaborate measures. So far from being, as critics long supposed, utterly irregular, they are more like the *canzos* and *sirventes* of the mediaeval troubadours than any modern verse. The Latins lost the secret of these complicated harmonies, and made no serious attempt to imitate the odes of Pindar. The ode, as it was practised by the Romans, returned to the lyrical form of Sappho and Alcaeus. This was exemplified, in the most exquisite way, by Horace and Catullus.

The earliest modern writer to perceive the value of the antique ode was Ronsard, who attempted to recover the fire and volume of Pindar; his principal experiments date from 1550 to 1552. The poets of the Pleïad (*q.v.*) recognized in the ode one of the forms of verse with which French prosody should be enriched, but in their use of Greek words crudely introduced, and in their quantitative experiments, they offended the genius of the French language. The ode died in France almost as rapidly as it had come to life. Early in the 19th century the form was resumed, and we have the *Odes* composed between 1817 and 1824 by Victor Hugo, the odes of Lamartine, those of Victor de Laprade (collected in 1844), and the *Odes funambulesques* of Théodore de Banville (1857).

The earliest odes in English, using the word in its strict form, were the *Epithalamium* and *Prothalamium* of Spenser. Ben Jonson introduced a kind of elaborate lyric to which he gave the name of ode; and some of his disciples, in particular Randolph, Cartwright and Herrick, followed him. The "Hymn on the Morning of Christ's Nativity," begun by Milton in 1629, may be considered an ode, and his lyrics "On Time" and "At a Solemn Music" belong to the same category. But it was Cowley who introduced into English poetry the ode consciously built up, on a solemn theme and as definitely as possible on the ancient Greek pattern. He was no more perspicacious than others, however, in observing what the rules were which Pindar had followed. He published his "Pindaric" odes in 1656. These shapeless pieces became very popular after the Restoration, and enjoyed the sanction of Dryden in three or four irregular odes which are the best of their kind in the English language. In 1705 Congreve published a *Discourse on the Pindarique Ode,* and he wrote odes, in strophe, antistrophe and epode, which were the earliest of their kind in English; unhappily they were not very poetical. The attempts of Gilbert West (1703–56) to explain the prosody of Pindar (1749) inspired Gray to write his "Progress of Poesy" (1754) and "The Bard" (1756). Collins, meanwhile, had in 1747 published a collection of odes devised in the Aeolian or Lesbian manner. The odes of Wordsworth, Coleridge and Tennyson are entirely irregular. Shelley desired to revive the pure manner of the Greeks, but he understood the principle of the form so little that he began his "Ode to Naples" with two epodes, passed on to two strophes, and then indulged in four successive antistrophes. Coventry Patmore, in 1868, printed a volume of irregular *Odes.* Swinburne, although some of his odes, like those of Keats, are really elaborate lyrics, written in a succession of stanzas identical in form, cultivated the Greek form also, and some of his political odes follow very closely the type of Bacchylides and Pindar. Neither Sir William Watson nor Laurence Binyon, each of whom wrote memorable odes, adopted the Pindaric form.

*See* Philipp August Böckh, *De metris Pindari* (1811); Wilhelm Christ, *Metrik der Griechen und Römer* (1874); Edmund Gosse, *English Odes* (1881).

**ODENKIRCHEN,** former German town, 21 mi. by rail S.W. of Düsseldorf, and at the junction of lines to Munich, Gladbach and Stolberg. Pop. was 19,194. Odenkirchen became a town in 1856 and united with Gladbach-Rheydt in 1929. It carried on cotton spinning and weaving, tanning and dyeing.

**ODENSE,** a city of Denmark, the chief town of the *amt* (county) of its name, which forms the northern part of the island of Fyn (Fünen). Pop. (1940) 87,521. Odense, or Odinsey, originally Odinsoe, *i.e.,* Odin's island, is one of the oldest cities of Denmark. St. Canute's shrine was a great resort of pilgrims throughout the middle ages. In the 16th century the town was the meeting-place of several parliaments, and down to 1805 it was the seat of the provincial assembly of Fyn. The city lies 4 mi. from Odense fjord on the Odense Aa, the main portion on the north side of the stream, and the industrial Albani quarter on the south side. It has a station on the railway route between Copenhagen and Jutland and Schleswig-Holstein via Korsør. A canal, 15½ ft. to 21 ft. deep, gives access to the town from the fjord. St. Canute's cathedral is one of the largest and finest buildings of its kind in Denmark. It is constructed of brick in a pure Gothic style. Originally dating from 1081–93, it was rebuilt in the 13th century. Under the altar lies Canute (Knud), the patron saint of Denmark, who intended to dispute with William of Normandy the possession of England, but was slain in an insurrection at Odense in 1086; Kings John and Christian II. are also buried within the walls. Our Lady's church, built in the 13th century and restored in 1851–52 and again in 1864, contains a carved altar-piece (16th century) by Claus Berg of Lübeck. Odense castle was erected by Frederick IV., who died there in 1730. Exports, mostly agricultural produce (butter, bacon, eggs); imports, iron, petroleum, coal, yarn and timber.

**ODENWALD,** a wooded mountain region of Germany, almost entirely in Hesse, with small portions in Bavaria and Baden. It stretches between the Neckar and the Main, and is 50 m. long by 20 to 30 broad. Its highest points are the Katzenbuckel (2,057 ft.), the Neunkircher Höhe (1,985 ft.) and the Krähenberg (1,965 ft.). The wooded heights overlooking the Bergstrasse are studded with castles and mediaeval ruins.

**ODER** (Lat. *Viadua;* Slavonic *Vjodr*), a European river, 560 m. long, which rises in the Odergebirge (Lower Carboniferous rocks of the Bohemian massif). After flowing south-east it quickly turns north-east and after a short distance north-west enters upon the Silesian plain, which general direction it maintains across the recent deposits of the lowlands in a wide valley and with low banks. In its lower course it frequently bifurcates, forming many islands, and its main channel passes Stettin into the Grosses Haff, which is connected with the Baltic sea by three arms, the Peene, Swine and Dievenov forming the islands of Usedom and Wollin. The Swine in the middle, is the main channel for navigation.

Rising in Czechoslovakia it touches the Upper Silesian coalfield

and enters Germany above Ratibor, after forming the frontier between Germany and Poland from Bohumin. It receives a number of left-bank tributaries from the gneisses and granites of the Bohemian massif, the chief being the Glatzer Neisse, Katzbach, Bober and Lausitzer Neisse, but the biggest affluents are those on the right-bank, the Warthe with its tributaries the Netze (Notéc) and the Obra, the Malapane and Bartsch, all of which rise in Poland. The most important towns on the river banks are Ratibor, Oppeln, Brieg, Breslau, Glogau, Frankfort-on-Oder, Küstrin, Stettin and Swinemünde. The river forms an important highway into eastern Germany, Poland and Czechoslovakia. It is utilized by three main currents of traffic, traffic between Stettin and Berlin, goods transported to or from the mining area of Upper Silesia (this traffic was reduced by the partition of Upper Silesia between Germany and Poland) and the traffic to and from Poland by the Warthe and its connections. The river begins to be navigable for barges at Ratibor, when it is about 100 ft. wide, and for larger vessels at Breslau where constant dredging is always necessary. Several parts of the main stream have been canalized, especially in the low-lying reaches, in its upper courses and between Stettin and the sea. It is now possible for sea-going vessels, drawing 24 ft. of water to reach Stettin. In addition navigation is possible on the Warthe, Netze and Obra, and the river is connected by canals with the Vistula, the Havel and the Spree.

By the Treaty of Versailles (1919) Poland extended her territory westwards to include the province of Posen (Posnania) but, although the boundary nowhere touches the Oder, long portions of its right-bank are now in Poland. The treaty also declared international the Oder and all navigable portions of its system which provide natural access to the sea for more than one State, and also appointed a commission consisting of three representatives of Prussia, and one each of Poland, Czechoslovakia, Great Britain, France, Denmark and Sweden to prepare an Act of Navigation. The work of this commission was by no means easy, for unforeseen difficulties arose upon the question of the right of the commission to legislate for the upper reaches of the Warthe, the Netze and the Old Netze.

**ODESSA,** a seaport of the Ukrainian S.S.R., in 46° 29′ N., 30° 44′ E., on the southern shore of a semi-circular bay, at the north-west angle of the Black sea. Pop. (1939) 604,223. It has five harbours; the Quarantine, New Harbour, Pratique and Cabotage harbours are sheltered by two breakwaters, 4,020 ft. and 2,120 ft. in length. The Petroleum harbour is sheltered by a breakwater 840 ft. in length. There is very good anchorage in the inner roads and a floating crane with a capacity of 40 tons. There are two patent slips and a double-sided floating dock, lifting power 4,800 tons. The harbours freeze for a few days in each year, and the bay occasionally freezes. Navigation is interrupted on an average for 16 days per annum, though the powerful ice breaker now installed lessens this time. The climate is influenced by its proximity to the steppe, and is continental. Average January temperature 23·2° F, July 72·8° F, average rainfall 14 in. per annum. The exports are mainly grain, linseed, wool, cattle, sugar and timber, and the imports coal, naphtha, iron, machinery, agricultural implements, raw cotton, tobacco, manufactured goods and tea, coffee and other colonial goods. Coal cargoes are discharged in the new harbour, several travelling steam cranes being fitted for the purpose. The Cabotage harbour is reserved for Russian coasting vessels. A repairing yard with a pontoon and fitting out basin is situated near the petroleum harbour. Improvements to the port are now being carried out, with a view to providing quayside and berths for 21 steamers, with warehouses and railway lines along the quay.

The town is picturesquely situated on a plateau 150 ft. above sea-level, which is intersected by ravines and forms the limit of the steppe region. The climate is milder than that of the rest of the Ukraine and in the vicinity of Odessa are numerous health resorts along the *limans*. In these limans, or former river mouths now cut off from the sea by the silting up of the rivers, are waters containing concentrated salt solutions, with high proportions of magnesium and calcium salts, iodine and bromine. Their mud is strongly impregnated with sulphuretted hydrogen and is highly beneficial to sufferers from rheumatism, nervous disorders and skin diseases. Spring gives the environs of Odessa a brief glory of brightly coloured blossoms but summer heat and drought soon parch the vegetation. The broad streets of the town have been planted with trees, peculiarly grateful in the brief intense heat of summer and in contrast with the general treeless condition of the surrounding steppe. The population is exceedingly mixed even for a seaport, and includes Great Russians, Ukrainians, Jews, Poles, Germans, Greeks, Armenians, Tatars and Turks, among others.

**History.**—The bay of Odessa has had a chequered history; it was colonised by Greeks at a very early period, but their ports Istrianorum Portus, Isiacorum Portus and Odessus at the mouth of the Tiligul liman disappeared in the 3rd and 4th centuries.

In spite of its favoured position between the Dniester and the Dnieper estuaries, no further settlements were made until the 14th century, when a Tatar chief Khaji Beg or Bey founded a fort on the present site of Odessa. Olgerd, prince of Lithuania, captured the fort in 1396 and it remained alternately in the power of Lithuania and Poland until its capture by Tatars in the 16th century. During the whole of this period it continued to be an important export centre for grain, salt and fish. The Turks captured it from the Tatars in the 16th century and built a fortress Yeni-Dunia to protect the harbour. In 1774 during the Russo-Turkish War, the Russians captured the town, but returned it to the Turks, finally occupying it and the whole territory between the Dniester and the Bug in 1789. A French captain, de Ribas, who had led the Russians in their assault on the town, was afterwards entrusted with the planning, in consultation with the French engineer Voland, of a military and commercial port, and a finely laid out Russian city replaced the former Turco-Tatar settlement.

In 1803 Odessa became the chief town of a separate municipal captaincy under Armand, duc de Richelieu, who developed its trade and importance. In 1824 it became the seat of the governors of Novorossia (New Russia) and Bessarabia and, as a free port, became very prosperous. Railway communication with Kiev and Kharkov and with Jassy in Rumania was established in 1866. The free port was closed in 1859. The town successfully resisted a Turkish attack in 1876–77. A numerous floating population began to be attracted, abundant work being available in years of good harvest, but unemployment became rife in years of bad harvest. In the 1905 revolution the workers, supported by the insurrectionary battleship "Potemkin," of the Black sea fleet, took active part in the revolutionary movement. The rising was suppressed, but broke out with renewed vigour in October of the same year and was again suppressed.

After the overthrow of the Kerensky government in October 1917, the Ukrainian Rada (Petlura) occupied the town. In January 1918 the Bolshevik workers of the town, aided by troops from the former Rumanian front and from the Black sea fleet expelled the followers of Petlura and proclaimed a soviet republic. In mid-March German and Austro-Hungarian troops occupied the town, and later the Ukrainian government, installed under German protection, called in the Entente troops, who occupied the greater part of the town. The French fleet bombarded the wretched inhabitants and French, Serbian, Polish and later Greek troops were landed. Eventually, however, a second soviet government was set up in April 1919, but was overthrown by General Denikin in August 1919. In February 1920 the soviet finally captured the town.

During this disastrous period a third of the houses were destroyed and numbers of the population were killed, while others fled into the surrounding villages. During 1921 and 1922 famine and famine diseases further devastated the town and lack of fuel caused the inhabitants to pull down many wooden buildings. But in 1923 conditions became somewhat easier and since then trade has slowly returned. Another difficulty, however, faced the town. Formerly much of its trade came via the Dniester river and Akkerman (now Cetatea Alba) from Bessarabia and in the absence of diplomatic relations between Rumania and Russia, a state of

armed neutrality existed on that river and trade was practically nonexistent. However, in spite of all these adverse conditions, the population in 1926 had reached normal size, increasing in 1937 to 534,000 and in 1939 to 604,223, thus showing an increase of about 40% as compared with 1926. The city gradually returned to normal conditions and trade and shipping were flourishing, making Odessa the principal seaport and commercial centre on the Black sea.

In the course of World War II Odessa played a very considerable role. The enormous strategic and economic importance of Odessa, not only for the Ukraine but for the entire U.S.S.R., made it quite necessary for the invading Germans to take possession of it in the shortest possible time in order to secure their flank and to use it as a basis for expansion over the Ukrainian industrial and mining area and the North Caucasian region. Besieged by the German and Rumanian troops Odessa fell after a gallant defense on Oct. 16, 1941, and was liberated only in the course of the great German retreat in 1943–44.

**Industry.**—In addition to its trading, port and shipbuilding activities Odessa has numerous industrial enterprises, amongst which the production of salt takes an important place. There are also glass, metal and brick works and factories for producing machinery, especially for agricultural purposes, and munitions, superphosphates, tin, cork, glue and oil from oleaginous seeds are produced. Recently introduced industries are the manufacture of cinematograph apparatus, of water gauges, of twine and of preserved foods. There is also an aeroplane factory and a regular air service has been established between Odessa and Kharkov, with intermediate stations at Poltavo and Zinovievsk. The water supply of the town is obtained from the Dniester river. The town has several theatres and museums. The former University of South Russia has been converted into a Technical institute, and there are Medical and Agricultural institutes, a State Public library and a Jewish Academical library. The medley of languages has encouraged the use of Esperanto and there is an Esperanto institute. There is a zoological garden, laid out chiefly for purposes of acclimatisation, and animals destined for the more severe conditions of the north are kept here for some time. The Bacteriological station was the first of its kind in Russia.

**ODIN** or **OTHIN,** the chief god of the northern pantheon, is represented as an old man with one eye. Frigg is his wife, Thor and Balder, among other gods, are his sons. He is also said to have been the father of several legendary kings. His exploits and adventures are a common theme in the poetic and prose Eddas. Here his character is distinguished rather by wisdom than martial prowess, and reference is frequently made to his skill in poetry and magic. In *Ynglinga Saga* he is represented as reigning in Sweden. In notices relating to religious observances Odin appears chiefly as the giver of victory or as the god of the dead. He receives the souls of the slain, who in his palace, Valhalla (*q.v.*), live a life of fighting and feasting, similar to that which has been their desire on earth. Human sacrifices were frequently offered to Odin, especially prisoners taken in battle. In the poem *Hávamál* the god himself is represented as sacrificed. The worship of Odin seems to have prevailed chiefly, if not solely, in military circles. To the Anglo-Saxons he was known as Woden (*q.v.*) and to the Germans as Wodan (Wuotan). Owing to the peculiar character of this god and the prominent position which he occupies, the mythology of the north presents a striking contrast to that of Greece. *See* TEUTONIC PEOPLES, *ad fin.;* and WODEN.

**ODO** or EUDES (d. 898), king of the Franks, a son of Robert the Strong, count of Anjou (d. 866), is sometimes referred to as duke of France and also as count of Paris. For his resistance to the attacks of the Normans Odo was chosen king by the Western Franks when the emperor Charles the Fat was deposed in 887, and was crowned at Compiègne in February 888. He defeated the Normans at Montfaucon and elsewhere, but was soon involved in a struggle with powerful nobles, who supported the claim of Charles, afterwards King Charles III., to the Frankish kingdom. To gain support Odo owned himself a vassal of the German king, Arnulf, but in 894 Arnulf declared for Charles. Eventually, after a struggle of three years, Odo was compelled to come to terms with his rival, and to surrender to him a district north of the Seine. He died at La Fère on Jan. 1, 898.

*See* E. Lavisse, *Histoire de France,* tome ii. (1903); and E. Favre, *Eudes, comte de Paris et roi de France* (1893).

**ODO** or EUDES (d. *c.* 736), king, or duke, of Aquitaine, obtained this dignity about 715, and his territory included the southwestern part of Gaul from the Loire to the Pyrenees. In 718 he appears as the ally of Chilperic II., king of Neustria, who was fighting against the Austrasian mayor of the palace, Charles Martel; but after the defeat of Chilperic at Soissons in 719 he probably made peace with Charles by surrendering to him the Neustrian king and his treasures. Odo was also obliged to fight the Saracens who invaded the southern part of his kingdom, and inflicted a severe defeat upon them at Toulouse in 721. When, however, he was again attacked by Charles Martel, the Saracens renewed their ravages, and Odo was defeated near Bordeaux; he was compelled to crave protection from Charles, who took up this struggle and gained his momentous victory at Poitiers in 732. In 735 the king abdicated, and was succeeded by his son Hunold.

**ODOACER** or ODOVACAR (*c.* 434–493), the first barbarian ruler of Italy, son of Aedico or Idico, was born in the district bordering on the middle Danube about the year 434. He was probably one of the tribe of Scyrri who had invaded Pannonia about 430. It is said that as a tall young recruit for the Roman armies, dressed in a sordid vesture of skins, on his way to Italy, he entered the cell of St. Severinus, to ask his blessing. The saint had an inward premonition of his future greatness, and in blessing him said, "Fare onward into Italy. Thou who art now clothed in vile raiment wilt soon give precious gifts unto many."

Odoacer was probably about thirty years of age when he thus entered the imperial service. By the year 472 he had risen to some eminence. In the year 475 the emperor Nepos was driven into exile, and the successful rebel Orestes was enabled to array in the purple his son, a handsome boy of fourteen or fifteen, who was named Romulus after his grandfather, and nicknamed Augustulus, from his inability to play the part of the great Augustus. Before this puppet emperor had been a year on the throne the barbarian mercenaries rose in mutiny, demanding to be made proprietors of one-third of the soil of Italy. To this request Orestes returned a peremptory negative. Odoacer now offered his fellow-soldiers to obtain for them all that they desired if they would seat him on the throne. On Aug. 23, 476, he was proclaimed king; five days later Orestes was made prisoner at Placentia and beheaded. Augustulus was compelled to descend from the throne, but his life was spared.

Odoacer was forty-two years of age when he thus became chief ruler of Italy, and he reigned thirteen years with undisputed sway. The administration was conducted as much as possible on the lines of the old imperial government. The settlement of the barbarian soldiers on the lands of Italy probably affected the great landowners rather than the labouring class. To the herd or *coloni* and *servi* it probably made little difference whether the master whom they served called himself Roman or Rugian.

In 477 or 478 the dethroned emperor Nepos sent ambassadors to Zeno, emperor of the East, begging his aid in the reconquest of Italy. These ambassadors met a deputation from the Roman senate, sent nominally by the command of Augustulus, really no doubt by that of Odoacer, to declare that they did not need a separate emperor. The senate had chosen Odoacer, and they therefore prayed Zeno to confer upon him the dignity of patrician, and entrust the "diocese" of Italy to his care. Zeno returned a harsh answer to the senate, requiring them to return to their allegiance to Nepos. In fact, however, he did nothing for the fallen emperor, but accepted the new order of things, and even addressed Odoacer as patrician. On the other hand, the latter sent the ornaments of empire to Constantinople as an acknowledgment of the fact that he did not claim supreme power. Our information as to the actual title assumed by the new ruler is somewhat confused. He does not appear to have called himself king of Italy, but only king of the tribes of barbarians that followed him. By the Roman inhabitants of Italy he was addressed as "dominus noster," but his right to exercise power would in their eyes rest, in theory, on his recognition as patricius by the Byzantine Augustus. At the same time

he marked his own high pretensions by assuming the prefix Flavius. His internal administration was probably, upon the whole, wise and moderate, and he may be looked upon as a not altogether unworthy predecessor of Theodoric.

In the history of the papacy Odoacer figures as the author of a decree promulgated at the election of Felix II. in 483, forbidding the pope to alienate any of the lands or ornaments of the Roman Church, and threatening any pope who should infringe this edict with anathema.

The chief events in the foreign policy of Odoacer were his Dalmatian and Rugian wars. In the year 480 the ex-emperor Nepos, who ruled Dalmatia, was traitorously assassinated in Diocletian's palace at Spalato by the counts Viator and Ovida. In the following year Odoacer invaded Dalmatia, slew the murderer Ovida, and reannexed Dalmatia to the Western state. In 487 he appeared as an invader in his own native Danubian lands. War broke out between him and Feletheus, king of the Rugians. Odoacer entered the Rugian territory, and defeated and captured Feletheus. In the following year Frederick, son of the captive king, endeavoured to raise again the fallen fortunes of his house, but was defeated by Onulf, brother of Odoacer, and took refuge at the court of Theodoric the Ostrogoth.

This Rugian war was probably an indirect cause of the fall of Odoacer. His increasing power rendered him too formidable to the Byzantine court. At the same time, Zeno was embarrassed by the formidable neighbourhood of Theodoric the Ostrogoth. In these circumstances arose the plan of Theodoric's invasion of Italy, the details of which belong properly to the life of Theodoric. It is sufficient to state here that he entered Italy in August 489, defeated Odoacer at the Isontius (Isonzo) on the 28th of August, and at Verona on the 30th of September. Odoacer then shut himself up in Ravenna, and there maintained himself for four years, with one brief gleam of success, during which he emerged from his hiding place and fought the battle of the Addua (Aug. 11, 490), in which he was again defeated. A sally from Ravenna (July 10, 491) was again the occasion of a murderous defeat. At length, the famine in Ravenna having become almost intolerable, and the Goths despairing of ever taking the city by assault, negotiations were opened for a compromise (Feb. 25, 493). It was stipulated that Ravenna should be surrendered, that Odoacer's life should be spared, and that he and Theodoric should be recognized as joint rulers of the Roman state. The arrangement was evidently a precarious one, and was soon terminated by the treachery of Theodoric. He invited his rival to a banquet in the palace of the Lauretum on the 15th of March, and there slew him with his own hand. "Where is God?" cried Odoacer when he perceived the ambush into which he had fallen. "Thus didst thou deal with my kinsman," shouted Theodoric, and clove his rival with the broadsword from shoulder to flank. Thelan, his son, was not long after put to death by order of the conqueror. Thus perished the whole race of Odoacer.

LITERATURE.—The chief authorities for the life of Odoacer are the so-called "Anonymus Valesii," generally printed at the end of Ammianus Marcellinus; the *Life of Severinus,* by Eugippius; the chroniclers, Cassiodorus and "Cuspiniani Anonymus" (both in Roncalli's collection); and the Byzantine historians, Malchus and John of Antioch. A fragment of the latter historian, unknown when Gibbon wrote, is to be found in the fifth volume of Müller's *Fragmenta Historicorum Graecorum.* There is a thorough investigation of the history of Odoacer in R. Pallmann's *Geschichte der Völkerwanderung,* vol. ii. (Weimar, 1864). *See* also T. Hodgkin, *Italy and Her Invaders,* vol. iii. (Oxford, 1885).

**ODOFREDUS,** Italian jurist of the 13th century. He was born at Bologna and studied law under Balduinus and Accursius. After having practised as an advocate both in Italy and France, he became professor at Bologna in 1228. The commentaries on Roman law attributed to him are valuable as showing the growth of the study of law in Italy, and for their biographical details of the jurists of the 12th and 13th centuries. Odofredus died at Bologna on Dec. 3, 1265.

Over his name appeared *Lecturae in codicem* (Lyons, 1480), *Lecturae in digestum vetus* (Paris, 1504), *Summa de libellis formandis* (Strasbourg, 1510), *Lecturae in tres libros* (Venice, 1514), and *Lecturae in digestum novum* (Lyons, 1552).

**ODONATA:** *see* INSECTS; DRAGON-FLY.

**O'DONNELL,** the name of an ancient and powerful Irish family, lords of Tyrconnel in early times, and the chief rivals of the O'Neills in Ulster. Like the family of O'Neill (*q.v.*), that of O'Donnell was descended from Niall of the Nine Hostages, king of Ireland at the beginning of the 5th century; the O'Neills, or Cinel Owen, tracing their pedigree to Owen (Eoghan), and the O'Donnells, or Cinel Connell, to Conall Gulban, both sons of Niall.

Tyrconnel, the district named after the Cinel Connell, where the O'Donnells held sway, comprised the greater part of the modern county of Donegal except the peninsula of Inishowen; and since it lay conterminous with the territory ruled by the O'Neills of Tyrone, who were continually attempting to assert their supremacy over it, the history of the O'Donnells is for the most part a record of tribal warfare with their powerful neighbours, and of their own efforts to make good their claims to the overlordship of northern Connaught.

The first chieftain of mark in the family was Goffraidh (Godfrey), son of Donnell Mor O'Donnell (d. 1241). Goffraidh, who was "inaugurated" as "The O'Donnell," *i.e.,* chief of the clan, in 1248, successfully raided Tyrone and Connaught, and was severely wounded in the battle of Roscede (1257). In the following year he defeated Brian O'Neill, but died soon after from his old wounds. He was succeeded in the chieftainship by his brother Donnell Oge.

In the 16th century, when the English began to make determined efforts to bring the whole of Ireland under subjection to the Crown, the O'Donnells of Tyrconnel played a leading part, cooperating at times with the English, especially when such cooperation appeared to promise triumph over their ancient enemies the O'Neills, at other times joining with the latter against the English authorities.

MANUS O'DONNELL (d. 1564), son of Hugh Dubh O'Donnell, was left to rule Tyrconnel during his father's pilgrimage to Rome about 1511; and retained the chief authority when Hugh Dubh returned. A family quarrel ensued, but with the help of the O'Neills, Manus established his hold over Tyrconnel. In 1522, however, the O'Neills and O'Donnells were again at war. Conn Bacach O'Neill, 1st earl of Tyrone, determined to subjugate the O'Donnells. Supported by several septs of Munster and Connaught, and assisted by English contingents and the MacDonnells of Antrim, O'Neill took the castle of Ballyshannon, and after devastating a large part of Tyrconnel encamped at Knockavoe, near Strabane. Here he was surprised at night by Hugh Dubh and Manus O'Donnell, and severely defeated. The war continued, however, and in 1531 O'Donnell applied to the English Government for protection, giving assurances of allegiance to Henry VIII. In 1537 Lord Thomas Fitzgerald and his five uncles were executed for rebellion in Munster, and the English Government made every effort to lay hands also on Gerald, the youthful heir to the earldom of Kildare, a boy of 12 years of age who was in the secret custody of his aunt Lady Eleanor McCarthy. This lady, in order to secure a powerful protector for the boy, accepted an offer of marriage by Manus O'Donnell, who on the death of Hugh Dubh in July 1537 was inaugurated The O'Donnell. Conn O'Neill was a relative of Gerald Fitzgerald, and this event accordingly led to the formation of the Geraldine League, a federation which combined the O'Neills, the O'Donnells, the O'Briens of Thomond, and other powerful clans; the primary object of which was to restore Gerald to the earldom of Kildare, but which afterwards aimed at the complete overthrow of English rule in Ireland. In Aug. 1539 Manus O'Donnell and Conn O'Neill were heavily defeated by the lord deputy at Lake Bellahoe, in Monaghan.

In the west Manus continued to assert the supremacy of the O'Donnells in north Connaught, where he compelled O'Conor Sligo to acknowledge his overlordship in 1539. In 1542 he went to England and presented himself, together with Conn O'Neill and other Irish chiefs, before Henry VIII. In his later years Manus was harassed by his son Calvagh, who imprisoned him in 1555, and deposed him from all authority in Tyrconnel. He died in 1564. Manus O'Donnell is also described by the Four Masters

as "a learned man, skilled in many arts, gifted with a profound intellect, and the knowledge of every science." At his castle of Portnatrynod near Strabane he supervised if he did not actually dictate the writing of the *Life of Saint Columbkille* in Irish, which is preserved in the Bodleian library at Oxford. Manus was several times married. His first wife, Joan O'Reilly, was the mother of Calvagh, and two daughters, both of whom married O'Neills; the younger, Margaret, was wife of the famous rebel Shane O'Neill. His second wife, Hugh's mother, by whom he was ancestor of the earls of Tyrconnel (*see* below), was Judith, sister of Conn Bacach O'Neill, 1st earl of Tyrone, and aunt of Shane O'Neill. He died in 1564.

CALVAGH O'DONNELL (d. 1566), eldest son of Manus O'Donnell, in the course of his above-mentioned quarrel with his father and his half-brother Hugh, sought aid in Scotland from the MacDonnells, who assisted him in deposing Manus and securing the lordship of Tyrconnel. Hugh then appealed to Shane O'Neill, who invaded Tyrconnel at the head of a large army in 1557 to secure supremacy over Ulster, and encamped on the shore of Lough Swilly. Calvagh surprised the O'Neills in their camp at night and routed them. Calvagh was then recognized by the English Government as lord of Tyrconnel; but in 1561 he and his wife were captured by Shane O'Neill in the monastery of Kildonnell. His wife, Catherine Maclean, who had previously been the wife of the earl of Argyll, was kept by Shane O'Neill as his mistress and bore him several children, though grossly ill-treated by her savage captor; Calvagh himself was subjected to atrocious torture during the three years that he remained O'Neill's prisoner. He was released in 1564 on conditions which he had no intention of fulfilling; and crossing to England he appealed to Queen Elizabeth. In 1566 Sir Henry Sidney marched to Tyrconnel, and restored Calvagh to his rights. Calvagh, however, died in the same year, and as his son Conn was a prisoner in the hands of Shane O'Neill, his half-brother Hugh MacManus was inaugurated The O'Donnell in his place. Hugh, who in the family feud with Calvagh had allied himself with O'Neill, now turned round and combined with the English to crush the hereditary enemy of his family; and in 1567 he utterly routed Shane at Letterkenny, compelling him to seek refuge with the MacDonnells of Antrim, by whom he was put to death. In 1592 Hugh abdicated in favour of his son Hugh Roe O'Donnell (*see* below); but Niall Garve, second son of Calvagh's son Conn, resented the passing of the chieftainship to the descendants of Manus O'Donnell's second marriage. His elder brother was Hugh of Ramelton, whose son John, an officer in the Spanish army, was father of Hugh Baldearg O'Donnell (d. 1704), known in Spain as Count O'Donnell, who commanded an Irish regiment as brigadier in the Spanish service. This officer came to Ireland in 1690 and raised an army in Ulster to be used in the service of James II., afterwards deserting to the side of William III., from whom he subsequently accepted a pension.

NIALL GARVE O'DONNELL (1569–1626), grandson of Calvagh, made terms with the English Government, to whom he rendered valuable service both against the O'Neills and against his cousin. But in 1601 he quarrelled with the lord deputy, who, though willing to establish Niall Garve in the lordship of Tyrconnel, would not permit him to enforce his supremacy over Cahir O'Dogherty in Inishowen. Charged with complicity in Cahir O'Dogherty's rebellion in 1608, Niall Garve was sent to the Tower of London, where he remained till his death in 1626. He married his cousin Nuala, the sister of Hugh Roe and Rory O'Donnell. When Rory fled with the earl of Tyrone to Rome in 1607, Nuala, who had deserted her husband when he joined the English against her brother, accompanied him, taking with her her daughter Grania. She was the subject of an Irish poem, of which an English version was written by James Mangan from a prose translation by Eugene O'Curry.

HUGH ROE O'DONNELL (1572–1602), eldest son of Hugh MacManus O'Donnell, and grandson of Manus O'Donnell by his second marriage with Judith O'Neill, was the most celebrated member of his clan. His mother was Ineen Dubh, daughter of James MacDonnell of Kintyre; his sister, the second wife of Hugh O'Neill, 2nd earl of Tyrone. These family connections with the Hebridean Scots and with the O'Neills made the lord deputy, Sir John Perrot, afraid of a powerful combination against the English Government, and induced him to establish garrisons in Tyrconnel and to demand hostages from Hugh MacManus O'Donnell, which the latter refused to hand over. In 1587 Perrot conceived a plan for kidnapping Hugh Roe (Hugh the Red), now a youth of 15, who had already given proof of exceptional ability. A merchant vessel laden with Spanish wines was sent to Lough Swilly, and Hugh Roe with some youthful companions was enticed on board, when the ship immediately set sail and conveyed the party to Dublin. The boys were kept in prison for more than three years. In 1591 young O'Donnell escaped; and after enduring terrible privations he made his way to Tyrconnel, where in the following year his father handed the chieftainship over to him.

Red Hugh then led an expedition against Turlough Luineach O'Neill, who was at war with his kinsman Hugh, earl of Tyrone, with whom O'Donnell was in alliance, at the same time assuring the lord deputy of his loyalty. Determined to vindicate the traditional claims of his family in north Connaught, he aided Hugh Maguire against the English, though on the advice of Tyrone he abstained for a time from committing himself too far. When, however, in 1594 Enniskillen castle was taken and the women and children flung into the river from its walls by order of Sir Richard Bingham, the English governor of Connaught, O'Donnell sent urgent messages to Tyrone for help; and while he himself hurried to Derry to withstand an invasion of Scots from the isles, Maguire defeated the English with heavy loss at Bellanabriska (The Ford of the Biscuits). In 1595 Red Hugh again invaded Connaught, putting to the sword all above 15 years of age unable to speak Irish; he captured Longford and Sligo, which placed north Connaught at his mercy. In 1596 he agreed in conjunction with Tyrone to a cessation of hostilities with the English, and met the Government commissioners near Dundalk.

The terms he demanded were, however, refused. He hoped for help from Philip II. of Spain, with whom he and Tyrone had been in correspondence. In the beginning of 1597 he raided Connaught, where O'Conor Sligo had been set up by the English as a counterpoise to O'Donnell. He devastated the country and returned to Tyrconnel with rich spoils; in 1598 he helped to defeat the English at the Yellow Ford on the Blackwater; and in 1599 he defeated an attempt by the English under Sir Conyers Clifford, governor of Connaught, to succour O'Conor Sligo in Collooney castle, which O'Donnell captured, forcing Sligo to submission. The Government now sent Sir Henry Docwra to Derry, and O'Donnell entrusted to his cousin Niall Garve the task of opposing him. Niall Garve, however, went over to the English, making himself master of O'Donnell's fortresses of Lifford and Donegal. While Hugh Roe was besieging Donegal in 1601, he heard that a Spanish force had landed in Munster. He marched rapidly to the south, and was joined by Tyrone at Bandon, but a night-attack on the English besieging the Spaniards in Kinsale having utterly failed, O'Donnell, who attributed the disaster to the incapacity of the Spanish commander, took ship to Spain on Jan. 6, 1602, to lay his complaint before Philip III. He was favourably received by the Spanish king, but he died at Simancas on Sept. 10 in the same year.

RORY O'DONNELL, 1st earl of Tyrconnel (1575–1608), second son of Hugh MacManus O'Donnell, and younger brother of Hugh Roe, accompanied the latter in the expedition to Kinsale; and when his brother sailed for Spain he transferred his authority as chief to Rory. In 1602 Rory gave in his allegiance to Lord Mountjoy, the lord deputy; and in the following summer he went to London with the earl of Tyrone, when James I. created him earl of Tyrconnel. In 1605 he was made the king's lieutenant in Donegal. But the arrangement between Rory and Niall Garve insisted upon by the Government displeased both O'Donnells, and Rory, like Hugh Roe before him, entered into negotiations with Spain. His country had been devastated by famine and war, and his own extravagance had plunged him in debt. These circumstances and the fear that his designs were known to the Govern-

ment induced him to leave Ireland. In Sept. 1607 "the flight of the earls" (*see* O'NEILL) took place, Tyrconnel and Tyrone reaching Rome in April 1608, where Tyrconnel died on July 28. His wife, the beautiful daughter of the earl of Kildare, was left behind in the haste of Tyrconnel's flight, and lived to marry Nicholas Barnewell, Lord Kingsland. By Tyrconnel she had a son Hugh; and among other children a daughter Mary Stuart O'Donnell, who, born after her father's flight from Ireland, was so named by James I. after his mother. This lady, after many romantic adventures, married a man called O'Gallagher and died in poverty on the Continent.

Rory O'Donnell was attainted by the Irish parliament in 1614, but his son Hugh, who lived at the Spanish court, assumed the title of earl; and the last titular earl of Tyrconnel was this Hugh's son Hugh Albert, who died without heirs in 1642, and who by his will appointed Hugh Baldearg O'Donnell (*see* above) his heir, thus restoring the chieftainship to the elder branch of the family. To a still elder branch belonged Daniel O'Donnell (1666–1735), a general of the famous Irish brigade in the French service, whose father, Turlough, was a son of Hugh Dubh O'Donnell, elder brother of Manus, son of an earlier Hugh Dubh mentioned above. Daniel served in the French army in the wars of the period, fighting against Marlborough at Oudenarde and Marlplaquet at the head of an O'Donnell regiment. He died in 1735.

The famous Cathach, or Battle-Book of the O'Donnells, was in the possession of General Daniel O'Donnell, from whom it passed to more modern representatives of the family, who presented it to the Royal Irish Academy, where it is preserved. This relic, of which a curious legend is told (*see* P. W. Joyce, *A Social History of Ancient Ireland,* 1903, vol. i. p. 501), is a Psalter said to have belonged to St. Columba, a kinsman of the O'Donnells, which was carried by them in battle as a charm or talisman to secure victory. Two other circumstances connecting the O'Donnells with ancient Irish literature may be mentioned. The family of O'Clery, to which three of the celebrated "Four Masters" belonged, were hereditary Ollaves (doctors of history, music, law, etc.) attached to the family of O'Donnell; while the "Book of the Dun Cow" (*Lebor-na-h Uidhre*), one of the most ancient Irish mss., was in the possession of the O'Donnells in the 14th century; and the estimation in which it was held at that time is proved by the fact that it was given to the O'Connors of Connaught as ransom for an important prisoner, and was forcibly recovered some years later.

*See* O'NEILL, and the authorities there cited.

**O'DONNELL, LEOPOLD** (1809–1867), duke of Tetuan, Spanish general and statesman, was born at Santa Cruz, Teneriffe, on January 12, 1809. General of division in the army of Queen Christina, he accompanied her into exile in 1840; attempted unsuccessfully a rising in her favour at Pamplona in 1841, helped in the overthrow of Espartero (1843) and from 1844–48 served the new government in Cuba. War minister (1854) under Espartero, he plotted successfully against his chief in 1856 and became head of the cabinet from the July revolution until October, and again in July 1858. He took command of the expedition to Morocco (Dec. 1859) and was made duke after the surrender of Tetuan. He resigned office in 1863 until 1865, resumed it and resigned again in favour of Narvaez in 1866. He died at Bayonne, Nov. 5, 1867.

*See* C. Navarro y Rodrigo, *O'Donnell y su tiempo* (Madrid, 1869).

**O'DONNELL, PATRICK** (1856–1927), cardinal archbishop of Armagh, Ireland, was born of humble parents at Kilraine, Donegal, on Nov. 28, 1856, and was educated locally, then at the Catholic university at Dublin, and finally at Maynooth, where he took priest's orders in 1880. Eight years later he became bishop of Raphoe, a see which he held for 34 years, during which he transformed the diocese set in the wild highlands of Donegal. Dr. O'Donnell was a strong constitutional nationalist and one of the wisest men in the party. Perhaps his supreme gift to Ireland was his sense of the importance of substituting peace for the violent religious hatred prevailing in northern Ireland. He believed in good-will for the modification of existing differences due to territorial and religious conditions. He was a member of the Irish convention 1917–18.

In 1923 the pope nominated him coadjutor to Cardinal Logue, archbishop of Armagh, whom he succeeded in the primacy in the following year. In 1925 he received the cardinalate. In 1927 he held a plenary synod of the Irish hierarchy, at which far-reaching reforms were undertaken. The cardinal spoke Gaelic from his childhood and promoted the use of the vernacular. He died on Oct. 22, 1927, at Carlingford.

**ODONTOGLOSSUM,** a genus of epiphytic plants of the orchid family (Orchidaceae), comprising about 100 species native to the mountains of tropical America. Many species are well known in greenhouse cultivation, including numerous hybrids. *O. grande,* the baby orchid, has showy yellow flowers, barred with cinnamon-brown, 5 in. to 6 in. across. (*See* ORCHIDS.)

**ODONTORNITHES,** the term proposed by O. C. Marsh for birds possessed of teeth (Gr. *ὀδούς,* tooth, *ὄρνις, ὄρνιθος* bird), notably the genera *Hesperornis* and *Ichthyornis* from the Cretaceous deposits of Kansas. In 1875 he divided the "sub-class" into *Odontolcae,* with the teeth standing in grooves, and *Odontotormae,* with the teeth in separate alveoles or sockets. In his magnificent work, *Odontornithes: A monograph on the extinct toothed birds of North America* (New Haven [Conn.], 1880), he logically added the Saururae, represented by *Archaeopteryx,* as a third order. As it usually happens with the selection of a single anatomical character, the resulting classification was unnatural. The Odontornithes, as a matter of fact, are a heterogeneous assembly, and the fact of their possessing teeth proves nothing but that many types of birds still possessed them in Cretaceous times. These teeth are heritages from their reptilian ancestry, of which abundant evidence is found in various parts of the skeleton. No fossil birds of later than Cretaceous age are known to have teeth, and recent birds possess not even embryonic vestiges.

The best known of the Odontornithes are *Hesperornis regalis,* standing about 3ft. high, and the somewhat taller *H. crassipes.* Both show the general configuration of a diver, but whether *Hesperornis* can be regarded as ancestral to the Colymbiformes or whether the many points of resemblance to this group are due to "convergence" is a moot point. There are about 14 teeth in a groove of the maxilla and about 21 in the mandible; the vertebrae are typically heterocoelous; of the wing-bones nothing but the humerus, or upper arm-bone, remained and this was reduced to a vestigial condition; clavicles slightly reduced; coracoids short and broad, movably connected with the scapula; sternum very long, broad and quite flat, without the trace of a keel. Hind limbs very strong and of the Colymbine type, but the outer or fourth capitulum of the metatarsus is the strongest and longest, an unique arrangement in an otherwise typically steganopodous foot. The pelvis shows much resemblance to that of the divers, but there is still an incisura ischiadica instead of a foramen. The tail is composed of about twelve vertebrae, without a pygostyle. *Enaliornis* of the Cambridge Greensand of England, and *Baptornis* of the mid-Cretaceous of North America, are probably allied, but imperfectly known. The vertebrae are biconcave, with heterocoelous indications in the cervicals; the metatarsal bones appear still somewhat imperfectly anchylosed. The absence of a keel led the earlier naturalists to regard *Hesperornis* as one of the Struthious birds, and it has even been described as a "swimming ostrich." But there can be no doubt but that it is to be reckoned as one of the Neognathae which, becoming flightless, lost the keel of the sternum, as some of the land-birds have also done—*e.g.,* the kakapo (*q.v.*) of New Zealand.

There remain the *Odontotormae,* notably *Ichthyornis victor, I. dispar, Apatornis* and *Graculavus* of the middle and upper Cretaceous of Kansas. The teeth stand in separate alveoli. The vertebrae are amphicoelous, but at least the third cervical has somewhat saddle-shaped articular facets. Tail composed of five free vertebrae, followed by a rather small pygostyle. Shoulder girdle and sternum well developed and of the typical carinate type. Pelvis still with incisura ischiadica. Marsh based the restoration of *Ichthyornis,* which was obviously an aquatic bird possessing full powers of flight, upon the skeleton of a tern, though there is no natural affinity between them. The teeth, vertebrae, pelvis and small brain are all primitive so that the Odontotormae may form a separate order of the Neognathae, near the Colymbomorphous Legion. (W. P. P.)

*See* G. Heilman, *The Origin of Birds* (1927).

**ODO OF BAYEUX** (*c.* 1036–1097), Norman bishop and English earl, was a uterine brother of William the Conqueror, from whom he received, while still a youth, the see of Bayeux (1049). But his active career was that of a warrior and statesman. He found ships for the invasion of England and fought in person at Senlac; in 1067 he became earl of Kent, and for some years he was a trusted royal minister. At times he acted as viceroy in William's absence; at times he led the royal forces to chastise rebellions. But in 1083 he was suddenly disgraced and imprisoned for having planned a military expedition to Italy. He was accused of desiring to make himself pope; more probably he thought of serving as a papal condottiere against the emperor Henry IV. The Conqueror, when on his death-bed, reluctantly permitted Odo's release (1087). The bishop returned to his earldom and soon organized a rebellion with the object of handing over England to his eldest nephew, Duke Robert. William Rufus, to the disgust of his supporters, permitted Odo to leave the kingdom after the collapse of this design (1088), and thenceforward Odo was the right-hand man of Robert in Normandy. He took part in the agitation for the first crusade, and started in the duke's company for Palestine, but died on the way, at Palermo (Feb. 1097). Little good is recorded of Odo. His vast wealth was gained by extortion and robbery. His ambitions were boundless and his morals lax. But he was a patron of learning and, like most prelates of his age, a great architect. He rebuilt the cathedral of his see, and may perhaps have commissioned the unknown artist of the celebrated Bayeux tapestry.

Odo must be distinguished from two English prelates of the same name and also from an English earl. Odo or Oda (d. 959), archbishop of Canterbury, was bishop of Ramsbury from 927 to 942, and went with King Aethelstan to the battle of Brunanburh in 937. In 942 he succeeded Wulfhelm as archbishop of Canterbury, and he appears to have been an able and conscientious ruler of the see. He had great influence with King Edwy, whom he had crowned in 956. Odo (d. 1200), abbot of Battle, was a monk of Christ Church, Canterbury, and was prior of this house at the time when Thomas Becket was murdered. In 1175 he was chosen abbot of Battle, and on two occasions the efforts of Henry II. alone prevented him from being elected archbishop of Canterbury. Odo or Odda (d. 1056), a relative of Edward the Confessor, during whose reign he was an earl in the west of England, built the minster at Deerhurst in Gloucestershire.

*See* the authorities cited for WILLIAM I. and WILLIAM II., the biographical sketch in *Gallia Christiana,* xi. 353–360; H. Wharton, *Anglia Sacra,* i. 334–339 (1691); and F. R. Fowke, *The Bayeux Tapestry* (1898). (H. W. C. D.)

**ODORIC** (*c.* 1286–1331), styled "of Pordenone," one of the chief travellers of the later middle ages, and a *Beatus* of the Roman Church, was born at Villa Nuova, a hamlet near the town of Pordenone in Friuli, in or about 1286. According to the ecclesiastical biographers, in early years he took the vows of the Franciscan order and joined their convent at Udine, the capital of Friuli.

Friar Odoric was despatched to the East, where a remarkable extension of missionary action was then taking place, about 1316–18, and did not return till the end of 1329 or beginning of 1330. He was in western India soon after 1321 (pretty certainly in 1322) and he spent three years in China between the opening of 1323 and the close of 1328. His route to the East lay by Trebizond and Erzerum to Tabriz and Sultanieh, in all of which places the order had houses. From Sultanieh he proceeded by Kashan and Yázd, and turning thence followed a devious route by Persepolis and the Shiraz and Baghdad regions, to the Persian gulf. At Hormuz he embarked for India, landing at Thana, near Bombay. After visiting many parts of India he sailed in a junk to Sumatra, visiting various ports on the northern coast of that island, and thence to Java, to the coast (it would seem) of Borneo, to Champa (South Cochin-China), and to Canton, at that time known to western Asiatics as *Chin-Kalan* or Great China (Mahachin). He travelled extensively in China, and visited Hangchow, then renowned, under the name of *Cansay, Khanzai,* or *Quinsai* (*i.e., Kingsze* or royal residence), as the greatest city in the world, of whose splendours Odoric gives details.

At Peking he remained for three years, attached, no doubt, to one of the churches founded by Archbishop John of Monte Corvino, at this time in extreme old age. Returning overland across Asia, through the Land of Prester John and through Casan, the adventurous traveller seems to have entered Tibet, and even perhaps to have visited Lhasa. He then returned to Venice *via* Persia and Asia Minor. During a part at least of these long journeys the companion of Odoric was Friar James, an Irishman. After his return Odoric went to the Minorite house attached to St. Anthony's at Padua, and there, in May 1330, he related the story of his travels, which was taken down in homely Latin by Friar William of Solagna. Odoric died at Udine on Jan. 14, 1331. The fame of his vast journeys appears to have made a much greater impression on the laity of his native territory than on his Franciscan brethren.

Popular acclamation made him an object of devotion, the municipality erected a noble shrine for his body, and his fame as saint and traveller had spread far and wide before the middle of the century, but it was not till four centuries later (1755) that he was formally beatified.

Odoric's credit was not benefited by the liberties which Sir John Mandeville took with it. The substance of that knight's alleged travels in India and Cathay is stolen from Odoric, though amplified with fables from other sources and from his own invention, and garnished with his own unusually clear astronomical notions. There are many details in Odoric's narrative which prove its genuineness.

The best editions of Odoric are by G. Venni, *Elogio storico alle gesta del Beato Odorico* (Venice, 1761); H. Yule in *Cathay and the Way Thither* (1866), vol. i., pp. 1–162, vol. ii. appendix, pp. 1–42, and H. Cordier, *Les Voyages . . . du . . . frère Odoric . . .* (1891) (edition of Old French version of *c.* 1350). The edition by T. Domenichelli (Prato, 1881) may also be mentioned; likewise those texts of Odoric embedded in the *Storia universale delle Missione Franc scane,* iii. 739–781, and in Hakluyt's *Principal Navigations* (1599); ii. 39–67. *See* also John of Viktring (Joannes Victoriensis) in *Fontes rerum Germanicarum,* ed. J. F. Boehmer; vol. i. ed. by J. G. Cotta (Stuttgart, 1843), p. 391; Wadding, *Annales Minorum,* A.D. 1331, vol. vii., pp. 123–126; Bartholomew Albizzi, *Opus conformitatum . . . B. Francisci . . .*, bk. i. par. ii. conf. 8 (fol. 124 of Milan ed. of 1513): John of Winterthur in Eccard, *Corpus historicum medii aevi,* vol. i. cols. 1894–97, especially 1894; C. R. Beazley, *Dawn of Modern Geography* (1897, etc.), iii. 250–287, 548–549, 554, 565–566, 612–613, etc.

**ODYSSEUS** (also ODYSEUS, OLYS[S]EUS, Lat. VLIXES, whereof ULYSSES is a mis-writing), one of the best-known Greek heroes.

(1). In Homer, he is son of Laërtes, king of Ithaca, and Anticleia his queen; he succeeds his father as king, is husband of Penelope (*q.v.*) and father of Telemachus. During the Trojan War (*Iliad*) he is prominent as a brave and skilful fighter, but still more as a giver of shrewd counsel and for his daring and cunning enterprises, alone or with Diomedes. After the war he starts to go home, but is driven off his course by unfavourable winds (*Odyssey*), successively visiting numerous unknown regions, (*see* CIRCE, CYCLOPES, LAESTRYGONES, LOTUS-EATERS, SCYLLA), till, losing all his ships and men, he arrives alone on the island of Calypso (*q.v.*). After eight years he is let go, and is wrecked on the coast of the Phaeacians, who receive him hospitably and send him home in one of their ships. All these places are out of the known world, although later writers in antiquity identified them with various regions known to them and have been followed by some moderns. Arrived home, he finds his wife Penelope beset with a number of suitors who are devouring his substance. With the help of Athena, Odysseus and Telemachus, aided by two faithful thralls, kill them all.

(2). After Homer, the character of Odysseus degenerates from a cunning to a wholly unscrupulous and dishonourable man. He tries to shirk service at Troy by pretending to be mad; but Palamedes discovers the trick. In revenge, Odysseus brings about his ruin and death (*see* PALAMEDES). He and Diomedes steal the Palladium (*q.v.*) and in some accounts he tries to murder Diomedes, to get all the credit for himself. After the death of Achilles, Odysseus and Ajax contend for his armour, which is adjudged to the former (*see* AJAX I.). He is at length accidentally killed by

Telegonus, his son by Circe or Calypso; this story is worked up from hints in the *Odyssey*. A common legend makes Odysseus son of Sisyphus (*q.v.*), thus bringing the two notorious rogues together.

There is no need whatever to suppose Odysseus other than a real man, renowned for his skill and resource, about whom in the course of centuries numerous fictions have gathered. The plot of the *Odyssey* is a well-known *märchen,* however, and not a saga; *see* M. P. Nilsson, *History of Greek Religion,* p.38. His name is not Greek, and probably belongs to a prehellenic speech.

BIBLIOGRAPHY.—J. Schmidt in Roscher's *Lexikon;* P. O. Gruppe, *Griechische Mythologie,* II., 624, 705 ff. (1906); L. Preller and H. Ritter, *Griechische Mythologie,* II. (1865); V. Bérard, *Les Phéniciens et l'Odyssée* (1902–03), and edition of the Odyssey (1924–25) contains the most ingenious attempt to localize his wanderings.

(H. J. R.)

**OECOLAMPADIUS, JOHN** (1482–1531), German Reformer, whose real name was Hussgen or Heussgen[1], was born at Weinsberg, a small town in Württemberg, but then belonging to the Palatinate. He went to school at Weinsberg and Heilbronn, and then, intending to study law, he went to Bologna, but soon returned to Heidelberg and betook himself to theology. He passed from the study of Greek to that of Hebrew, taking his bachelor's degree in 1503. He became cathedral preacher at Basle in 1515, serving under Christopher von Uttenheim, the evangelical bishop of Basle. From the beginning the sermons of Oecolampadius centred in the Atonement, and his first reformatory zeal showed itself in a protest (*De risu paschali,* 1518) against the introduction of humorous stories into Easter sermons. In 1520 he published his *Greek Grammar.* The same year he was asked to become preacher in the high church in Augsburg. Germany was then ablaze with the questions raised by Luther's theses, and his introduction into this new world, when at first he championed Luther's position especially in his anonymous *Canonici indocti* (1519), seems to have compelled Oecolampadius to severe self-examination, which ended in his entering a monastery for a short time. But in Feb. 1522 he made his way to Ebernburg, near Creuznach, where he acted as chaplain to the little group of reformers who had settled there under the leadership of Franz von Sickingen.

The second period of Oecolampadius's life opens with his return to Basle in Nov. 1522, as vicar of St. Martin's and (in 1523) reader of the Holy Scripture at the university, and after more than a year of earnest preaching and four public disputations in which the popular verdict had been given in favour of Oecolampadius and his friends, the authorities of Basle began to see the necessity of some reformation. They began with the convents, and Oecolampadius was able to refrain in public worship on certain festival days from some practices he believed to be superstitious. Basle was slow to accept the Reformation; the news of the Peasants' War and the inroads of Anabaptists prevented progress; but at last, in 1525, it seemed as if the authorities were resolved to listen to schemes for restoring the purity of worship and teaching. In the midst of these hopes and difficulties Oecolampadius married, in the beginning of 1528, Wilibrandis Rosenblatt, the widow of Ludwig Keller, who proved to be *non rixosa vel garrula vel vaga,* he says, and made him a good wife. After his death she married Capito, and, when Capito died, Bucer. She died in 1564. In Jan. 1528 Oecolampadius and Zwingli took part in the disputation at Berne which led to the adoption of the new faith in that canton, and in the following year to the discontinuance of the Mass at Basle. The Anabaptists claimed Oecolampadius for their views, but in a disputation with them he dissociated himself from most of their positions. He died on Nov. 24, 1531.

Oecolampadius was not a great theologian, like Luther, Zwingli or Calvin, and yet he was a trusted theological leader. With Zwingli he represented the Swiss views at the unfortunate conference at Marburg. His views on the Eucharist upheld the metaphorical against the literal interpretation of the word "body," but he asserted that believers partook of the sacrament more for the sake of others than for their own, though later he emphasized it as a means of grace for the Christian life. To Luther's doctrine of the ubiquity of Christ's body he opposed that of the presence and activity of the Holy Spirit in the church. He did not minutely analyse the doctrine of predestination as Luther, Calvin and Zwingli did, contenting himself with the summary "Our Salvation is of God, our perdition of ourselves."

[1]Changed to Hausschein and then into the Greek equivalent.

*See* J. J. Herzog, *Leben Joh. Oecolampads u. die Reformation der Kirche zu Basel* (1843); K. R. Hagenbach, *Johann Oecolampad u. Oswald Myconius, die Reformatoren Basels* (1859). For other literature *see* W. Hadorn's art. in Herzog-Hauck's *Realencyklopädie für prot. Rel. u. Kirche.*

**OECUMENICAL,** a word chiefly used in the sense of belonging to the universal Christian Church. It is thus specifically applied to the general councils of the early church (*see* COUNCIL). In the Roman Church a council is regarded as oecumenical when it has been summoned from the whole church under the presidency of the pope or his legates; the decrees confirmed by the pope are binding. The word has also been applied to assemblies of other religious bodies, such as the Oecumenical Methodist Conference, which met for the first time in 1881.

**OEDIPUS,** the central figure of the Theban saga (Gr. *Oidipous,* probably "Swell-foot"). In Homer we are told that he unwittingly killed his father and married his own mother, Epikaste (the Jocasta of later writers), and that she hanged herself when the matter became known. Oedipus continued, though in great tribulation, to reign in Thebes, apparently until his death. (*Odyssey* xi. 271 *et seq., Iliad,* xxiii, 679). According to the post-Homeric story, Laius, king of Thebes, received an oracle that his son should slay him; therefore, when his wife Jocasta bore a son, he exposed him on Mt. Cithaeron, with a spike driven through his feet. He was saved, however, and was adopted by the childless Polybus, king of Corinth. Reaching manhood, he had occasion to visit Delphi, where he was told that he would slay his father and wed his mother. Departing in great horror, and resolving never to return to Corinth, he met Laius, whom he did not recognize, and killed him in a quarrel. Coming to Thebes, he found the city plagued by the Phix or Sphinx, a winged monster, usually represented with the head of a woman, who asked all passers-by a riddle, killing them if they could not answer. Oedipus solved the riddle, the Sphinx killed herself in disgust, and he was rewarded, according to the promise made by the regent, Creon, son of Menoeceus, with the kingdom and the hand of his sister, the widowed queen. They had two sons, Eteocles and Polyneices, and two daughters, Antigone and Ismene. But later, the whole story came to light; Jocasta hanged herself, Oedipus put out his own eyes, and then lived shut up in a room of the palace (ordinary version), or went into exile, ultimately dying at Colonus and becoming a protecting hero of Attica (Athenian version, *see* Sophocles, *Oedipus Coloneus*). His sons proved undutiful and he cursed them. Therefore they quarrelled over the kingship, finally agreeing to reign alternately. Eteocles' turn came first; Polyneices went into temporary exile, and married Argeia, daughter of Adrastus, king of Argos, whose other daughter, Deiphyle, married Tydeus of Calydon. The latter had gone into exile for homicide; he and Polyneices met and quarrelled, and Adrastus recognized them, by their dress or their shield-devices, as the lion and boar to whom the gods had bidden him betroth his daughters. At the end of a year, Polyneices claimed to rule Thebes in his turn; Eteocles refused, and Adrastus gathered an army to restore his son-in-law. The chieftains, besides the three already named, were Capaneus, Amphiaraus (*q.v.*), Eteoclus, and Parthenopaeus, son of Atalante. Of these, known as the Seven against Thebes, only Adrastus returned. Tydeus would have been made immortal for his valour, but Athena saw him gnaw the head of a slain enemy as he lay dying, and in disgust withheld the intended gift. Amphiaraus was swallowed up in the ground, and in later times was much revered as an oracular hero or god. Polyneices killed Eteocles and was killed by him. Creon now became king; he ordered the bodies of the dead Argives to be left unburied, but Antigone secretly buried her brother, Polyneices. For this, despite the entreaties of his son, Haemon, to whom she was betrothed, Creon walled her up in a tomb (a form of ordeal; the gods might save her if they approved of her conduct). She

hanged herself, Haemon, who had broken into the tomb, killed himself, and so did Creon's wife Eurydice, on hearing the news (so Sophocles; in Euripides, Antigone escaped and lived happily with Haemon, at least for some years; *see* the fragments of his *Antigone* in Nauck). According to an Attic legend, Theseus (*q.v.*) attacked Thebes at the prayer of the mothers of the slain, and forced the Thebans to bury them; Creon was killed by Theseus in the battle. Another story represents him as surviving for many years, to be ultimately killed by the usurper Lycus (so Euripides, *Herc. Fur.*, 33). Oedipus died before, or not long after, the end of the war.

Adrastus bided his time, and when the sons of the Seven (known as the *Epigoni*, or second generation; hence the application of the word to successors of the *Diadochi* (*q.v.*), the immediate successors of Alexander the Great) came to manhood, he once more attacked the city. On the advice of Teiresias (*q.v.*) the Thebans evacuated the place by night. Adrastus led his army back, but died on the way, at Megara, from grief at the death of his son Aigialeus, the only one of the *Epigoni* to fall in the campaign.

There is no reason to doubt that this legend has a historical basis, probably in the events of Minoan-Mycenaean times. Gems from Thisbe show incidents strongly resembling the fight between Oedipus and Laius, and the former's encounter with the Sphinx. Several incidents, such as the prophecies and the incestuous marriage, are patently folk-tales.

**Mediaeval Legends.**—In the *Golden Legend* of Jacobus de Voragine (13th century) and the *Mystère de la Passion* of Jean Michel (15th century) and Arnoul Gréban (15th century), the story of Oedipus is associated with the name of Judas. The main idea is the same as in the classical account. The Judas legend, however, never really became popular, whereas that of Oedipus was handed down both orally and in written national tales (Albanian, Finnish, Cypriote). The Theban legend, which reached its fullest development in the *Thebaïs* of Statius and in Seneca, reappeared in the *Roman de Thèbes* (the work of an unknown imitator of Benoît de Sainte-More). Oedipus is also the subject of an anonymous mediaeval romance (15th century), *Le Roman d'Oedipus, fils de Layus,* in which the sphinx is depicted as a cunning and ferocious giant. The Oedipus legend was handed down to the period of the Renaissance by the *Roman* and its imitations, which then fell into oblivion. The legend has survived amongst the modern Greeks, without any traces of the influence of Christianity (B. Schmidt, *Griechische Märchen,* 1877). The works of the ancient tragedians (especially Seneca, in preference to the Greek) came into vogue, and were followed by modern imitators down to the 17th century.

*See* L. Constans, *La Légende d'Oedipe dans l'antiquité, au moyen âge, et dans les temps modernes* (1881); D. Comparetti's *Edipo* and Jebb's introduction to his ed. of Sophocles, *Oedipus Tyrannus;* for the "Oedipus Complex" *see* PSYCHOLOGY. (H. J. R.)

**OELS,** a town in the Prussian province of Silesia, Germany, on the Oelsbach, 20 mi. N.E. of Breslau by rail. Pop. (1939) 18,147. Oels was founded about 940, and became a town in 1255. It appears as the capital of an independent principality at the beginning of the 14th century. The principality, with an area of 700 sq.mi. and about 130,000 inhabitants, passed through various hands and in 1884 it lapsed to the crown of Prussia. The château, dating from 1558, was restored in 1891–94, and became after 1918 the residence of Frederick William, the ex-crown prince of Prussia. The inhabitants are chiefly engaged in making shoes, furniture and machines.

**OELWEIN,** a city of Fayette county, Iowa, U.S.A., in the northeastern part of the state; served by the Chicago Great Western and the Rock Island railways. Pop. (1940 federal census) 7,801. It is in a farming, dairying, poultry and stock-raising region; has railroad shops and various other manufacturing industries. The city was founded in 1873, by August Oelwein; was incorporated in 1888, and chartered as a city in 1897.

**OENOMAÜS** in Greek legend, son of Ares and Harpinna, king of Pisa in Elis and father of Hippodameia. It was predicted that he should be slain by his daughter's husband. His father gave him winged horses and Oenomaüs promised his daughter to the man who could carry her off in a chariot; he himself was to drive after, and spear the suitor if he could catch him. This may be founded on some marriage rite of simulated capture. Thirteen aspirants having thus perished, Pelops (*q.v.*) arrived, and won, having winged horses which Poseidon had given him. He is usually said to have bribed Oenomaüs' charioteer Myrtilus to take out his master's linch-pins and substitute wax dummies; Oenomaüs was thus thrown and killed.

*See* Diod. Sic. iv. 73; Pausanias vi. 21, and elsewhere; Sophocles, *Electra,* 504, with Jebb's note; Hyginus, *Fab.* 84. 253.

**OENONE,** in Greek legend, daughter of the river-god Cebren and wife of Paris, who deserted her to kidnap Helen (*q.v.*). Just before the capture of the city, Paris, wounded by Philoctetes, sought the aid of Oenone, who had told him that she alone could heal him if wounded. She refused to help him, and Paris returned to Troy and died of his wound. Oenone soon repented and hastened after him, but finding that she was too late to save him slew herself from grief at the sight of his dead body.

**OENOTHERA,** the generic name of the evening primrose and sundrops, several species of which are favourite garden plants. The genus, which comprises numerous species, is confined to America and belongs to the family Onagraceae. The common evening primrose (*O. biennis*) is often a troublesome weed both in North America and Europe; the form known as var. *grandiflora* or *O. lamarckiana* is a showy plant, sometimes cultivated for its larger, handsome flowers. Other species grown in gardens are *O. missouriensis* and *O. speciosa,* the latter with white flowers, grading to pink. The evening primrose acquired importance in connection with Hugo Devries' theory of mutations. (*See* PRIMROSE; HEREDITY.)

**OESEL:** *see* SAARE MAA.

**OESOPHAGUS, DISEASES OF.** (*See* ALIMENTARY CANAL.) The human oesophagus is liable to certain accidents and diseases, from its function and its situation. One of the commonest accidents is the lodgment of foreign bodies. An impacted substance may be removed by the oesophageal forceps, or a coin-catcher or may be pushed down into the stomach. A purgative should never be given, but soft food such as porridge. Should gastric symptoms develop operation may be necessary. Charring and ulceration of the oesophagus may occur from the swallowing of corrosive liquids, strong acids or alkalis, or even of boiling water. Stricture of the oesophagus may be spasmodic, fibrous or malignant. *Spasmodic stricture* usually occurs in young hysterical women; under an anaesthetic a bougie will slip down easily. *Fibrous stricture* is usually situated behind the cricoid cartilage, and results from swallowing corrosive fluids or the healing of a syphilitic ulcer. Occasionally it is congenital. The ordinary treatment is repeated dilatation by bougies. *Malignant strictures* are usually squamous cell carcinoma (*see* TUMOUR) and chiefly occur in males between the ages of 40 and 70 years. An X-ray photograph taken after the patient has swallowed a preparation of bismuth will show the situation of the growth, and Killian and Brünig have introduced the oesophagoscope, which makes direct examination possible. Dilatation by bougies must not be attempted, the oesophagus being so softened by disease that perforation might take place. Radium treatment, so far, has not been successful. The method of transpleural approach to the thoracic oesophagus and insertion of radium into the wall of the tube has been introduced, but as yet it is too early to evaluate the results. The most satisfactory treatment is the operation of gastrotomy, a permanent artificial opening being made into the stomach through which the patient can be fed.

**OETA** (mod. *Katavothra*), a mountain in Greece, 7,080 ft. high, to the S. of Thessaly, between the valleys of the Spercheius and the Boeotian Cephissus. Its east end, Callidromus, overhangs the sea at the famous pass of Thermopylae (*q.v.*). There was also a high pass W. of Callidromus into the upper Cephissus. In mythology Oeta is the scene of the death of Heracles.

**OFFA** (d. 796), king of Mercia, obtained that kingdom in A.D. 757, after driving out Beornred, who had succeeded a few months earlier on the murder of Aethelbald. He traced his

descent from Pybba, the father of Penda, through Eowa, brother of that king, his own father's name being Thingferth. In 779 he was at war with Cynewulf of Wessex from whom he wrested Bensington. It is not unlikely that the Thames became the boundary of the two kingdoms about this time. In 787 the power of Offa was displayed in a synod held at a place called Cealchythe. He deprived Jaenbeorht, archbishop of Canterbury, of several of his suffragan sees, and assigned them to Lichfield, which, with the leave of the pope, he constituted as a separate archbishopric under Hygeberht. He also took advantage of this meeting to have his son Ecgfrith consecrated as his colleague, and that prince subsequently signed charters as *Rex Merciorum*. In 789 Offa secured the alliance of Berhtric of Wessex by giving him his daughter Eadburg in marriage. In 794 he appears to have caused the death of Aethelberht of East Anglia, though some accounts ascribe the murder to Cynethryth, the wife of Offa. In 796 Offa died after a reign of 39 years and was succeeded by his son Ecgfrith.

It is customary to ascribe to Offa a policy of limited scope, namely the establishment of Mercia in a position equal to that of Wessex and of Northumbria. This is supposed to be illustrated by his measures with regard to the see of Lichfield. It cannot be doubted, however, that at this time Mercia was a much more formidable power than Wessex. Offa, like most of his predecessors, probably held a kind of supremacy over all kingdoms south of the Humber. He seems to have entertained the design of putting an end to the dependent kingdoms. At all events we hear of no kings of the Hwicce after about 780, and the kings of Sussex seem to have given up the royal title about the same time. Further, there is no evidence for any kings in Kent from 784 until after Offa's death. To Offa is ascribed by Asser, in his life of Alfred, the great fortification against the Welsh which is still known as "Offa's dike." It stretched from sea to sea and consisted of a wall and a rampart. An account of his Welsh campaigns is given in the *Vitae duorum Offarum*, but it is difficult to determine how far the stories there given have an historical basis.

See *Anglo-Saxon Chronicle*, ed. J. Earle and C. Plummer (1899), *s.a.* 755, 777, 785, 787, 792, 794, 796, 836; W. de G. Birch, *Cartularium Saxonicum* (1885–93), vol. i.; Asser, *Life of Alfred*, ed. W. H. Stevenson (1904); *Vitae duorum Offarum* (in works of Matthew Paris, ed. W. Wats, 1640).

**OFFA,** the most famous hero of the early Angli. He is said by the Anglo-Saxon poem *Widsith* to have ruled over Angel, and the poem refers briefly to his victorious single combat, a story which is related at length by the Danish historians Saxo and Svend Aagesen. Offa (Uffo) is said to have been dumb or silent during his early years, and to have only recovered his speech when his aged father Wermund was threatened by the Saxons, who insolently demanded the cession of his kingdom. Offa undertook to fight against both the Saxon king's son and a chosen champion at once. The combat took place at Rendsburg on an island in the Eider, and Offa succeeded in killing both his opponents. According to *Widsith* Offa's opponents belonged to a tribe or dynasty called Myrgingas, but both accounts state that he won a great kingdom as the result of his victory. A somewhat corrupt version of the same story is preserved in the *Vitae duorum Offarum*, where, however, the scene is transferred to England. It is very probable that the Offa whose marriage with a lady of murderous disposition is mentioned in Beowulf is the same person; and this story also appears in the *Vitae duorum Offarum*, though it is erroneously told of a later Offa, the famous king of Mercia. Offa of Mercia, however, was a descendant in the 12th generation of Offa, king of Angel. It is probable from this and other considerations that the early Offa lived in the latter part of the 4th century.

*See* H. M. Chadwick, *Origin of the English Nation* (1907), where references to the original authorities will be found.

**OFFALY,** a county of Eire in the province of Leinster, bounded north by Meath and Westmeath, west by Roscommon, Galway and Tipperary (the boundary with the first two counties being the river Shannon); south by Tipperary and Leix County, and east by Kildare. The area of the county is 493,636 ac. or about 772 sq.mi. Pop. (1936) 51,308. The greater part of the county is included in the Carboniferous Limestone plain of central Ireland. In the south-east the Slieve Bloom Mountains, composed largely of Old Red Sandstone, form the boundary between Offaly County and Leix County, and run into the former county from south-west to north-east for a distance of about 20 m. consisting of precipitous crags through which there are two narrow passes, the Black Gap and the Gap of Glandine. In the north-east, basic volcanic rocks rise in Croghan Hill to a height over 700 ft. In the centre of the county from east to west a large portion is occupied by the Bog of Allen. Here and there drier deposits of esker-gravels rise as green hills above the clay soils and bogs of the plain. The county shares in the advantage of the navigation of the Shannon, which skirts its western side. The Brosna, which issues from Loch Ennell in Westmeath, enters the county near the town of Clara, and joins the Shannon after receiving the Clodagh and the Broughill. A small portion of the north-eastern extremity is skirted by the upper Boyne. The Barrow forms the south-eastern boundary with Leix. The Little Brosna, which rises in the Slieve Bloom Mountains, forms the boundary of Offaly County with Tipperary, and flows into the Shannon.

Offaly County, with portions of Tipperary, Leix County and Kildare, at an early period formed one kingdom under the name of Offaly, a title which it retained after the landing of the English. Subsequently it was known as Glenmallery, Western Glenmallery corresponding closely to the present Offaly County, and Eastern Glenmallery to Leix County. These two divisions were formed into shires in 1556, being then known as King's County and Queen's County respectively.

In the Slieve Bloom Mountains is a pyramid of white stones called the Temple of the Sun or the White Obelisk. There are many Danish raths, and a chain of moats commanding the passes of the bogs extended throughout the county. On the borders of Tipperary is an ancient causeway leading presumably to a crannog or lake-dwelling. The most important ecclesiastical ruins are those of the seven churches of Clonmacnoise (*q.v.*) on the Shannon in the north-west of the county, where an abbey was founded by St. Kieran in 648, and where the remains include those of churches, two round towers, crosses, inscribed stones and a castle. Other famous religious houses were Durrow Abbey, founded by St. Columba in 550; Monasteroris founded in the 14th century by John Bermingham, earl of Louth; and Seirkyran Abbey, founded in the beginning of the 5th century. The principal old castles are Rathmore, probably the most ancient in the county; Banagher, commanding an important pass on the Shannon; Leap Castle, in the Slieve Bloom Mountains; and Birr or Parsonstown.

The whole of the county would appear to have been covered formerly by a vast forest, and the district bordering on Tipperary is still richly wooded. The soil is generally either a deep bog or a shallow gravelly loam. On the borders of the Slieve Bloom Mountains there are some very rich pastures, and there are also extensive grazing districts on the borders of Westmeath, chiefly occupied by sheep. Along the banks of the Shannon there is good meadow land. With the exception of the tract occupied by the Bog of Allen, the county is nearly all under tillage, the most productive portion being that to the north-west of the Hill of Croghan.

Oats, barley and rye, potatoes and turnips, are all considerably grown. Cattle, sheep, pigs and poultry are widely bred; dairies are numerous in the north of the county, and the sheep are pastured chiefly in the hilly districts.

The county is traversed from south-east to north-west by the Portarlington, Tullamore, Clara and Athlone line of the Great Southern railway, with a branch from Clara to Banagher; other branches run from Roscrea (Co. Tipperary), to Parsonstown (Birr), from Enfield (Co. Kildare) to Edenderry, and from Streamstown (Co. Westmeath) to Clara. The Grand Canal runs through the county from east to west, entering the Shannon at Shannon harbour.

The administrative counties of Leix and Offaly together return 5 members to Dáil Eireann.

**OFFENBACH, JACQUES** (1819–1880), French composer of *opéra bouffe,* was born at Cologne, of German Jewish parents, on June 21, 1819. In 1833 he was sent to Paris to study the violoncello at the conservatoire. As a member of the orchestra of the Opéra Comique, he turned his opportunities to good account and eventually was made conductor at the Théâtre Français. His first complete work, *Pepito* (Opéra Comique, 1853), was followed by a crowd of light dramatic pieces of a light character, which effected a complete revolution in the popular taste of the period. Offenbach obtained a lease of the Théâtre Comte in the Passage Choiseul, reopened it in 1855 under the title of the Bouffes Parisiens, and produced a succession of brilliant, humorous trifles. Ludovic Halévy, the librettist, was associated with him from the first, but still more after 1860, when Halévy obtained Henri Meilhac's collaboration (*see* HALÉVY). Beginning with *Les Deux Aveugles* and *Le Violoneux,* the series culminated in 1867 with *La Grande Duchesse de Gérolstein,* perhaps the most popular *opéra bouffe* that ever was written, not excepting even his *Orphée aux enfers,* produced in 1858. In 1866 his own connection with the Bouffes Parisiens ceased, and he wrote for various theatres. In twenty-five years Offenbach produced no less than sixty-nine complete dramatic works, some of which were in three or even in four acts. Among the latest of these were *Le Docteur Ox,* founded on a story by Jules Verne, and *La Boîte au lait,* both produced in 1877, and *Madame Favart* (1879). Offenbach died at Paris on Oct. 5, 1880. *Les Contes d'Hoffmann,* posthumously published, was revised by Léo Delibes, and has proved, as he himself prophesied, the most popular of all his works.

*See* P. Bekker, *Jacques Offenbach* (1909); E. Rieger, *Offenbach und Seine Wiener Schule* (1920); L. Schneider, *Offenbach* (Paris, 1923).

**OFFENBACH,** a town of Germany, in the *Land* of Hesse, on the left bank of the Main, 5 m. E.S.E. of Frankfort-on-Main, with which it is connected by the railway to Bebra and by a local electric line. Pop. (1939) 84,163. The earliest mention of Offenbach is in a document of 970. In 1486 it came into the possession of the counts of Isenburg, and in 1816, when their lands were mediatized, it was assigned to Hesse. French Protestant refugees settled here at the end of the 17th, and the beginning of the 18th century, and brought prosperity which increased with the accession of Hesse to the German Zollverein in 1828. The most interesting building in the town is the Renaissance château of the counts of Isenburg. Offenbach is the principal industrial town of the *Land,* and manufactures include chemicals, boilers, machines, wire goods and celluloid. Its characteristic industry, however, is the manufacture of fancy goods in leather.

**OFFENBURG,** a town of Germany, in the territory of Baden, 27 m. by rail S.W. of Baden, on the river Kinzig. Pop. (1939) 20,521. Offenburg is first mentioned about 1100. In 1223 it became a town; in 1248 it passed to the bishop of Strassburg; and in 1289 it became an imperial free city. Soon this position was lost, but it was regained about the middle of the 16th century, and Offenburg remained a free city until 1802, when it became part of Baden. The chief industries are dyeing and the making of cotton, linen, silk, cement, machinery, cigars and glass.

**OFFICE,** a duty or service, particularly the special duty cast upon a person by his position; also a ceremonial duty, as in the rites paid to the dead, the "last offices." The term is thus especially used of a religious service, the "daily office" of the English Church or the "divine office" of the Roman Church (*see* BREVIARY). It is also used in this sense of a service for a particular occasion, as the Office for the Visitation of the Sick, etc. For the "Holy Office" *see* INQUISITION.

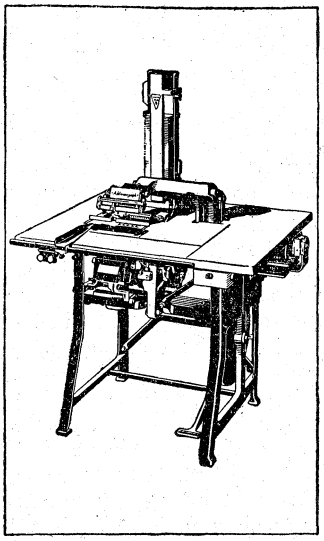
**OFFICE APPLIANCES.** Many office tasks, being of a repetitive character, naturally adapt themselves to the principle of "division of labour," and consequently to the use of machinery also. But these facts alone are not sufficient justification for the purchase of appliances. Four purposes are considered by good office management in deciding when the use of machinery is advisable. These are:—

**Objects of the Appliances.**—(1) To save labour. This saving should be evidenced in a reduced pay roll. Hypothetical savings of "half a man" are seldom realized.

(2) To save time. In many cases this is more important than the saving of labour; to speed up a slow routine, extra expenditure is often an economic advantage.

(3) To promote accuracy. Mechanical methods are advisable when accuracy is vitally important and otherwise difficult to obtain.

(4) To avoid monotony. The substitution of a machine for manual repetitive movements will usually achieve this.



BY COURTESY OF THE ADDRESSOGRAPH-MULTIGRAPH CORPORATION

ADDRESSOGRAPH MACHINE CAPABLE OF ADDRESSING 3,000 ENVELOPES AN HOUR, ONE PERSON OPERATING IT

Inventive skill and genius have not been lacking to meet these needs, and the list of available devices is very long, machinery being now extensively used.

Adding and calculating machines are largely used for the promotion of accuracy, and save time by avoiding extended search for errors. The ordinary clerk is usually incapable of correctly handling a large amount, even of simple calculations, with a fair degree of accuracy by the mental-manual method, and these machines have therefore become a practical necessity for the modern business office.

**Adding Machines.**—All adding machines may be used for addition, subtraction, multiplication and division; but as certain types are better adapted for multiplication and division, a technical distinction has grown up in the trade between adding and calculating machines, the latter being used more extensively for multiplication and division.

There are two principal types of adding machines: those which print on paper the amount being added, and those which do not—the former being known as listing, and the latter as non-listing machines. The listing machines are again divided into two classes, the first being the full keyboard model carrying a row of keys numbered from 1 to 9 for each column, and the machine of the second class having ten keys arranged in two or three rows. Each of these keys represents a digit, and the depression of a key for an item automatically causes progressive columnar position. Thus, if 23 is to be added, the 2 is first depressed, then the 3 and the mechanism takes care of the numerical order. The items are printed either on a roll of narrow paper or on a wide form held in the carriage of the machine.

Some models have two sets of adding dials—one for accumulating individual totals, the other for accumulating a grand total. On some machines a "split" feature provides for splitting the printing mechanism into two or more sections, so that several columns may be listed and added at the same time and the total of one or more columns printed. On others, subtraction is accomplished by means of complementary numbers, a "complement" being any number which, added to another, makes a full number. Thus if the digits are changed to 9's—as 9, 99, 999 and so on—and a 1 then added, we can convert any number into a full or complementary number on the keyboard of any adding machine. The complementary numbers are usually indicated by small figures on the keys, the two digits on a key, if added, invariably making nine. Other machines perform subtraction by depressing a subtract key. Multiplication is consecutive addition. Thus, if 26 is to be multiplied by 5, it is merely added five times. For division, the divisor is subtracted from the dividend as many times as it is contained in that dividend, the number of subtractions being automatically registered on the counting wheels as a quotient. There is also a small portable adding machine, weighing about 7 lb., operated with a pull-down lever keyboard. A very small adding device, known as a vest pocket machine, is operated by inserting a pick or stylus, in positions for the

amounts.

**Calculating Machines.**—Where rapid addition, multiplication, subtraction and division are required, and no need for a printed record exists, calculating machines are used. They do not print a record of the items, but indicate the result on total dials. One type, known as the key-driven, causes the items to appear immediately on the dials when the keys are depressed, the operation of a crank clearing the figures off the dial faces again. As with adding machines, the four arithmetical operations are all performed as variations of simple addition. In another type, known as the key-set, the amounts are first set up on the keyboard and operation of the machine, either by hand or by motor, effects the calculation. The total dials, situated in the laterally moving carriage above the keyboard, show the total in addition, the product in multiplication, the minuend or remainder in subtraction and the quotient in division. Proof dials, placed in, above or below the carriage, show the multiplier in multiplication and the divisor in division. An extra set of dials is sometimes provided, which furnish an additional check for accuracy by showing the amounts set up on the keyboard. The dials are cleared by various means, distinctive with each make of machine.

For subtraction, the amount from which the deduction is to be made is set up, the operation of the machine causing that figure to appear on the total dials. The figure to be subtracted is then set up and the machine operated and the answer appears on the total dials. Multiplication is consecutive addition, though in some models multiplication is by means of a plus bar; in others, by means of an extra row of multiplying keys. Division is consecutive subtraction, some models dividing by means of a minus key, while another model provides for setting up amounts by means of levers pulled down to the desired numbers, this machine otherwise conforming to the key-set type.

A recent invention is a tape-printing calculating machine which prints the factors, figures and prints the answer and accumulates a total of all answers, all on a single operating stroke. It is primarily designed for accomplishing calculations in multiplication at high speed (20 multiplications a minute) by a direct, single cycle operation, and to provide printed totals of resulting products automatically. It is equally suitable for performing division by reciprocals; as an adding machine, it is equipped to subtract directly. The production speed, after the factors are set up, is uniformly $2\frac{1}{2}$ or 3 seconds per calculation (depending upon the timing of the mechanism) regardless of the size of the factors; that is, a problem such as $649{,}538 \times 369{,}486$ is as speedily computed as $2 \times 2$. The decimal place in the printed answer is automatically positioned. Its adding feature is not as rapid as with some of the standard adding machines. There are two keyboards with a capacity of six columns; the product or totaling capacity is 14 places. The multiplicand is set up on the left keyboard, the multiplier on the right. The machine, being motor driven, merely needs the depression of the motor control to multiply one factor by the other and print them side by side, together with the product, in a straight line on a detail strip.

**Book-keeping Machines.**—The so-called book-keeping machine is in reality a device for posting on loose ledger sheets or cards. The amount is not merely entered to the account as in hand book-keeping—to be added and balanced at a specified period—but a balance is struck each time a posting is made. The original entry from which the account is posted is usually a sales ticket, credit slip or copy of the invoice. (*See* BOOK-KEEPING.)

All such machines are designed to print and add an old balance, print and add debit items, print and subtract credit items and compute the new balance, in some cases printing it automatically, in others showing it in the adding and subtracting mechanism so that it may be copied in the proper column by the operator. Proof of the correctness of posting varies with the type of machine. One type is an adding machine which subtracts directly; it is equipped with means for printing dates, folio numbers, characters and abbreviations, and with a tabulating carriage which moves automatically to the next column as each amount is computed and printed, and in some cases returns automatically to any required position on the printing line. Both vertical and horizontal columns are added, subtracted and computed. Items are set up as on an adding machine, the operation of the motor causing them to be printed, added or subtracted. When a new balance is printed, the accumulator clears, ready for the next operation. Some models have two counters, thus making it possible to compute individual balances and accumulate a total of all postings. The keyboard may be split into two sections so that both ledger and statement can be inserted in the carriage and posted at the same operation—that posting being automatically repeated.

The design of a second class of book-keeping machine embodies a typewriter—on which any description may be typed—and a calculating machine, built as one unit. Some machines add and subtract in vertical columns; others compute amounts across the sheets as well. The typewriter carriage moves to correct column positions by means of a decimal tabulator. Typing the amounts on the number keys effects addition or subtraction. The amounts are visible in registers or totalizers placed either on the carriage truck, in positions corresponding to the columns to be added or subtracted, or at the front of the machine below the keyboard. In posting, a new balance is computed, and the operator types in the proper column the amount appearing in the register which functions to compute across the sheet. If the typing is correct, this register clears. Ledger and statement are made at the same time, in some cases by means of a carbon and in others by the split-platen method, one machine of this class being unique in that its typewriter section is mounted on a carriage which moves from left to right across a flat printing surface on which the forms are held, a back and forward motion providing line spacing. Registers are mounted on the rear of the typewriter section, and ledger and statement are posted at one operation by means of carbon.

A third class of machine carries, below the typewriter keyboard, a 10-key keyboard which controls the calculating mechanism. Here the split-platen method is used for making ledger and statement at the same time. Still another class, used for ledger posting and instalment accounts, follows cash register design, amounts being set up on a push-in key-set keyboard and turned into the mechanism by the operation of the motor. There is a sliding printing table on which the forms to be posted are inserted. Two forms may be posted at the same time, the amount being printed on one and repeated on the other. This machine automatically computes and prints the amount of the balance outstanding on each account. Debits and credits are classified and a total of each is accumulated, as many as 18 individual and two group totals being obtainable. A detailed record of all postings is printed on a strip of paper inside the machine.

**Billing Machines.**—The writing of an invoice for goods sold, by means of a carbon duplication, can be made to serve other purposes also, and it is quite common at one writing to make the invoice, the original sales record, the shipping notice, the shipping record and other memoranda required for various kinds of business. By means of calculating devices, the amounts of the items may be computed and totals accumulated for controlling accounts. Combination typewriters designed to do this work are known as billing machines. These are designed to write, at one operation, the several necessary copies of orders, invoices, bills of lading and other forms and in some cases to compute amounts as they are written. Cut forms, printed and padded in individual sets so that each set is torn off and loose carbon inserted between the sheets to make the necessary copies, are used with some machines. Others use continuous-length forms, which provide multiple copies of the same or related forms, in rolls or folded flat, these forms being fed through the machine with the carbon interleaved between the copies, so that it is not necessary to insert new forms after writing each set.

Among the billers which write, but do not compute, is an ordinary correspondence typewriter equipped with an inbuilt carbon-changing device which removes the carbons from a set of continuous-length forms just written and inserts them in another set. Another non-computing biller has a standard keyboard typewriter mounted on a carriage which moves from left

to right across the flat writing surface over which the forms are fed. Cut forms may be used with this machine, and it may be equipped to add in vertical columns and to cross compute as well. Book-keeping machines which combine a typewriter with a calculating mechanism have been adapted to billing work which requires the adding or subtracting of amounts as they are typed. One such has an inbuilt carbon-changing device which provides for the use of continuous-length forms; another uses cut forms and may be equipped with a split cylinder so that billing and ledger posting can be done simultaneously.

Still another embodies a typewriter and a calculating mechanism which handles addition, subtraction and multiplication, and is operated from a separate 10-key keyboard below the typewriter keyboard. By means of a split-platen, billing and ledger posting can be done at the same time.

**Accounting and Tabulating Machines.**—The preparation of statistics requires, first, the sorting of data and, second, the accumulation, by classes, of the amounts involved. Machines for this work were first used by the U.S. Census Bureau, but are now being rapidly adapted to business uses, such as cost work, sales analysis and similar work.

Cards printed with vertical columns numbered from 0 to 9, or from 0 to 12, and separated into fields of one or more columns, each field representing an item, such as department, job number and so forth, form the basis of two systems. Facts are expressed in figures, letters or symbols, and are recorded by perforations on the card at the proper numerical positions, made by a punching machine which operates like a typewriter. The cards are then arranged by a sorting machine, according to a predetermined classification. Contact—electrical or mechanical, depending on the make of the machine—sets the mechanism in motion. The cards are next fed through the tabulating machine, which makes a printed final report, in multiple if so desired. Contact through the perforations causes the machine to designate and add what has been perforated into the cards—listings, sub-totals, totals or grand totals being obtained, depending upon the arrangement desired for the report.

**Alphabetical Machines.**—A recent improvement is a machine fitted to print a condensed alphabet by symbols as well as figures. This improvement makes it possible to perform automatically many operations, such as the writing of invoices of standard products, keeping stock records and the like. When detailed listing and printing is not required, a non-printing tabulator registers the quantities in counters which accumulate the totals, the figures being posted by hand to report forms. The 80 column card now available permits finer classification and enables a greater number of products or facts to be recorded.

Another type of machine is built on the same principle as the book-keeping machine of cash-register design. Twenty-seven keys, each representing a classification, accumulate individual totals and as many as three grand totals can be obtained and the number of items in each classification counted. A continuous permanent record of all operations is made within the machine on a roll of paper called a visible audit sheet, and notations may be hand-written opposite any printed item. This record may be used as a posting medium, a proof sheet or a permanent record. A ticket may be issued on any operation, showing the date, serial number, identifying numbers, symbols for the totals used and the amount. It may be used as a voucher, pay ticket, receipt, requisition or posting medium or for filing purposes. The same information may be printed on any form inserted in the printing-table.

**Duplicating Machines.**—In offices there is much need for devices that will quickly produce multiple copies of typewriting or handwriting, for the time and labour thus saved is an important economy. Sometimes only a few copies are needed, sometimes many. For a limited number of copies, say up to five or six, the carbon method of duplication is perhaps the cheapest in most cases; but where from 5 to 100 copies are required, the hektograph process is preferable.

**Stencils.**—For a still larger number of copies, the stencil methods and type methods are available. With the former, the stencil was originally made on a sheet of wax-covered paper, which was written upon either with a stylus or with a typewriter from which the ribbon was removed—a system that had many defects. The modern method utilizes a specially prepared sheet of tough, flexible tissue, which can be filed away after using and used many times. One manufacturer provides a glass-topped, electrically illuminated table for making stencils by hand with a stylus. Typewriting, handwriting and drawing may all be combined on one stencil sheet. The duplicator consists of a hollow revolving cylinder, partially covered by an ink pad, over which the stencil is fastened. Each revolution brings the stencil sheet in contact with the paper, and the ink, passing through the character or design, makes the impression. From 1,500 to 5,000 copies can be made in an hour, depending on whether the model is hand- or motor-operated and whether it is automatically fed.

**Hektographs.**—The hektograph is many years old, and its operation is based on the principle of absorption. The original writing is done on a sheet of hard bond paper with a water-soluble ink or with a typewriter ribbon impregnated with such ink. This sheet is then placed in contact with a moist surface of gelatin or clay composition, and the writing is absorbed from the paper and appears in reversed form on the gelatin or clay surface. Then, by placing a sheet of blank dry paper on this moist surface, the impression is transferred to the paper. The gelatin was originally used in flat tin pans, and in this form the hektograph was of little use in the office, as registration was difficult. The clay form of hektograph was, and is, extensively used for the reproduction of drawings by architects and draftsmen, because it is a simple matter to prepare this composition for large sizes of work. The modern hektograph uses the old principle, but the gelatin is coated on a long band, a small portion of which is exposed at a time. This band runs over a flat iron surface. Registration is accomplished by a special feeding device. The unique feature of the hektograph duplicator is its use in routines of order or billing systems, in which from 10 to 15 copies of the same writing (or any portion of it) may be transferred to sheets of various sizes and shapes. Such copies are much clearer than carbons, and the paper does not have to be thin. The hektograph can also be used for bulletins of which 100 or less copies are desired.

**Type Reproduction.**—There are several devices which duplicate from type, the principal feature of most being a simple method of setting the type, which does not require a trained typesetter, the printing also being simplified by means of a revolving drum. The style of type most used is the imitation typewriter face, and the chief use is for the reproduction, through a ribbon, of facsimile typewritten letters, there being also a special device which may be used for the reproduction of the signature. A printing-ink attachment makes possible the use of printer's type and of electrotypes or stereotypes curved to fit the drum. Some models are hand-fed and operated; those which are automatically fed and motor driven attain a speed of 2,400 to 4,800 pieces an hour. Another machine produces letters from typewriter type cast on a linotype machine, at the same time filling in the name, address and salutation from slugs—one for each name on the mailing list—which change automatically as each letter is printed through a ribbon, the slugs being filed for future use. The speed is 1,000 letters and envelopes an hour, the latter being addressed from the same slugs. Certain machines which print from typewriter type are really small presses adapted to the printing needs of the layman, and print from printer's type, electrotypes, linotype, monotype, flat zincs and half-tones.

**Automatic Typewriters.**—The automatic typewriter is designed to produce actual typewritten letters at three times the average speed of a typist. Its mechanical movements are controlled by a paper roll, similar to that of a player-piano, in which perforations representing characters on the typewriter keys are made by a perforator. When an entire letter has been thus perforated, the paper is cut from the roll, and its ends are cemented together to form an endless belt, which is then placed over the drum of the automatic typewriter. The operator writes by hand the name and address and starts the automatic device. Pins

dropping through the perforations into slots, as the roll is carried forward by the revolution of the drum, actuate the typewriter keys, causing the typing of the words; when all the perforations have passed over the drum, the operator removes the finished letter and then repeats. Insertions of special words or sentences may be made by hand at any desired point.

**Photocopying Machines.**—A special photographic machine, in which a roll of sensitised paper coated on rag stock is used as a negative, photographing directly without the intervention of plates, has of late years been highly developed and used extensively as an office device. It offers a means of quickly producing a fac-simile copy of any document, and has therefore to a great extent eliminated the laborious hand copying of records, deeds, insurance applications, contracts and the like. The equipment consists of a large camera combined with a developing machine, so that after an exposure is made the sensitised paper is carried first to the developing bath and then to the fixing bath. Dials and levers control all operations, and the machine is so scientifically adjusted that an office boy can turn out perfect copies. The colours are reversed in the first print, called a "black print"; that is, the whites in the original are black and the blacks are white. As the photograph is made through a reversing prism, the letters appear exactly as in the original. A white positive print is made by re-photographing the black print. By continuing to photograph the original, as many black prints as desired can be made; and as many positives as required can be made by photographing the black prints. It is also possible, by using a special kind of paper, coated on both sides, to print two sides of a page simultaneously and have the photograph with an image on each side.

**Addressing Machines.**—These are in reality devices designed for duplicating small pieces of writing. Originally designed for duplicating names and addresses—hence the name—they now have many other uses, such as the making of invoices, statements, receipts and other office records. They are of especial value in businesses where the same list of names and addresses must be repeatedly used. Each name and address must first be impressed upon a metal plate, cut on a fibre stencil or set in type, according to the character of the machine. The metal plate is prepared by an embossing machine operated by hand or electric motor; a blank plate is inserted in the machine, and the required characters are selected by an indicator and stamped into the metal. Some embossers have a typewriter keyboard, the embossing being performed by depressing the keys. Some metal plates carry a name card and others a record card for recording relevant data. A fibre stencil consists of a frame in which is mounted a panel of semi-transparent paper coated with a gelatinous material, some frames having spaces for the insertion of relevant data. The name and address are cut by means of a typewriter from which the ribbon has been removed, a special device holding the stencil while it is cut. When printer's type is used, names and addresses are cast on a linotype machine.

Addressing machines, despite many structural differences, operate on the same general principle. The metal plates, stencils or slugs are fed from a magazine to the printing point where the envelope or other matter to be addressed is placed either by hand or by a mechanical device. Directly over the printing point is a stamping arm which comes down on the envelope when the machine is operated, thereby bringing it into contact with the plate, stencil or slug either directly, in case ink is used, or through a ribbon. As the arm rises, another plate comes to the printing point, the one just used passing to a receiving machine, where it re-files itself in original order. Models are hand, foot-treadle or motor operated, the speed varying from 1,000 to 15,000 impressions an hour. Special models are designed for publishers addressing on large envelopes, on mailer strip or directly on the margins of newspapers and magazines. The adaptability of addressing machines is greatly increased by attachments, some of which are so common as to be considered standard equipment. The metal plates and fibre stencils are filed like index cards in drawers kept in cabinets, slugs being filed in galleys and stored in cabinets. One machine is unique in that its metal plates are linked together to form an endless chain; they pass to the printing point from a reel on which they are wound and they are then re-wound on another reel, the reels being stored in cabinets.

**Hand Stamp Affixers.**—Stamps provided in rolls of 500 by the post-office are locked in a stamp affixer and applied to envelopes by the downstroke of a plunger, moisture being applied in some cases to the stamp, in others to the envelope. Extra containers, allowing for quick change from one denomination to another, are furnished with some models. Some machines are spring-locked; others are key-locked to guard against unauthorized operation; still others count the stamps used.

**Sealing Machines.**—These are designed for the rapid sealing of large quantities of envelopes. The envelopes are fed to the machine one at a time, either by hand, semi-automatically by holding them against revolving feed rollers or automatically from a hopper—depending on the type of machine. The gummed flaps come in contact with a moistening device—a wick, a roller or a metal disk—which receives its water-supply from a reservoir or by a position feed suction. The envelopes then pass between sealing rollers and are ejected from the machine. Letter opening machines are frequently used in offices. In many mail order houses and similar establishments these are considered a necessity. Their principles of operation usually include mechanism for placing, cutting and sorting various sizes of letters.

**Permit Mailing Machines.**—An office having occasion to mail a thousand or more letters a day could greatly expedite their passage through the routine of mailing if the office were permitted to cancel the stamps or to print some indication that postage was paid. For this purpose, a U.S. post office regulation, passed in 1920, provides for the printing of the permit, or indicia, as it is called, directly on the envelope in the office of the mailer. Permit mail is of two kinds—metered and non-metered; for either, the licence must be obtained from the Post Office Department through the local postmaster, the mail being delivered to the post office by the sender, as such mail is handled separately. Machines which handle non-metered mail print the indicia, seal the envelopes and count the pieces. The impression must show the postmark—city and state, month, day and year, denomination and sender's permit number. The number shown in the counter of the machine after a mailing is completed, multiplied by the denomination, gives the amount of postage to be paid. Payment is made either with each individual mailing or by a cash balance carried at the post office. Certain machines will print the indicia without sealing, seal without printing, or count without either sealing or printing.

The basis of the meter system is a printing and recording mechanism demountable from the machine with which it is used, so that it can be taken to the post office to be set for a given number of impressions, payment being made at that time, and the mechanism locked and sealed. Two sets of registers indicate how much postage has been used. A separate meter is used for each denomination, and any number of meters can be secured for one machine. The indicia are the same as those printed by the non-metering type, except that the sender's meter number is shown. The speed of such machines varies from 150 to 200 a minute. One type of machine is adapted for use with either the metered or the non-metered system. In 1924 the U.S. Post Office Department issued a regulation permitting first-class mail to be sent out with pre-cancelled stamps attached. The stamps, obtained in coils from the post office, are applied by a hand stamp-affixer and the envelopes are then passed through a non-metering permit machine which seals and counts them and prints the postmark and additional cancellation required. Where bulk of mail does not warrant a permit machine, the postmark and additional cancellation are applied by a rubber stamp bearing a changeable date. One sealing machine is adapted to metered, non-metered and pre-cancelled systems, without mechanical alteration.

**Cash Registers** (*q.v.*).—Motor-driven models have now become available.

**Autographic Registers.**—On many occasions it is necessary to make by the carbon method several copies of pencil memoranda. The autographic register is a device for making at one writing an original and from one to six copies of sales slips, bills

of lading, requisitions and other business records on continuous forms. These, interleaved with carbon, are retained within the register and fed across a writing table or platen. Some registers use rolled forms, one roll for each copy of the record; others use flat folded forms. Various types of registers have various methods of aligning the several copies that make up a set. As a written set is issued from the register, either by pulling out by hand or by the turn of a crank, and is torn off against a knife edge, another set, automatically leaved with carbon, is brought into a writing position.

**Coin-handling Devices.**—In all business houses where large amounts of coin are handled and packaged daily, the use of mechanical devices for sorting, counting and packaging saves time and labour. Coin-counters simply sort mixed coins into denominations. The usual type of machine has a disk revolving in a hopper and the coins are carried by the disk to a rail finger from which they roll by gravity and are sorted by dropping through slots of various diameters into separate boxes. From 1,000 to 12,000 coins can be separated in a minute, depending on whether the model is hand or motor operated. Coin-counting and packaging machines count the coins and deliver them into bags or wrappers, and, in specific cases, check pre-determined amounts into bags. One denomination of coin is dumped into the machine and a revolving disk throws the coins to the outer edge of the hopper, where they pass under a register which counts them.

In some models the coins fall through a stem into a tubular wrapper which the operator has previously placed there; other models wrap with continuous rolls of paper, fed down as the coins are counted; when the required number of coins are in place, they are carried over to the paper and tightly wrapped, the machine automatically locking off further passage of coins. Coin-counters and separators serve the dual purpose of counting and sorting coins of mixed denominations at the same operation. The registering devices of some machines provide for a totalled sum in connection with each separate adding counter; others have a sub-total and a total register. Other coin-handling devices are bag-loading machines; proving and bagging machines which recount and bag coins that have been previously separated; continuous counting and bagging machines, which count and bag coins at a high rate of speed; counting machine heads, which handle one denomination at a time and handle metal tokens also; manual counters and packagers, which combine in one operation hand-counting and wrapping.

**Dictating Machines.**—By means of the cylinder phonograph the time of a stenographer taking notes may be saved. The executive who uses this system speaks into the mouthpiece of a small machine which records his voice by engraving on a revolving wax cylinder. He may pause in his dictation, correct an error, and at any time listen back to what he has said. When the cylinder is full, a typist puts it in a transcribing machine placed alongside her typewriter, and the reproduction of what has been dictated is carried to her by receivers placed over her ears, she typing the words as she hears them. The engraved surface of a used cylinder is removed by a shaving machine so that it may be used again and again.

*Phone Recorder.*—It is also possible—and several devices are available for the purpose—to record automatically an entire telephone conversation. As the conversation proceeds, it is recorded on the wax cylinder of the device which is attached to the telephone.

**Typewriters** (*q.v.*).—One type of machine which has been on the market a comparatively short time is practically noiseless in operation, because the principle of pressure printing instead of percussion printing is utilized. Another is electrically powered and can be operated either from a direct or an alternating current; the keys are touched lightly—about one-quarter of an inch depression—and electricity takes up the burden. Portable typewriters serve the need of the individual for a personal writing machine. Their construction embodies many features of standard office typewriters. The machine is usually secured to the bottom of the case in which it is carried, a permanent base being thus provided, making its use convenient under all conditions. The weight varies from 7 to 12 pounds. A wide selection of special keyboards and type arrangements for engineers, doctors, chemists and all those requiring special symbols and extra characters is available.

**Cheque Writers and Protectors.**—Besides writing the permanent and unchangeable amounts on cheques, thereby protecting, as far as it is mechanically possible, against losses from raised and forged cheques, these devices save time and labour in concerns which issue large quantities of payroll cheques and in banks and establishments which issue dividend cheques periodically. Protection is afforded by printing, by shredding or by perforating the amount, using acid ink in one or two colours. The amount is written in words, in figures or in words and figures. Certain models protect the payee's name as well, by "crimping" or shredding an un-inked design over it. After a cheque is inserted in the machine, the amount to be written is selected by slide levers set in vertical columns, by a hand-wheel or by an indicator on the dial, depending on the type of machine. Some models require one stroke of the operating handle for each word or number; others print the whole amount at one operation. In some models the amount is visible before and after printing, and in certain cases the name of the user is also printed. Repeated writing of the same amount on a number of cheques, without change of set-up, is a feature of some cheque writers. An interesting development is the cheque writer with many combinations of foreign denominations for use in foreign banking.

**Cheque Certifiers.**—These devices print a form of acceptance on cheques, either through a ribbon from a bronze die or from steel wheels inked by a felt pad. Some number the cheques with consecutive serial numbers. Certain models are locked against unauthorized operation.

**Cheque Endorsers.**—Motor-driven machines are used for endorsing large numbers of cheques. Impressions are made from either a rubber or a metal die inked from rollers and having movable type for dates and batch numbers. Cheques are fed by hand, one at a time, to those models designed for use alongside an adding machine, so that as each cheque is listed for clearing-house, transit or deposit, the operator turns it over and drops it into the endorser, which prints the endorsement and places the cheque in its original order in a tray beneath the machine. Other models provide for feeding a large number of cheques held at the feeder guide by the operator's hand.

**Cheque Cancellers.**—Enduring and inerasable evidence that a cheque has been paid, together with the date of payment, is provided by machines which perforate the cancellation through cheques, and if desired, the bank's American Bankers Association number. Dating of deposit slips, notes, mortgages and other papers may also be done. Hand models cancel from 100 to 225 cheques a minute; motor-driven models are speedier.

**Cheque Signers.**—Pay-cheque signing is speeded by devices which sign from five to ten cheques at once. A sheet of cheques is placed on an extension table under a writing frame to which are attached five to ten fountain pens controlled by a monitor penholder. As the operator signs a sheet of cheques they are pushed into a tray and another sheet is brought into position.

**Finding and Filing Devices.**—Simplification of filing and locating data compiled in digest form is achieved by three mechanical devices differing in construction, operation and purpose. The purpose of one is to find a single card by number. It is a metal, desk-like affair, in the top of which are ten trays, each holding numerically filed cards numbered from 0 to 999—1,000 in all. A card is found and filed according to its number. By depressing the proper number-keys of the finding mechanism, the corresponding card is instantly raised above the others in the file. In filing a card, the operator raises the card immediately following to indicate the filing position. Means are provided for finding misfiled cards.

Another device finds a single card by means of the general class or name under which it has been classified. This system uses a steel drawer, on the front of which are two rows of keys marked with the classifications, such as "Farm Lands," "West

Side Property," etc. The keys are connected with rods extending back through the drawer. One card can be filed under many classifications, by means of clips placed in position along its lower edge, which correspond to the classifications desired. Pressure on the proper key raises the desired card, together with all those having a clip corresponding to the key. A tap returns the card to position.

A third system provides for the automatic selection and segregation of cards according to any number of classifications, the basis of the system being the card. The top carries a brief summary of the record, or can be extensive enough for a posting record. The body of the card is perforated, two vertical perforations constituting a "position" to which some classification is assigned. Each card is prepared for automatic selection by converting the two holes of significant positions into a slot by means of a hand-operated slotting punch. The cards are placed in a file drawer, which has a brass front perforated to conform to the cards. If, for example, the device is used for a list of garages, and all garage cards are to be selected, a steel rod is placed in the position designating garages. If all garages having service stations for a particular motor-car are to be selected, another rod is placed in the position designating that information. The more rods, the finer the classification. The drawer is then inverted, and the cards that are suitably slotted drop down. A rod inserted at the bottom of the drawer locks them in place, and when the drawer is held upright, the desired cards are held above the others in the file. When the work is finished, the locking rods are removed and the cards fall into place.

**Visible Index Systems.**—An operation on a card system may be divided into several parts: (1) locating and removing the card; (2) making the record or noting the information; and (3) returning the card to place. If the second part is a small proportion of the whole time required, the total operation may be greatly simplified by using the so-called visible system.

The cards are usually mounted on panels in such manner that they overlap, showing only the title line, a slight lifting movement revealing the whole card. The panels are housed in several ways. Sometimes they fit into steel cabinets and may be pulled out at a convenient angle for posting or removed entirely. In other cases, the panels—with cards inserted on both sides—are hung vertically, either on a circular track which rotates at the touch of a finger to bring the panel with the desired card before the eye or on a straight track so that they turn like the pages of a book. Another type of visible index is in book form, the cards being either held on panels inserted between the covers or fastened into the binder, as in a loose-leaf binder. Still another kind, which looks like a card drawer with the sides and ends cut down, consists of an aluminium tray in which cards tabbed at different heights so that a portion of each tab is always visible are held by a lock rod. Aluminium guides permit indexing. Pulling forward a guide exposes the tabs of a group of 24 cards, and the full surface of any one is visible when the intervening ones are thrown over. With each type of visible index colour signal systems may be used to call attention to pertinent facts.

**Electric Paging Systems.**—By audible code signals sounded throughout the premises, this equipment immediately locates individuals who are away from their desks. The central station is usually placed near the telephone switchboard, and the telephone operator sends the signals.

**Telegraph Typewriter.**—An electrically operated typewriter used in hotel offices, banks and other businesses where information is daily transmitted to distant points, transmits messages in written form to any number of distant stations. As the message is typed on the sending typewriter, the words are written simultaneously and automatically by the distant receiving typewriter. The paper is fed from a roll mounted on a frame behind the typewriter. Tabulated forms and duplicated copies can be written. The telautograph is used for a similar purpose, but the message is handwritten instead of typed.

**Credit Authorizing Systems.**—Three distinct types of systems are used for transmitting to a department making a charge sale the credit department's O.K. on the sale. One is an electric telephone system with a switchboard in the credit department and a telephone in each sales department. As the sales person calls the credit department, she places the slip in an aperture in the telephone, and the credit authorizer causes his approval to be printed on it if the sale is approved. (W. H. Le.)

**OFFICE MANAGEMENT.** The office is that part of an enterprise which is devoted to the direction and co-ordination of the various activities of the enterprise. It is characterized by the gathering, classification and preservation of data of all sorts; the making, using and preservation of all kinds of records; the analysis and utilization of these data in planning, executing and determining the results of operation; the preparation, issuing and preservation of instructions and orders and the composition, copying and filing of written messages.

Though clerks and clerical work have existed for centuries and large groups of clerks for decades, it is only in recent years that the management of clerks or office management, has become a problem of importance. This is wholly due to the rapidity of industrial change, which is best shown in the United States. In 1880, when there were but 172,575 clerks in that country, mostly book-keepers and accountants, the problem might be considered as practically non-existent; but in 1920, when the number of clerical workers of all kinds had grown to 2,951,008, it assumed proportions that could not be ignored. In 1920, one in ten of all persons engaged in "gainful occupations" was a clerical worker. The change was necessitated by the exigencies of an ever-growing large-scale industry. While business organizations were small, and direct contact existed between producer and consumer, beyond simple book-keeping few records were required, there was little written communication between sections of an organization, and consequently few clerks were needed. All this has changed, and to-day the office has attained a position of major importance in business.

Many offices employ more than 100 clerks each and a considerable number employ several thousands. Evidently the employment of such numbers of workers requires management of a high order, yet it is only recently and among the most progressive companies that the subject has received the attention it deserves. Ingenious systems of record keeping and filing have been invented, scores of clever appliances and marvellous office machines are available (*see* Office Appliances), but the problem of securing the greatest result for the least expenditure of effort has not been given the attention in the office that it has in other lines of endeavour. This is due to the newness of the problem, but there are signs that this condition is sure to change as time passes.

Frederick Winslow Taylor (*q.v.*), the "father of scientific management," was himself probably the first person to apply—at least in a limited measure—scientific principles to office work. In Copley's biography of Taylor is shown a "Time Note," dated about 1885, giving "piece-work" rates on 17 clerical operations, the implication being that Taylor had at least studied these operations, found the best method of performing them and controlled them to the extent that he offered an incentive wage for their accomplishment.

### THE HUMAN ELEMENT

The major divisions of office work are given herewith, but not necessarily in the order of their importance.

**Organization.**—The most essential factor here is clearly defined lines of authority, and its lack is the greatest defect to be found in many companies. In the struggle for advancement it seems difficult to prevent officers from claiming more authority than is granted them, and where confusion of this kind exists, loss of morale invariably results. Functionalization—one of the leading principles of scientific management—is as efficacious in the office as elsewhere. The office manager himself holds a functional position—that of managing clerks, wherever placed. Where this principle is fully carried out, work, instead of being departmentalized, will be functionalized, and therefore performed much more effectively. Thus, a stenographer employed exclusively in taking notes and transcribing letters, will do much more effective work than one who also keeps and files records, answers telephone calls

and performs other miscellaneous work. Functionalization, however, is to its fullest extent only feasible in large offices. It is uneconomical to have too many departments under the charge of one officer. A chart of the organization, and an organization diagram, both giving not only the position of each individual in the office but his duties and relation to others, are necessities. Also there should be standard methods for performing each task, and written standard practice instructions so that the carefully devised methods may be perpetuated. Otherwise great loss of output will result.

**Personnel Methods.**—Progressive records of each employee's performance are necessary as they serve as a basis for future advancement. Special tests for ascertaining the ability of new employees will prevent to a large extent the great wastage of continuous hiring and discharging. Many psychological tests, special ability and trade tests have been prepared, extensively used and found advantageous. (*See* INTELLIGENCE TESTS.) While there are many clerical positions which demand the very highest intelligence, all clerical work does not, and much of the simpler clerical work is found irksome when allotted to those capable of a higher grade of activity. Training is extremely important, though often sadly neglected. In some offices the various lines of promotion are laid down and made known to all employees, so they can prepare themselves for advancement. Some offices also have officers who devote their activities wholly to employment, and all persons who are to be discharged are referred for final adjudication to this officer—the employment manager. The advantage here is that competent employees are not lost to the organization solely because of the personal pique of some hasty or temperamental officer. The employment manager also ascertains by tactful questioning the reasons why employees leave, and by a careful, classified record of such reasons is enabled to check bad practices, and to determine any other causes for dissatisfaction.

**Turnover.**—The "rate of turnover," that is, the ratio of employees leaving to those on the pay roll, is a most important factor in good office management. An average cost of over $100 is represented in the training of a new employee who replaces one who has left, so that it is evidently desirable to retain employees for long periods. Turnover is dependent upon many factors. If employees are not properly selected, many replacements will be needed; if salaries are not right, physical conditions bad, or the relations of officers not as they should be, there will be many voluntary separations. A minimum turnover is considered to be about 10% annually. Length of service depends upon much the same conditions as rate of turnover.

**Routines and Methods.**—A routine is a collection of separate operations through which a piece of work successively passes. Division of labour has been highly developed in office work, and few operations are complete in themselves. Routines as a rule are seldom consciously developed but come into existence gradually through the use of machinery combined with hand-work. As a result, operations wholly or partially useless and of little or no value to the "finished product"—the result desired—are frequently found. Methods also have generally speaking a similar evolution, and yield great results from scientific research. Unless both routines and methods are carefully studied, there is apt to be much waste.

**Control of Output.**—To secure maximum results for minimum effort, a continuous and uninterrupted flow of work is necessary, and this is one of the most difficult achievements in office work. In the manufacturing of any material commodity the work can be precisely scheduled, step by step, and the maintenance of a steady flow is largely a mechanical problem, as every piece of similar character goes through precisely the same steps. But in the office there is the added difficulty that office work of similar character does not always take the same course; and even in some work of exactly the same nature, the flow is governed by conditions beyond the control of the office manager. Because of this fact it was, until very recently, considered impossible to plan and schedule office work. Peaks, that is, periods demanding intensified and additional work, were handled either by overtime work, or by the permanent maintenance of a sufficient force of clerks to handle them, both plans being evidently wasteful. Analysis of this matter, however, showed that in many cases they could be adequately met by pre-planning. The office force should be well balanced, and sufficiently large to handle average conditions; but a sufficient number of clerks should be trained in several operations. Then by utilizing the idea of the "flying squadron"—a selected group of clerks that can be used almost anywhere in an emergency—most of the minor peaks can be handled without difficulty. Major peaks can be dealt with by a re-adjustment of working force and the employment of extra clerks for positions which require only a minimum of training.

**Clerical Output.**—On this subject all the major factors of office management converge, and all have a bearing upon it. Under conditions where all factors have been scientifically studied, clerical output is invariably much greater than in organizations in which they are largely ignored. Thus in the office of the latter character the average output of a stenographer will rarely exceed 100 sq.in. per hour, while in a scientifically managed office this particular output will be increased to an average of 200 sq.in. per hour. The maintenance of the latter rate does not depend alone upon the skill and application of the stenographer—for 200 sq.in. per hour is but 30 words a minute, while the world's typewriting record is over 800 sq.in. per hour—but largely upon other factors outside the control of the operator and decidedly within that of the office manager. As with typewriting, so it is with all other clerical operations; the output usually depends much more upon the efforts of the management than upon those of the individual clerk. The effort should not be to obtain the highest possible output from any individual, but that which should be expected from a first-class worker.

**The Incentive Wage.**—Still another factor which aids in obtaining a high clerical output is an incentive wage of some kind, wherever it is possible to measure the work. The various methods of incentive wage used in other lines of business endeavour have all been tried in the office, some with considerable success, others with disastrous results. In the cases of failure the main causes generally are that (1) work was not properly standardized; (2) not properly measured; (3) steady flow not obtained; (4) work not properly controlled; and (5) no adequate check upon its quality. Piece-work in the office is not so generally applicable, because the worker must have a guaranteed minimum wage, and it is not always possible to supply him with sufficient work to make that wage on a piece-work basis.

### THE MECHANICAL SIDE

The preceding factors deal almost wholly with the management of the human element, and now other factors must be considered—those physical factors without which efficient management is not possible.

**Arrangement.**—The physical arrangement of an office affects all other factors of management. As most offices are in large cities, rentals are high and therefore space must be conserved. For this reason the cubicles of the old-fashioned office are giving way to the open office. Departments having relations with each other should be contiguously situated, and the seating of the workers in each department be regulated also on this principle. Work should flow in straight lines. Adequate light, both daylight and artificial, should be provided, the standard of the latter being placed by experts at not less than 10 foot-candles. (*See* ILLUMINATING ENGINEERING.) The completely indirect system, in which the light is thrown from its source to the ceiling, and thence reflected down, is considered the best. Ventilation is an important matter also. Experiments show that the best ventilating system is that which brings in fresh air from the outside without altering it in any way, this being superior to the elaborate washed and heated air systems. (*See* HEATING AND VENTILATION.) Excessive noise is also detrimental to good work, and noisy machines, if numerous, should be segregated.

**Equipment.**—Under this head are included desks, tables, chairs, filing cabinets and similar furnishings. The old-fashioned roll-top desk has disappeared, and as the present tend-

ency is to the extended use of small loose-leaf books and cards, the high-standing book-keeper's desk is seldom seen. At present the usual office desk is too large and contains too many drawers, and as clerks have little need for more than one or two drawers, a table is generally preferable. The size of a desk depends naturally upon the character of the work, but a desk larger than 54×30 in. is rarely needed, though no desk should be smaller than 40×30 inches. Chairs to be comfortable require designing to fit the human anatomy in an upright seated position. A few good anatomical chair types are available, but most of the others are uncomfortable.

**Office Machinery.**—Here the greatest development has taken place, office appliances being now available for almost every occasion. (*See* OFFICE APPLIANCES.) There was a tendency to use machines to the exclusion of competent brainwork, but office managers are beginning to see that this is a mistake.

**Correspondence.**—This is naturally an extremely important part of office management, not only between the company and outside correspondence, but within the organization itself. The present tendency is toward brevity and clarity, and the florid style and redundant expressions of the so-called "business English" are in process of elimination.

**Filing.**—The vertical system of filing has almost entirely superseded the old-fashioned flat file, and elaborate systems have been greatly simplified. Its greatest present misuse is the filing of valueless and superfluous material. The filing problem requires not only adequacy in equipment and system, but also accuracy, which necessitates adequately trained operators, for misfiled papers may easily cause great loss.

**Stock-keeping.**—In a large office the maintenance and issue of an adequate stock of all forms in use becomes a problem in scientific stock-keeping. Order and neatness are necessary, and an adequate location system, so that material can be found with a minimum loss of time. Stores should be classified according to some well-devised system, and there should be a perpetual inventory and a systematic method of issuing stores to, or on the order of, authorized persons.

**Intercommunications.**—This factor is a most important one in large offices. The telephone is of course the most common method, but there is usually a large transfer of papers from one part of the organization to another, and this must be taken care of by well-organized messenger systems with regularly scheduled trips. In many offices automatic belt systems or other forms of conveyors are used. Mechanical devices of other kinds are automatic signalling systems, automatic telephones and so forth.

**Forms.**—Most office work is performed by writing upon some kind of blank form, whether they be detached or loose-leaf forms. The quality of paper selected for any form should be governed by the use to which it is put. If it is to be written upon with pencil it is wasteful to use a high-grade paper designed for writing with ink. When forms have a temporary value only, the paper should be of a cheaper quality than that of forms to be kept for a number of years. Selecting standard qualities of paper for these various purposes requires considerable study. A large variety of colours should not be used, as many of them—particularly the reds and blues with their varying shades—are difficult to read under artificial light. Not more than nine standard sizes of forms are usually needed.

**Salary Standards.**—In most offices salaries vary widely and often unreasonably, clerks doing similar work frequently receiving widely different salaries. Some of the best-managed organizations have made a careful gradation of salaries, with a maximum and minimum for each class of worker. The minimum is that salary which a clerk is entitled to as soon as he is assigned his position, and the maximum the highest salary which the company can afford to pay for that type of work. Such gradation eliminates gross inequalities, gives more equitable payment for results and minimizes dissatisfaction among the office force.

### SUMMARY

Office management is highly complicated, and requires a specialist—a manager of high order who at the same time thoroughly understands clerical work. The scientific approach to the factors of office management may be briefly defined. First it is necessary to define thoroughly the purpose of any work about to be undertaken, for if this is neglected the path of the subsequent investigation is likely to follow incorrect lines. Then the problem should be carefully analysed by dividing it into its factors. These preliminary steps, though simple in a statement, are by no means so simple in fact. The next step involves a careful search for all the facts in the situation which govern each and every factor in the analysis. It is a very common oversight to gather an abundance of facts on one part of a problem, and ignore or minimize other parts. To infer, without investigating, is a most prolific source of error, the method of actual test being by far the best. These three steps are precisely those of experimental science, and may be called the scientific method of thinking out a problem. By its use, the office manager can correctly approach each problem and devise the right method, otherwise known in management as "the one best way." With the best method secured, it is then necessary to select the person best fitted to perform it, for all cannot be equally proficient in the same things. The person best fitted for any particular task will invariably produce better results than the so-called "average" person. When found, it then becomes necessary to teach the person who has been thus selected.

These six steps constitute the basic procedure in any form of scientific management and lead up to the seventh, which is planning. Without careful planning, all the scientifically designed work which has gone before will be wasted. Finally, to secure the best results it is vitally important to win the co-operation of the workers. An office force labouring without interest or enthusiasm will accomplish some results, but certainly not of the type desired by a competent office manager. The management which does not and cannot secure co-operation is necessarily defective. These eight steps cover the basic principles of scientific management in all activities.

There is also a considerable tendency toward the simplification of office methods and the entire elimination of much that has been done in the past, on the ground that it is either superfluous or not worth the effort expended. These tendencies are continuously accelerated by economic conditions. Scientific management will be the principal means of reducing the numerical growth of office workers. (W. H. LE.)

BIBLIOGRAPHY.—H. L. Wylie, M. P. Gamber, and R. P. Brecht, *Practical Office Management* (1937); W. H. Leffingwell, *Office Management, Principles and Practice* (1925) and *A Textbook of Office Management* (1932); G. M. Darlington, *Office Management* (1935); J. H. MacDonald, *Office Management* (1927); D. G. McCarty, *Law Office Management* (1926).

**OFFICERS.** The employment of the word "officer" to denote a person holding a military or naval command as representative of the State, and not as deriving his authority from his own powers or privileges, marks an entire change in the character of the armed forces of civilized nations. Originally signifying an official, one who performs an assigned duty (Lat. *officium*), an agent, and in the 15th century actually meaning the subordinate of such an official (even to-day a constable is so called), the word seems to have acquired a military significance late in the 16th century. (At sea the relatively clear partition of actual duties amongst the authorities of a ship brought about the adoption of the term "officer" somewhat earlier.) It was at this time that armies, though not yet "standing," came to be constituted almost exclusively of professional soldiers in the king's pay. Mercenaries, and great numbers of mercenaries, had always existed, and their captains were not feudal magnates. But the bond between mercenaries and their captains was entirely personal, and the bond between the captain and the sovereign was of the nature of a contract. The non-mercenary portion of the older armies was feudal in character. It was the lord and not a king's officer who commanded it, and he commanded in virtue of his rights, not of a warrant or commission.

### HISTORICAL

European history in the late 15th century is the story of the

victory of the Crown over the feudatories. The instrument of the Crown was its army, raised and commanded by its deputies. But these deputies were still largely soldiers of fortune and, in the higher ranks, feudal personages, who created the armies themselves by their personal influence with the would-be soldier or the unemployed professional fighting man. Thus the first system to replace the obsolete combination of feudalism and "free companies" was what may be called the proprietary system. Under this the colonel was the proprietor of his regiment, the captain the proprietor of his company. The king accepted them as his officers, and armed them with authority to raise men, but they themselves raised the men as a rule from experienced soldiers who were in search of employment, although, like Falstaff, some captains and colonels "misused the King's press damnably." All alike were most rigorously watched lest by showing imaginary men on their pay-sheets they should make undue profits. A "muster" was the production of a number of living men on parade corresponding to the number shown on the pay-roll. An inspection was an inspection not so much of the efficiency as of the numbers and the accounts of units. A full account of these practices, which were neither more nor less prevalent in England than elsewhere, will be found in J. W. Fortescue's *History of the British Army,* vol. i. So faithfully was the custom observed of requiring the showing of a man for a man's pay, that the grant of a special allowance to officers administering companies was often made in the form of allowing them to show imaginary John Does and Richard Roes on the pay-sheets. The next step was taken when armies, instead of being raised for each campaign and from the qualified men who at each recruiting time offered themselves, became "standing" armies fed by untrained recruits. During the late 17th and 18th centuries the Crown supplied the recruits, and also the money for maintaining the forces, but the colonels and captains retained in a more or less restricted degree their proprietorship.

Thus, the profits of military office without its earlier burdens were in time of peace considerable, and an officer's commission had therefore a "surrender value." The practice of buying and selling commissions was a natural consequence, and this continued long after the system of proprietary regiments and companies had disappeared. In England "purchase" endured until 1873, nearly 100 years after it had ceased on the Continent of Europe and more than 50 after the clothing, feeding and payment of the soldiers had been taken out of the colonels' hands. The purchase system, it should be mentioned, did not affect artillery and engineer officers, either in England or in the rest of Europe. These officers, who were rather semi-civil than military officials until about 1715, executed an office rather than a command—superintended gun-making, built fortresses and so on. As late as 1780 the right of a general officer promoted from the Royal Artillery to command troops of other arms was challenged. In its original form, therefore, the proprietary system was a most serious bar to efficiency. So long as war was chronic, and self-trained recruits were forthcoming, it had been a good working method of devolving responsibility. But when drill and the handling of arms became more complicated, and, above all, when the supply of trained men died away, the State took recruiting out of the colonels' and captains' hands, and, as the individual officer had now nothing to offer the Crown but his own potential military capacity (part of which resided in his social status, but by no means all), the Crown was able to make him, in the full sense of the word, an officer of itself. This was most fully seen in the reorganization of the French army by Louis XIV. and Louvois. The colonelcies and captaincies of horse and foot remained proprietary offices in the hands of the nobles but these offices were sinecures or almost sinecures. The colonels, in peace at any rate, were not expected to do regimental duty. They were at liberty to make such profits as they could make under a stringent inspection system. But they were expected to be the influential figure-heads of their regiments and to pay large sums for the privilege of being proprietors. This classification of officers into two bodies, the poorer, which did the whole of the work, and the richer, upon which the holding of a commission conferred an honour that birth or wealth did not confer, marks two very notable advances in the history of army organization, the professionalization of the officer and the creation of the prestige attaching to the holder of a commission *because* he holds it and not for any extraneous reason.

The distinction between working and quasi-honorary officers was much older, of course, than Louvois's reorganization. Moreover, it extended to the highest ranks. About 1600 the "general' of a European army, except in the Italian republics, was always a king, prince or nobleman. The lieutenant-general, by custom the commander of the cavalry, was also, as a rule, a noble, in virtue of his command of the aristocratic arm. But the commander of the foot, the "sergeant-major-general" or "major-general," was invariably a professional soldier. It was his duty to draw up the army (not merely the foot) for battle, and in other respects to act as chief of staff to the general. In the infantry regiment, the "sergeant-major" or "major" was second-in-command and adjutant combined. Often, if not always, he was promoted from amongst the lieutenants and not the (proprietary) captains. The lieutenants were the backbone of the army. Seventy years later, on the organization of the first great standing army by Louvois, the "proprietors," as mentioned above, were reduced to a minimum both in numbers and in military importance. The word "major" in its various meanings had come, in the French service, to imply staff functions. Thus the sergeant-major of infantry became the "adjutant-major." The sergeant-major-general, as commander of the foot, had disappeared and given place to numerous lieutenant-generals and "brigadiers," but as chief of the staff he survived; and in modern times the chief of staff of a French army is known by the title of "the major-general."

Moreover, a new title had come into prominence, that of "marshal" or "field-marshal." This marks one of the most important points in the evolution of the military officer, his classification by rank and not by the actual command he holds. In the 16th century an officer was a lieutenant *of,* not *in,* a particular regiment, and the higher officers were general, lieutenant-general and major-general *of* a particular army. When their army was disbanded they had no command and possessed therefore no rank—except of course when, as was usually the case, they were colonels of permanent regiments or governors of fortresses. Thus in the British army it was not until late in the 18th century that general officers received any pay as such. The introduction of a distinctively military *rank* of "marshal" or "field-marshal," which took place in France and the empire in the first years of the 17th century, meant the establishment of a list of general officers, and the list spread downwards through the various regimental ranks, in proportion as the close proprietary system broke up, until it became the general army list of an army of to-day. At first field-marshals were merely officers of high rank and experience, eligible for appointment to the offices of general, lieutenant-general, etc., in a particular army. On an army being formed, the list of field-marshals was drawn upon, and the necessary number appointed. Thus an army of Gustavus Adolphus's time often included six or eight field-marshals as subordinate general officers. But soon armies grew larger, more mobile and more flexible and more general officers were needed. Thus fresh grades of general arose. The next rank below that of marshal, in France, was that of lieutenant-general, which had formerly implied the second-in-command of an army, and a little further back in history the king's lieutenant-general or military viceroy. Below the lieutenant-general was the *maréchal de camp,* the heir of the sergeant-major-general. In the imperial service the ranks were field-marshal and lieutenant field-marshal (both of which survived up to the World War) and major-general. A further grade of general officer was created by Louis XIV., that of brigadier, and this completes the process of evolution, for the regimental system had already provided the lower titles. (X.)

### MODERN ARMY OFFICERS

The ranks of officers of a modern army are therefore as follows:—

(*a*) *Field-Marshal:*—In Spain, *Capitan-General;* in France, *maréchal*[1]; in Germany, *Generaloberst;* in Italy, *Maresciallo.*[1]

(*b*) *General:*—In the British army this officer is not identified with any particular arm but generally commands an army, of all arms. In Germany, however, he is general of infantry, general of cavalry or general of artillery. In France, the highest grade of general officer is the general of division.[2] In the United States, before the World War, the grade of full general had only been held by Washington, Grant, Sherman and Sheridan. In 1917 Pershing was selected to command the U.S. army in Europe, and he was made a general in Oct. 1917. He was confirmed in the permanent rank of general by the U.S. Senate on Sept. 1, 1919.[3]

(*c*) *Lieutenant-General* (except in France):—In the U.S. army the title lieutenant-general before the 20th century was comparatively rare. It was abolished as an American rank in 1907, but during the World War the army commanders were made temporary lieutenant-generals. In the British army a lieutenant-general commands a corps. *Général de division* is the relative rank in France; in Germany, *Generalleutnant.*

(*d*) *Major-General* (in France, general of brigade):—This is the highest grade normally found in the U.S. army, generals and lieutenant-generals being promoted for special service only.[4] In the British service a major-general commands a division in war and either a division or an "area" in peace; in Germany, *General-major.*

(*e*) *Brigadier-General:*—In British and U. S. service, before and during the World War, commander of a brigade; also served on the staff of corps and higher formations. In France, *général de brigade;* Germany, *Oberst.* In Great Britain, this rank was superseded by *colonel-commandant* after the World War, but from June 1, 1928, the latter has been superseded by "brigadier." (*See* BRIGADIER.)

The above are the ranks of the higher commanders and, with the exception of the colonel-commandant, are termed general officers. With slight modifications their duties are practically the same in all the chief countries; viz., field-marshals and generals command groups of armies, generals command armies, lieutenant-generals command corps, major-generals command divisions, and brigadier-generals command brigades. Each country has, however, some peculiarity of its own either in the rank of the commander or the composition of his command.

The next class of officers in seniority to general-officers is field-officers (France, *officiers supérieurs;* Germany, *Stabsoffiziere*); they are as follows:—

(*a*) *Colonel:*—This rank exists in its primitive significance in almost every army, and denotes a regimental commander, or an officer of equal status on the staff. In Great Britain, however, regiments of infantry do not work as units, and the executive command of battalions, regiments of cavalry and brigades of artillery is in the hands of lieutenant-colonels, and when brigaded are under a brigadier. In the British service the colonel of the regiment or colonel commandant of a corps holds a quasi-honorary appointment, and is usually a royal personage or general officer, and sometimes, though rarely, a colonel. The holders of these appointments now vacate them on reaching the age of 70. Some regiments and corps have colonels-in-chief who are invariably royal personages.

(*b*) *Lieutenant-Colonel:*—In Great Britain, the commanding officer of a battalion of equivalent unit; in the United States and elsewhere, where the regiment and not the battalion is the executive unit, the second in command and sometimes commander of one of the battalions. In Germany, *Oberstleutnant.*

(*c*) *Major:*—In France, *chef de bataillon* or *chef d'escadron,* colloquially *commandant.* In the British infantry he preserves some of the characteristics of the ancient sergeant-major as a second-in-command with certain administrative duties. The junior majors command companies. In the cavalry the majors, other than the second-in-command, command squadrons; in the artillery they command batteries. In armies which have the regiment as the executive unit, majors command battalions ("wings" of cavalry, "groups" of artillery).

Lastly, the company officers (called in France and Germany, subaltern officers) are as follows:—

(*a*) *Captain* (Germany and Austria all arms except cavalry, *Hauptmann;* cavalry, *Rittmeister;* in Belgium, *le commandant de compagnie*). In the infantry of most countries he is the company commander, and in the British Service a captain is also second in command of a company. Under the captain, with such commands and powers as are delegated to them, are the subalterns usually graded as:—

(*b*) *Lieutenant* (first lieutenant in the United States, *Oberleutnant* in Germany and Austria, in Belgium *le chef de peloton*).

(*c*) *Sub-lieutenant* (*sous-lieutenant* in France, second-lieutenant in Great Britain and the United States, *Leutnant* in Germany and Austria).

(*d*) *Aspirants,* or probationary young officers, not of full commissioned status.

### BRITISH ARMY

**Methods of Entry into the Regular Army.**—There are two methods of obtaining admission to the cadet colleges, *i.e.,* Royal Military academy, Woolwich, and Royal Military college, Sandhurst: (1) By successful competition at Army entrance examination. (Provided they fulfil other conditions, the following enter without competition:—King's cadets, honorary King's cadets, King's India cadets, honorary King's India cadets, and pages of honour, the three latter to Royal Military college only.) (2) On the nomination of the Army Council. As to general qualifications, a candidate must be unmarried; he must also be a British subject and the son of British subjects, and of pure European descent. No candidate is accepted unless the Army Council consider he is suitable in all respects to hold a commission in the army; must have attained the age of 18 but not 19. The Army entrance examination is conducted by the civil service commissioners, and a fairly high standard of education is essential. All candidates for *nomination* sit for the competitive army entrance examination and are required to fulfil various conditions. From the 18th century warrant officers, n.c.o.'s and men have been promoted to commissioned rank during war, but since the World War a limited number of specially selected n.c.o.'s under the age of 23 can, in peace, obtain cadetships under certain conditions.

Candidates for cadet colleges come under three headings: (*i.*) Those from approved schools, *i.e.,* public or secondary schools approved by the Army Council; (*ii.*) Candidates recommended to the Army Council by the secretary of State for the colonies, the governors-general of the dominions and certain governors. (*iii.*) Certain naval officers, midshipmen and cadets recommended by the lords commissioners of the Admiralty; in such cases the upper age limit is raised to 21 years.

**Cadet Colleges.**—The course of instruction is designed (*a*) to lay the foundation of military and academic knowledge upon which the future military studies of an officer can be built, (*b*) to ensure that a gentleman cadet joins his unit so thoroughly grounded in drill, weapon training, equitation and physical training as a private soldier that no further instruction of this kind is required.

**Appointment to Commissions and Choice of Regiments.**—Cadets on passing out receive seniority according to their places on the passing-out list. Appointment to particular regiments is governed by the existing vacancies and the requirements of the service. Subject to these conditions, cadets passing out highest receive first choice of regiments, but territorial and special family claims are also considered irrespective of position on the list.

**Commissions Granted to Candidates from Certain Universities.**—Commissions are granted to duly qualified candidates nominated each half-year by certain universities. The universities, which must be "recognized" by the Army Council, are in two groups: (*i.*) Those with established courses of military study—

[1]The full titles are "maréchal de France" and "Maresciallo d'Italia."

[2]In France, the ranks of "général de corps d'armée" and "général d'armée" are likely to be created soon. In war, the rank of "général de groupe d'armées" will be created.

[3]Under the Army Reorganization Act 1920 a "general of the army" is allowed for.

[4]In the Confederate service the grades were General for army commanders, lieutenant-general for corps commanders, major-general for divisional commanders and brigadier-general for brigade commanders.

Oxford, Cambridge, London, Edinburgh, Manchester, McGill (Montreal) and Sydney (New South Wales), and (*ii.*) those without established courses of military study—St. Andrews, Glasgow, Aberdeen, Durham, Wales, Birmingham, Liverpool, Leeds, Belfast, Bristol, Sheffield, Dublin (Trinity College), Toronto. Candidates from group (*i.*) are commissioned senior to those from group (*ii.*).

**Training of Officers.**—A cadet becomes an officer from the date of his commission as published in the *London Gazette*. The training of officers in the various branches of the army differs considerably, and the officers of each branch might be regarded as specialists in their own particular line. Before the World War the infantry weapons were simply the rifle and bayonet, but now, in addition, an efficient officer is required to possess expert knowledge of the various kinds of grenades, machine guns, Lewis guns and gas. Even with this diversity of specialized training, there are some basic features common to all arms, such as drill, physical training, duties in barracks and on the march, dress and certain elements of discipline and military law which are fairly common to the everyday life of the army. This elementary instruction is carried out at the regimental or corps depôt or with the home service unit, and usually occupies the first six months of the officer's service. Having completed his recruit's course, the young officer is drafted to a service unit, where his training is continued on a higher level, his responsibilities increasing with efficiency. For the first few weeks he carries out the various duties as "supernumerary" to another officer until he is considered fit to undertake the duties by himself. Not the least part of his training is that of entering into the games of his men.

According to the *King's Regulations:* "Every officer is expected, if he has been two years in the service, to be capable of commanding and exercising a company, etc., in every situation, and to be perfectly acquainted with its interior management, economy and discipline." Also, "Officers above the rank of 2nd Lieutenant will be required to pass professional tests comprising examinations or courses of instruction for each step of substantive promotion up to and including the rank of Lieutenant-Colonel." The courses have for their object the specialized training of selected officers and other ranks, and are carried out at schools set apart for the purpose, and an official programme of the *Courses of Instruction* is published annually.

**Advanced Training.**—During the young officer's first few years he is absorbing knowledge and experience from the above-mentioned sources, in addition to special lectures arranged by the higher commands and delivered by experts on some particular phase of military science. Not only the young officer but officers generally are kept busy in an endeavour to keep abreast with the development of modern fighting methods. The mechanization of the army, the development of the tank, and the various kinds of grenades, guns, etc., all demand constant attention. The views of officers on military topics find expression in "service" journals under the control of unofficial bodies, the chief being *The Journal of the Royal United Institution, The Army Quarterly, Fighting Forces, The Cavalry Journal, Journal of the Royal Artillery* and other corps journals.

The regulations for promotion examinations are contained in the *King's Regulations,* and are divided into two parts, written and practical. The result of any examination may fall under one of the following three heads: "fail," "pass," or, higher still, "special certificate." Officers awarded the "special certificate" become eligible for special consideration for advancement and employment. Second lieutenants are not required to pass an examination for lieutenant but must receive satisfactory reports from the three senior officers present with the corps. An officer who fails twice in "duties in the field" is not, as a rule, permitted to remain in the service.

An officer below the rank of substantive lieutenant-colonel is required, before promotion to higher substantive rank (lieutenant-colonel or colonel) to undergo a course at the senior officers' school.

**The Staff Colleges.**—The staff colleges at Camberley and Quetta (India) are maintained for the purpose of affording selected officers instruction in the higher branches of the science of war and in the duties of the staff. The course lasts two years. An officer who graduates at either college has the letters "p.s.c." recorded after his name in the *Army List* and is eligible for employment on the staff. Both colleges are open to officers of all arms, including the Indian army and the Royal Marines, but that at Quetta is limited to officers borne on the Indian establishment. The entrance examination for both colleges is identical. A limited number of officers of the permanent staff of the permanent forces of the dominions selected by their respective Governments are permitted to undergo the course. For instructional purposes the staff college is divided into two divisions—senior and junior—each under a general staff officer, first grade. The junior division comprises students in their first year and the senior division students in their second year. Instruction is given by means of lectures, conferences, indoor exercises, sand models, practical work on the ground, and by visits to the other services and various technical schools and colleges. During the vacations the students are attached to arms of the service other than their own.

**Promotion from the Ranks in Time of War.**—On active service soldiers are promoted to commissioned rank direct from private, n.c.o. rank or warrant officer rank "for service in the field." In such cases they are not required to pass any examination. In addition to this type of war-time promotion from the ranks, there are cadet schools to which promising n.c.o.'s are sent for a course of instruction at home, usually lasting six months. Successful students are granted commissions into regiments where their services are required. Any soldier who shows ability has, therefore, an opportunity of rising to commissioned rank, and though he may not have a field-marshal's bâton in his knapsack, he has a splendid opportunity of commanding a company and even a battalion. Quartermasters and equivalent grades are invariably promoted from the ranks, and such promotion only comes at the end of many years of faithful service.

## FRANCE

Physical training is compulsory in all primary schools and forms part of the curriculum of the great majority of secondary schools. The military preparation of the youth of France may, therefore, be said to commence at the age of seven to ten, according to whether a boy goes to a primary or secondary school, and is continued up to the time of incorporation in the army. Up to the age of 15 the training is chiefly of a physical nature, but from 16 onwards his education in definitely military subjects is undertaken in addition. Military preparation is arranged in two degrees, for each of which certificates are granted to those successful in the respective tests and examinations. The *certificat de préparation militaire* is the lower of the two, and the tests entailed are such as will enable those successful therein rapidly to become efficient soldiers on joining the colours. The *brevet de préparation militaire supérieure* (B.P.M.S.) is the higher, and successful competitors are qualified to join one of the special units for the training of prospective reserve officers. In addition to these two certificates there are certain *brevets de spécialité* or special diplomas, which may be obtained by individuals who care to specialize in various branches of training, and are designed especially to attract young men of intelligence to become officers of the reserve.

**Cadet Colleges.**—(*a*) The *École Spéciale Militaire* at St. Cyr, founded by Napoleon in 1808, situated close to Versailles. It trains candidates for appointment to commissions in the infantry, colonial infantry, cavalry, tanks and aviation of the *active* army and prospective *reserve* officers for the infantry and colonial infantry. Entrance to the college is by competitive examination, which may be taken by candidates of not less than 18 years of age, and not more than 22 on Dec. 31 preceding the examination. Candidates for examination must be in possession of the certificate of the *baccalauréat secondaire,* obtained by passing an examination comparable with the Oxford and Cambridge local examinations.

**Choice of Arms by Candidates.**—An annual decree enumerates the units in which vacancies will exist for those successfully passing out of St. Cyr. This is communicated to the candidates on the occasion of the oral part of the examination for entrance

to the college who submit to the president of the board their wishes as to the arm in which they prefer to serve. The duration of the course is, normally, two years. The subjects taught are similar to those of the Royal Military college, Sandhurst.

(*b*) *The École Polytechnique, Paris,* established in 1794, and, although under the War Ministry, is not designed exclusively for the training of candidates for the army. The conditions of entry are similar to those of St. Cyr. The course lasts two years. A greater number of non-military subjects are taught than at St. Cyr. Successful students are given their choice of appointments existing in the various public services for which the course qualifies them. Those who do not succeed in obtaining an appointment in the army or navy, and those who select an appointment in the services other than the army or navy, are compelled to perform one year of service as second lieutenants of the reserve.

(*c*) *The St. Cyr Marocain.*—At the end of 1918 Marshal Lyautey created a Corps of Moroccan officers, recruited from amongst the élite belonging to the best class in Morocco, so that the *Goums, tirailleurs* and *spahis* should have officers in command of them endowed with that prestige which belongs to those bearing a name which the traditions of the country associate with the sons of leading Arab chiefs. In June 1919 was formed the first "promotion" of 11 students. These officers are confirmed in their native rank in the same way as other Tunisian or Algerian officers. North African officers, however, are always promoted in separate lists to French officers, and cannot rise above the rank of captain.

**Schools of Instruction for N. C. O. Candidates for Commissioned Rank.**—These schools are (*a*) infantry and tanks at St. Maixent; (*b*) artillery at Fontainebleau; (*c*) cavalry at Saumur; (*d*) engineers and air service at Versailles. Entry is by competitive examination. European n.c.o.'s of the metropolitan and colonial armies are allowed to compete, who must have performed two years' service as n.c.o.'s (sergeant and upwards). The course lasts one year and is divided into two parts—general instruction and military instruction. After leaving their schools, candidates go to the *École d'application* for their arm of the service, except in the case of infantry students, who join the unit to which they are posted after completing their two months' leave.

*École d'Administration Militaire* at Vincennes.—This school is designed for the instruction of n.c.o.'s recommended for appointment as officers in the *service d'administration.*

**Training of Officers of the Active Army.**—The whole of the French military educational system is directed towards the formulation and propagation of one common doctrine, and from the moment when a prospective officer comes under the influence of military teaching to the time when he leaves the army, even though he rises to the highest rank, his education is continuously and progressively assured and his thought and action kept within accepted bounds by the precepts of the common doctrine. This training is provided at courses and schools for specialists dealing exclusively with one arm of the service or with some special branch of instruction.

*Cycles d'information* (courses for senior officers).—Officers of the rank of colonel and upwards attend courses which consist of a series of visits to the principal schools and centres of instruction. These courses occupy about six weeks and are attended by officers of all branches of the service.

*École Supérieure de Guerre* (Staff College).—The course at the school is designed, first and foremost, as one at which the higher art of war is taught, as opposed to a course devoted exclusively to the study of staff duties. The entrance examination is open to majors, captains and subalterns of all arms of the metropolitan and colonial armies who are between 28 and 38 years of age.

## THE UNITED STATES ARMY

**Appointment of Officers.**—Appointments of second lieutenants in the active army are made from (*a*) graduates of the military academy at West Point; (*b*) warrant officers and enlisted men of the regular army with at least two years' service; (*c*) officers of the Officers' Reserve Corps, and officers, warrant officers and enlisted men of the National Guard; (*d*) members of the Enlisted Reserve Corps; (*e*) graduates of certain technical institutions approved by the secretary of war. Candidates from categories (*b*), (*c*), (*d*) and (*e*) must be within the ages of 21 and 30 years. Original appointments in the judge-advocate-general's department are made in the rank of captain under separate regulations. Appointments to the medical, dental, veterinary, medical administrative and chaplain's corps are also governed by special regulations. Appointments as second lieutenants in the Philippine Scouts are open to citizens of the Philippine Islands only, between the ages of 21 and 30 years.

(*a*) *The Military Academy at West Point.*—This is the only purely military cadet college in the United States. Candidates must, at the date of admission, be between the ages of 17 and 22 years. All cadets are appointed by the President. On conclusion of the four-year course the successful cadets are assigned to branches of the service as far as possible in accordance with their choice, and take their place on the promotion list as second lieutenants in the order obtained by them on leaving the academy. Each cadet on entry into the academy is required to give a written undertaking that he will serve at least four years in the army after obtaining his first commission. The number of cadets at the academy is usually about 1,250, of whom roughly one-quarter graduate each year.

(*b*) *From Warrant Officers and Enlisted Men.*—Warrant officers and enlisted men must establish their fitness for appointments to commissions as second lieutenants by taking the prescribed examination. Those who qualify in this examination are commissioned ahead of all other applicants examined at the same time.

(*c*) and (*d*).—The conditions for candidates in categories (*c*) and (*d*) are as for category (*b*).

(*e*) *Graduates of Technical Institutions Approved by the Secretary of War.*—The approved institutions are those which maintain the full equivalent of a four years' course of instruction in technical or scientific subjects, the successful completion of which entitles a graduate to a degree in a recognized technical subject. Any candidate who has graduated or who will graduate within six months from a technical course in any recognized college is considered eligible for appointment to the army.

**Promotion of Officers.**—All officers of the combatant arms and supply departments are included on a "single list" for promotion; those of the medical, chaplains, etc., departments belong to what is called the "non-single list." Promotions from colonel to brigadier-general and from brigadier-general to major-general are made from an eligible list prepared annually by a board of not less than five general officers. The examination of officers for promotion in technical subjects is the function of the corps area or department commanders, except in the case of the medical, dental, and veterinary corps, in which promotion takes place after stated periods of service.

## GERMANY

Officers of the combatant branches of the German army are taken from the ranks. This does not, however, in practice involve any lowering of the social scale of the officers' corps, as candidates for commissions are youths of good family recruited with a view to their adoption of an officer's career. Candidates for commissions volunteer direct to regimental commanders during the recruiting period, April 1 to Oct. 1 each year. Candidates for commissions who, on enlistment, are in possession of an education certificate from a "higher school" (*höhere Schule*) of at least nine classes, receive preferential treatment. The candidate, at the end of his first year's service, if recommended for a commission by his commanding officer, undergoes an examination on general and elementary military subjects (officer probationer's examination: *Offizieranwartenprüfung*). On passing this, he is, in the course of his second year's service, promoted to lance-corporal (*Gefreiter*) and then to corporal (*Unteroffizier*) as vacancies in his unit permit. At the end of his second year (whatever his arm or branch) he proceeds to the infantry school at Dresden to undergo a course of instruction as corporal and officer probationer (*Unteroffizier* and *Offizierwarter*) for 10½ months, at the end of which period he sits for the ensign's examination (*Fähnrichsprüfung*). If he passes

this examination he is promoted to ensign (*Fähnrich*) and undergoes a course of 10½ months at the special school of his arm, which culminates in the officers' examination (*Offiziersprüfung*). On passing the officers' examination he is immediately promoted to senior ensign (*Oberfähnrich*). He is simultaneously posted to his regiment, where he serves as senior ensign, until the following March, when, with the permission of his commanding officer, he comes up for election to a commission as second lieutenant (*Leutnant*) by the officers' corps of his regiment.

In the case of candidates without school certificates the minimum training from enlistment to promotion to senior ensign is six years. For the first two years the candidate continues to serve in the ranks. In the third year he undergoes a preliminary examination in general subjects. In the fourth year he must sit for a second examination in general subjects, and, if successful, for the officers' probation examination. From this point his training continues under the same conditions as those described above for candidates with school certificates until his promotion of senior ensign at the end of the sixth year.

**Reserve of Officers.**—No official reserve of officers is permitted by the Treaty of Versailles. A considerable number of ex-officers of the imperial army are, however, still (1928) of military age, and these, together with officers who have retired from the present army, would be available in case of war. Ex-officers are forbidden to assist at manoeuvres, and to take part in training of any kind with the army. They do, however, keep in close touch with those units of the present army which maintain the traditions of their respective regiments.

**Reports on Officers.**—A confidential report (*Qualifikationsbericht*) is written every two years on second lieutenants and lieutenants and annually in the case of all other officer ranks.

### ITALY

Officers are recruited from two sources: (*a*) cadets from military colleges at Rome and Naples, who leave these colleges at the age of 17 or 18, and (*b*) youths with the necessary educational qualifications who apply for commissions shortly before they are called up for conscript service at the age of 20. Both categories go through the same process of further education before they are commissioned. First, they attend an army corps cadet school for student reserve officers, one of which is established in each army corps area, for seven or eight months; then they are attached to a regiment for three months, which qualifies them as second lieutenants of reserve (*di complemento*), with which rank they can then return to civil life if they like. Finally, if they carry out their original intention of taking regular commissions, they go to the military academy at Modena for two years, or, if entering the artillery or engineers, to the "school of application" at Turin for three years. On passing out, all officers are commissioned as first lieutenants in the regular army. Artillery and engineer officers are antedated a year for seniority when they pass out, to put them on an equality with those passing out at Modena. A certain number of commissions as second lieutenants in the Commissariat and Administrative Corps are given to under-officers (*i.e.*, n.c.o.'s) of the corps and to civilians.

**Categories of Officers.**—Officers of the Italian army are nominated by royal decree but do not hold documentary "commissions," as in the British army. Honorary nominations and honorary ranks do not exist. All officers are classified into two groups, each of which is divided into certain categories. The first group is known as "*ufficiali in servizio attivo permanente*" (officers in permanent service), and corresponds approximately to the British "active list." The second group is called "*ufficiali in congedo,*" a term for which no correct British equivalent exists. The verbal translation is "officers on furlough," but as this group forms the reserve of officers of the Italian army, the latter term has been adopted.

The system of training is similar to that of the British service, and similarly there are schools of instruction and courses for every kind of specialist training.

**Promotion.**—During peace, promotion is carried out partly by selection and partly by seniority throughout the army, a general list being kept for each arm up to and including a certain rank, which varies with each arm, *e.g.*, in the Carabinieri up to general of division, but in the Commissariat Corps up to lieutenant-colonel. In order to qualify for promotion, officers must serve a minimum period of (*a*) three years as a lieutenant, (*b*) four years as a captain, and (*c*) two years in all other ranks. In addition to this time qualification confidential reports have to be rendered on all officers concerning their general efficiency. Up to and including majors, these reports are rendered separately by three senior officers, and on officers above this rank by two senior officers and a central promotion commission. This body exists for the purpose of considering promotions to the rank of colonel and to the various ranks of general. It consists of the chief of staff and the four army commanders designate. Other senior officers may also be co-opted to give evidence for or against the promotion of an officer under their command, but such officers have no vote. The decisions of the C.P.C. are final, provided they are approved by the minister of war. If they are not approved, or if there is an equality of votes, the final decision rests with the minister of war.

### BELGIUM

The combatant officers are drawn from a very wide social class. Entry can be effected through the ranks or by direct appointment to the *École militaire*. In both cases a preliminary examination is compulsory. Examinations are held yearly for entrance to the *École militaire,* the equivalent to Sandhurst and Woolwich. Candidates are drawn from three sources: (*a*) private life, (*b*) the *École des Pupilles,* and (*c*) n.c.o.'s and men of the active army, who have a special examination and are afforded facilities for study with a view to passing it.

**Reserve of Officers.**—This is a most difficult problem in the Belgian army owing to the absence of a statute defining the exact status and duties of reserve officers and the dislike of the average citizen to undertaking a duty which means giving up his business or his holidays for training. The supply of officers in war emanates from the following sources: (*a*) actual army, (*b*) regular officers unattached, on half-pay, or in the Congo, (*c*) retired regular officers, under the age limit and fit, (*d*) *École militaire* and *École d'Application* students, (*e*) voluntary engagements of retired officers, not subject to recall, (*f*) men specially selected, (*g*) promoted n.c.o.'s.

**Reports on Officers.**—After passing the schools prior to commission, officers have no further examination until they come up for promotion to field rank. They are, however, reported upon periodically by their commanding officers.

### SWITZERLAND

All officers pass through the ranks prior to commission, and have attended certain definite courses of instruction in each rank. The training of recruits and cadres (officers and n.c.o.'s) is carried out at courses of instruction, specially held for that purpose, by a small permanent body of officers and n.c.o.'s, called the corps of instructors. As a general rule, officers of each rank must have held that rank for four years before they can be promoted. They must prove their fitness for promotion by obtaining a certificate of efficiency. Promotion to lieutenant is by seniority, to all other ranks by selection.

### POLAND

All citizens of the Polish State can become officers; thus Jews, or men of Russian or German nationality who are citizens of Poland, are equally eligible, with the native Pole, to become officers. As a general rule, only men of good social position are taken into the cavalry and horse artillery. The corps of officers is divided into several branches, but all have equal rights and stand on an equal footing. All officers who were previously officers in the old Russian, Austrian or German armies were accepted into the Polish army in the same rank as they held in their previous army. A young man may become a regular officer either by direct entry or by passing through the ranks. Young men wishing to obtain a direct commission must pass through the *podchorgzy* or officers' school. N.c.o.'s who desire to obtain commissions

must complete three years' service as n.c.o.'s, have reached the rank of *plutonowy* (sergeant), be specially recommended, and have passed certain middle school classes or have war service. Selected n.c.o.'s are sent for a two years' course at the officers' school for n.c.o.'s at Bydgosc. Promotion is by selection and seniority; second lieutenants are promoted lieutenant after two years' service; further promotion is governed by length of service and selection.

### BALTIC STATES

**Estonia, Latvia and Lithuania.**—Officers are obtained solely from cadet schools, which in Estonia and Latvia are the smartest and most efficient institutions in the army. The cadets are drawn mainly from the secondary schools and universities. They do a two years' course of training (in Estonia three years, for all except infantry). The cadet schools contain in Estonia about 300 cadets, in Latvia 200, in Lithuania 400. All officers on retirement, except in special circumstances, are held to serve in the reserve.

### THE NETHERLANDS

Officers are obtained from (*a*) cadets from the Royal Military college at Breda, (*b*) n.c.o.'s who have graduated at the *Hoofd cursus* or final course at Kampen; such n.c.o.'s must previously have passed through the instructional battalion. The training of officers is on the same general lines as other European armies. The staff college (*hoogere krijgsschol*) at The Hague trains officers for the staff, the course being of three years' duration. There are various schools of instruction for specialized training.

### THE AIR SERVICES

The systems of appointment to commissions in the air services differ under the various governments and are dealt with accordingly under the headings of their several countries.

### GREAT BRITAIN—THE ROYAL AIR FORCE

**Methods of Entry.**—There are three methods of entry into the general duties branch: (*i.*) By passing through Cranwell Cadet college by means of a competitive examination similar to Sandhurst and Woolwich. The course lasts two years and the training is on lines similar to Sandhurst and Woolwich. In addition, the flight-cadet receives training in the elements of engineering and is taught to fly a service aeroplane. As physical fitness is an essential for efficient piloting, the closest attention is given to athletics. (*ii.*) By direct entry of university candidates similar to the army system. (*iii.*) By obtaining a short service commission of five years' duration, offered to candidates between the ages of 18 and 30. On appointment, these officers are posted direct to a flying training school to undergo a 12 months' course, which includes training in discipline, administration, aero engines, meteorology, navigation, armament, signals and photography. In addition, they are taught to fly a service aeroplane.

**Training.**—On leaving Cranwell on first commissioning, the young officer is posted to a service unit for four to five years, during which he carries out his duties as a pilot. At the end of this time he is expected to specialize in one of the several branches, and along one of these channels he looks for promotion. An officer who does not specialize has little prospect, if any, of promotion above the rank of squadron leader. Flying is carried out as an essential part of normal duties. On successfully passing out of the flying training school short-service commission officers are confirmed in their rank and posted to service units for four years. At the end of their five years' engagement they are transferred to the reserve for a further four years, during which they undergo periodical training in flying. Those who remain efficient may have their reserve service extended, four years at a time, up to the age of 40.

*The Air Force Staff College,* situated at Andover, is for training officers in staff duties. Entry is made by selection from successful candidates after a qualifying examination. The course lasts one year.

*General Training.*—R.A.F. officers undergo various courses of instruction, one of the most important being the engineering course. This starts with a period of two years at the home aircraft depôt at Hendon, followed, in some cases, by a two years' course at Cambridge. A few of the most successful are selected to undergo a final course of 10 months at the Imperial college. Other courses are for wireless at Flower Down; armament at Eastchurch; photography at Farnborough; navigation at Calshot.

### UNITED STATES OF AMERICA

Aviation in the United States is in three distinct branches, the army, the navy and the post office air mail services. The army air service is administered by the office of the chief of the air service, who is a subordinate of the chief of staff. There are two methods of entry to commissioned rank: (*i.*) direct entry through West Point or by competitive examination from civil life; (*ii.*) by transfer from another arm of the army. Other ranks are obtained by voluntary enlistment. The army air service training establishments are under the training division, which embraces schools for primary flying, advanced flying, mechanics, communication, photography, tactics, engineering, flight surgeons, balloons and airships. Officers on joining pass through the primary and advanced flying schools, after which they are available for duty in a unit as pilots. There is no specified duration for the courses. To become an observer, an officer must first qualify as a pilot. Technical training is carried out at the technical school group (mechanics, communications and photography), where there are numerous courses of varying duration for the specialist trades required. The higher technical training of officers is carried out at the engineering division, McCook Field, Dayton.

### FRANCE

The French military air service is an integral part of the army. The service relies to a very large extent on non-commissioned personnel for its pilots, and the proportion of officer pilots is small, which is rather an assurance that an officer can make a career in that service. Officers are drawn from three sources: (*i.*) École Militaire de St. Cyr, (*ii.*) École Polytechnique, (*iii.*) by promotion from the ranks. The n.c.o. ranks are divided into three branches: (*i.*) flying personnel, (*ii.*) skilled ground personnel, (*iii.*) unskilled ground personnel. The flying personnel is recruited from those who obtain a pilot's bursary (*i.e.,* are allowed to joint the colours a year before their due date and are trained at the Government's expense) and by enlistment into the flying branch of the service. The skilled ground personnel is recruited from men who obtain a mechanic's bursary by enlistment or re-enlistment and by the incorporation of conscripts. The unskilled ground personnel is recruited by the incorporation of conscripts. Warrant officers, n.c.o.'s or soldier pilots receive the same rates of "flying pay" as officers.

### GERMANY

By the aeronautical clauses of the Treaty of Versailles, Germany is forbidden to maintain a military or naval air service. In 1926, however, the terms of these clauses were modified and Germany is now permitted to construct aircraft of certain patterns. Not more than six members of the fighting forces (army and navy) per annum may be trained as pilots up to a total of 36; thereafter three per annum may be trained as replacements. Such training is to be undertaken at the private expense of the pupil and must not include instruction in military aviation.

### BELGIUM

The military aviation service is under the Ministry of National Defence. Only officers, *sous-officiers* and corporals are held on the permanent establishment. All officer personnel are only attached to the air service, being seconded from their regiments. During their term in the air service they receive special promotion according to the most favoured arm. If, however, they revert to regimental duty, they return to their permanent rank according to regimental seniority.

Officers are drawn from the following sources: (*i.*) Officers transferred during 1914–18; these are chiefly senior officers employed on administrative duties; (*ii.*) young officers seconded from other arms for an indefinite period, who must, prior to trans-

fer, pass all the military tests for an observer and a balloon or aeroplane pilot; (*iii.*) adjutants of the aviation troops; (*iv.*) *sous-lieutenants de réserve,* who are chosen from volunteers; (*v.*) reserve officers. Other ranks: Any unmarried Belgian, civilian or *milicien* performing, or having performed, his active service, and between 18 and 25 years of age and able to pass certain physical and educational tests, can become a candidate n.c.o. in the navigating branch of the aviation service. If a civilian, he enlists for two years. Balloonists, observers and bomber n.c.o.'s are trained under similar conditions. Training beyond that carried out in the squadrons is organized as follows: (*i.*) the civilian flying schools train 100 pilots annually; (*ii.*) the military flying school at Courtrai takes all the officers, *sous-officiers* and corporals required for training yearly; (*iii.*) the école de sous-lieutenants de reserve attached to (*ii.*) trains 40 pupils yearly; (*iv.*) the school for mechanics deals with *miliciens.* There is no air staff college.

### JAPAN

The air forces of the army and navy are quite distinct. That of the army is administered by the war department. Officers for flying duties are recruited from young officer volunteers of all arms who have at least one year's service. The majority of senior officers have been selected for command and for administrative purposes, from other arms. Other ranks are recruited from those possessing general intelligence and experience in mechanical trades.

### SWITZERLAND

(*a*) The Swiss air service is under the general staff. The service is composed of all classes, subject to military duty, and all ranks belonging to it are liable to the same periods of training and musketry as other troops. Officers are either promoted from flying duties or recruited from young officer volunteers of all n.c.o.'s and men are recruited in the ordinary way. Training is carried on at schools of instruction chiefly at Dübendorf and Thun, the curriculum being similar to that of other countries.

### NETHERLANDS

The air services of the army and navy are separate. The air service of the colonial army is, like that army, under the Colonial Office. The headquarters of the air service is at Soesterberg, where the main workshops, training schools and other services are situated. There are schools for every form of specialized training.

### POLAND

The air force is part of the regular army under the Ministry of War. The force is organized into aeroplane regiments. Recruiting and terms of service for aviation are identical with those for the rest of the army. Officers are obtained either from cadets or from officers transferring from other arms. The officers' aviation school is at Deblin, where they undergo a two years' course. There are schools for specialized subjects at Lida and Bydgoszcz.

### CZECHOSLOVAKIA

The air service is an integral part of the army under the Ministry of National Defence. It is organized in regiments, each consisting of four wings, viz., reconnaissance, fighting, bombing and training. The majority of pilots are n.c.o.'s. The normal channel of recruitment of officers is from the academy at Hranice or by transfer from other arms. N.c.o.'s are eligible for promotion to commissioned rank. Schools exist for training in specialized subjects.

### YUGOSLAVIA

The air service is a part of the army. It is organized in regiments. Officers are recruited from the military academy at Belgrade, who have served at least one year in a unit. N.c.o.'s form a special body and generally serve for 15 years with the force. No commissions are given to n.c.o.'s in air regiments. Training in specialized subjects is carried out at schools at Novi Sad, Mostar and Sarajevo.

### BALTIC STATES

The air forces of the three States (Estonia, Latvia and Lithuania) were founded in 1918. In Estonia the air force is a separate service, but in Latvia and Lithuania the air forces are an integral part of the army. In Estonia, the junior officers are regulars, who are posted from other arms or join direct from the military cadet school. The other ranks are conscripts. Preliminary training is carried out at Reval. In Latvia, the officer personnel is obtained either by direct entry or by attachment from the army. Other ranks are selected conscripts, and in Lithuania officers and n.c.o.'s are selected from the army.

*Corresponding Ranks in the British Services*

| Army | Navy | Royal Air Force |
|---|---|---|
| Field-marshal | Admiral of the fleet | Marshal of the Royal Air Force. |
| General | Admiral | Air chief marshal. |
| Lieutenant-general | Vice-admiral | Air marshal. |
| Major-general | Rear-admiral | Air Vice-marshal. |
| Brigadier | Commodore (1st and 2nd class) | Air commodore. |
| Colonel | Captain | Group captain. |
| Lieutenant-colonel | Commander | Wing commander. |
| Major | Lieutenant-commander | Squadron leader. |
| Captain | Lieutenant | Flight lieutenant. |
| Lieutenant | Sub-lieutenant | Flying officer or observer officer. |
| Second-lieutenant | Commissioned officer from warrant officer. | Pilot officer. |

(T. J. E.)

**OFFICIAL SECRETS.** At common law there was, and is, no such offence as espionage in time of peace. In time of war, however, the act of communicating information useful to an enemy State was always punishable under the head of treason. In 1889, by the first Official Secrets Act this gap in the law was filled by making it a felony to obtain or communicate any "sketch," information, or "document" concerning the country's defences which "might be useful to an enemy" for "any purpose prejudicial to the safety of the State." This very necessary statute was, however, almost completely diverted from its original purpose by successive Acts of 1911 and 1920, into a statute for the better protection of the bureaucracy against well-informed criticism. Entirely new sections were introduced making it an offence, punishable with two years' hard labour, for anyone who has ever served the Crown to communicate to "any person" any "information" whether prejudicial to the State or not which he has acquired in his official capacity. It is sufficient for a conviction that the "information" was acquired when the person communicating it was serving the Crown and the accused is not allowed to plead, or prove, that publication was " in the public interest." Truth is also no defence; it is, in fact, essential to a conviction. If the accused can prove that the "information" he communicated was false, he will be acquitted. Any person connected with a newspaper, director, editor, leader-writer, receiving the information is also liable to conviction. It is unnecessary for the prosecution to prove *mens rea* (guilty intent), on the part of such recipient. Search warrants may be issued, for the purpose of such prosecution, by any superior police officer without the usual authorization of a magistrate; any newspaper office may be raided and any member of the staff who refuses, or omits, to give information to the police is guilty of a statutory offence. These extraordinary departures from the rules of law prevailing in England are the result of these statutes and their interpretation in *Rex* v. *Crisp and Homewood,* 83 J. p. 121, and *Rex* v. *Blake* (Times Law Report, 16th December 1926). The Acts have been the subject of deservedly severe criticism, and the Newspaper Proprietors Association are now agitating for their drastic amendment.

(J. H. Mo.)

**OFFSET,** a term expressing the distance between two parallel planes, or between two parallel axles in a machine; also used in plumbing work to describe a connection between a large and a small pipe, in which the opening of the smaller pipe is eccentrically placed, so that the axes of the pipes, although parallel, are not in the same line. In architecture, an offset is a slanting plane, forming a transition between a thin wall above and a thick wall below, or between varying depths of a buttress; an offset buttress

is one deeper at the bottom than at the top, with the difference between the upper and lower faces taken up by one or more offsets.

**OFFSET PRINTING:** *see* PRINTING.

**OGASAWARA-JIMA** (BONIN ISLANDS, OGASAWARA-SHOTŌ, OGASAWARA-GUNTŌ), a group of some 20 small islands, 27 sq.mi. in area, lying about 500 mi. S.S.E. of the Japanese mainland. The population, of mixed Asiatic and European origin, was about 7,500 in 1940. Administratively it forms a part of Tokyo prefecture, and includes the three islands of an adjacent group which is sometimes distinguished as the Kwazan Rettō (Volcano chain) or the Iwojima Rettō (Sulphur Island chain). The principal island is Chichi-Jima (Peel Island), which is of some strategic importance, having a good deep water anchorage at Futami, where there is a protected naval base. Eastern Asia is fringed by island arcs, the innermost consisting of the large islands of Japan, Formosa and the Philippines, and the outermost of small islands alone. The Ogasawara islands form part of one outer festoon which stretches from the central volcanic zone of Japan through the Volcano, Marianne, Mackenzie, Yap and Pelew Islands to the Moluccas and which, originating in the latter stages of the "Alpine" fold movements, is still unstable. The northern end of the arc passes into central Honshu, that part of Japan where earthquakes are most frequent, and in the Ogasawara group tiny islands appear and disappear. The arc, which, with the single exception of Guam, is administered by Japan, has an important strategic position with regard to the Pacific approaches of the far east.

Although known to several explorers, each of whom gave the group a different name, these islands, originally called Bonin, were not permanently settled until 1830. The term "Bonin" is a corruption of the Japanese "Munin" meaning "empty of men," but the Japanese themselves term them "Ogasawara-Guntō" after Ogasawara, their alleged discoverer in 1593. Vague claims by Britain and the United States were not pursued and Japan formally annexed them in 1876. Only about 11% of the total area is good arable land, the remainder being hilly and forest-covered. The valuable timber includes cedar, rosewood, ironwood, boxwood, sandal and white oak.

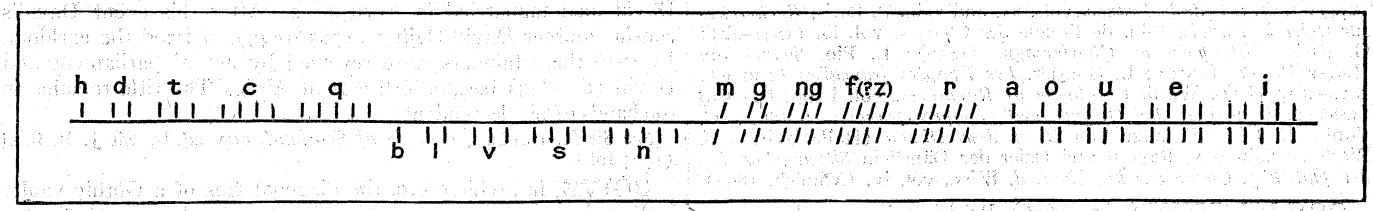
**OGDEN,** a city of Utah, U.S.A., 35 mi. N. of Salt Lake City, at the confluence of the Ogden and the Weber rivers and the foot of the Wasatch mountains; the county seat of Weber county and the second city of the state in size. It is on federal highways 30S, 89 and 91; has a municipal airport; and is served by the Denver and Rio Grande Western, the Southern Pacific, Oregon Short Line, the Union Pacific and several electric railways. The population was 40,272 in 1930; by the federal census of 1940, 43,688. Ogden is 15 mi. E. of the point on Great Salt lake where the Lucin cutoff begins (the railroad trestle 32 mi. long, completed in 1903). It lies 4,300 ft. above sea level, on an alluvial fan or semicircular delta, formed under the water of the ancient Lake Bonneville. Mt. Ogden (10,100 ft. high, from which the entire shore line of the ancient lake, covering 19,750 sq.mi., may be clearly seen) and Mt. Ben Lomond (10,900 ft.) rise abruptly on the east, and between them the Ogden river makes its way through one of the most picturesque canyons in America. In a broad valley 10 mi. up the canyon the Pine View dam created Pine View lake, a body of water for boating, swimming and fishing. The dam covers 38,000 ac.-ft. Ogden is the principal railroad centre of the region between the Rockies and the coast. Four roads maintain roundhouses and repair shops within its limits, and it is headquarters for much of the construction work in the western states. Its manufacturing industries are important, with an aggregate output valued at $32,348,459 in 1940. Chief among them are flour milling, meat packing, vegetable canning, and the manufacture of beet sugar, candy, tin cans, cement, butter and powdered milk. A large oil refinery was established in 1927. The city's assessed valuation for 1941 was $32,255,532. Bank debits for 1940 totalled $199,425,967.

Ogden was settled by the Mormons in 1847; was laid out under the direction of Brigham Young in 1850; and was incorporated in 1851. It had long been known as Ogden's Hole, from the cache which the trapper, Peter Skene Ogden, had located there in 1826. The northern end of the city was a grassy meadow, where the Indians met for games and races and to trade with the white men.

**OGDENSBURG,** a city of St. Lawrence county, New York, U.S.A., on the St. Lawrence river at the mouth of the Oswegatchie, 50 mi. from Lake Ontario. It is served by the New York Central and the Rutland railways and lake and river steamers, and is connected by passenger and car ferry with the Canadian Pacific and the Grand Trunk railways at Prescott, Ontario, on the opposite bank of the St. Lawrence. Pop. (1920), 14,609 (81% native white); federal census 1940, 16,346. The city lies on high ground above the river, which is a mile wide there. It has a fine harbour, open throughout the year, and is an important shipping and transfer point, especially for lumber, grain and coal. The traffic of the harbour in 1937 amounted to 506,000 short tons (333,000 receipts; 173,000 shipments). With the completion of the Welland canal in 1930 it became accessible to the largest lake vessels. Ogdensburg is a port of entry, headquarters of the St. Lawrence customs district, which in the fiscal year 1936 exported goods to the value of $8,129,770 and received imports valued at $7,691,065. In 1940, 6,394 freight cars and 204,129 passenger vehicles were transferred through the port. The city's manufactures (including shade-rollers, paper and pulp) were valued in 1940 at $7,597,907. It is the seat of a state hospital for the insane; a state armory; and the Remington Art memorial, containing the collection of Indian relics and many of the paintings and statuettes of Frederic Remington, who was born in Canton, the county seat. The Thousand islands of the St. Lawrence lie about 30 mi. southwest. Ogdensburg was the site of the Indian settlement of La Présentation, founded in 1749 by the Abbé François Picquet for converted Iroquois, and of Ft. Presentation, built by the British at the outbreak of the Revolution and held by them until 1796. The settlement that grew up about the fort was named after Abraham Ogden (1743–98), a New Jersey lawyer who bought land there. During the early part of the war of 1812 it was an important point on the American line of defence, and on Feb. 22, 1813, both fort and village were captured and partly destroyed by the British. Ogdensburg was incorporated as a village in 1817 and as a city in 1868.

**OGEE,** in architecture, a curve of double curvature, concave below and convex above. Thus an ogee arch is a pointed arch in which each side has an ogee curve; also applied to the moulding (*q.v.*) more commonly known as a *cyma reversa.*

**OGHAM LANGUAGE.** The language of the Ogham inscriptions is the oldest form of Goidelic with which we are acquainted. Some 300 inscriptions have been discovered in this alphabet, the majority of them hailing from the southwest of Ireland (Kerry and Cork). In Scotland 22 are known, while in England and Wales about 30 have turned up. Most of the latter are in South Wales, but odd ones have been found in North Wales, Devon and Cornwall, and one occurs in Hampshire. The Isle of Man possesses two. The letters in the oldest inscriptions are formed by strokes or notches scored on either side of the edge of an




SYMBOLS OF THE OGHAM ALPHABET, ORIGINALLY USED BY THE CELTS IN BRITAIN AND IRELAND

upright stone. Thus we obtain the alphabet on the preceding page.

This system, which was eked out with other signs, would seem to have been framed in the south-west of Ireland by a person or persons who were familiar with the Latin alphabet. Some of the inscriptions probably go back to the 5th century and may even be earlier. The simplest forms of Ogham inscriptions are: *Doveti maqqi Cattini, i.e.* "(the stone) of Dovetos son of Cattinos"; *Trenagusu Maqi Maqi-Treni* is rendered in Latin *Trenegussi Fili Macutreni hic jacit; Sagramni Maqi Cunatami,* "(the stone) of Sagramnos son of Cunotamos"; *Ovanos avi Ivacattos,* "(the stone) of Ovanus descendant of Ivacattus."

In the oldest of these inscriptions *q* is still kept apart from *k* (*c*), and the final syllables have not disappeared (cf. *maqqi,* O.Ir. *maicc*); but it appears certain that in Oghamic writing stereotyped forms were used long after they had disappeared in ordinary speech. Several stones contain bilingual inscriptions, but the key to the Ogham alphabet is supplied by a treatise on Oghamic writing contained in the Book of Ballymote, a manuscript of the late 14th century.

*See* R. R. Brash, *The Ogham Inscribed Monuments of the Gaedhil* (1879); R. A. Stewart Macalister, *Studies in Irish Epigraphy* (3 vols., 1897–1907), and *Archaeology of Ireland* (1928). Welsh inscriptions are given in J. Rhys, *Lectures on Welsh Philology* (1879). The Scottish stones have also been treated by Rhys in the *Proceedings of the Scottish Society of Antiquaries* (Edinburgh, 1892). *See* also G. M. Atkinson for the tract in the Book of Ballymote, *Kilkenny Journal of Archaeology* (1874). The Irish Christian inscriptions were published by Margaret Stokes as the annual volumes of the Roy Hist. and Archaeol. Association of Ireland (1870–77), and have been republished by R. A. Stewart Macalister.

**OGIER THE DANE,** a hero of romance, identified with the Frankish warrior Autchar (Autgarius, Auctarius, Otgarius, Oggerius) who in 771 or 772 accompanied Gerberga, widow of Carloman, Charlemagne's brother, and her children to the court of Desiderius, king of the Lombards, with whom he marched against Rome. In 773 he submitted to Charles at Verona. He finally entered the cloister of St. Faro at Meaux. Colour is lent to the theory of the Bavarian origin of the Ogier of romance by the fact that he, with Duke Naimes of Bavaria, led the Bavarian contingent at Roncevaux.

In the romances of the Carolingian cycle he is, on account of his revolt against Charlemagne, placed in the family of Doon de Mayence, being the son of Gaufrey de "Dannemarche." Ogier, who was the hostage for his father at Charlemagne's court, gained the emperor's favour by his exploits in Italy. One Easter at the court of Laon, however, his son Balduinet was slain by Charlemagne's son, Charlot, with a chess-board. Ogier in his rage slew the queen's nephew Loher, and would have slain Charlemagne himself but for the timely intervention of the knights. In his stronghold at Castelfort he resisted the imperial forces for seven years, but was at last taken prisoner. He was eventually released to fight the Saracen chief Bréhus or Braihier, who had defied Charlemagne to single combat. Ogier, after marrying an English princess, received from Charlemagne the fiefs of Hainaut and Brabant.

BIBLIOGRAPHY.—*La Chevalerie Ogier de Danemarche,* ed. J. B. Barrois (2 vols., 1842); *Les Enfances Ogier,* ed. A. Scheler (Brussels, 1874); *Hist. litt. de la France,* vols. xx. and xxii., P. Paris, *Recherches sur Ogier le Danois,* Bibl. de l'École des Chartes, vol. iii. (1841–42); G. Paris, *Hist. poét. de Charlemagne* (1856); L. Pio, *Sagnet om Holger Danske* (1870); L. Gautier, *Les Epopées françaises* (2nd ed., 1878–96); H. L. Ward, *Catalogue of Romances,* vol. i. pp. 604–610 (1883); P. Rajna, *Le Origini dell' epopea francese* (1884); C. Voretzsch, *Über die Sage von Ogier dem Dänen* (Halle, 1891); S. Riezler, "Naimes v. Bayern und Ogier der Däne" in *Sitzungsberichte der phil. hist. Classe der kl. Akad. d. Wiss.,* vol. iv. (Munich, 1892).

**OGILBY, JOHN** (1600–1676), British writer, was born in or near Edinburgh in Nov. 1600. He accompanied Thomas Wentworth, earl of Strafford, when he went to Ireland as lord deputy, and became tutor to his children. Strafford made him deputy-master of the revels, and he built a little theatre in St. Werburgh Street, Dublin, which was very successful. The outbreak of the Civil War ruined his fortunes, and in 1646 he returned to England. Finding his way to Cambridge, he learned Latin from kindly scholars who had been impressed by his industry. He then ventured to translate Virgil into English verse (1649–50), which brought him a considerable sum of money. Ogilby learnt Greek from David Whitford, who was usher in the school kept by James Shirley the dramatist. *Homer his Iliads translated . . .* appeared in 1660, and in 1665 *Homer his Odysses translated . . .* Anthony à Wood asserts that in these undertakings he had the assistance of Shirley. At the Restoration Ogilby received a commission for the "poetical part" of the coronation. His property was destroyed in the Great Fire of 1666, but he rebuilt his house in Whitefriars, and set up a printing press, from which he issued many magnificent books; the most important were a series of atlases by Hollar and others. He died in London on Sept. 4, 1676.

Ogilby also translated the fables of Aesop, and wrote three epic poems. His bulky output was ridiculed by John Dryden in *MacFlecknoe* and by Alexander Pope in the *Dunciad.*

**OGILVIE** (or OGILBY), **JOHN** (*c.* 1580–1615), English Jesuit, was born in Scotland and educated mainly in Germany, where he entered the Society of Jesus, being ordained priest at Paris in 1613. As an emissary of the society he returned to Scotland in this year disguised as a soldier, and in Oct. 1614 he was arrested in Glasgow. He defended himself stoutly when he was tried in Edinburgh, but he was condemned to death and was hanged on Feb. 28, 1615.

*A True Relation of the Proceedings against John Ogilvie, a Jesuit* (Edinburgh, 1615), is usually attributed to Archbishop Spottiswoode. *See* also James Forbes, *L'Église catholique en Ecosse: martyre de Jean Ogilvie* (Paris, 1885); and W. Forbes-Leith, *Narratives of Scottish Catholics* (1885).

**OGILVY,** the name of a celebrated Scottish family of which the earl of Airlie is the head. The family was probably descended from a certain Gillebride, earl of Angus, who received lands from William the Lion. The earldom of Findlater, bestowed on James Ogilvy, Lord Ogilvy of Deskford, in 1638, was united in 1711 with the earldom of Seafield and became dormant after the death of James Ogilvy, the 7th earl, in October 1811.

James Ogilvy (*c.* 1593–1666), was created earl of Airlie by Charles I. at York in 1639. A loyal partisan of the king, he joined Montrose in Scotland in 1644 and was one of the royalist leaders at the battle of Kilsyth. The destruction of the earl's castles of Airlie and of Forther in 1640 by the earl of Argyll, who "left him not in all his lands a cock to crow day," gave rise to the song, "The bonny house o'Airlie." His eldest son, James, the 2nd earl (*c.* 1615–*c.* 1704) also fought among the royalists in Scotland. He was three times a prisoner of the English, and was in the Tower of London during most of the years of the Commonwealth. This earl's grandson, James Ogilvy (d. 1731), took part in the Jacobite rising of 1715 and was attainted; consequently on his father's death in 1717 he was not allowed to succeed to the earldom, although he was pardoned in 1725. When he died his brother John (d. 1761) became earl *de jure,* and John's son David (1725–1803) joined the standard of Prince Charles Edward in 1745. He was attainted, and after the defeat of the prince at Culloden escaped to Norway and Sweden, afterwards serving in the French army, where he commanded *"le régiment Ogilvy"* and was known as *"le bel Ecossais."* In 1778 he was pardoned and was allowed to return to Scotland, and his family became extinct when his son David died unmarried in April 1812. After this event David's cousin, another David Ogilvy (1785–1849), claimed the earldom. In 1826 the attainders were reversed by act of parliament and David (d. 1849) became 6th earl of Airlie. The title remains in the hands of his descendants.

*See* Sir R. Douglas, *Peerage of Scotland,* new ed. by Sir J. B. Paul (1904 fol.).

**OGIVE,** in architecture, the diagonal ribs of a Gothic vault; in French usage applied to any pointed arch. As a result Gothic architecture is frequently termed in France *le style ogival.*

**OGLESBY,** a city of La Salle county, Illinois, U.S.A., 100 mi. S.W. of Chicago, on the Illinois river at the mouth of the Vermilion, opposite La Salle and Peru. It is on federal highway 51, and is served by the Chicago, Milwaukee, St. Paul and Pacific, the Illinois Central, and (through La Salle and Peru) the Burlington Route railways. Pop. (1920), 4,135 (35% foreign-born white); and by the federal census of 1940, 3,938. It is part of the Tri-City industrial district, engaged chiefly in the manufacture of cement

and coal-mining. The city was founded in 1856 and incorporated in 1903. Until 1914 it was called Portland.

**OGLETHORPE, JAMES EDWARD** (1696–1785), English general and philanthropist, the founder of the State of Georgia, was born in London on Dec. 21, 1696, the son of Sir Theophilus Oglethorpe (1650–1702) of Westbrook Place, Godalming, Surrey. He entered Corpus Christi college, Oxford, in 1714, but in the same year joined the army of Prince Eugène. He became aide-de-camp to the prince, and served in the campaign against the Turks, 1716–17, more especially at the siege and capture of Belgrade. After his return to England he was in 1722 elected member of parliament. With the idea of providing an asylum for persons who had become insolvent, and for oppressed Protestants on the continent, he projected the settlement of a colony in America between Carolina and Florida (*see* GEORGIA). In 1745 Oglethorpe was promoted to the rank of major-general. His conduct in connection with the Scottish rebellion of that year was the subject of a court-martial, but he was acquitted. In 1765 he was breveted general. He died at Cranham Hall, Essex, in 1785.

Sir Theophilus Oglethorpe, the father, had four sons and four daughters, James Edward being the youngest son, and another James having died in infancy. Of the daughters, Anne Henrietta, Eleanor and Frances Charlotte (Bolingbroke's "Fanny Oglethorpe") may be specified as having played rather curious parts in the Jacobitism of their time; their careers are described in the essay on "Queen Oglethorpe" by Miss A. Shield and A. Lang, in the latter's *Historical Mysteries* (1904). *See* also Lives by Harris (1841), Wright (1867), Bruce (1890), and Harriet C. Cooper (1904).

**OGOWÉ,** a river of West Central Africa, about 750 m. long, rising in 3° S. in the highlands known as the Crystal range, and flowing north-west and west, reaches the Gabun coast of the Atlantic by Cape Lopez, a little south of the equator. Here it forms a considerable delta. In its upper course the Ogowé is much obstructed by rapids as it descends the successive steps of the tablelands. It breaks through the outer chains of the mountainous zone, between 10¾° and 11¾° E. In its lower course the river passes through a lacustrine region in which it sends off secondary channels. These channels, before reuniting with the main stream, traverse a series of lakes, one north, the other south, of the river. These lakes are natural regulators of the river when in flood. Of its tributaries the chief are the Lolo, which joins on the south bank in 12° 20′ E., and the Ivindo, which enters the Ogowé a few miles lower down. Below the Ivindo the largest tributaries are the Ofowé, 400 yd. wide at its mouth (11° 47′ E.), but unnavigable except in the rains, and the Ngunye, the largest southern tributary, navigable for 60 m. to the Samba or Eugénie Falls. Apart from the narrow coast plain the whole region of the lower Ogowé is densely forested and the predominant industry of the region is the timber trade. The fauna includes the gorilla and chimpanzee.

The Ogowé rises in March and April, and again in October and November; it is navigable for steamers at low-water as far as the junction of the Ngunye, and at flood time for a distance of 235 m. to N'Jole. The first person to explore the valley of the Ogowé was Paul du Chaillu, who travelled in the country during 1857–59. The Ogowé lies wholly in French Equatorial Africa (*q.v.*).

For a vivid account of life on the lower Ogowé *see* A. Schweitzer, *On the Edge of the Primeval Forest* (1922).

**O'GRADY, STANDISH JAMES** (1846–1928), Irish man of letters, was born at Castletown, Co. Cork, on Sept. 18, 1846, the son of a Protestant clergyman, studied at Trinity college, Dublin, and after taking his degree in 1868 was called to the bar in 1872. He died at Shanklin, Isle of Wight, on May 18, 1928. O'Grady was one of the pioneers of the Celtic renaissance in Ireland. His interest in Irish antiquities was roused by the reading of O'Halloran's *History of Ireland,* and he set himself to awaken living interest in the Irish past by telling over again the Irish legends of the heroic age. He himself believed in the historical existence of the heroes of Irish epic, being convinced that primitive singers could not have invented them. His first work, *History of Ireland: the Heroic Period* (Dublin, 1878), was republished, in part, under the title of *Cuculain: an Epic,* in London (1882), and was succeeded by *History of Ireland: Cuculain and his Contemporaries* (Dublin, 1880). From these he developed his cycle of romantic histories: *Finn and his Companions* (1892), *The Coming of Cuculain* (1894), *In the Gates of the North* (Kilkenny, 1901), and the *Passing of Cuculain* (Dublin, 1917). He began a *History of Ireland, Critical and Philosophical,* of which the first volume only was written (Dublin, 1881). He also wrote *Ulrick the Ready* (1896); *The Bog of Stars* (1893); *Red Hugh's Captivity* (1889).

*See* Standish O'Grady, *Selected Essays and Passages* (Dublin, 1918).

**OGYGES** or **OGYGUS,** in Greek mythology, the first king of Thebes. During his reign came a great deluge (*see* DEUCALION); this is one of the two Greek versions of the widespread flood-legend. Ogyges is variously described as a Boeotian autochthon, as the son of Cadmus, or of Poseidon.

**O'HARA, THEODORE** (1820–1867), U.S. lawyer, soldier, journalist and poet, was born Feb. 11, 1820. He served with distinction in the U.S. army in 1846–48 during the Mexican War, took part in the filibustering expeditions to Cuba, and was with the Confederate army during the U.S. Civil War. He wrote the well-known poem "The Bivouac of the Dead," in memory of soldiers who died at the battle of Buena Vista.

**O'HIGGINS, BERNARDO** (1776–1842), soldier and statesman, head of the first permanent national Government of Chile, was born at Chillán on Aug. 20, 1776, the natural son of the Irishman Ambrosio O'Higgins, governor of Chile (1778–95), and viceroy of Peru (1795–1801). Educated in England and Spain, he returned to Chile in 1802, and on the outbreak of the nationalist revolution in 1810 joined the party of Martínez de Rozas and distinguished himself in the early fighting against the royalists. In Nov. 1813, he was appointed to supersede J. M. Carrera in command of the patriot forces, and the rivalry of Carrera eventually resulted in the defeat of the national troops at Rancagua, in Oct. 1814. O'Higgins fled with most of the patriots across the Andes to Mendoza, where José de San Martín (*q.v.*) was preparing a force for the liberation of Chile and Peru. San Martín espoused O'Higgins's part against Carrera, and O'Higgins readily consented to serve under San Martín. His loyalty and energy were an important factor in the success of the campaign, especially in the decisive victories of Chacabuco (Feb. 1817) where O'Higgins's cavalry charge carried the day, and of Maipú (April 1818). After the battle of Chacabuco O'Higgins was entrusted with the administration of Chile; he kept order in the country and co-operated loyally with San Martín in his preparation for the invasion of Peru. But once the overthrow of the Spanish supremacy in Peru had freed Chile from fear of attack, agitation broke out for constitutional government. O'Higgins called a congress which adopted a Constitution (1822) giving him dictatorial powers. The discontent, however, continued; risings occurred in Concepción and Coquimbo, and on January 28, 1823, O'Higgins gave up his post of director-general. He retired to Peru where he was granted an estate, and lived quietly until his death on Oct. 24, 1842. In 1839 the Chilean senate had restored him to his honours and his military rank.

**O'HIGGINS, KEVIN CHRISTOPHER** (1892–1927), Irish statesman, youngest son of Dr. T. Higgins (who was murdered by unknown men in 1923), of Stradbally, Queen's County, was born in 1892 at Stradbally and educated at Clongowes and St. Patrick's College, Carlow, and in the National University of Ireland. He was articled to his uncle Maurice Healy, a solicitor in Cork. After the Easter rebellion in 1916 he joined the Sinn Fein movement, and was interned. While still in gaol he was elected member for Queen's County (1918). He acted as assistant minister for local government to Mr. Cosgrave, and in 1922 became a member of the provisional government as minister of justice and vice president of the Executive Council. As minister of justice he established the Civic Guard, and put down disorder with a strong hand. He was called to the Irish bar in 1923, and in June 1927 added to his existing duties those of minister for external affairs.

In the midst of the controversy with De Valera over the taking

of the oath in the Dail he was waylaid by three armed men while on his way to mass at Booterstown, outside Dublin, and shot dead (July 10, 1927). It was believed that the crime was connected with the fact that, as minister of justice O'Higgins had been largely responsible for the 77 executions which were carried out in the course of the civil war. He married Bridget Mary Cole, of Dublin, in 1921, who, with the two children of the marriage, survived him.

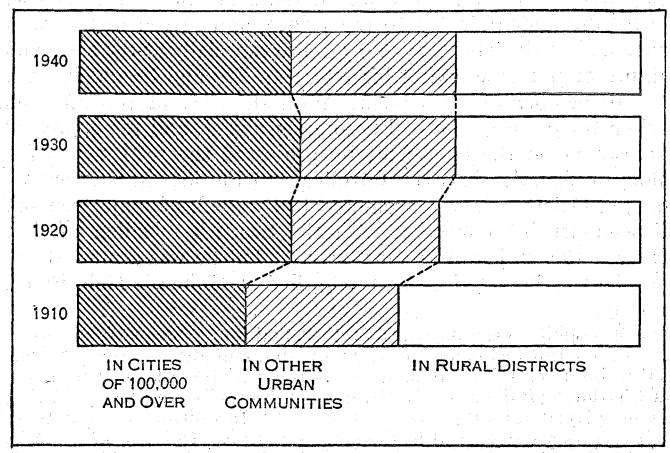
**O'HIGGINS,** an inland province of central Chile, bounded north by Santiago, east by Argentina, and south and west by Colchagua. Area, 2,746 sq.mi.; population (1940), 200,297. Named after Bernardo O'Higgins, the first president of the Republic of Chile, the province was included with that of Colchagua from 1928 to 1933, inclusive. Most of the western half of the province lies in the Central valley of Chile whose surface is interrupted in many places by the alluvial piedmont slopes of the Andes and the transverse valleys of perennial streams which have their sources in the snow-capped summits of the Cordillera. The climate of the western part of the province is typically Mediterranean, with summers that are hot and rainless, and winters that are mild and rainy. Eastward the climate reflects the control of increasing altitude; temperatures are lower, rainfall is heavier, and much of the precipitation which falls in the winter is in the form of snow. The streams which give life to the Central valley during the long, dry summer are fed by the melting snows of the high Andes. Under irrigation the valley lands are highly productive, although only a small fraction of the total area is under cultivation. The principal crops on irrigated lands are wheat, corn, barley, oats, alfalfa, clover, legumes and grapes; the bulk of the nonirrigated land is pasturage having a low carrying capacity. Mining is carried on in the eastern highlands, the province being widely known for its production of copper, especially that of the El Teniente mines of the Braden Copper company.

Rancagua, the capital of the province (population 31,018 in 1940), is in central O'Higgins 51 mi. south of the nation's capital on the State railways. Rengo, the second largest city (6,730 in 1940), is about 20 mi. S.S.W. of Rancagua. Both cities are centres of commerce for the surrounding agricultural districts. The province is particularly noted for its hot springs and mineral waters, and many popular health resorts are within relatively short distances from the capital. Termas de Cauquenes (Cauquenes hot springs), significant in the history of the emancipation of Chile, and the most important centre of mineral waters in the country, is slightly more than 80 mi. by car E.S.E. from Rancagua. Also famous are the mineral waters of El Teniente and Baños de Cachantun, the latter being only 15 mi. from the provincial capital. (R. W. Rd.)

**OHIO,** popularly known as the "Buckeye State," is a north central state of the United States of America, lying between latitudes 38° 27′ and 41° 57′ N. and between longitudes 80° 34′ and 84° 49′ W. of Greenwich. It is bounded north by Michigan and Lake Erie, east by Pennsylvania and by the Ohio river, which separates it from West Virginia, south by the Ohio river which separates it from West Virginia and Kentucky and west by Indiana. The state is nearly square in shape, its extremes from north to south and from east to west being about 210 mi. and 220 mi. respectively. The total area is 41,222 sq.mi., of which 100 sq.mi., exclusive of its Lake Erie jurisdiction, are water surface.

**Physical Features.**—The state lies on the borderland between the Prairie plains and the Allegheny plateau. The disturbances among the underlying rocks of Ohio have been slight, and originally the surface was a plain only slightly undulating; stream dissection changed the region to one of numberless hills and valleys; glacial drift then filled up the valleys over large broken areas, forming the remarkably level till plains of northwestern Ohio; but at the same time other areas were broken by the uneven distribution of the drift, and southeastern Ohio, which was unglaciated, retains its rugged hilly character, gradually merging with the typical plateau country farther southeast. The average elevation of the state above the sea is about 850 ft. but extremes vary from 425 ft. at the confluence of the Great Miami and Ohio rivers in the southwest corner, to 1,550 ft. on the summit of Hogues hill about 1½ mi. east of Bellefontaine in the west central part.

The main water parting is formed by a range of hills which are composed chiefly of drift and extend west-southwest across the state from Trumbull county in the northeast to Drake county, or about the middle of the west border. North of this water parting the rivers flow into Lake Erie; south of it into the Ohio river. Passing the village of Cuyahoga Falls the Cuyahoga river descends more than 200 ft. in three miles; a part of its course is between walls of sandstone 100 ft. or more in height, and near its mouth, at Cleveland, its bed has been cut down through 60 ft. of drift. In the middle north part of the state the Black, Vermilion and Huron rivers have their sources in swamps on the water parting and flow directly to the lake through narrow valleys. The till plains of northwestern Ohio are drained chiefly by the Maumee and Sandusky rivers, with their tributaries.




DISTRIBUTION OF POPULATION BETWEEN URBAN AND COUNTRY DISTRICTS, 1910–40

In the southwest the Great Miami and Little Miami rivers have uniform falls through basins that are decidedly rolling and that contain the extremes of elevation for the state. The central and south middle part is drained by the Scioto river and its tributaries. Its basin is about 40 mi. wide and only moderately rolling, but toward the mouth of the river the basin becomes narrow and is shut in by high hills. In the eastern part of Ohio the Muskingum river and its tributaries drain an area of about 7,750 sq.mi. or nearly one-fifth of the entire state. The Ohio flows for 436 mi. through a narrow valley on the southern border of the state, and Lake Erie forms the northern boundary for a distance of 230 miles. At the west end of the lake are Sandusky and Maumee bays, each with a good natural harbour. There are several small lakes on the water parting, especially in the vicinity of Akron and Canton.

**Fauna and Flora.**—Opossums, skunks and raccoons are plentiful in some parts of the state; and rabbits and squirrels are still numerous. Most of the songbirds and birds of prey of the temperate zone are plentiful. Whitefish, bass, trout and pickerel are important as food from the waters of Lake Erie, and the land streams and lakes are stocked with game fish.

Ohio is known as the "Buckeye State" from the prevalence of the buckeye chestnut (*Aesculus glabra*). The state was originally covered with a dense forest mostly of hardwood timber, and although the merchantable portion of this has been practically all cut away, there are still undergrowths of young timber and a great variety of trees. The white oak is the most common, but there are 13 other varieties of oak, six of hickory, five of ash, five of poplar, five of pine, three of elm, three of birch, two of locust and two of cherry. Beech, black walnut, butternut, chestnut, catalpa, hemlock and tamarack trees are also common. Wild flowers are well represented. Of native ferns there are many.

**Climate.**—The mean annual temperature of Ohio is about 51° F; in the north, 49.5°, and in the south, 53.5°. But except where influenced by Lake Erie the temperature is subject to great

extremes; at Coalton, Jackson county, in the southeast part of the state, the highest recorded range of extremes is from 104° to −38° or 142°; at Wauseon, Fulton county, near the northwest corner, it is from 104° to −32° or 136°; while at Toledo, on the lake shore, the range is only from 99° to −16° or 115°. July is the warmest month, and in most parts of the state January is the coldest; in a few valleys, however, February has a colder record than January. The normal annual precipitation for the entire state is about 39 inches. It is greatest in the southeast and least in the northwest. At Marietta, for example, it is 42.1 in., but at Toledo it is only 30.8 inches. The prevailing winds in most parts are westerly, but sudden changes, as well as the extremes of temperature, are caused mainly by the frequent shifting of the wind between northwest and southwest.

**Soil.**—In the driftless area, the southeast part of the state, the soil is largely a decomposition of the underlying rocks, and its fertility varies according to their composition; there is considerable limestone in the east central portion, and this renders the soil very productive. In the valleys also are strips covered with a fertile alluvial deposit. In the other parts of the state the soil is composed mainly of glacial drift, and is generally deep and fertile. It is deeper and more fertile, however, in the basins of the Great Miami and Little Miami rivers, where there is a liberal mixture of decomposed limestone and where extensive areas with a clay subsoil are covered with alluvial deposits.

**Population.**—The population of Ohio in 1940 was 6,907,612. This figure represents an increase of 3.9% over the population in 1930. The population per square mile was 168 as compared with 44.2 for the United States as a whole. Of the 1940 population, 4,612,986, or 66.8%, lived in urban places, that is, in cities and villages of 2,500 or more. The number of occupied dwelling units returned in the housing census of 1940 was 1,898,212, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 3.9 in 1930 to 3.6 in 1940. The white population of Ohio formed 95.1% of the total in 1940, as compared with 95.3% in 1930, practically all the nonwhite population being Negro. The number of males per 100 females in the population of the state was 100.5. The population of the state and its principal cities is as follows:

| Area | Population | | | Per cent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 6,907,612 | 6,646,697 | 5,759,394 | 3·9 | 15·4 |
| Urban | 4,612,986 | 4,507,371 | 3,677,136 | 2·3 | 22·6 |
| Rural | 2,294,626 | 2,139,326 | 2,082,258 | 7·3 | 2·7 |
| Per cent urban | 66·8 | 67·8 | 63·8 | .. | .. |
| Principal cities: | | | | | |
| Cleveland | 878,336 | 900,429 | 796,841 | −2·5 | 13·0 |
| Cincinnati | 455,610 | 451,160 | 401,247 | 1·0 | 12·4 |
| Columbus | 306,087 | 290,564 | 237,031 | 5·3 | 22·6 |
| Toledo | 282,349 | 290,718 | 243,164 | −2·9 | 19·6 |
| Akron | 244,791 | 255,040 | 208,435 | −4·0 | 22·4 |
| Dayton | 210,718 | 200,982 | 152,559 | 4·8 | 31·7 |
| Youngstown | 167,720 | 170,002 | 132,358 | −1·3 | 28·4 |
| Canton | 108,401 | 104,906 | 87,091 | 3·3 | 20·5 |
| Springfield | 70,662 | 68,743 | 60,840 | 2·8 | 13·0 |
| Lakewood | 69,160 | 70,509 | 41,732 | −1·9 | 69·0 |

**Government.**—Ohio is governed under the constitution of 1851 as revised by a constitutional convention in 1912 and subsequently amended. An amendment may be proposed at any time by either branch of the general assembly, and if after being approved by ⅗ of the members of both branches it is also approved at a general election by a majority of those voting on the question, it is declared adopted. Under the constitutions of 1802 and 1851 the suffrage was limited to "white male" citizens of the United States, but by an amendment approved in 1923 these words were stricken out and the constitution was made to conform with the 15th and 19th amendments to the federal constitution. The right of suffrage is bestowed on every United States citizen 21 years of age or over (with certain restrictions), provided he or she has resided within the state one year, in the county 30 days and in the voting precinct 28 days previous to the election. A system of permanent registration was established in 1929. Under this law registration is mandatory in all cities of 16,000 or more population. Any municipality of less than 16,000 may by ordinance become a registration municipality. Voters once registered are not required to register again except in case of removal, change of name, etc.

Registration may be required in territory adjacent to a registration city when deemed necessary to prevent fraud in elections. The constitution requires that all elections be by ballot. Constitutional amendments, approved in 1912, provide for the use of the initiative and referendum in legislation.

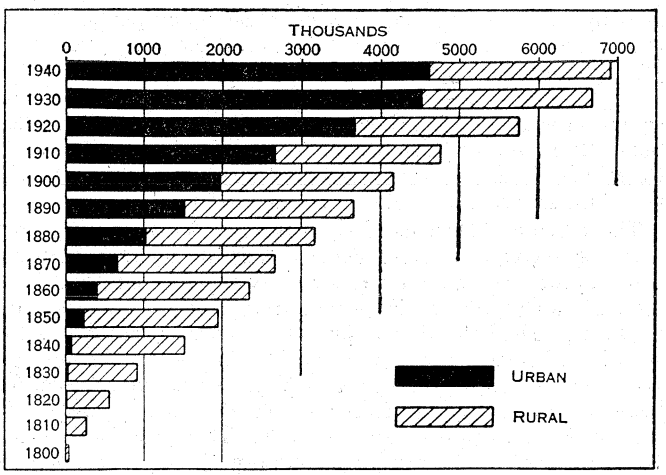
The executive department consists of a governor, lieutenant governor, secretary of state, auditor, treasurer and attorney-general. All are elected in November of even-numbered years for a term of two years; an exception is the auditor, who serves for four years. The right of veto was not given the governor until the adoption of a constitutional amendment in 1903. Bills must be vetoed in their entirety, except that in appropriation bills specific, individual items may be vetoed; a ⅗ vote of all the members of each house is required for re-passage. The governor has full power to grant pardons and reprieves except for treason or conviction after impeachment by the general assembly. If he die in office, resign or be impeached and removed from office, the officers standing next in succession are the lieutenant governor, the president of the senate and the speaker of the house of representatives in the order named. By an administrative reorganization act, passed in 1921, 37 departments, commissions, etc., were combined into eight departments—finance, commrece, highways and public works, agriculture, health, industrial relations, education and public welfare—in which the former departments are known as divisions. Each department has at the head a director who is appointed by the governor and serves during his pleasure; each departmental director receives an annual salary of $6,500. In 1927 the division of public works was separated from the department of highways and made the ninth department with a director at its head. The system of administration thus established is closely analogous to that of the federal government.

The general assembly consists of a senate and a house of representatives, the members of which are elected for terms of two years. The ratio of representation in the senate is obtained by dividing the total population of the state by 35, the ratio in the house by dividing the population by 100. The membership in each house, however, is above these figures (36 in the senate and 138 in the house in 1941), because of a system of fractional representation and of the constitutional amendment of 1903 which allows each county at least one representative in the lower house. The constitution provides for a reapportionment every 10 years beginning 1861. Biennial sessions are held beginning the first Monday in January of odd-numbered years. The constitution prohibits special acts conferring corporate powers, retroactive legislation, legislation impairing obligation of contracts and legislation levying a tax on state, municipal and public school bonds outstanding Jan. 1, 1913, and it limits the amount and specifies the character of public debts which the legislature may contract.

The judicial department in 1941 was composed of a supreme court of seven judges, nine judicial courts of appeals of three judges each, courts of common pleas, and probate, juvenile, justice of the peace and municipal courts. Under the constitution of 1802 judges were chosen by the legislature, but since 1851 they have been elected by direct popular vote—the judges of the supreme court being chosen at large. They are removable by a concurrent resolution approved by a ⅔ majority in each house of the general assembly, by impeachment, and by special law.

The terms of supreme court judges, judges of the courts of appeals and of the courts of common pleas are six years; probate judges and justices of the peace, four years.

The principal units of local government are the county, the township, the city and the village. The chief county authority is the board of commissioners of three members elected for terms of four years. The other officials are the auditor and engineer, sheriff, treasurer, recorder, coroner, clerk of courts and prosecuting attorney, elected for four years. The county also has a board of education elected by the qualified voters of the county school district. This board appoints the county superintendent of




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF OHIO, 1800–1940

schools who has supervisory jurisdiction within the district. The county school district includes all rural and village districts within the county but excludes city and exempted village districts. The chief township authority is a board of trustees of three members, elected by popular vote for four years. The other township officials are the clerk, justices of the peace and constables. Under the constitution of 1802, municipal corporations were established by special legislation. The constitution of 1851, however, provided for a general law, and the legislature in 1852 enacted a "general municipal corporation act," the first of its kind in the United States. The system was changed again in 1912 when the so-called "home rule" amendment was put into the constitution. This allows each municipality to make its own charter or constitution. As a result, a variety of charters exist. Municipalities with more than 5,000 population are cities; all others are villages. State and county officials as well as U.S. senators and representatives are nominated at primaries held in even-numbered years on the second Tuesday in August (second Tuesday in May in presidential election years).

**Finances.**—The ordinary expenses of the state government are met entirely by indirect taxation. There was, however, in 1932, a state levy of .20 mills for the redemption of the $25,000,000 issue of World War compensation bonds. These bonds were the last bonded indebtedness of the state; the only outstanding debt is the non-interest bearing debt of $5,542,000 proceeding from the sale of lands given by congress for educational purposes. The chief sources of the general revenue fund are a one-tenth of 1% tax on the asset valuation of domestic and foreign corporations, a premium tax on insurance companies, a 4% gross earnings tax on steam railways, a tax of 1·35% of the gross receipts of miscellaneous utilities, an inheritance tax, assessments on banks and finance companies, a franchise tax on new corporations, a 1·2% gross earnings tax on electric railways, a cigarette tax, a 3% retail sales tax, a liquid fuel tax and other receipts. In 1940 the net receipts for this fund were $150,624,606, the disbursements $155,328,263, and the balance at the end of the fiscal year $16,676,270. The gasoline tax, automobile registration fees and certain other revenues are handled as separate funds. The disbursements of the highway department for the fiscal year were $43,500,000. The total revenue derived from tax levies and assessments on real estate and public utilities for all divisions for the tax year ending Dec. 31, 1939 was $199,570,315.75. Of this total tax $44,002,011.45 was regular and special county; $5,363,814.34 regular and special township; $72,457,000.02 school and $77,747,489.94 regular and special municipal. There were on Dec. 31, 1940, 454 commercial and savings banks operating in the state under state law. Their total resources were $1,819,764,592 and deposits $1,639,636,578. As of Oct. 1939 there were 244 national banks in Ohio with assets of $1,251,027,000.

**Education.**—Ohio has an excellent system of public education extending from the kindergarten through college and university work. The basis of Ohio's educational system was laid by an act of congress in 1785 setting apart 1 sq.mi. in each township of 36 sq.mi. for the support of education. After the reorganization of the administrative departments in 1921, the superintendent of public instruction became the chief administrative officer of the department of education with the title director of education. The tax limitation amendment curtailed the revenues of the public schools and in 1935 the school foundation was established. Under this system the state gives to the local school districts each year, subject to definite restrictions, sufficient funds to bring the schools of the state up to certain standard specifications. The cost to the state is about $50,000,000 per annum. According to the annual report of the director of education, the total public school operating expenditures for the year 1939–40 were $107,325,076, or $16.15 per capita of total population and $87.68 per capita of enrolment. The public school enrolment for that school year was 1,224,013. Of this total, 813,679 were in the kindergarten and elementary grades, 487,403 were in secondary schools and 22,931 were in special schools. The parochial school enrolment for the same year was 133,287 in the elementary grades and 22,386 in the secondary schools. The private schools had an enrolment of 2,770 in the elementary grades and 3,633 in the secondary schools. The percentage of illiteracy in Ohio is very low; it was 2·3% in 1930. All children between the ages of 6 and 16 are required to attend school for the full term.

The institutions of higher education supported in whole or in part by the state are: Ohio university at Athens, founded in 1804 on the proceeds derived from two townships granted by congress to the Ohio company; Miami university (chartered in 1809) at Oxford, which received the proceeds from a township granted by congress in the Symmes purchase; Ohio State university (1873) at Columbus, which received the proceeds from the lands granted by congress under the act of 1862 for the establishment of agricultural and mechanical colleges, and reorganized as a university in 1878. Bowling Green State university and Kent State university were normal schools prior to 1935. Wilberforce university, for Negroes (1856), at Wilberforce, is under the African Methodist Episcopal church; Akron, Cincinnati, Cleveland, Dayton and Toledo support universities. Among the numerous denominational or privately endowed colleges and universities within the state are Western Reserve university at Cleveland, Oberlin college at Oberlin and Ohio Wesleyan university at Delaware.

**Charities and Corrections.**—The state charitable and penal institutions in 1941 were under the general control of the department of public welfare, this department having superseded the board of administration on July 1, 1921. The director of public welfare has control of hospitals for the insane at Athens, Cleveland, Columbus, Dayton, Lima, Cincinnati (the Longview state hospital), Massillon and Toledo; a hospital for epileptics at Gallipolis; a sanatorium for tubercular patients at Mt. Vernon; an institution for the feeble-minded at Columbus; a soldiers' and sailors' home at Sandusky; the Madison home at Madison; the bureau of juvenile research at Columbus; the commission for the blind at Columbus; an industrial home for boys at Lancaster and a similar institution for girls at Delaware; the state penitentiary at Columbus; and others. The state school for the blind and the state school for the deaf were transferred to the department of education in 1927.

**Agriculture.**—Ohio, in 1940, ranked sixth among the states in the total value of its agricultural products. The estimated value of crops and livestock products in that year was $329,255,000, as compared with $309,095,000 in 1939, $308,336,000 in 1938 and $363,235,000 in 1937. Government payments of $16,971,000 in 1940 brought total income of Ohio farmers in that year to $346,226,000. Of its total land surface (26,073,600 ac.), 22,858,000 ac. or 87·7% were included in farms in 1935. The number of farms in the state increased steadily from 1930 to 1935 the total in the former year being 219,296 as compared with 255,146 in the latter year. In acreage per farm, however, there was a large decrease. The average in 1930 was 98·1, and in 1935 it was 89·6. The total value of land and buildings in 1935 was $1,277,556,000 as compared with $1.603,031,000 in 1930.

During the decade 1930–40 the rural population of Ohio (persons living on farms or in cities with populations of less than 2,500) increased by 7·3% to a total of 2,294,626 (33·2% of the total population of the state).

There is a great variety of produce in the state, but the principal crops are ordinarily corn (maize), hay, wheat, oats, potatoes, soybeans, apples, tobacco and barley. In 1940 the acreage devoted to the principal crops was as follows: corn, 3,220,000; tame hay, 2,923,000; wheat, 1,960,000; soybeans, 1,037,000; oats, 1,020,000; potatoes, 118,000; rye, 99,000; barley, 55,000; tobacco, 30,000. The increase in acreage planted to soybeans was a notable agricultural change of the decade 1930–40 in Ohio, as in other midwestern states.

Production of the leading crops in 1940 was estimated as follows (averages for 1929–38 are in parentheses): corn, 120,750,000 bu. (134,812,000); tame hay, 4,241,000 tons (2,979,000); wheat, 42,137,000 bu. (40,211,000); soybeans for beans 8,400,000 bu. (1,713,000); soybeans for hay, 436,000 tons (181,000); oats, 44,880,000 bu. (44,220,000); potatoes, 11,800,000 bu. (12,429,000); rye, 1,683,000 bu. (903,000); barley, 1,650,000 bu. (1,278,000); tobacco, 26,430,000 lb. (32,924,000); apples, 5,074,000 bu. (4,698,000 bu. average for 1934–38).

The livestock and poultry products of Ohio are of great importance. The aggregate value of the five principal species of livestock in Ohio on Jan. 1, 1941 was estimated at $172,723,000, as compared with the ten-year (1930–39) average of $164,030,000. Horses and colts on Jan. 1, 1941 numbered about 441,000, valued at $34,965,000. Mules and mule colts numbered 29,000, valued at $2,504,000. Cattle and calves numbered 2,133,000, valued at $98,792,000. Of the total number of cattle, 1,064,000 were cows and heifers kept for milk. Hogs and pigs were estimated at 3,117,000, valued at $21,659,000; sheep and lambs, 2,501,000, valued at $14,803,000. The number of chickens was estimated at 21,275,000, valued at $15,318,000; turkeys, 171,000, valued at $436,000.

**Mineral Products.**—The mineral wealth of Ohio is well distributed in both area and products. In 1938 pig iron, bituminous coal, coke, clay and natural gas were the chief products, but the state also had considerable production in cement, ferro-alloys, lime, petroleum, salt, sand and gravel and stone. The total production for 1938 was valued at $104,812,531, as compared with $131,025,104 in 1937. In both years Ohio ranked tenth among the states in the total value of its mineral production.

The fire-clay mines of Tuscarawas, Jefferson, Columbiana, Stark and Carroll counties supply the raw material for the greater part of the state's pottery, tile and brick industry. The coal fields, comprising a total area of 10,000 sq.mi. or more, are in the eastern half of the state. In 1938, 18,590,618 short tons were mined, as compared with 25,177,867 in 1937 and 20,610,000 in 1935. Natural gas is found in the eastern, central and northwestern parts of the state; production in 1938 was 35,257,000,000 cu.ft.

The output of pig iron, Ohio's leading mineral in 1938, was 4,186,217 long tons valued at $85,186,824. There were 3,699,995 short tons of coke, valued at $18,413,808, produced in Ohio during 1938. In 1896 Ohio produced 23,941,169 bbl. of petroleum, or 39% of the total output in the United States; by 1938 this amount had fallen to 3,298,000 bbl.—only a fraction of 1% of the nation's aggregate production.

Some of the best sandstone in the United States is obtained from Cuyahoga and Lorain counties; it is exceptionally pure in texture and is durable. From the sandstone known as Berea grit, a large portion of the nation's grindstones, pulpstones and oilstones is obtained. The output of the stone quarries in 1938 was 9,888,730 short tons, valued at $8,970,552. Other important mineral products with their values in 1938 were as follows: cement, $7,094,745; clay products, $17,679,691; ferro-alloys, $2,793,907; lime, $6,658,853; salt, $2,562,620; and sand and gravel, $5,635,217.

**Manufactures.**—Ohio is pre-eminently a manufacturing state. The output of its factories in 1925 was exceeded in value by those of New York, Pennsylvania and Illinois only. The value of products manufactured in the state increased from $748,670,855 in 1900 to $5,995,007,000 in 1929, then decreased to $3,660,903,592 in 1935, or a decrease of approximately 40% during the six-year period 1929–35. Within the next two years recovery was rapid, however, so that by 1937 the value of products amounted to $5,099,816,893, of which $2,793,189,697 represented cost of materials, energy, etc., and $2,306,627,196 represented value added by manufacture. Wages paid in 1937 totalled $957,650,237.

The most important manufacturing industry is that of steel and rolling-mill products—an industry which was first established near Youngstown in 1804. The value of the output increased from $138,935,256 in 1900 to $733,351,272 in 1937. In addition, blast-furnace products to the value of $154,655,026 were manufactured in Ohio in the latter year. The industry second in importance was the manufacture of rubber tires and inner tubes for motor vehicles. This industry, in 1937, employed 38,719 wage earners in 17 establishments and manufactured products valued at $307,255,214. The manufacture of electrical machinery and supplies was third in importance, with products valued at $234,152,633, displacing motor vehicle bodies and parts, which had long held third rank. The product value of the latter industry in 1937 was $206,133,617.

Other leading manufactures in 1937, with the value of their products, were as follows: meat packing ($139,669,127); miscellaneous machinery ($137,295,853); newspaper and periodical printing and publishing ($121,105,209); bread and bakery products ($105,261,182); petroleum refining ($97,297,783); paper ($81,552,239); machine tools ($80,111,824); machine shop products ($77,630,032); stamped and pressed-metal products $73,042,299); heating and cooking apparatus, except electric ($66,533,525); non-ferrous metal products, except aluminium ($64,919,294); chemicals ($64,315,497); printing and publishing, except newspaper and periodical ($63,660,613); glass ($62,050,523); foundry products (gray iron and malleable iron) ($60,337,592); clothing (regular factories) ($59,813,878) and paints, pigments and varnishes ($54,918,984).

The great manufacturing centres are Cleveland, Akron, Cincinnati, Toledo, Youngstown, Dayton, Columbus, Canton and Springfield. The value of the products of these cities in 1937 amounted to approximately 83% of that for the entire state. A large portion of the iron and steel was manufactured in Cleveland, Youngstown, Steubenville, Lorain, Bellaire, Cleveland Heights, East Youngstown and Irontown. Most of the motor vehicles were manufactured in Cleveland and Cincinnati; most of the cash registers and calculating machines in Dayton; most of the motor tires and other rubber goods in Akron.

**Transportation and Commerce.**—The most important natural means of transportation are the Ohio river on the southern border and Lake Erie on the northern border. One of the first great public improvements made within the state was the connection of these waterways by two canals—the Ohio and Erie canal from Cleveland to Portsmouth, and the Miami and Erie canal from Toledo to Cincinnati. The Ohio and Erie was opened throughout its entire length (309 mi.) in 1832. The Miami and Erie was completed from Middletown to Cincinnati in 1827; in 1845 it was opened to the lake (250 mi. from Cincinnati). A flood in 1913 wrecked these canals.

The national Government began in 1825 to extend the National road across Ohio from Bridgeport, opposite Wheeling, West Virginia, through Zanesville and Columbus, and completed it to Springfield in 1837. Before the completion of the Miami and Erie canal to Toledo, the building of railways was begun in this region, and in 1836 a railway was completed from that city to Adrian, Michigan. At the close of 1938 there was a total mileage of 8,518 as compared with 9,159 in 1915, this reduction being a part of a general shrinkage prevalent throughout the country during this period. As the building of steam railways lessened and then ceased, the building of suburban and interurban electric railways was begun. These railways were rapidly extended until a maximum of 4,236 mi. was reached in 1917, and all the more populous districts were connected by them; but by 1937 the total miles of track operated within the state had been reduced to 1,767. There were on Jan. 1, 1939, 16,223 mi. of highway in the

state system. Of this total 16,068 mi. were surfaced. The total motor vehicle registration for 1939 was 1,886,984.

The eight Lake Erie ports of Ohio had, in 1938, a total commerce amounting to 51,017,000 tons. Chief among the ports was Toledo with over 37% of the total. Others of great importance were Cleveland, Ashtabula, Sandusky, Conneaut, Lorain and Fairport. Toledo, according to the *Annual Report* of the Chief of Engineers, U.S. Army, had over 32% of the foreign trade (imports 65,854 tons, exports 1,487,574 tons) in 1934. Cincinnati is the state's chief port on the Ohio river.

**History.**—Ohio was the pioneer state of the old North-West territory, which embraced also what are now the states of Indiana, Illinois, Michigan and Wisconsin and the northeast corner of Minnesota. When explored by Europeans, late in the first half of the 17th century, the territory included within what is now Ohio was a battleground of Indian tribes. From the middle to the close of the 17th century the French were establishing a claim to the territory between the Great Lakes and the Ohio river by discovery and occupation.

About 1730 English traders from Pennsylvania and Virginia began to visit the eastern and southern parts of the territory and a conflict approached as a French Canadian expedition under Céleron de Bienville took formal possession of the upper Ohio valley by planting leaden plates at the mouth of the principal streams. This was in 1749 and in the same year George II. chartered the first Ohio company, formed by Virginians and London merchants trading with Virginia for the purpose of colonizing the west. This company, in 1750, sent Christopher Gist down the Ohio river to explore the country as far as the mouth of the Scioto river, and four years later the erection of a fort was begun in its interest at the forks of the Ohio. The French drove the English away and completed the fort (Ft. Duquesne) for themselves. The Seven Years' War was the immediate consequence and this ended in the cession of the entire North-West to Great Britain. The former Indian allies of the French, however, immediately rose up in opposition to British rule in what is known as the conspiracy of Pontiac (*see* PONTIAC), and the suppression of this was not completed until Col. Henry Bouquet made an expedition (1764) into the valley of the Muskingum and there brought the Shawnees, Wyandots and Delawares to terms. With the North-West won from the French, Great Britain no longer recognized those claims of her colonies to this territory which she had asserted against that nation, but in a royal proclamation of Oct. 7, 1763, the granting of land west of the Alleghenies was forbidden and on June 22, 1774 parliament passed the Quebec act which annexed the region to the province of Quebec. This was one of the grievances which brought on the Revolutionary War, during which the North-West was won for the Americans by George Rogers Clark (*q.v.*). During that war also, those states which had no claims in the west contended that title of these western lands should pass to the union and when the Articles of Confederation were submitted for ratification in 1777, Maryland refused to ratify them except on that condition. The result was that New York ceded its claim to the United States in 1780, Virginia in 1784, Massachusetts in 1785 and Connecticut in 1786. Connecticut, however, excepted a strip bordering on Lake Erie for 120 mi. and containing 3,250,000 acres. This district, known as the Western Reserve, was ceded in 1800 on condition that congress would guarantee the titles to land already granted by the state. Virginia reserved a tract between the Little Miami and Scioto rivers, known as the Virginia Military district, for her soldiers in the Revolutionary War. When the war was over and these cessions had been made, a great number of war veterans wished an opportunity to repair their broken fortunes in the west, and congress, hopeful of receiving a large revenue from the sale of lands here, passed an ordinance on May 20, 1785, by which the present national system of land surveys into townships 6 mi. sq. was inaugurated in what is now southwest Ohio in the summer of 1786. In March 1786 the second Ohio company (*q.v.*), composed chiefly of New England officers and soldiers, was organized in Boston, Mass., with a view to founding a new state between Lake Erie and the Ohio river. The famous North-West Ordinance was passed by congress on July 13, 1787. This instrument provided a temporary government for the territory with the understanding that, as soon as the population was sufficient, the representative system should be adopted, and later that states should be formed and admitted into the union. There were to be not less than three nor more than five states.

On the adoption of the North-West Ordinance the work of settlement made rapid progress. There were four main centres. The Ohio company founded Marietta at the mouth of the Muskingum in 1788, and this is regarded as the oldest permanent settlement in the state. An association of New Jersey people, organized by John Cleves Symmes, secured a grant from congress in 1788–92 to a strip of 248,540 ac. on the Ohio, between the Great Miami and the Little Miami, which came to be known as the Symmes Purchase. Their chief settlements were Columbia (1788) and Cincinnati (1789). The Virginia Military district, between the Scioto and the Little Miami, reserved in 1784 for bounties to Virginia continental troops, was colonized in large measure by people from that state. Their chief towns were Massieville, now Manchester (1790) and Chillicothe (1796). A small company of Connecticut people under Moses Cleaveland founded Cleveland in 1796 and Youngstown was begun a few years later, but that portion of the state made very slow progress until after the opening of the Ohio and Erie canal in 1832.

During the territorial period (1787–1803), Ohio was first a part of the unorganized North-West territory (1787–99), then a part of the organized North-West territory (1799–1800) and later the organized North-West territory (1800–03), Indiana territory having been detached from it on the west in 1800. The first territorial government was established at Marietta in July 1788, and Gen. Arthur St. Clair, the governor, arrived in that month. His administration was characterized by the final struggle with the Indians. The Revolutionary War was succeeded by a series of Indian uprisings. Two campaigns, the first under Gen. Josiah Harmar (1753–1813) in 1790, and the second under Gen. St. Clair in 1791, failed on account of bad management and ignorance of Indian methods of warfare, and in 1793 Gen. Anthony Wayne (*q.v.*) was sent out in command of a large force of regulars and volunteers. The decisive conflict, fought on Aug. 20, 1794, near the rapids of the Maumee, is called the battle of Fallen Timbers, because the Indians concealed themselves behind the trunks of trees which had been felled by a storm. Wayne's dragoons broke through the brushwood, attacked the left flank of the Indians and soon put them to flight. In the treaty of Greenville (Aug. 3, 1795) the Indians ceded their claims to the territory east and south of the Cuyahoga, the Tuscarawas, and an irregular line from Ft. Laurens (Bolivar) in Tuscarawas county to Ft. Recovery in Mercer county, practically the whole of eastern and southern Ohio. The Jay treaty was ratified in the same year, and in 1796 the British finally evacuated Detroit and the Maumee and Sandusky forts. By cessions and purchase in 1804, 1808 and 1817–18, the state secured all of the lands of the Indians except their immediate homes, and these were finally exchanged for territory west of the Mississippi. The last remnant migrated in 1841. Gen. Wayne's victory was followed by an extensive immigration of New Englanders, of Germans, Scotch-Irish and Quakers from Pennsylvania and of settlers from Virginia and Kentucky, many of whom came to escape the evils of slavery. This rapid increase of population led to the establishment of the organized territorial government in 1799, and to the admission of the state into the union in 1803.

The Congressional Enabling act of April 30, 1802 followed that alternative of the North-West Ordinance which provided for five states in determining the boundaries, and in consequence the Indiana and Michigan districts were detached. A rigid adherence to the boundary authorized in 1787, however, would have resulted in the loss to Ohio of 470 sq.mi. of territory in the northwestern part of the state, including the lake port of Toledo. After a long and bitter dispute—the Toledo War (*see* TOLEDO)—the present line, which is several miles north of the south bend of Lake Michigan, was definitely fixed in 1837, when Michigan came into the union. (For the settlement of the eastern boundary, *see* PENNSYLVANIA.) After having been temporarily at Marietta, Cincinnati, Chillicothe and Zanesville, the capital was established at Columbus in 1816.

Since congress did not pass any formal act of admission there has

been some controversy as to when Ohio became a state. The Enabling act was passed April 30, 1802, the first state legislature met March 1, 1803, the territorial judges gave up their offices on April 15, 1803, and the federal senators and representatives took their seats in congress Oct. 17, 1803. Congress decided in 1806, in connection with the payment of salaries to territorial officials, that March 1, 1803, was the date when state government began. During the War of 1812 the Indians under the lead of Tecumseh were again on the side of the British. Battles were fought at Ft. Meigs (1813) and Ft. Stephenson (Fremont, 1813), and Commodore Oliver Hazard Perry's naval victory on Lake Erie in 1813 was on the Ohio side of the boundary line.

Owing to the prohibition of slavery, the vast majority of the early immigrants to Ohio came from the north, but, until the Mexican War forced the slavery question into the foreground, the Democrats usually controlled the state, because the principles of that party were more in harmony with frontier ideas of equality. The Whigs were successful in the presidential elections of 1836 and 1840, partly because of the financial panic and partly because their candidate, William Henry Harrison, was a "favourite son," and in the election of 1844, because of the unpopularity of the Texas issue. Victory was with the Democrats in 1848 and 1852, but from the organization of the Republican party in 1854 until 1932 the state gave to the Republican presidential candidates its electoral votes, except in 1912 and 1916 when a split in the dominant party (Republican) allowed the Democrats to win. In the Civil War Ohio loyally supported the union, furnishing 319,659 men for the army. Dissatisfaction with the president's emancipation program resulted in the election of a Democratic congressional delegation in 1862, but the tide turned again after Gettysburg and Vicksburg; Clement L. Vallandigham, the Democratic leader, was deported from the state by military order, and the Republicans were successful in the elections of 1863 and 1864. A detachment of the Confederate cavalry under Gen. John Morgan invaded the state in 1863, but was badly defeated in the battle of Buffington's island (July 18). In 1873 the Democrats succeeded for the first time since 1856 in electing a governor, but in the years that have since elapsed the administrations have been almost evenly divided between Democrats and Republicans. Six presidents have come from Ohio, William Henry Harrison, Rutherford B. Hayes, James A. Garfield, William McKinley, William Howard Taft and Warren G. Harding.

Distinctive advance has been made in adapting the constitution and the system of administration to the new needs of the state. At the election in 1910, a general constitutional convention was approved by a large majority. Delegates were chosen in Nov. 1911, and the convention sat from January to June 1912. The delegates, of whom the majority were Democrats, represented the progressive elements of both major parties. Forty-two amendments were submitted to the voters on Sept. 3, 1912, of which 34 were ratified; among those defeated were the abolition of capital punishment, woman suffrage and a $50,000,000 bond issue for a state system of roads. The tax reformers secured for the general assembly the power to impose inheritance, income and franchise taxes as well as taxes upon the production of coal, oil, gas and other minerals. Several of these sources of taxation have since been adopted. In 1929 an amendment to the constitution was adopted authorizing classification of property for taxation. The uniform rule had been in effect in Ohio for almost 100 years. Under this amendment the classified tax was enacted in 1931, providing low rates for intangible personal property. In 1934 another amendment was adopted, fixing a limitation of 1% on real property except by vote of the people. Other laws fix debt limitations which cannot be increased except by vote of the people. The League for Direct Legislation secured the initiative and referendum, and those opposed to the liquor interests succeeded, in 1918, in establishing prohibition by a constitutional amendment. Civil service has been in operation in Ohio since 1912. In 1933 a retirement system was created for state employees. This was expanded in 1937 to include county, city and other local employees.

Ohio has the state monopoly system of liquor control. For the year 1940 receipts for sales of liquor amounted to more than $58,000,000 and profit to the state was $7,946,000. In addition, the state liquor gallonage tax amounted to more than $8,000,000.

From 1933 to 1936 the farmers of the state received $38,668,662 in benefit payments from the Agricultural Adjustment Administration. Political power in Ohio has, since 1930, tended to fluctuate between the two major parties but in the elections of 1938 and 1940 the Republicans carried the state.

Southern Ohio has suffered at various times from floods. During the great flood of 1884, the Ohio river at Cincinnati reached the highest flood stage ever recorded at that place (over 71 ft. above normal), and throughout the Ohio valley millions of dollars worth of damage was done. Another disastrous flood in 1913, affecting especially the inhabitants of the Miami, the Scioto and the Muskingum river valleys, led to a measure for the protection of the river valley from future damage of the kind. This was made possible by the adoption of a constitutional amendment on conservation in 1912, which authorized, among other things, "laws providing for the formation of drainage and conservation districts." A third great flood occurred in 1937. The protective system, which consists of a series of dry reservoir dams, was undertaken by two conservancy districts—the Miami and the Upper Scioto—at a cost of $34,700,000 and $306,300 respectively. Later the Mahoning valley sanitary district was completed at a cost of about $17,000,000, and the Muskingum watershed conservancy district was about completed in 1941 at an estimated cost of $34,000,000. Other conservancy districts authorized were the following: Massilon, Springfield, Mansfield, Little Miami, Scioto-Sandusky and Bellevue. These districts may levy taxes and issue bonds and range in size from one county to 18 counties.

BIBLIOGRAPHY.—For a treatment of the physical features of Ohio *see* Stella A. Wilson, *Ohio* (1902); the publications of the Geological Survey of Ohio (1837 *seq.*); and the volumes of the *Ohio Co-operative Topographical Survey* (1916 *seq.*). For administration *see* the *Report of the Joint Committee on Administrative Reorganization* (Columbus, 1921); *Americanization Bulletin* No. 1 published by the education department (1922); and the annual reports of the various State officials and departments. Older works of merit are S. P. Orth, *The Centralization of Administration in Ohio,* in the Columbia university Studies in History, Economics and Public Law, xvi., No. 3 (1903), and W. H. Seibert, *The Government of Ohio, its History and Administration* (1904). The work of J. A. Wilgus, "Evolution of Township Government in Ohio," in the *Annual Report* of the American Historical Association for 1894 (1895), is a study in local government.

*Archaeology and History:* P. G. Thomson's *Bibliography of Ohio* (1880) is an old but excellent guide to the study of Ohio's history. For archaeology *see* Cyrus Thomas, *Catalogue of Prehistoric Works East of the Rocky Mountains* (1891), and his *Report on the Mound Explorations of the Bureau of Ethnology* in the 12th Report (1894) of that bureau; G. Fowke, *Archaeological History of Ohio; the Mound Builders and Later Indians* (1902); W. K. Moorehead, "The Hopewell Mound Group of Ohio" in *Publication* No. 211 of the Field museum of natural history, Anthropological Series, vol. vi.; W. C. Mills, *Archaeological Atlas of Ohio* (1914); and the volumes of the *Ohio Archaeological and Historical Quarterly* (1887 *seq.*). The best histories are Rufus King, *Ohio; First Fruits of the Ordinance of 1787* (2nd ed. 1903); and E. O. Randall and D. J. Ryan, *History of Ohio; the Rise and Progress of an American State* (1912). Eugene H. Roseboom's *History of Ohio* (1925) contains many facts and is well arranged. W. R. Jillson, *The Ohio Country* (Columbus, 1932), is good for the period before 1787. Of the older histories Caleb Atwater, *History of the State of Ohio, Natural and Civil* (1838) and James W. Taylor, *History of the State of Ohio: First Period 1650–1787* (1854), are useful. For the Territorial period, and especially for the Indian wars of 1790–94, *see* W. H. Smith (ed.) *The St. Clair Papers: Life and Services of Arthur St. Clair* (1882); C. E. Slocum, *Ohio Country Between 1783 and 1815* (1910); John Armstrong, *Life of Anthony Wayne* in Sparks' "Library of American Biography" (1834–38), series i., vol. iv.; and A. B. Hulbert (ed.), *Ohio in the Time of the Confederation* in Marietta college historical collections. There is considerable material of value, especially for local history, in the *Ohio Archaeological and Historical Society Publications* (1887 *seq.*); in H. Howe, *Historical Collections of Ohio* (1889–91); *The Ohio Hundred Year Book* compiled by Elliot H. Gilkey (1901); and *The Western Reserve Historical Society Tracts. See* also W. F. Gephart, *Transportation and Industrial Development in the Middle West* (1909), a commercial history of Ohio; D. J. Ryan, *Ohio in Four Wars* (1917); and *The Ohio Guide* (1940); *Reports* of U.S. Census. (V. D.)

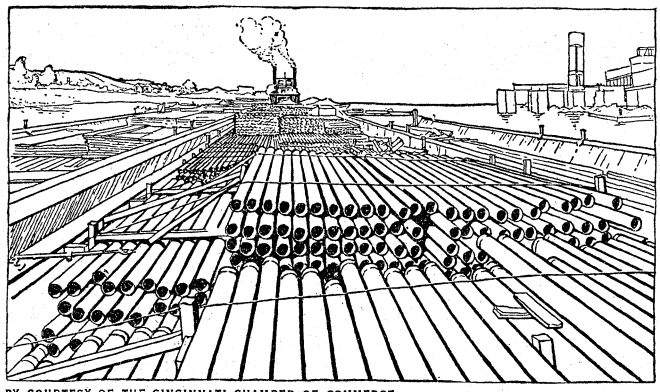
**OHIO COMPANY,** a name of two companies organized in the 18th century for the colonization of the Ohio valley. The first Ohio company was organized in 1749, partly to aid in securing for the English control of the valley, then in dispute between England and France, and partly as a commercial project for trade with the Indians. The company was composed of Virginians, including Thomas Lee (d. 1750) and the two brothers of George Washington, Lawrence (who succeeded to the management upon the death of Lee) and Augustine; and of Englishmen, including John Hanbury, a wealthy London merchant. In 1752 the company had a pathway blazed between the small fortified posts at Will's creek (Cumberland), Maryland, and at Redstone creek (Brownsville), Pennsylvania, which it had established in 1750; but it was finally merged in the Walpole company (an organization in which Benjamin Franklin was interested), which in 1772 had received from the British Government a grant of a large tract lying along the southern bank of the Ohio as far west as the mouth of the Scioto river. The Revolutionary War interrupted colonization and nothing was accomplished.

The second company, the Ohio Company of Associates, was formed at Boston in 1786. The leaders in the movement were General Rufus Putnam, Benjamin Tupper (1738–92), Samuel Holden Parsons (1737–89) and Manasseh Cutler. Dr. Cutler was selected to negotiate with Congress, and seems to have helped to secure the incorporation in the ordinance for the government of the North-West Territory of the paragraphs which prohibited slavery and provided for public education and for the support of the ministry. On Oct. 27, 1787, Cutler and Major Winthrop Sargent (1753–1820), who had joined him in the negotiations,

signed two contracts; one was for the absolute purchase for the Ohio company, at 66⅔ cents an acre, of 1,500,000ac. of land lying along the north bank of the Ohio river, from a point near the site of the present Marietta, to a point nearly opposite the site of the present Huntington, Kentucky; the other was for an option to buy all the land between the Ohio and the Scioto rivers and the western boundary line of the Ohio company's tract, extending north of the tenth township from the Ohio, this tract being pre-empted by "Manasseh Cutler and Winthrop Sargent for themselves and others"—actually for the Scioto company (*see* GALLIPOLIS). On the same day Cutler and Sargent "for themselves and associates" transferred to William Duer, then secretary of the Treasury board, and his associates "one equal moiety of the Scioto tract of land mentioned in the second contract," it being provided that both parties were to be equally interested in the sale of the land, and were to share equally any profit or loss. Colonists were sent out by the Ohio company from New England, and Marietta, the first permanent settlement in the present state of Ohio, was founded in April, 1788.

*See* E. J. Benton, ed., "Side Lights on the Ohio Company of Associates from the John May Papers," Western Reserve Hist. Soc. Tracts, No. 97 (Cleveland, 1917); A. B. Hulbert, ed., *The Records of the Original Proceedings of the Ohio Company* (Marietta, O., 1917); and Herbert T. Leyland, "The Ohio Company," *Hist. and Philos. Soc. of Ohio, Quart. Pub.*, vol. xvi., no. 1 (Cincinnati, 1921).

**OHIO RIVER,** the principal eastern tributary of the Mississippi river, U.S.A. It is formed by the confluence of the Allegheny and Monongahela rivers at Pittsburgh (Pa.), and flows north-west nearly to the west border of Pennsylvania, south-south-west between Ohio and West Virginia, west by north between Ohio and Kentucky, and west-south-west between Indiana and Illinois on the north and Kentucky on the south. It is the largest of all the tributaries of the Mississippi in respect to the amount of water discharged (an average of about 158,000cu.ft. per sec.), is first in importance as a highway of commerce, and in length (967m.) as well as in the area of its drainage basin (approximately 210,000sq.m.) it is exceeded only by the Missouri. The slope of the river at low water ranges from 1ft. or more per mile in the upper section to about 0·75ft. per mile in the middle section and 0·29ft. per mile in the lower section, and the total fall is approximately 500ft. The greatest falls are at Louisville, where the river within a distance of 2·25m. descends 23·9ft. over an irregular mass of limestone. The ordinary width of the upper



BY COURTESY OF THE CINCINNATI CHAMBER OF COMMERCE

A SHIPMENT OF STEEL TUBES AWAITING TRANSPORTATION DOWN THE OHIO RIVER

half of the river is uniform, from 1,200 to 1,500ft. Islands are numerous and vary in size from an acre or less to 5,000ac.

Besides its parent streams, the Allegheny and the Monongahela, the Ohio has numerous large branches. On the north it receives the waters of the Muskingum, Scioto, Miami and Wabash rivers, and on the south those of the Kanawha, Big Sandy, Licking, Kentucky, Green, Cumberland and Tennessee.

The drainage basin of the Ohio, in which the annual rainfall averages about 43in., is especially in the southern part of the river, of the "quick-spilling" kind, and as the swift mountain streams in that section are filled, the Ohio rises very suddenly and not infrequently attains a height of 30 to 50ft. or more above low water level spreads out 10 to 15 times its usual width, submerges the bottom lands, and causes great damage. In March 1913, an especially destructive flood reached the highest stages on record on that part of the river between Wheeling and Cincinnati and on the tributaries entering from the north.

Robert Cavelier, Sieur de La Salle, asserted that he discovered the Ohio and descended it until his course was obstructed by a fall (thought to be the falls at Louisville); this was probably in 1670, but until the middle of the next century, when its strategic importance in the struggle of the French and the English for the possession of the interior of the continent became fully recognized, little was generally known of it. By the treaty of 1763 ending the Seven Years' War the English finally gained undisputed control of the territory along its banks. By the treaty of 1783 the entire Ohio country became a part of the United States and by the famous Ordinance of 1787 the north side was opened to settlement. Most of the settlers entered the region by the headwaters of the Ohio and carried much of their market produce down the Ohio and Mississippi to New Orleans.

### DEVELOPMENT

Until the successful navigation of the river by steamboats a considerable portion of the imports was carried overland from Philadelphia or Baltimore to Pittsburgh. The first steamboat on the Ohio was the "New Orleans," which was built in 1811 by Nicholas J. Roosevelt and sailed from Pittsburgh to New Orleans in the same year, but it remained for Capt. Henry M. Shreve (1785–1854) to demonstrate with the "Washington," which he built in 1816, the success of this kind of navigation on the river. From 1820 to the Civil War the steamboat on the system of inland waterways of which the Ohio was a part was a dominant factor in the industrial life of the Middle West. Cincinnati, Louisville and Pittsburgh on its banks were extensively engaged in building these vessels. Until the Erie canal was opened in 1825 the Ohio river was the chief commercial highway between the East and the West.

The Federal Government in the year 1827 undertook to remove the snags and to increase the depth of water on the bars by the construction of contraction works, such as dikes and wing dams, and appropriations for these purposes as well as for dredging were continued until 1844 and resumed in 1866; but as the channel obtained was less than 3ft. in 1870, locks with movable dams—that is, dams that can be thrown down on the approach of a flood—were then advocated, and five years later Congress made an appropriation for constructing such a dam, the Davis island dam immediately below Pittsburgh, as an experiment. This was opened in 1885 and was a recognized success. As a result of the activity of the Ohio Valley Improvement Association, Congress authorized the secretary of war to appoint a board of engineers to report on the merits of a channel 9ft. in depth. The board reported in 1908 in favour of such a channel.

In 1910 Congress adopted the report and provision was made for a comprehensive project for canalizing the Ohio. Only slight changes have since been authorized. As it stood in 1926, the project provided for 50 locks and dams, all of the movable type, except the one immediately below Pittsburgh (Pa.), which is a fixed dam, completed in 1921. Of these dams 42 were completed and in operation, and the other eight were under construction.

The total tonnage shipped via the Ohio river in 1925 was 15,737,072 tons, of which 43·5% was sand and gravel and 41·4% was coal.

*See* the board of engineers' *Report of Examination of Ohio River with a view to obtaining channel depths of 6 and 9ft. respectively* (Washington, 1908); and A. B. Hulbert, *Waterways of Westward Expansion* (Cleveland, 1903) and *The Ohio River, a Course of Empire* (1906).

**OHLAU,** a town in the Prussian province of Silesia, Germany, 16 mi. by rail S.E. of Breslau, on the Oder. Pop. (1939) 12,710. It has a castle, became a town in 1291 and passed to Prussia in 1742. Ohlau is the centre of a tobacco-growing district.

**ÖHLENSCHLÄGER, ADAM GOTTLOB** (1779–1850), Danish poet, was born in Vesterbro, a suburb of Copenhagen, on

Nov. 14, 1779. His father, a Schleswiger by birth, was at that time organist, and later became keeper, of the royal palace of Frederiksberg. Through Edvard Storm, Adam received a nomination to the college called "Posterity's High School," of which Storm was the principal. Storm himself taught the class of Scandinavian mythology, and thus Öhlenschläger received his earliest bias towards the traditions of his ancestors. His studies were interrupted first by the death of his mother, and by the English attack on Copenhagen in April 1801, which, however, inspired a dramatic sketch (*April the Second 1801*).

In the summer of 1802, when Öhlenschläger had an old Scandinavian romance, as well as a volume of lyrics, in the press, the young Norse philosopher, Henrik Steffens, came back to Copenhagen after a long visit to Schelling in Germany, full of new romantic ideas. His lectures at the university, in which Goethe and Schiller were for the first time revealed to the Danish public, created a great sensation. Steffens and Öhlenschläger met, and after a conversation of sixteen hours the latter went home and wrote at a sitting his splendid poem *Guldhornene,* in a manner totally new to Danish literature. A volume of poems in the romantic style is now chiefly remembered as containing the lovely piece called *Sanct-Hansaften-Spil.* The next two years saw the production of the epic of *Thors Reise til Jotunheim,* the charming poem in hexameters called *Langelandsreisen,* and fantasy *Aladdin's Lampe* (1805).

At the age of twenty-six Öhlenschläger was universally recognized, even by the opponents of the romantic revival, as the leading poet of Denmark. He now collected his *Poetical Writings* in two volumes. He obtained a grant for foreign travel from the government, and joined Steffens at Halle in August 1805. Here he wrote the first of his great historical tragedies, *Hakon Jarl.* In the spring of 1806 he went on to Weimar, where he spent several months in daily intercourse with Goethe. The autumn of the same year he spent with Tieck in Dresden, and proceeded in December to Paris. Here he resided eighteen months, and wrote his three famous masterpieces, *Baldur hin Gode* (1808), *Palnatoke* (1809) and *Axel og Valborg* (1810). In the spring of 1809 Öhlenschläger went to Rome to visit Thorwaldsen, and in his house wrote (in German) his tragedy of *Correggio.*

He returned to Denmark in the spring of 1810 to take the chair of aesthetics at the University of Copenhagen. In 1811 he published the Oriental tale of *Ali og Gulhyndi,* and in 1812 the last of his great tragedies, *Staerkodder.* His talent culminated in the cycle of verse-romances called *Helge,* published in 1814. The tragedy of *Hagbarth og Signe,* 1815, showed a distinct falling-off in style. In 1817 he went back to Paris, and published *Hroars Saga* and the tragedy of *Fostbrödrene.* In 1818 he was again in Copenhagen, and wrote the idyll of *Den lille Hyrdedreng* and the Eddaic cycle called *Nordens Guder.* His next productions were the tragedies of *Erik og Abel* (1820) and *Vaeringerne i Miklagaard* (1826), and the epic of *Hrolf Krake* (1829).

In 1829 Öhlenschläger was publicly crowned with laurel in front of the high altar in Lund cathedral by Bishop Esaias Tegnér, as the "Scandinavian King of Song." His last volumes were *Tordenskjold* (1833), *Dronning Margrethe* (1833), *Sokrates* (1835), *Olaf den Hellige* (1836), *Knud den Store* (1838), *Dina* (1842), *Erik Glipping* (1843) and *Kiartan og Gudrun* (1847). On his seventieth birthday, Nov. 14, 1849, a public festival was arranged in his honour, and he was decorated by the king of Denmark. He died on Jan. 20, 1850, and was buried in the cemetery of Frederiksberg. Immediately after his death his *Erindringer* ("Recollections") were published in two volumes.

With the exception of Holberg, there has been no Danish writer who has exercised so wide an influence as Öhlenschläger. He awakened in his countrymen an enthusiasm for the poetry and religion of their ancestors, and his name remains to this day synonymous with Scandinavian romance. His plays, partly, no doubt, in consequence of his own early familiarity with acting, fulfilled the stage requirements of the day, and were popular beyond all expectation. The earliest are the best—Öhlenschläger's dramatic masterpiece being, without doubt his first tragedy, *Hakon Jarl.* In his poems and plays alike his style is limpid, elevated, profuse; his flight is sustained at a high pitch without visible excitement. His fluent tenderness and romantic zest have been the secrets of his extreme popularity. Although his inspiration came from Germany, he is not much like a German poet, except when he is consciously following Goethe; his analogy is much rather to be found among the English poets, his contemporaries. With all his faults he was a very great writer, and one of the principal pioneers of the romantic movement in Europe.

(E. G.; X.)

The critical edition of Öhlenschläger's works is that by J. L. Lubenberg (32 vols., 1857–62). *See* B. Andersen, *Öhlenschläger et livs poesie* (3 vols., 1899).

**OHLIGS,** former German town known before 1891 as Merscheid, 17 mi. by rail N. of Cologne, on the railway to Elberfeld. Pop. was 29,812. It manufactured cutlery, surgical instruments and hardware and united with Solingen in 1929.

**OHM, GEORG SIMON** (1787–1854), German physicist, was born at Erlangen on March 16, 1787, and was educated at the university there. He became professor of mathematics in the Jesuits' college at Cologne in 1817, and in the polytechnic school of Nuremberg in 1833. In 1849 he was appointed conservator of the physical collection at Munich, and in 1852 professor of experimental physics in the High School of Munich, where he died of apoplexy on July 7, 1854. His writings were numerous, but, with one important exception, not of the first order. The exception is his pamphlet, published in Berlin in 1827, with the title *Die galvanische Kette mathematisch bearbeitet.* This work, the germs of which had appeared during the two preceding years in the journals of Schweigger and Poggendorff, has exerted a great influence on the whole development of the theory and applications of current electricity. (*See* ELECTRICITY.) The most important part of the pamphlet is summarized in what is now known as Ohm's Law. (*See* RESISTANCE, MEASUREMENT OF.) This work was so coldly received that Ohm's susceptibilities were hurt, and he resigned his post at Cologne. He eked out a precarious livelihood until appointed at Nuremberg. At this time his work began to be recognized, he was awarded the Copley medal of the Royal Society in 1841 and was made a foreign member of that society in 1842. In addition to a number of papers on mathematical subjects, Ohm wrote a memoir on interference in uniaxial crystals, and also a *Text Book of Physics* (1854).

*See* a memoir on Ohm by J. Lamont in *Denkschrift Münchener Akademie.*

**OHMMETER** an electrical instrument employed for measuring insulation-resistance or other high electrical resistances. The ohmmeter is described in INSTRUMENTS, ELECTRICAL: *Resistance Measuring Instruments* (*q.v.*).

**OHNET, GEORGES** (1848–1918), French novelist and man of letters, was born in Paris on April 3, 1848. After the war of 1870 he became editor of the *Pays* and the *Constitutionnel* in succession. In collaboration with the engineer and dramatist Louis Denayrouze (b. 1848) he produced the play *Regina Sarpi,* and in 1877 *Marthe.* He was an admirer of George Sand and bitterly opposed to the realistic modern novel. He began a series of novels, *Les batailles de la vie.* The series included *Serge Panine* (1881) which was crowned by the Academy; *Le Maître de forges* (1882), *La Grande Marnière* (1885), *Volonté* (1888), *Dernier amour* (1891). Many of his novels have been dramatized with great success, *Le Maître de forges,* produced at the Gymnase in 1883, holding the stage for a year. He published in 1908 *La route rouge,* and in 1912 *La serre de l'aigle.* His last work was *Journal d'un bourgeois de Paris pendant la guerre de 1914* (1914–18).

**OIL, MINERAL:** *see* PETROLEUM.

**OIL, PALM:** *see* PALM OIL.

**OIL, SHALE:** *see* SHALE OIL.

**OIL-BIRD** or **GUACHARO** (*Steatornis caripensis*), the sole member of a family, *Steatornithidae.* As big as a crow, its plumage exhibits blended tints of chocolate-colour and grey, barred and pencilled with dark-brown or black, and spotted in places with white. The guacharo is nocturnal, slumbering by day in deep and dark caverns. Towards evening it arouses itself and, with croaking and clattering, which has been likened to that of casta-

nets, it approaches the exit of its retreat. In Trinidad the young are esteemed a great delicacy for the table.

**OIL BUNKERING:** *see* BUNKERING OF SHIPS.

**OIL-CAKE,** a feeding-stuff of great value, prepared from the residue resulting from the crushing of various oil-seeds. For details *see* FEEDING STUFFS; COTTON and COTTON INDUSTRY; LINSEED; COCO-NUT OIL AND CAKE.

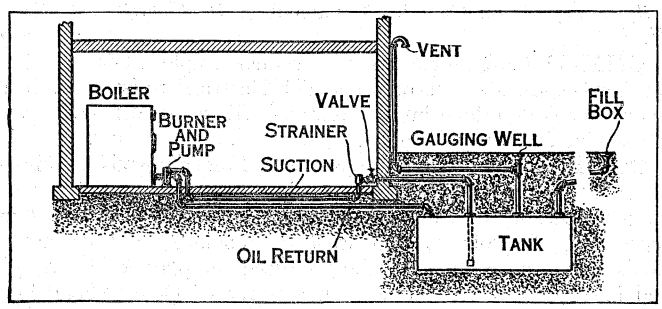
**OIL CITY,** a city of Venango county, Pennsylvania, U.S.A., on the Allegheny river, at the mouth of Oil creek, 75 mi. N. of Pittsburgh. It is served by the Erie, the New York Central and the Pennsylvania railways. The population in 1920 was 21,274 (88% native white); in 1930, by the federal census, it was 22,075 and in 1940, 20,379, with as many more in near-by places. The city lies 1,000 ft. above sea level, in a rolling and wooded country. The central part is almost encircled by a deep bend of the river, and is connected with the south, west and east sides by several bridges. Oil City is the metropolis and market of the Pennsylvania oil region; has large oil refineries and machine shops; and manufactures steel drums, boilers, pumping machinery, oil-well supplies and various other commodities. The aggregate factory output in 1937 was valued at $12,684,090. Natural gas is used for domestic and industrial purposes. The city has a commission form of government. Oil City was founded in 1860, following the drilling of the Drake well at Titusville (16 mi. N.) on Aug. 27, 1859. It was incorporated as a borough in 1863, as a city in 1874. Between 1860 and 1870 there were 20 passenger and tow boats and 3,000 flatboats plying on the river, and 17,000,000 bbl. of oil were shipped to Pittsburgh. Trading in oil certificates led to the establishment of the Oil Exchange, which for many years set the price of oil for the world.

On May 14 and 15, 1884, sales aggregated 29,000,000 and 27,000,000 bbl. respectively, and clearings for 1885 amounted to $1,433,738,000.

**OIL ENGINE:** *see* INTERNAL COMBUSTION ENGINES.

**OIL FUEL:** *see* FUEL.

**OIL HEATING, DOMESTIC,** that branch of the heating of dwellings and other buildings in which the fuel burned is a mineral oil, such as shale oil or one of the heavier and less expensive grades of petroleum (*q.v., see* also KEROSENE). Oil has been used for fuel and for heating since the time of Moses; but the mechanical development of the oil burner dates from the middle

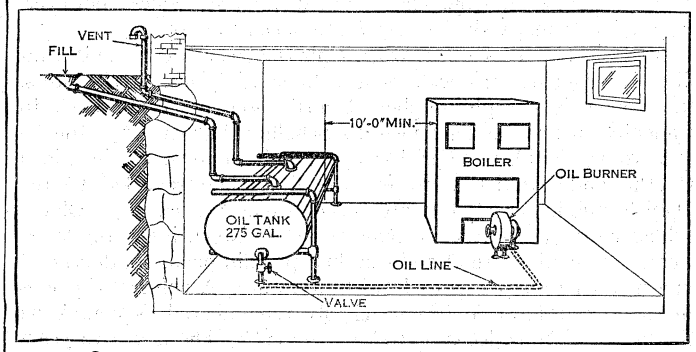



BY COURTESY OF THE DOMESTIC OIL HEATING INSTITUTE

CHARACTERISTIC UNDERGROUND TANK INSTALLED BELOW BURNER LEVEL

of the 19th century, and only since 1922, in the United States particularly, has it come into widespread use. "Oil heating" refers here only to the method of generating heat, without regard to the medium (steam, hot water or air) used to carry the heat throughout the building; "oil" refers here only to petroleum. Oil in its native state will burn, but not with maximum effect until it is atomized and mixed with air. The history of modern oil heating is the record of the search for simple and efficient methods of preparing heavy oils for complete combustion. In 1861 a mechanic named Werner, employed in one of the refineries of the Russian oil fields of the Caucasus, first suggested that what was then "refuse oil" be used as fuel; his burner, consisting of a series of griddles over which the oil trickled and burned was widely used though not patented until 1867. In 1862 two experimenters took out patents on an oil burner which solved the combustion problem by introducing the oil into the furnace in a gaseous state, the heavy oil first being heated and made to give off lighter oils. In 1863 Brydges Adams introduced into America the first spray burner, and in 1866 Ayden brought out a burner using hot air to atomize the oil and Spakorsky one using super-heated steam. Spakorsky's method was later embodied in an oil burner by Thomas Urquhart, an American at that time in the employ of a Russian railway.

Public interest was attracted by the possibilities of oil burning with a very considerable increase in the oil production of Cali-




CHARACTERISTIC 275GAL. TANK INSTALLED IN BASEMENT

fornia and Texas about 1900. Small burners, suitable for heating forges, treating furnaces, drying ovens and melting furnaces were soon produced. Larger burners were designed for boilers producing steam for power and heat. In 1902 and 1903 the U.S. naval liquid fuel board conducted tests of all available burners to determine whether vessels of the U.S. navy should be equipped for oil burning. The report, completed in 1904, was so favourable that the newer vessels were immediately designed to burn oil fuel and many of the older ones were converted.

The first attempts at domestic oil burning were crude and, in the majority of cases, consisted primarily of a pipe from a tank dropping the oil on hot, refractory material in an open pan. These were followed by natural-draught vaporizing burners, which, however, did not provide the uniform combustion necessary for economical and reliable operation. A later development was the mechanical-draught automatic burner, the foundation of the modern, domestic oil heating industry. In 1919, following the World War, oil fuel began to enter the American home on a national scale. By 1928 close to 450,000 American homes and buildings had been equipped for oil heating. The rapid rise of the oil burner lies in its convenience; an oil fire can be built or banked by the turn of a switch. Through electrical control, all the processes of furnace tending have been made automatic.

Another advantage is that oil may be conveniently stored in congested business districts. The labour required for attending oil-fired boilers is considerably less than that where coal is used, even when this is handled by modern equipment.

**Types of Burners.**—There are numerous varieties of oil burners, but all may be included under two distinct types: the natural draught and the mechanical draught burners. In the first type, sometimes called a gravity burner, there are no moving parts and the force of the draught depends on the size and height of the chimney, and on the differences in temperature and density between the outside air and the flue gases in the chimney. For this reason it is affected by changes in the weather, wind currents above the chimney and similar factors controlling variations in draught intensity. The natural draught burner is usually limited to heating on a small scale and requires lighter oils for efficient operation. In the second type, the air for combustion is supplied by a fan or blower. When a fan is used, the entire amount of air for combustion is usually supplied under pressure. The mechanical draught burner, since its air supply is controlled for the most part by the fan or blower, is more efficient than the natural draught burner, and maintains uniformly efficient combustion under all conditions.

Burners are also classified by the means employed to prepare the fuel for combustion. The oil may be atomized or vaporized. In the latter type, oil is prepared for combustion by first being heated. The vapour is mixed with the air just before or during

the combustion process. Burners of this type are especially flexible, with low oil capacities, and moving mechanical parts can be eliminated. In the atomizing burner, high or low pressure air or steam, mechanical pressure or rotating parts break up the fuel into small particles which are quickly vaporized by the heat of combustion. In commercial installations, where oil fuel is used in the heating of factories, office buildings, schools, theatres, apartments, etc., atomizing burners are used almost to the exclusion of other types because of their ability to burn the heavier and cheaper grades of fuel oils. The modern oil burner is automatic. A room thermostat electrically controls the burner so that the heat of the house can be kept constant within two degrees on either side of the desired temperature. A boiler or furnace control prevents overheating of the boiler and, in the case of a steam boiler, prevents abnormal pressures being developed. A burner safety control establishes a time limit within which the oil must be ignited every time the burner is started up; if the oil is not ignited the burner mechanism is shut down. When ignition is electric, it is accomplished by means of a spark from a high-tension transformer or by a hot resistance coil. The spark type of ignition is more widely used. Some burners require a gas pilot. An oil burner can be installed in practically any hot water or steam boiler, or in any warm-air heater.

The fuel oil used in automatic oil heating equipment varies in accordance with the needs of the individual burner; ranging from very light, untreated kerosene or distillate for burners that prepare the fuel for combustion by vapourization to heavier, straw-coloured distillates and dark coloured gas or Diesel oils for burners that employ atomization in preparing the fuel for combustion. The Commercial Standards Specifications for fuel oils as published by the U.S. Bureau of Standards are the most widely recognized specifications covering fuel oils. The grade numbers and names, together with their old designations and approximate A.P.I. (American Petroleum Institute) gravity range are:

| Specification Number | Standard Name | Approximate Gravity Range | Old Designation Name |
|---|---|---|---|
| 1 | No. 1 Fuel Oil | 40–36 | Distillate |
| 2 | No. 2 Fuel Oil | 36–30 | Gas Oil |
| 3 | No. 3 Fuel Oil | 30–22 | Light Fuel Oil |
| 5 | No. 5 Fuel Oil | 24–18 | Medium Fuel Oil |
| 6 | No. 6 Fuel Oil | 18–10 | Heavy Fuel Oil |

Oils number 1, 2, 3 are most generally used in automatic burners. Oils 5 and 6, because they generally require pre-heating, are used primarily in large commercial and industrial installations.

The utility of a fuel oil for domestic heating depends also upon its flash point. The flash point of any oil is the lowest temperature at which the vapours on the surface of the oil will ignite and burn momentarily on application of a spark or flame. About 20° F. above the flash point is the fire point of the oil. This is the temperature at which the oil will ignite and burn continuously.

It is desirable that this fire point should be sufficiently low so that the oil will ignite from a cold start without hesitation. A flash point as low as 100° F. or 110° F. is allowable, and an oil with a flash point above 230° F. should not be used with most burners because of the difficulty of initiating ignition.

BIBLIOGRAPHY.—H. A. Romp, *Oil Burning* (1937); H. A. Kunitz, *Oil Heating Hand Book* (1936); H. F. Tapp, *Hand Book of Oil Burning* (1931); A. H. Senner, *A Study of the Oil Burner,* Technical Bulletin 109, United States Department of Agriculture (1929); American Oil Burner Association, *Hand Book of Domestic Oil Heating* (1928); P. E. Fansler, *House Heating with Oil Fuel* (1927); Haslam and Russell, *Fuels and Their Combustion* (1926); William N. Best, *Burning Liquid Fuel* (1922); Bureau of Steam Engineering U.S.N., *Report of the U. S. Naval Liquid Fuel Board* (1904); United States Bureau of Standards, *Commercial Standard Specifications, Fuel Oils,* (1938). (H. F. T.)

**OILLETS,** the architectural term for the arrow slits in the walls of mediaeval fortifications, but more strictly applied to the round hole or circle with which the openings terminate; also applied to the small circles in the tracery head of the windows of the Decorated and Perpendicular periods which were sometimes varied with trefoils and quatrefoils.

**OIL PAINTING, TECHNIQUE OF.** As the musician must be taught, and the subtlest of harmonies are subject to material limitations, so the art of the painter must be learned, and he, more perhaps than any other artist, is bound by severe material necessities. It is not intended here to give instruction in the art of painting or to express individual preferences. The object in view is rather, taking as a basis the various methods employed by the great masters, to give an account of the technical considerations which all painters are obliged to bear in mind.

One thing to be noted in a consideration of painting is that there is a wider divergence in the techniques employed than in that of any other art. We should not find this diversity so extensive if, instead of discussing the technique of oil painting, we were analysing the technical methods of the Primitives who painted with wax, yolk of egg, or in fresco. Whatever difference there may be in the appearance of a painting by Cimabue and one by Mantegna, it will be very much less than the difference between the work of two artists painting after the invention of oil painting.

It may not be necessary to recall that all the colours used in painting, whether they are of mineral or vegetable origin, finally appear in the form of more or less soft stones which are ground to a powder in order to be used. These coloured powders require some binding vehicle in order to bring them to a sufficient consistency. The vehicle may be wax, mortar, glue, glycerine or resin. The brothers Van Eyck are generally believed to have been the first to mix their colours with oil. From the numerous controversies to which their discovery has given rise, it would seem that the principal achievement of the brothers Van Eyck was that they perfected, for the purpose of painting easel pictures, the results of the much earlier practice which had been to use oil for the painting of large surfaces, and especially for the painting of boats. The effect of oil in rendering colours durable had been observed previously; pictures painted with yolk of egg had been covered with a coating of oil which was hardened by drying in the sun and which at once protected and intensified the colours.

Once, however, the practical method of grinding colours with oil had been discovered, a vast field of technical research opened up before painters, and they were naturally tempted to explore the new possibilities which were provided. It was this possibility of variety in technical methods which, in combination with the individual genius of the great masters, enabled the art of oil painting strictly so called to rise to such great heights at the time of the Renaissance.

**The Support.**—Oil paint will adhere to a number of materials, and during the ages painters have experimented in painting on a number of metal and mineral grounds. Slate, marble and alabaster have been used, but comparatively rarely owing to their fragility. Copper has also been utilised, though, of course, only for works of small size. Paper deserves special mention. Far from being an inferior material as might be supposed, paper is perhaps the most suitable ground for works of a spontaneous character. It was used by Flemish painters, who glued it to wood panels or canvases by means of casein. Later, in the 18th and early 19th centuries, a large number of French painters used this process, which was of great value in setting off their brilliant execution. No other material gives such transparency to browns or so much depth to blacks.

Practical considerations have, however, led most painters to prefer two supporting materials: first, wood, and second, canvas. Up to the end of the Renaissance period wood was generally employed; but it would be an error to suppose that the change to canvas was a sudden one. There are a number of examples of wood panels upon which a fine canvas has been glued. Besides, although the use of canvas became very frequent after the Renaissance, it cannot be said to have been universal, since at all periods in the history of painting, including the present, many artists have painted on wood. In Italy the white poplar was generally used; in Flanders they used oak. To-day mahogany, which does not crack so easily as oak, is often used.

Canvas appears to be the most suitable material for pictures of a large size. There are, however, exceptions, even among painters,

who habitually used canvas for their large works. Thus Rubens' *Magi* in the Antwerp Museum, one of the largest as well as one of the most admired compositions of that master, is executed on an enormous wooden panel formed by several transverse sections. Rubens' choice of a panel in this case and in others is not a mere chance. It may be laid down as an axiom that everything counts in the execution of a picture, and the support is not the least important factor in the final appearance of the work. It is an even more important factor in its preservation. Too much stress cannot, therefore, be laid on the importance of seeing that the support of the painting is of the best quality.

The history of painting shows so many examples of fine works which have perished that we must take every possible precaution to prevent damage to those which may be painted in the future. If wood is used, it must be carefully seasoned, thoroughly dry and cut radially, as otherwise it will be affected by changes of temperature and the picture will warp or split. If canvas is chosen, it should be of hemp, or better still of pure, unbleached flax fibre, without any admixture of cotton; this will prevent its being too liable to suffer from changes of temperature. It will easily be understood that if the tissue is constantly expanding and contracting the priming or the paint itself will be likely to scale off.

**Preparation of the Support.**—There is, however, another important matter to consider; the wood or canvas may be treated with a priming or used without. The latter method, which is the simplest, may be dealt with first without regard to chronology; for though it was occasionally used by old masters, such as Rembrandt and Van Goyen, it is in the main a modern practice. Many present-day painters prefer to dispense with priming, and this often gives good results, especially in painting on wood. If canvas is used the method has certain disadvantages, for contact with the oil renders the canvas brittle, and it thus loses the flexibility which is one of its principal merits.

Canvas, therefore, needs to be covered with priming before it is used, and the priming is, of course, an important factor. It has been the subject of extensive research from the time when it was first used. The basis of all priming is either size or casein mixed with plaster or carbonate of lime, or else a thin coating of white lead over a coating of size. These simple elements can be combined in a great variety of ways. Experiments with different kinds of priming have been tried at all periods of the history of painting. The Primitives used plaster and carbonate of lime for tempera painting, and this practice was continued long after the invention of oil painting. It was principally in the 17th century that it became customary to use white lead, more or less strongly tinted with grey, red or brown. A transitional method, which the present writer regards as excellent, was to cover the canvas with a thin coat of carbonate of lime, and then to complete the priming with white lead. Later, painters contented themselves with sizing the canvas and then covering it with one or two thin coatings of white lead. This process has become almost universal at the present day, but some painters are tending to return to plaster priming. It should never be forgotten that the principal quality which should be possessed by the priming of canvases is flexibility. Consequently the first coating of size which is placed over the canvas in order to fill up the interstices in the fabric must not be too thick, and if subsequent coats of carbonate of lime or white lead, or both of those materials in succession, are put on, they also should be very thinly applied. If the canvas is to dry well, it is better to apply several thin coats of priming than one thick one. It is extremely important to make sure that the canvas has dried properly. This is not always done with sufficient care before a picture is begun, and yet nothing is more dangerous than to use a canvas which has not dried properly. The dark colours will inevitably crack sooner or later. Industrially prepared canvases are often prepared without paying pre-consideration to the artist's requirements and so expose the paintings to accidents of this kind. This can be proved by a very simple experiment; take a piece of wood or canvas, and cover it with a coat of white lead; then, instead of waiting several months, as would be necessary if a picture were to be painted, paint on it patches of brown, madder lake, ultramarine and emerald green. These colours will rapidly crack; the first cracks will be noticeable on the emerald green after a few days only.

**Colours and Their Preparation.**—Colours, in the state in which they reached the painter when he prepared them himself, and in the state in which they now reach the manufacturer, are in the form of blocks, either crystalline or powdery, but generally of the consistency of soft chalk. Their quality undoubtedly depends above all on the purity of the raw materials used. The chemist isolates the colouring matter from the crude materials which he receives. In some cases the material is earth, as in the case of ochres; the earth is in its natural state in the case of yellow and red ochre, and it can be calcined so as to obtain other colours such as burnt sienna. Other colours are obtained from elementary materials; thus different kinds of black are produced from lamp black, bone charcoal and charcoal obtained from vine stocks. Ultramarine is also a natural stone—lapis lazuli. But unlike the coloured earths, which are abundant, natural ultramarine is so rare that it is scarcely used. By means of laboratory research a fairly stable blue resembling natural ultramarine has been obtained from sodium sulphide and silicate of aluminium.

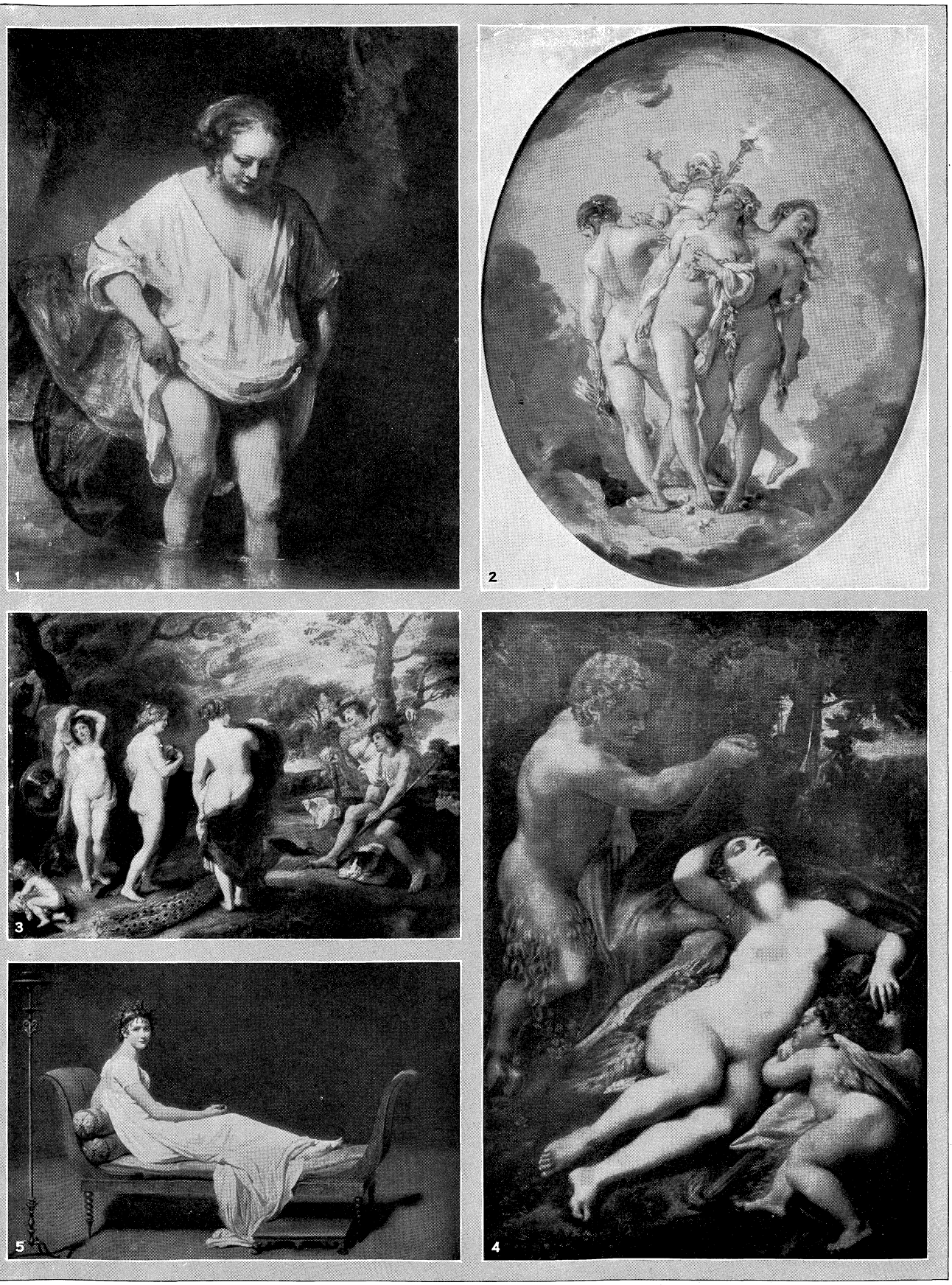
It would be desirable if painters could use only colours extracted from simple sources such as earths. A colourist can do a great deal merely with yellow ochre, red ochre and black. These materials are little subject to alteration. Even the most skilful artist, however, cannot go far without the use of white; and this is the first stumbling block. The white which is known as flake white (in French, *blanc d'argent*) is a carbonate of lead, or in other words a purified form of white lead. It turns black in the course of time. The least that can happen is that it will turn yellow. Zinc white has not this disadvantage, but it cracks, does not spread easily and dries slowly. Moreover, even if the problem of the stability of white were solved, there would remain that of other colours which are absolutely necessary to the painter, such as bright yellow, whether strontian or cadmium, red, such as vermilion or even madder lake, blue, green and brown. These colours are the product of chemical combination and are only relatively stable. Some turn black, others absorb the colours mixed with them, while others become opaque.

However, not all of the hundreds of colours at the painter's disposal are equally bad. In order to choose the lesser of two evils, the painter should only add to the tones obtained from earths the indispensable minimum of other less durable colours.

Prussian blue, which was discovered in 1710 and was used to excess in the early 19th century, is today almost abandoned. Unless it is laid on as a light glaze, or supported by a considerable admixture of white, it tends to turn black and to absorb the colours mixed with it. A green composed of Prussian blue and a yellow (especially if this is not one of the earth yellows) gradually turns blue; similarly a violet into which Prussian blue enters gradually loses its red elements. Cobalt blue has the serious defect of appearing violet by artificial light.

It is possible to make a verbal distinction and to say that Rubens and Rembrandt did not use bitumen; they used a bituminous colour, and so did all the Dutch and Flemish painters; indeed all painters of whatever school have used a transparent brown resembling bitumen and fulfilling the same function; but it was recognised that the use of this colour was subject to certain strict technical conditions. At the end of the 18th century an attempt was made to recover the exact tone of bitumen which was believed to be that used by Rembrandt; it was believed to be very durable, and most of the painters of the day made abundant use of it. The terrible consequences are well known at the present time. The worst of it is that the damage due to bitumen, which never dries, combined with varnish which dries rapidly, may not become apparent until after many years.

The industrialisation of the manufacture of colours thus gives rise to a number of problems and technical points with which modern painters are unacquainted. They ought themselves to try experiments on the power of resistance of colours by exposing them to sunlight, and to fumes containing sulphur, sulphuretted hydrogen and ammonia; and in addition it would be in their interest to simplify their palette. Experience has shown, for



BY COURTESY OF (1, 3) THE NATIONAL GALLERY, LONDON; PHOTOGRAPHS (2, 4, 5) COLLECTION ARCHIVES PHOTOGRAPHIQUES, PARIS

## VARIETY OF TECHNIQUE IN EXECUTION AND COLOUR

1. "A Woman Bathing," by Rembrandt van Rijn (1606–1669), Dutch. Rembrandt used glazes to add to the richness and luminous depth of the picture. 2. "The Three Graces," by François Boucher (1703–1770), French. Boucher here used a pink-tinted ground-work. 3. "The Judgment of Paris," by Peter Paul Rubens (1577–1640), Flemish. Rubens used glazes freely to add to the brilliance and charm of his colour. 4. "The Sleep of Antiope," by Correggio (1494–1534), Italian. In the Louvre. The glazes and half-tones have largely disappeared because of poor restoration in the 18th century. 5. "Portrait of Mme. Récamier" (unfinished), by Jacques Louis David (1748–1825), French. In the Louvre

# OIL PAINTING, TECHNIQUE OF

BY COURTESY OF (3, 5) THE NATIONAL GALLERY, LONDON; PHOTOGRAPHS, (1, 2) ANDERSON, (4) G. ZAZZARINI

## VARIETY OF TECHNIQUE IN COLOUR AND LIGHT

1. Miracle of St. Mark (1548), by Tintoretto (Jacopo Robusti, 1518–94), Venetian School (The Academy, Venice). This artist was one of the first to project vast canvases in oil. He covered gigantic surfaces with rich oil colour, where fresco (on the fresh plaster) had been previously used as a medium
2. Landscape, by Nicolas Poussin (1594–1665), French. (The Prado, Madrid). Poussin used a canvas with a brown priming. His paintings have suffered accordingly and his landscapes are badly faded
3. The Bay of Baiae, with Apollo and the Sibyl, by J. M. W. Turner (1775–1851), English. Turner was fascinated with light, and uses colour with fluidity and brilliance. He greatly influenced the Impressionists
4. Adoration of the Magi, by Peter-Paul Rubens (1577–1640), Flemish. (Musée Royale des Beaux-Arts, Antwerp). This achievement unparalleled from the technical point of view is one of the largest and most admired of the master's compositions. It is executed on a large wooden panel, made up of several sections, directly over a ground-sketch in brown. Signs of the removal by the restorer of the vermilion and the old varnish appear below, right
5. Two Gentlemen, portrait of George Huddesford and of Codrington Warwick Brampfylde, by Sir Joshua Reynolds (1723–92), English. Reynolds worked with very long brushes, being thus enabled to see the effect of his work from some distance while laying on the colour. He often blocked in his pictures in *impasto* or *grisaille*, then coloured it and carried it further with glazes. His paintings evaporated, turned yellow, cracked, and perished even during his life time

example, that Naples yellow becomes dull and greenish; that umber darkens and rapidly alters the colours mixed with it; that cadmiums lose their brightness in time; that ultramarine becomes opaque; that bitumen should only be used as a light glaze; and that colours which may be highly recommended must pass the test of time, and cannot be used with certainty until they have done so. It is only possible to calculate their palettes by making a close study of the old masters' pictures in a good light. It is possible to train oneself in a study of this kind by beginning with modern pictures. If the painting of a picture is closely examined, it is almost always possible to discern, in a single brush stroke, particles of the pure colours of which it is composed. If a study of several pictures by the same painter gives the same results, they may be taken as accurate.

A simple example may be found in the works of Pissarro; in all his pictures painted between 1878 and 1885 approximately, a mixture of Veronese green and ultramarine can clearly be distinguished. The use of these two colours during the period in question is thus established. This example has been selected because Pissarro obtains highly characteristic effects by this means. The remainder of his palette could easily be ascertained by continuing the analysis. Although, however, analysis may be simple in the case of the Impressionist school, it becomes more difficult as we go further back in the history of painting. The present writer frankly confesses that he cannot himself read the palette of all painters from their works. It is, however, possible to derive one general conclusion from a close study of the works of the great masters: that it is not necessarily the number of colours used which makes the colourist.

The grinding of the colours is a long and somewhat difficult business. It consists in pounding the powder, moistened with oil, until the grains are so fine as to be imperceptible. (*See* COLOUR MILLS.) This is done with a heavy muller, the under surface of which is as smooth as the slab of granite, on which the colours are ground. From time to time the grinder adds a few drops of oil. He has to continue kneading the paste until it is of the requisite fineness and consistency. It should be noted that a colour which reaches different grinders in the same state of chemical purity may not be of equal quality when it leaves their hands; the cleanliness with which the operation is carried out and the quality of the oil used affect the final result. The manufacture of colours is not a simple operation. Great practice is for example necessary to bring cobalt blue to the right consistency. Oil alone will not bind the paste sufficiently, and wax has to be added. The kind of oil used has its importance; olive oil, which was formerly much used in Italy because of its abundance, has now been given up because it dries slowly. Linseed oil on the other hand dries rapidly; copal oil is much esteemed by certain manufacturers; but poppy oil, which is light and colourless, is by far the most frequently used.

The painter should be able to use the paints in the form in which they reach him. He may use a siccative to make them dry more rapidly, but he should remember that this is an evil, even if a necessary one. He may use the colours in a thick paste, or slightly diluted, or as a thin wash; they are diluted with a quantity of oil, or turpentine, or a mixture of the two. It may be explained that the thin wash or glaze is composed of a transparent colour for choice, very much diluted, and its purpose is to heighten the value or activity of a tone which has already been laid on and has dried. Delicate effects and fine harmonies may be obtained in this way. The colours which are in practice used for this purpose are as a rule transparent yellows (Indian yellow, yellow lake, raw sienna and sometimes dark cadmium), nearly all the reds, but principally the lakes, black, nearly all the browns, and particularly bitumen. Although they have immense advantages, glazes have the defect of being liable to damage by the hand of time. They are slow in drying, and there is a risk that they may become incorporated in the varnish if the latter is applied too soon; and it must be admitted as an axiom that a picture will sooner or later have to be devarnished, and the painting itself should not be liable to injury when this happens.

A great number of prepared colours are now available; and while it is not necessary to give a list of them, it may be of use to mention a small number of specially durable colours with which a great variety of effects may be obtained. These are: flake white, golden ochre, strontian yellow, deep cadmium yellow, Venetian red, burnt sienna, cadmium red or vermilion, dark madder lake, ultramarine, cobalt blue, emerald green and ivory black or blue black.

This palette is only given as an example, since it would be arbitrary and useless to attempt to establish a uniform palette suitable to all temperaments. Some colours, too, may in themselves be injurious, and should be avoided as far as possible, but nevertheless may assist in creating the effect which is desired if they are used in the right place and with the necessary skill. For the nature of the colour itself is not the only factor; the manner in which it is used matters perhaps even more.

**Brushes.**—There are two kinds in general use, very different from one another; those made of sable hairs and those made of hogs' bristles. The latter are the most generally used. They consist of a metal collar which is generally flattened and keeps flat the bundle of bristles which form the brush itself. (*See* BRUSH: *in Art.*) The change from the round brushes, which were used until the 19th century, to flat brushes is due to the almost universal desire of the modern school to paint in separate touches with a full brush. The shape of the brush undoubtedly affects the nature of the stroke; but though it is difficult to describe the subtle difference made by the use of a round or a flat brush, because everything depends on the hand which uses it, it is easy to distinguish between passages executed with a sable brush and those executed with a hogs' bristle brush. The sable brush is better where precision of detail is required. The touch can be impasted and yet smooth, where bristle would not follow the exact intention of the painter with the same docility. Sable brushes are best for painting small pictures on panels, and for compositions where emphasis on detail gives the work part of its character. On the other hand it would be difficult to paint a life-size portrait or a large landscape with sable. The softness of the hairs would make it difficult to deal with a considerable quantity of paint, and the touch would be greasy and soft while a firm hogs' bristle brush would enable the painter to lay on a broad and vigorous surface.

Painters have at all times used their fingers and this use of the finger as a sort of flesh-and-blood trowel gave Courbet the idea of using the palette knife as a partial substitute for the brush. By using a flexible steel knife it is possible to obtain a vigorous touch and great variety of technique. It would of course be impossible to do any delicate drawing with the palette knife, but no instrument can be compared with it for preserving the purity of tones which often leave the palette fresh but are impaired by the time they reach the canvas. The palette knife can be wiped clean with a rag after each stroke; it represents an absolutely clean means of transferring the paint from the palette to the canvas, while only too often the brush is insufficiently cleaned and contains traces of all sorts of other colours. This does not however mean that the palette knife can take the place of the brush. The knife can only be used for certain restricted purposes, and for general use nothing can replace the brush. But everyone knows how important cleanliness is in the composition of colours, and it is only too often forgotten that the palette, the vessel which contains the vehicle, and the brushes, need careful attention because they are the last recipients of the colours, and colours cannot be beautiful unless they are skilfully used.

### DEVELOPMENT OF THE ACTUAL PAINTING

We often hear it said that a picture has darkened or turned yellow. We are not here referring to the changes to which the varnish is subject, since although varnish gives the colours their maximum intensity, it does not form an integral part of the picture and will be dealt with only at the end of the article. What we now have to consider is the development of the paint which actually constitutes the picture.

**Preparation of the Groundwork.**—It has already been said that artists should give the utmost personal attention to the prep-

aration of their canvases. Upon the preparation of the ground-work the final aspect of the finished picture may depend. The old masters varied the priming of their panels or canvases according to the nature of the picture which they intended to paint. Rubens used a ground-work which was sometimes grey, sometimes tinted with ochre, sometimes greenish, and sometimes plain white as in the "Miraculous draught of fishes." Poussin used a grey ground-work for his "Autumn," and Boucher a pink-tinted one for his "Three Graces."

There is no doubt that the ground-work affects the painting which is superimposed on it. Let us suppose that two replicas of the same picture are painted, one on a yellow and one on a red canvas. After a few years the two pictures will be seen to differ from one another, and their general colour harmony will change, becoming nearer to that of the ground-work. A painter can thus, to a limited extent, plan in advance the future development of his picture, and should not neglect a factor which may add to its beauty later.

The desire to obtain rich colour harmonies must however always be subordinated to the numerous and complex exigencies of paint. Many pictures painted on light grounds have preserved an astonishing freshness down to the present day, while others painted on red, brown and even black grounds have suffered; indeed such paintings have generally worn badly, even if they were painted by Tintoretto, Poussin or Courbet.

The red grounds which so many painters have found attractive certainly make it easy to obtain a vibrant and transparent tone. But such a ground is of no value unless the paint itself is very lightly applied over it. And although the results may be satisfactory at first and may remain so for a number of years, the thin layer of paint which covers the coloured ground nevertheless gradually tends to disappear, and the tone of the ground begins to prevail over the others, thus putting out the colour harmony of the picture and destroying the balance of values; for, as will readily be supposed, the only parts which resist will be the high lights, which are generally painted in strong colours and which last all the better because they have probably been applied with fairly vigorous impasto in order to hide more completely the dark ground on which they were painted.

From the last observations we may at once draw a general conclusion which is of the greatest consequence to the painter: it must never be thought that the colours of a picture can be neutralized by the final layers of paint which are applied over them. A proof of this may be found in the curious phenomena connected with what are known in France as *repentirs*. These are corrections of a part of a picture which has already been painted, made before the whole picture is complete. If for example, at one of the sittings for a portrait, the artist sees that the arm or leg of his subject would produce a more characteristic effect if its position were changed, he may merely repaint the arm or leg without scraping off the original paint. Or again, accessories which prove inconvenient in the composition of a picture may be covered over with a few strokes of the brush. It often happens that after a longer or a shorter period the original detail begins to show through, and sometimes becomes quite clearly visible. This can be seen in Velasquez' portrait of Philip IV. in the Prado, in Ingres' "Jesus among the doctors" at Montauban, and in Bonington's "View of Venice" and Gros' "Portrait of the Comte Fournier-Sarlovèze" in the Louvre, to mention a few examples chosen haphazard from hundreds of others equally striking.

**Development of Colours.**—It is difficult to praise too highly the fertility of invention in colour harmonies and the bold experiments in technique which are due to the painters of the present generation. Only too often, however, these inventions contain an element of risk, and only too often, quite apart from the quality of the work, technical considerations are sacrificed. The creation of a picture makes great demands on the intellect, and in its execution, strict discipline must be observed; otherwise the paint in time takes its revenge.

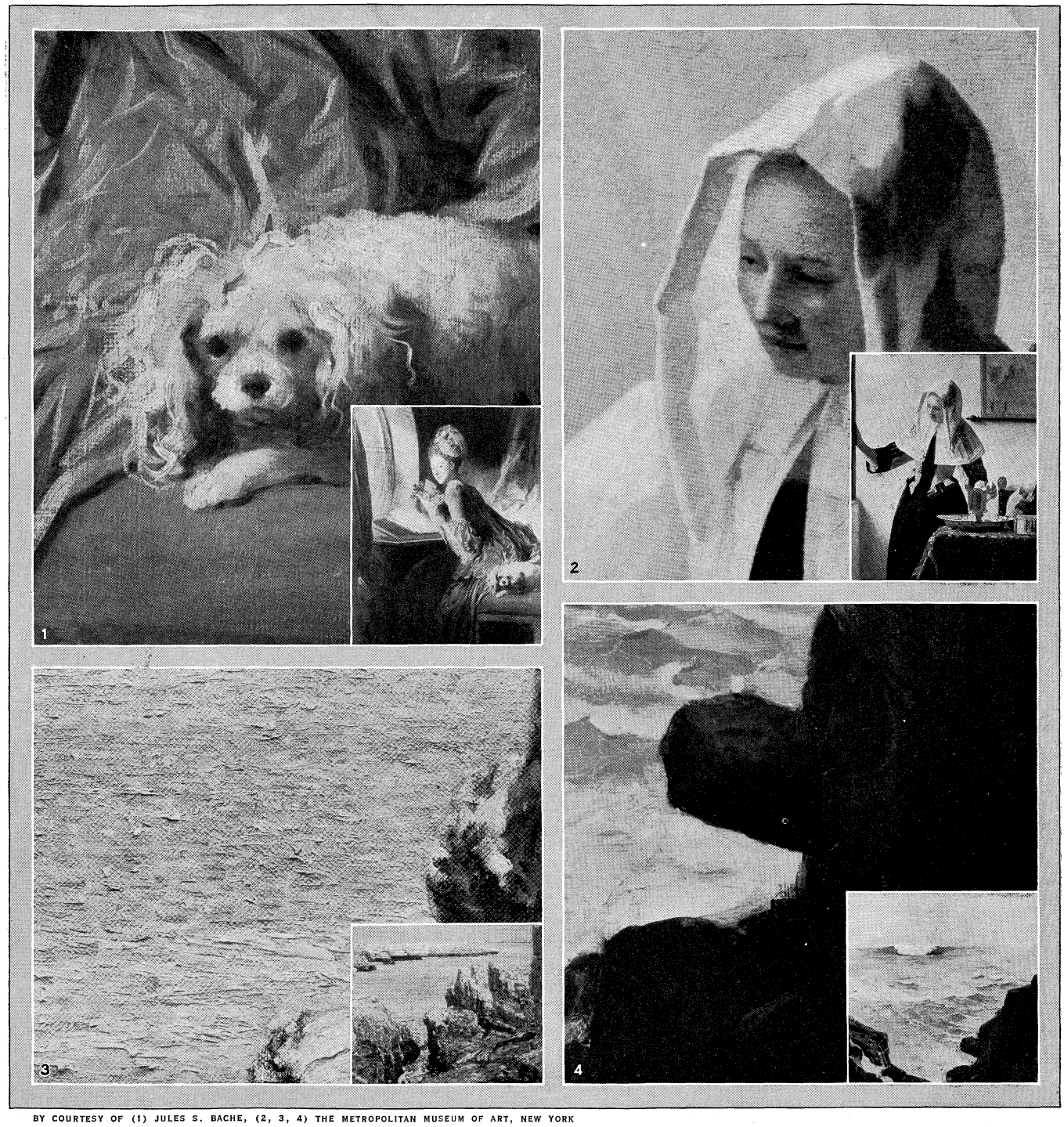
Some painters, having carefully studied portraits by Titian and important pieces of painting by Tintoretto, in which those masters obtained astonishing effects simply by the use of four durable colours, white, black, yellow ochre and red ochre, have tried to reduce their palette to that basis, adding the minimum of additional colours when necessary. Some very good work has certainly been done by this method in the last few years. At the same time there are a number of pictures painted in this way which are heavy even when freshly painted, and which soon afterwards become painfully opaque. And yet, even leaving aside the Italian Renaissance, even leaving aside Velasquez, it is easy to show what variety can be obtained with this sober palette. It is only necessary to look at what has been done by men such as Manet, Corot in some of his figure subjects, Whistler, and Cézanne in his first manner.

There is however one often tested axiom which will give us one of the keys of the enigma: When the same colour, with the same value, is applied twice in the same place, the second application becomes opaque. It is owing to skilful organisation of their work that painters are able to include other colours in their palette besides the ochres, which, incomparably valuable as they are, have their limitations. For it has been proved that the best colours, if not cleanly applied, may lose their qualities, while others, which are not usually used, may be so employed that they will stand the test of time. No more typical example could be found than that of Veronese green. Too many painters use this colour in all circumstances, for it is very attractive owing to the variety of tones which can be derived from it. Unfortunately the effects which it gives do not last, and the subtlest harmonies, the most delicate greys, turn to a muddy and leaden black. Yet Gauguin constantly uses Veronese green without ill results. It should however be noted that Gauguin only employs this dangerous colour either pure or mixed with strontian yellow. Another example is that of vermilion, which loses its freshness and intensity in a few days unless it is applied boldly and without retouching.

Colours have characteristics of their own and however gifted an artist may be, he cannot dispense with patient observation of the difficult technical side of his art. In this respect, the best example in modern times is set by the Impressionists. If we take their best period, arbitrarily selecting 1890 as the final date, we shall find that their palette does not by any means consist of the most stable colours. The cadmiums and the madders play a much greater part than the earth colours, which the Impressionists did not use very frequently; but what admirable technical knowledge was shown by these painters, who were so long criticised for their revolutionary ideas! In their pictures we may note a light and luminous outline; the spots of colour are interlaced, but yet remain distinct. The colour effects are produced rather by the juxtaposition than by the mingling of tones, and it is left to the hand of time to blend and harmonise colours whose original bloom has been respected.

III. **Technique of Execution.**—A painter cannot with impunity retouch his picture whenever he feels inclined; a fact which only too many fail to realise, much to their detriment. The coloured paste which is transferred from the palette to the canvas is a fragile and capricious substance. To paint as inspiration and fancy dictate is not to paint soundly, especially if the work undertaken is on a large scale. Pictures completed at a sitting give the best account of the painter's talent. Everyone knows that studies for pictures are nearly always more brilliant than the completed work. A good example may be provided by a comparison between the female torso by Delacroix in the Musée d'Angers and the same passage as it appears in the "Sardanapalus" in the Louvre.

What can be done with a small picture, however, becomes much more difficult when it is desired to paint on a larger scale. Some masters have, nevertheless, in certain cases been able to paint large canvases without going back over what they had once begun; examples are Tintoretto's "End of the World" in the Madonna dell'Orto at Venice, and Franz Hals' "Banquet of the officers of the corps of archers at Saint-Georges," at Haarlem. By this means they attained an extraordinary vitality of colouring, and their works defy the passage of time. Spontaneous execution of this kind is, however, necessarily limited to certain effects; it is, for example, impossible to arrive all at once at all the pro-



BY COURTESY OF (1) JULES S. BACHE, (2, 3, 4) THE METROPOLITAN MUSEUM OF ART, NEW YORK

## VARIETY IN TECHNIQUE OF EXECUTION

1. "The letter" (*Le billet-doux*) by Jean-Honoré Fragonard (1732–1806), French. This illustrates dexterity of handling. Fragonard was one of the most brilliant sketchers ever known, equally notable for the virtuosity of his facile swift brushwork and for his pure, delicate colouring. He was a master of the sketch as a thing complete in itself
2. "Young woman with a jug" by Jan Vermeer of Delft (1632–75), Dutch. A great colourist, famous for his light effects, Vermeer achieved his smooth even handling with a round soft brush
3. "The Isle of Shoals" by Childe Hassam (1859–1935), American. Childe Hassam, as an Impressionist and a follower of Monet, frequently paints in the *pointilliste* method, with separate points or touches of pure colour, applied in conformity with the configuration of the surface to get the modelling. The whole scene vibrates with light
4. "Cannon Rock" by Winslow Homer (1836–1910), American. This painting of the Maine Coast series, sometimes called Homer's "Ocean Symphony," illustrates the artist's technical command of palette-knife and brush in the use of thick and thin paint

# OIL PAINTING, TECHNIQUE OF

BY COURTESY OF (2, 3) THE METROPOLITAN MUSEUM OF ART, NEW YORK; PHOTOGRAPHS, (1) W. F. MANSELL, (4) ANDERSON

## FAULTS AND DEFECTS OF PAINTINGS—ENLARGED VIEWS SHOWING DETAILS OF TECHNIQUE

1. "Head of a Girl," by Jan Vermeer of Delft (1632–75), Dutch. In the Royal Picture Gallery at The Hague. The cracks are caused by painting over a smooth priming. 2. "Portrait of M. Leblanc," by Jean Auguste Dominique Ingres (1780–1867), French. The cracks due to "Siccatif" are clearly visible. 3. "The Harvesters," by Pieter Bruegel the Elder (1525?–69), Flemish. Underpainting showing through an overpainted correction is known as a *penimento*. Here the underpainting shows through, owing to the fact that the colours have become transparent from age. The tree trunk shows through the hat. 4. "Portrait of Philip IV," by Diego Velazquez (1599–1660), Spanish. In this famous portrait the original detail is beginning to show through and is clearly visible in places. In the Prado, Madrid

fundities of technique and observation which go to make up a Rembrandt; in such cases sketches must be made first.

Several methods of preparation have been and still are adopted. In order to retain as far as possible the impression of a picture executed without repainting, some masters have first sketched in their picture with a thin wash of a single colour, very much diluted. They thus mass in the lights and shadows and lay down the main lines of their subject, after which they attempt the final painting. This system was used for a great many 18th-century pictures in which the colours work in admirably with the original sketch executed in a reddish brown wash. An example is Fragonard's "Music Lesson," which has all the spontaneity of a rapid sketch.

Even before the 18th century Rubens, whose genius delighted in the overcoming of difficulties, was naturally attracted by this method. Not content with studies or simple compositions, he painted his "Kermesse" in the Louvre and his great "Adoration of the Magi" in Antwerp directly over a ground-sketch in brown. The latter work is an unparalleled *tour de force* from the technical point of view. But not all artists are Rubens, and a painter who does not possess his incomparable technical mastery cannot execute large-scale canvases by this method. There is, moreover, a danger; however vigorously the picture is painted, the colour in which the preliminary sketch is executed gradually tends to prevail in the general harmony. The result of this is indeed sometimes admirable; the "Portrait of Helène Fourment and her children" in the Louvre owes to its warm-tinted ground sketch a golden tone which is independent of the thick coat of varnish which has been applied.

Thus this attractive, but difficult and sometimes dangerous method, can only be used for limited purposes. It is more usual for painters to make use of all the materials at their disposal for sketching in their pictures; they use all the colours of their palette for the first groundwork, which matters so much to the success of the picture and still more to how it will develop in the future, and they gradually work up to the desired colour harmony. Great masters, such as Raphael, Chardin and Delacroix, have painted in this way. But they have never lost sight of the discipline which must be observed if a painting is to keep its pristine qualities. Like the sound technicians that they were, they did not forget the twofold danger which has to be avoided in the painting of a picture: overdone brushwork and muddy overlaid colour. A canvas painted without method is doomed to perish. If a sketch is painted over while it is only half dry, the paint will become muddy and dead; if solid colours, such as ochres, are applied over fragile groundwork painted with madders, or if a dark tone is put in over a light ground which is still fresh, cracking will result. What most often happens, however, is that one part of the canvas is painted over again to correct it without sufficient care; then all the dark parts become opaque black, while the lights lose their brilliance.

In order to avoid these dangers and to ensure good and solid quality in their paint, many painters work according to a system of division of labour. They use grisaille in the form of an undiluted paste for the preparation of their works, following a method first used by Italian Renaissance artists. Their pictures are sketched in with two colours, white and black or white and brown, as in a chalk and charcoal drawing. The painter can then, without any danger of working over the colour too much, work on a particular passage or modify the composition until the balance of the whole is satisfactory. The colour can then be put in on this solid foundation of grisaille; the final painting should be executed as rapidly as possible. This method has been used by Titian in his nudes and most of his portraits, El Greco and Rubens in many of their great works, Watteau in his "Gilles," Prud'hon in nearly all his pictures, and nearer to our own time Ricard and Gustave Moreau. Some painters go so far as to obtain their final harmony simply with glazes and a few touches of impasto over a monochrome ground; a typical example of this method carried to an extreme is to be found in Reynolds' "Portrait of Master Hare" in the Louvre. It will be observed that with this method the paint never becomes heavy, the colour may in some cases fade if it is put on too lightly, but no method of work does more to protect the delicate effects of a colourist or to preserve the unity of execution.

**The Varnish.**—The part played by varnish is twofold. In the first place it protects the picture from impurities in the air. In the second place it restores freshness to the picture when this has been lost, for as it dries, the oil which enters into the composition of the colours penetrates to the lower layers, as well as evaporates, leaving the colours dimmed. Varnish restores them to their original vigour, and it has the property of remaining transparent when it hardens. The theoretical value of varnish is thus simple and obvious. Its application is, however, often criticised. When painters leave the varnishing of their pictures to their colour dealers, and it is curious to note how many of them do, the dealer frequently puts on the varnish too thickly and irregularly. Pictures varnished in this way are painfully shiny, and as many modern painters give as much emphasis to their dark tones as to their high lights, it often happens that all the intersections of the dark strokes shine to such an extent that the picture cannot be properly seen. The first results of bad varnishing soon show themselves in the form of large stains on the picture corresponding to the irregularities in the application of the varnish.

Not only is varnishing sometimes badly done, but it is done too soon and at the wrong moment. Since varnish solidifies very quickly, it is quite obvious that it should not be applied until a painting is perfectly dry. This will prevent it from softening the paint even to the slightest extent, and thus causing it to crack by drying differently. Care should also be taken never to varnish a picture while it has dust on it; otherwise impurities will remain between the paint and the varnish and will in time spoil the picture. The coat of varnish should be extremely thin and applied firmly and regularly, since it loses its qualities and dries cloudy if it is put on thickly. Varnishing should not be done on a wet day, or moisture will be imprisoned between the varnish and the canvas. If this precaution is neglected, there will be a bluish film over the picture.

One of the most frequent stumbling-blocks for the painter is the result known as "matt" effect. The dulling of the paint, which has already been mentioned as one of the reasons for which varnish has to be used, may be produced while the picture is being painted, and will be especially marked if the first sketch is painted over before it is properly dry. The oil of the second coat may be absorbed so rapidly that the last touches which are put on appear to be of a dull grey nothing like the real colour. The "matt" effect at once disappears if any liquid is passed over the picture; but it often causes worse damage in the end, for the repeated imprisonment of moisture between the various layers of paint constituted by retouching will slowly but surely destroy the picture.

Siccatives, heavy oils and mixtures of all kinds are really responsible for much of the damage which is attributed to varnish. It is a matter of common knowledge that Delacroix was not always as strong on the technical side as he was lofty in his conceptions. It is difficult to say which did most to destroy his paintings—the curious mixtures of liquids which he used, or the disastrous qualities of the materials which entered into the composition of the colours with which he habitually painted. We can obtain some idea of the splendour which his works ought to have retained by looking at those canvases which he executed simply, such as the "Algerian Women," "The Artist's Studio" and the "Still Life" in the Moreau-Nélaton collection in Paris. And very often that delicate artist Prud'hon made excessive use of heavy oil and bitumen, which caused immense cracks to form in his pictures, as for example in his "Christ" in the Louvre.

How then, it will be asked, is it possible to correct a passage which is seen in the course of painting a picture to be unsatisfactory? And once the picture is painted, how can it be made fit for exhibition if it cannot yet be varnished without danger, and if the colours have a "matt" effect.

There are on the market a number of varnishes known as retouching varnishes, the merits or demerits of which cannot be discussed here. It may, however, be said that the lighter and more transparent the liquid to be applied over the piece which it

is desired to repaint, the less danger there is that it will impair its freshness in time to come.

When the painting is completed, the general effect can be clearly seen if it is washed over with a mixture of white of egg, water and sugar. This preparatory varnish does not affect the colours in any way, and it can be sponged off with water when the time comes, about a year later, to apply the final coat of varnish which it has by this means been possible to defer.

Some have thought that varnish can be replaced by glass, and many have followed the example of the British picture galleries by glazing oil paintings. Glass is an effective protection against damp, especially if the back of the picture is felted. This is the reason why it is used in London, where the air is very damp. At the same time glass protects the picture from the fingers of clumsy visitors to public galleries, and from smoke in private houses. But it can never be a substitute for varnish; indeed it often makes it impossible to see and appreciate a picture properly. Not only is glass no substitute for varnish, but it transforms the picture into a mirror, so that the spectator sees a reflection of himself rather than the painting.

The disadvantages of glass are not so serious in the case of pictures in which the general tone is light. The difficulty still exists, but it is lessened because white does not transform a sheet of glass placed in front of it into a mirror. Many modern painters who paint in light tones have refrained from varnishing their pictures, as it does not help very much to bring out light tones. The objection to varnish dates, naturally enough, from the Impressionist period. The Impressionists wished their colours to produce as vibrant an effect as possible, and they therefore took care not to cover the paint with a foreign substance which was liable to develop in a way which they did not like.

It was inevitable that as painters gave up the use of varnish, they should gradually come to use turpentine to dilute their colours, and at the same time to paint on absorbent canvas. Mat painting has the technical advantage of avoiding the difficulty of "bloom" which was mentioned above; a deliberate attempt is made to obtain harmonies by the use of colours which do not shine because they contain less oil, either on account of their having been mixed with turpentine or on account of the oil having been absorbed by the canvas. So many admirable works have been produced by this method that we cannot fail to rejoice at a new discovery in the technique of painting. It must, nevertheless, be asked in all impartiality how a painting from which for one reason or another varnish has been excluded will stand the effects of time. If pictures were always to be exhibited under favourable circumstances, in a dry climate, not exposed to changes of temperature, and sheltered from dust, smoke and fumes of all kinds, we could allow varnish to be an unnecessary protection. All persons who have had occasion to see a large number of paintings will, however, have met with cases, somewhat rare, it is true, of 18th century decorative panels which have never been varnished. As a general rule about one centimetre of the edge of the painting is concealed by a frame or beading. The painting has not turned yellow as it would have done if it had been too heavily varnished, but at the same time it has not kept its original brilliance; it is covered, as it were, with a veil of warm grey except under the frame, where it has been protected from the light and from the impurities in the air and has preserved its original freshness. The worst feature is that there is no way of cleaning pictures of this kind. The dust fixed on the paint by the moisture in the air has become incorporated with it; but still more, the very body of the colour has been affected. Simple tones such as light greys have remained comparatively luminous, but the reds have become purplish, the yellows have turned brown, and the browns have lost their transparency. The dirt produced by dust fixed on the picture by the moisture of the air has worked right into the grain of the canvas. Such attacks by foreign bodies would not have had so much effect on varnish, and even if owing to circumstances the varnished picture had suffered an accumulation of dirt, it would still be possible to remove the varnish and find underneath the picture as the painter conceived it.

It is most desirable to protect these mat pictures with glass, unless a coating of wax is put over them to preserve their non-shiny appearance. The merits of wax for this purpose have always been known; it is one of the best means of preserving paintings, and it isolates them from injury from without in the same way as varnish.

(*See* PAINTING; LANDSCAPE PAINTING; PORTRAIT PAINTING; STILL-LIFE PAINTING; MURAL PAINTING; FLOWER PAINTING.)

(J. G. G.)

BIBLIOGRAPHY.—M. P. Merrifield, *Original Treatises, dating from the 12th to the 18th Centuries, on the Arts of Painting in Oils, etc.* (2 vols., 1849); Leonardo da Vinci, *Trattato della Pittura* (Paris, 1651), Eng. trans., *A Treatise on Painting*, J. F. Rigaud (1802), German trans., *Lionardo da Vinci: das Buch von der Malerei*, H. Ludwig (Vienna, 1882); C. A. du Fresnoy, *De Arte Graphica Liber* (Paris, 1668), French trans., R. de Pibes (1673), Eng. trans., W. Mason, with illustrations by Sir J. Reynolds (1783); G. de Lairesse, *Het groot schilderboek* (Amsterdam, 1707), Eng. trans., J. F. Fritsch, *Treatise on the Art of Painting* (1738); Sir Joshua Reynolds, *Discourses delivered to the Students of the Royal Academy* (introd. and notes by R. Fry, 1905); R. E. Raspe, *A Critical Essay on Oil-painting, proving that the Art of Painting in Oils was known before the Pretended Discovery of John and Hubert Van Eyck* (1781); L. Marcucci, *Saggio analitico-chimico sopra i colori minerali, etc.* (Rome, 1813); J. N. Paillot de Montabert, *Traité complet de la peinture*, vol. ix. (9 vols., 1828–29); J. F. L. Mérimée, *De la peinture à l'huile* (1830); E. Hareux, *Cours complet de peinture à l'huile* (2 vols., 1901); Ch. Dalboy, *Les procédés des Primitifs, Les origines de la peinture à l'huile* (1904); E. Dinet, *Les fléaux de la peinture. Observations sur les vernis, les retouches et les couleurs* (1905); Ch. Moreau-Vauthier, *La Peinture: les divers procédés* (1912), Eng. trans., *The Technique of Painting* (1912), and *Comment on peint aujourd'hui* (1923); A. Lowe and G. de Beer, *Manuel de la Peinture a l'huile* (Brussels, 1916); J. G. Goulinat, *La technique des peintres* (1922); M. Busset, *La technique moderne des tableaux* (1928).

**OIL-PALM** (*Elaeis*), a genus of palms closely allied botanically to the coconut palm (*Cocos*). Two species are generally recognized, both medium-sized trees native to the tropics—one of considerable range in the Old World and the other found in South America.

The African oil-palm (*E. guineensis*), the source of palm oil and of palm-kernel oil, is a widely-known tree of great economic value. It occurs throughout an extensive area in tropical West Africa, and is also found in Malay archipelago and in the Sunda islands. It has been introduced into the West Indies and South America, and is grown to a limited extent in southern Florida. It is a handsome tree with a stout, deeply and coarsely ringed stem, 20 ft. to 30 ft. high, bearing at its summit a somewhat irregular crown of immense feathery leaves, 10 ft. to 15 ft. long. The leaves, which are pinnately divided into from 50 to 60 narrowly lance-shaped, sharp-pointed leaflets, are alike in colour on both sides, and are borne on stout leaf-stalks with spiny-toothed margins. The exceedingly numerous flowers are crowded on a short spadix and develop into a huge ovate fruit cluster containing usually from 150 to 200 reddish or orange-coloured thin-skinned drupes. The ripe drupes have a red or golden pulp which surrounds from one to three black hard-shelled stones or nuts with oily kernels (seeds). Upon attaining a height of several feet this species is one of the most attractive palms, and in suitably mild climates, as in southern California, young trees are grown for purely ornamental purposes.

The South American representative of the genus, *E. melanococca*, is a similar but much smaller tree. The leaves yield useful fibre and the fruit, like that of the Old World species, contains oil.

Palm oil, called also palm butter and palm grease, is extracted by a process of fermentation from the pulp of the oil-palm fruit. It is a fixed, butter-like, reddish-yellow fatty oil, possessing a faint violet odour, which is remarkably persistent, being conveyed to soap manufactured from it. Its chief constituents are free palmitic acid, varying from 12% in fresh oil to 55% in older oil, together with stearic acid and glycerides of palmitic and oleic acids. Its specific gravity varies from 0·920 to 0·927; its melting point is such (80·5° F to 108·5° F) that while it is usually a liquid in the Tropics, it is a semi-solid in temperate regions. Its saponification number is 202; its iodine value ranges from 65 to 72, and its Reichert number is 0·5. Palm oil is soluble in alcohol.

ether, carbon bisulphide and chloroform.

Palm oil is extensively used in the manufacture of soap and also of candles. Mixed with cottonseed oil and mineral oil it is widely utilized in the tin-plate industry for coating iron. It has long been employed as a lubricant, particularly for railway-car axles. It is also used to give colour to butter-substitutes. Palm oils that are low in fatty acids are called "soft oils"; those containing a high percentage of fatty acids are known as "hard oils." In tropical West Africa, especially in the Gold Coast, a specially prepared palm oil, called chop oil, is a staple article of food, being used in the same manner as olive oil, soy bean oil and butter are in temperate regions.

Palm-kernel oil or palm-nut oil, is extracted from the kernels of the crushed nuts either by pressure or with solvents, the yield ranging from 45% to 50%. It is a yellowish fatty oil more closely resembling coconut oil than palm oil. When fresh, palm-kernel oil is free from fatty acid, but, upon exposure to the air, quickly becomes rancid. Its principal constituents are triolein 15% to 25%; triglycerides of stearic, palmitic and myristic acids about 33%; and triglycerides of lauric, capric, caprylic and caproic acids 45% to 55%. The specific gravity of palm-kernel oil is 0·952; its melting point varies from 78·6° F to 86° F; its saponification number is 247·6, and its iodine value is 13·4–13·6. It is extensively used in the manufacture of soaps, chocolate products, pharmaceutical preparations and perfumery.

Tropical West Africa is the main source of the world's supply of palm oil. In 1939 the Netherlands Indies was the leading producer, exporting 255,293 tons. Nigeria was second, exporting 141,205 tons. In the same year the Belgian Congo exported 79,917 tons and British Malaya 66,910 tons. Prior to World War II other exporters of palm oil were French West Africa, French Equatorial Africa, the Cameroons, Angola and Sierra Leone.

While palm oil is prepared directly from the fruit pulp in the regions where the oil-palm grows, the hard-shelled nuts are largely exported in bulk and the extraction of oil from their kernels is made elsewhere. In 1940 the exports of palm kernels from Nigeria were estimated at 263,571 tons, those of the Netherlands Indies at 32,089 tons and those of Brazil at 52,665 tons. In 1939 the Belgian Congo exported 93,573 tons and Sierra Leone 78,142 tons. The total oil-equivalent of the products of the oil-palm in all countries in 1939 was estimated at about 945,000 tons. (See OILS, FATS AND WAXES; PALM; PALM OIL.) (F. W. J.; X.)

**OIL REFINING:** *see* PETROLEUM.

**OILS, FATS AND WAXES.** The term "oils" is loosely used as a generic term for substances having the common property of being greasy fluids, either at the ordinary temperature, or at temperatures below the boiling-point of water. Formerly, when substances were principally classified by obvious characteristics, the word included such a body as "oil of vitriol" (sulphuric acid), which has, of course, nothing in common with what is now understood under the term oils.

In its most comprehensive ordinary acceptation the word embraces at present the fluid, "fixed," or fatty oils (*e.g.*, olive oil), the soft fats which may be fluid in their country of origin (*e.g.*, coconut oil, palm oil), the hard fats (*e.g.*, tallow), the still harder vegetable and animal waxes (*e.g.*, carnaüba wax, beeswax), the odoriferous ethereal (essential) oils and the fluid and solid volatile hydrocarbons—mineral hydrocarbons—found in nature or obtained from natural products by destructive distillation (petroleum, shale oils, oils from the low-temperature distillation of coal).

The importance of fatty and mineral oils to the life and industry of a nation is a commonplace of everyday observation; the exigencies arising from the World War did but emphasize human dependence on these raw materials for food and power, and stimulated development and research in all branches of the industries connected with them. Great advances have been made in the utilisation of mineral (petroleum) oils (*q.v.*). The last two decades have seen great developments in oil-fuelled internal combustion engines and the widespread adoption of oil as a fuel for steam-raising, both in stationary boilers and for shipping, and more especially for battleships, where high power output combined with economy in fuel-storage space and stokehold labour are of primary importance. Improvements in the production of lubricating oils have been necessitated by the advances in modern machinery, which involve higher working temperatures and pressures. We may note in passing the development, especially in Germany, probably as a direct result of war-time isolation from supplies of mineral oils, of the production of oils by the distillation of lignites and by synthesis from producer gas.

The fatty oils, ever of paramount importance as food, acquired an increased significance during the War as sources of glycerine, the basis of explosives of the dynamite class. In England, strict government supervision was exercised over soap manufacture, and all industries involving the hydrolysis of fats, to ensure the maximum recovery of glycerine (about 10–14% of the weight of a fresh oil). Towards the end of the War period a process was mooted to replace the glycerol in edible fats by mannitol or a similar sugar, in order to obtain both the glycerine and a product equal in nutritive value to the original fat.

The shortage of edible oils in all countries during the War led to great advances in the technique of oil-refining; oils hitherto regarded as purely industrial became available for food as a result of improved methods of purification, and it may be said that to-day almost all fats, with the exception of those possessing marked physiological action, such as castor, curcas and chaulmoogra oils, can be utilised as food. Especially in the Central European countries, where, as a result of the blockade, the shortage of fats became acute, every effort was made to stimulate the investigation and production of synthetic fats. In some cases processes were put into actual operation; and in Germany attempts were made to supplement available resources with fat obtained from yeast under intensive cultivation. Synthetic fatty acids can be prepared by the oxidation of paraffin wax and other hydrocarbons, and glycerides have been synthesised on the large scale by heating these acids, under pressure, with glycerol, which may be obtained by the fermentation of non-crystallisable sugars. In view, however, of the enormous expansion of which the natural production of the fats is capable, it is extremely improbable that these methods will be commercially successful under normal economic conditions.

The common characteristic of all the "oils" is that they consist principally, in some cases exclusively, of compounds of carbon and hydrogen. They are all readily inflammable and are practically insoluble in water. The mineral hydrocarbons found in nature, or obtained by destructive distillation do not come within the range of this article (*see* NAPHTHA, PARAFFIN, PETROLEUM), which is restricted to the following two large groups of bodies, formed naturally within the vegetable and animal organisms, viz. (1) Fixed oils, fats and waxes, and (2) Essential, ethereal or volatile oils.

### FIXED [FATTY] OILS, FATS AND WAXES

The substances to be considered under this head divide themselves naturally into two large classes, viz., fatty (fixed) oils and fats on the one hand, and waxes on the other, the distinction between the two classes being based on a most important chemical difference. The fixed oils and fats consist essentially of *glycerides, i.e.*, esters formed by the union of three molecules of fatty acids with one molecule of the trihydric alcohol *glycerol* (glycerine, *q.v.*).

In a class of glycerides known as the phosphatides or phospholipines one or more of the fatty acid radicles is replaced by a grouping containing nitrogen and phosphorus, as, for example, lecithin.

The waxes consist of esters formed by the combination of one molecule of fatty acid with one molecule of a monohydric alcohol, such as cetyl alcohol, cholesterol, etc. Only in the case of the wax *coccerin* are two molecules of fatty acids combined with a dihydric alcohol. It must be pointed out that this distinction does not find ready expression in common parlance; thus *Japan wax* is a glyceride and should be more correctly termed Japan tallow, whereas *sperm oil* is, chemically speaking, a liquid wax. Although these two classes of substances have a number of physical properties in common it is better, for some purposes, to consider them

under separate heads. The true chemical constitution of oils and fats was first expounded by the classical researches of Chevreul, embodied in his work, *Recherches sur les corps gras d'origine animale* (1823, reprinted 1889).

**Occurrence.**—The oils and fats cannot be looked upon as definite chemical individuals, but as representatives of natural species which vary, although within narrow limits, according to the climate and soil in which the plants producing them are grown, or, in the case of animal fats, according to the climate, the race, the age of the animal and especially the food as well as the idiosyncrasy of the individual animal. The oils and fats are distributed throughout the animal and vegetable kingdom, from the lowest organisms to the highest, and are found in almost all tissues and organs. The vegetable oils and fats occur almost exclusively in the seeds and fruits; the waxes appear usually as thin films covering leaves and fruits. In animals the fats are enclosed mainly in the cellular tissues of the intestines and of the back, although a certain amount of fat is present in all the organs; in the lower animals fat is also stored in the liver, muscles, etc. There are a few liquid waxes known, occurring in the blubber and head cavity of sperm whales and stored in the stomach of certain arctic and antarctic birds (*e.g.*, Australian mutton-bird [*see* SHEARWATER]); other waxes occur as insect secretions, while wool-wax is the natural grease found in sheep's wool.

**Physiology of the Fats.**—The most evident function of the fats in animal organisms is that of food-reserve, to supply, by subsequent oxidation, energy for the growing and working tissues. The storage of fats and oils in vegetable seeds can be similarly explained as food-reserve for the embryo; it is difficult, however, to account for the presence of oil in large quantities in the pericarp of fruits such as the olive and palm, which is probably destroyed before germination of the seed. The fats, and especially the waxes, can fulfil other valuable service by virtue of their physical properties, *e.g.*, insolubility in water, and their chemical inertness. For instance, subcutaneous fat deposits protect the organism from cold; beeswax prevents dilution of the concentrated sugar solutions of the comb by external moisture; the waxes, and in some cases the fats, secreted in the leaves of plants preserve the underlying tissues from loss or access of water. It is probable that the resistant powers of the tubercle bacillus are largely attributable to the protective effect of the wax coating in which it is encased; this waxy secretion is remarkably inert and resists the action of the usual hydrolysing measures. It is probable that the fats fulfil still other, though more recondite, essential functions, quite distinct from their office as fuel supply for the cells.

It is only within the last few years that the importance of the animal fats as sources of the fat-soluble vitamins has been recognised: the discovery that vitamins (*q.v.*) may be produced in some non-active vegetable oils by the action of light is among one of the most recent advances of biochemistry. These bodies, of vital physiological importance as accessory growth factors, appear in minute proportions in the unsaponifiable (non-glyceridic) fraction of natural oils probably as a result of their physical solubility in these media; nevertheless the recognition of the part played by these substances attaches a new significance to the rôle played by the fats in animal metabolism.

**Synthesis and Oxidation of Fats in Living Organisms.**—The fat of the flesh-eating animals appears to be mainly derived from the fats consumed in the food; it has been demonstrated, however, by the classical researches of Lawes and Gilbert, that animal fats can be derived from carbohydrate food, while it is probable, although the proof is not so clear, that carbohydrates are the source of the fats in herbivorous animals and plants. In the case of vegetable seeds and fruits the formation of fats occurs late in the ripening process; in the unripe condition carbohydrates (sugars, starches, etc.) are to be found in the fruits and sap, but no fatty acids (or oils) and it is likely that the former are broken up and converted into fatty acids and subsequently into glycerides during the maturing process. In the case of almonds it has been observed that carbohydrates disappear as fat is formed.

It is a noteworthy fact that, almost without exception, only acids with an even number of carbon atoms in the molecule occur in the natural fats. The preponderance of $C_{18}$ acids suggests the hypothesis that the fats are derived from the $C_{18}$ nucleus of the polysaccharides, or, perhaps, from three molecules of glucose. Secondary oxidations and condensations are necessitated to explain the formation of $C_{16}$ and the higher acids $C_{20}$, $C_{22}$ and $C_{24}$. To account for the formation of milk fats and fats of the coconut class, which are distinguished by the presence of the lower fatty acids, a second type of synthesis has been postulated, involving a building-up process of the acids, one from another, and originating from simple sugars instead of the more complex polysaccharides. Yet other theories have been propounded to account for the formation of the unsaturated link in the middle of the oleic acid chain. It is possible that fats can be formed from protein material.

The utilisation of the stored fat by the plant embryo has been but little studied; it seems that the fat is hydrolysed by lipolytic (fat-splitting) enzymes and broken down, possibly into simpler fatty acids, with the ultimate production of carbohydrates (*cf.* conversion of fat into sugars in animals under abnormal conditions of glucosuria).

In the animal body the fats of the food are emulsified and hydrolysed by enzymes in the intestine; the glycerol and fatty acids are absorbed through the intestinal epithelium, recombined to form glycerides characteristic of the animal in question and transported *via* the blood and chyle to the connective tissues for storage. It may be noted that the fat of an individual animal can vary according to the fatty food supplied; for instance, the milk-fat of cows fed on a diet rich in coconut-oil simulates the latter in its properties; the fat of the Eskimo possesses an abnormally high iodine value, and resembles blubber oil.

The way in which the fat reserves are circulated to the organs in which combustion of the fat with the liberation of energy occurs, is scarcely understood. It is established that when mobilisation of reserve fat takes place the stream is primarily directed to the liver, where the fatty acids are desaturated, *i.e.*, unsaturated linkages are introduced into the fatty acid molecules. It is uncertain whether unsaturated acids so produced are distributed to the working cells as glycerides; it is possible that compounds of the fatty acids with nitrogen and phosphorus (the phospholipines, which are found in the liver and other organs) must be built up by the liver prior to transfer by the blood to the various organs. The unsaturated links introduced into the fatty acids by the liver appear to provide weak points for attack by the working cells in the process of combustion to the ultimate products of carbon dioxide and water.

## FATTY OILS AND FATS

The fixed oils and fats form a well-defined and homogeneous group of substances passing through all gradations of consistency, from oils which are fluid even below the freezing point of water, up to the hardest fats which melt at about 50° C. Therefore, no sharp distinction can be made between fatty oils and fats. Nevertheless it is convenient to apply the term "oil" to those glycerides which are fluid below 20° C, and the word "fat" to those which are solid above this temperature. As a general inclusive term the expression "fat" is preferable, since this avoids confusion with mineral and essential oils.

**Chemical Composition.**—No oil or fat is found in nature consisting of a single chemical individual. Following on Chevreul's work, the fats were considered to consist in the main of mixtures of "simple triglycerides," this is, of *glycerides* in which each molecule of *glycerol* is combined with three molecules of the same acid, *e.g.*, tristearin, $C_3H_5(O{\cdot}CO{\cdot}C_{17}H_{35})_3$, the glyceryl ester of stearic acid, $C_{17}H_{35}COOH$; triolein, $C_3H_5(O{\cdot}CO{\cdot}C_{17}H_{33})_3$. Recently, however, it has been shown that "mixed glycerides," *i.e.*, compounds wherein one molecule of glycerol is united with two or three different fatty acid radicles, preponderate, *e.g.*, dipalmito-stearin, $C_3H_5(O{\cdot}CO{\cdot}C_{15}H_{31})_2(O{\cdot}CO{\cdot}C_{17}H_{35})$; palmito-oleo-stearin, $C_3H_5(O{\cdot}CO{\cdot}C_{15}H_{31})\ (O{\cdot}CO{\cdot}C_{17}H_{33})\ (O{\cdot}CO{\cdot}C_{17}H_{35})$. The natural fats, therefore, may differ, firstly in the fatty acids which they contain, and, secondly, by the different arrangement of the acids in simple and mixed glycerides. Fatty diglycerides only

occur occasionally as products of partial hydrolysis of the oil by ferment action.

**Fatty Acids.**—The most important and widespread of the fatty acids are *palmitic*, $C_{15}H_{31}COOH$ and *stearic*, $C_{17}H_{35}COOH$, acids (of the saturated series), and the unsaturated *oleic* acid, $C_{17}H_{33}COOH$.

The fatty acids are classified into related (homologous) series according to their degree of unsaturation, *i.e.*, the number of unsaturated or ethenoid bonds $>C=C<$, in the molecule of the acid. This classification is amplified in the list of examples which here follows.

*Straight chain fatty acids.*—The acids of the saturated (*acetic*, or *stearic*) series, general formula $C_nH_{2n+1}COOH$, include among the lower members butyric acid, $C_3H_7COOH$, characteristic of butter fat (*q.v.*), caproic, $C_5H_{11}COOH$, caprylic, $C_7H_{13}COOH$, capric, $C_9H_{19}COOH$, lauric, $C_{11}H_{23}COOH$, and myristic acids, present in butter and fats of the coconut class; stearic and palmitic acids are higher in the series. Acids of the oleic series, $C_nH_{2n-1}COOH$, (one pair of doubly-linked carbon atoms), of which oleic acid $C_{17}H_{33}COOH$, present in nearly all oils and fats, and erucic acid $C_{21}H_{41}COOH$, characteristic of rape and fish oils, are the most important. Acids of the linoleic series, $C_nH_{2n-3}COOH$ (two ethenoid bonds), include linoleic acid, $C_{17}H_{31}COOH$, present to a large extent in maize and cottonseed oils. The linolenic series acids, $C_nH_{2n-5}COOH$ (three double bonds) of which linolenic acid, $C_{17}H_{29}COOH$, the characteristic acid of linseed oil is very important, as the high degree of unsaturation of this acid is responsible for the "drying" power or oxidisability upon which the commer-

TABLE I.

| Oil | Principal sources of raw material | Yield % | Iodine value | Principal applications |
|---|---|---|---|---|
| | *Vegetable Oils* | | | |
| *Drying oils* | | | | |
| Linseed | Argentina, India, N. America, Russia | 38–40 | 175–205 | Paint, varnish, linoleum, soft soap. |
| Tung | China, Japan | 40–41 | 150–165 | „ „ |
| Hempseed | W. Europe, N. America, India, Japan | 30–35 | 148 | „ „ soft soap, rubber substitute. |
| Poppyseed | Levant, India | 41–50 | 123–143 | Salad oil, artists' oil, soft soap. |
| *Semi-drying oils* | | | | |
| Soya bean | China, Japan | 13–17 | 122 | Edible, burning. |
| Maize; corn | U.S.A., Argentina | 6–10 | 113–125 | „ soap. |
| Cottonseed | „ India, Egypt | 30–32 | 116 | Food, soap, steel-plate industry. |
| Sesame | India, etc., Egypt, Levant | 24–26 | 108–110 | „ „ |
| Rape (Colza) | E. India, Europe | 33–43 | 94–102 | Food, lubricant, burning, wool oils, steel-plate industry. |
| *Non-drying oils* | | | | |
| Almond | S. Europe, N. Africa | 45–55 | 93–100 | Perfumery, pharmacy. |
| Arachis (ground-nut) | India, W. Africa, China, U.S.A. | 43–45 | 83–100 | Edible, soap. |
| Olive | Mediterranean countries | 40–60 | 79– 88 | „ „ soap, perfumery, lubricating, pharmacy. |
| Castor | E. India, Mediterranean, C. America | 46–53 | 83– 86 | Medicine, soap, lubricant, Turkey-red oil. |
| | *Animal Oils* | | | |
| *Marine Animal Oils* | | | | |
| Fish oils: | | | | |
| Menhaden | Atlantic coast of N. America | .. | 140–173 | Leather currying, steel-plate industry, linoleum. |
| Herring | N. Sea, Japan | .. | 124–142 | Leather currying. |
| Liver oils: | | | | |
| Cod liver | N. Sea, E. coast N. America | .. | 167 | Medicine, leather currying. |
| Shark liver | Coasts of N. America | .. | 115 | Leather currying. |
| Blubber oils: | | | | |
| Seal | Arctic and Antarctic seas | .. | 127–147 | Burning, leather currying. |
| Whale | „ „ „ „ | .. | 121–136 | „ soap, fibre dressing, margarine (after hardening), leather currying, screw oils, greases. |
| Dolphin, jaw and body oils | | .. | 33, 99–126 | Lubricating oil for delicate machinery. |
| Porpoise „ „ „ „ | | .. | 36, 119 | |
| *Terrestrial Animal Oils* | | | | |
| Neat's-foot | U.S.A., S. America, Europe | .. | 67–73 | Lubricating, high-grade leather-dressing. |
| | *Vegetable Fats* | | | |
| Mahua (Illipé) butter | India, Malaya | 50–55 | 53–67 | Food, soap, candles, inferior chocolate fat. |
| Shea butter | W. Africa, Sudan | 49–52 | 56 | Food, soap, candles. |
| Palm oil | W. Africa | 65–72 | 53 | Candles, soap, tin-plate industry. |
| Cacao (cocoa) butter | W. Indies | 32–41 | 32–41 | Chocolate, pharmacy, perfumery. |
| Palm-kernel oil | W. Africa | 45–50 | 13–14 | Food, soap. |
| Coconut oil | E. Indies, Ceylon, Oceania, S. American coasts | 20–25 | 8–10 | „ „ „ candles. |
| Japan wax | China, India, Japan | 25 | 4–10 | Polishes. |
| | *Animal Fats* | | | |
| *Non-drying fats* | | | | |
| Lard | U.S.A., Central Europe | .. | 50–70 | Food, soap, pharmacy, perfumery. |
| Bone | „ India, Europe | .. | 46–56 | Soap, candles. |
| Tallow, beef | Argentina, U.S.A. | .. | 38–46 | Food, soap, candles. |
| „ mutton | Australasia | .. | 35–46 | „ „ „ |
| Butter | N.W. Europe, Australasia, Canada | .. | 26–38 | Food. |

cial application of the oil in the paint industry depends. Still more unsaturated acids occur, such as clupanodonic acid, $C_{21}H_{33}$·COOH (five ethenoid bonds), typical of fish, liver and blubber oils. The oxidation products of these oils, however, do not form such tenacious films as linseed oil, to which they are much inferior as paint oils. The hydroxylated acids of the ricinoleic series, $C_nH_{2n-2}(OH)COOH$, are typified by ricinoleic acid, $C_{17}H_{32}(OH)COOH$, the occurrence of which is responsible for the solubility of castor oil in alcohol.

The occurrence of *cyclic* (closed chain) acids is confined to oils of the chaulmoograc and hydnocarpus family. Acids with more than twenty-two carbon atoms in the molecule are rare among the fats, but are of fairly frequent occurrence among the waxes.

**Unsaponifiable Matter.**—Since the methods of preparing the vegetable and animal fats are comparatively crude, they usually contain certain impurities of one kind or another, such as colouring and mucilaginous matter, remnants of animal and vegetable tissues, etc. For the most part these foreign substances can be removed by processes of refining, but even after this purification the fats still retain small quantities of foreign bodies, such as traces of colouring matter, albumenoid and (or) resinous substances, and other non-glyceridic compounds; these substances can only be isolated after saponification of the fat, and are comprised in the term "unsaponifiable matter." Included among the "unsaponifiable matter" are the *sterols* (cyclic alcohols) —*phytosterol*, $C_{27}H_{46}O$, *sitosterol*, $C_{27}H_{46}O$, *stigmasterol*, $C_{30}H_{48}O$, *ergosterol*, $C_{27}H_{42}O$, and the animal sterols—*cholesterol*, $C_{27}H_{46}O$, *coprosterol*, $C_{27}H_{48}O$, etc. Phytosterol (*i.e.*, "plant-sterol) occurs in all oils and fats of vegetable origin; cholesterol is characteristic of all oils and fats of animal origin. This important difference affords a means of distinguishing by chemical methods vegetable oils and fats from animal fats. It is in the "unsaponifiable" fraction of oils that the bodies known as the fat-soluble vitamins (*q.v.*) have been located; these appear to be substances related to the sterols; for example, it has recently been clearly demonstrated that vitamin D can be produced from inactive ergosterol by irradiation with ultra-violet light.

The amount of unsaponifiable matter in an oil or fat does not, as a rule, exceed 2%, but in the case of some shark-liver oils the proportion is abnormally high, as large quantities (up to 85%) of highly unsaturated hydrocarbons, such as spinacene and squalene ($C_{30}H_{50}$?) are present; the relationship of these bodies to the glycerides normally occurring in oils, including fish-body oils, is still a matter for research.

**Classification.**—Following subdivision into animal and vegetable oils and fats, a second guiding principle to classification is afforded by a consideration of the amount of iodine the various fats are capable of absorbing. This is a measure of the unsaturated acids present, since iodine is absorbed (under suitable conditions) at the ethenoid linkages of the molecule of fatty acid.

About 80 of the natural fats are commonly utilised to a greater or less extent; the annual world consumption of each of about 20 of these approaches or exceeds 100,000 tons, and in the case of some half dozen is in the neighbourhood of 1,000,000 tons. They are classified as follows:—

**Solid Vegetable Fats.**—These are found mainly in the kernels and seeds of tropical fruits. They melt at from 20–35° C, and contain in general but little combined oleic acid, the bulk of the component fatty acids being lauric, myristic and palmitic. Fruits of many of the palm family, notably coconut oil and palm kernel oil, contain very large amounts of combined lauric acid. Palm oil contains chiefly palmitic and oleic glycerides. All these fats, when suitably refined, are used for edible purposes, and many are used in the manufacture of the higher grades of toilet and other soaps.

**Solid Animal Fats.**—A most important group of animal fats is that of milk fats, which are used universally as *butter*. All milk fats are characterized by the presence of definite, if relatively small, quantities of fatty acids which are known respectively as butyric, caproic and caprylic acids.

**Physical Properties.**—The specific gravities of oils and fats range from 0·913 (rape oil) to 0·975 (Japan wax, myrtle wax); for the bulk of the fats the value is between 0·915 and 0·945. Some oils, notably those of the castor oil and chaulmoogra groups, rotate the plane of polarisation of light.

The oils and fats are practically insoluble in water; with the exception of oils of the castor oil group they are insoluble in cold, and only sparingly soluble in boiling, alcohol. They are completely soluble in ether, carbon disulphide, chloroform, carbon tetrachloride, petroleum ether and benzene. Oils and fats have no distinct melting or solidifying point; this is not solely due to the fact that they are mixtures of several glycerides, for even pure glycerides exhibit the phenomenon of a "double melting-point." The freezing points of the oils range from a few degrees above zero down to −28° C (linseed oil). At low temperatures (*e.g.*, at 12° C in the case of cottonseed oil), solid portions, usually termed "stearine" separate out from many oils. These solid portions can be filtered off; the filtrates constitute the commercial "demarginerated oils" or "winter oils" which will remain limpid at low temperatures.

Oils and fats can be heated to a temperature of 200° to 250° C without undergoing any material change, provided prolonged contact with air is avoided. On being heated above 250° up to 300° C some oils, *e.g.*, linseed oil, safflower oil, tung oil (*q.v.*) (Chinese or Japanese wood oil) and even castor oil, undergo a change, probably due to polymerisation, resulting in the formation of semi-solid or solid products. Above 300° C fats are decomposed; this is evidenced by the evolution of acrolein (a decomposition product of glycerin), which possesses the pungent odour of burning fat. Hydrocarbons are formed at the same time (*see* PETROLEUM).

On exposure to the air oils and fats gradually undergo certain changes. The *drying* oils absorb oxygen ("dry") somewhat rapidly, thin layers forming a skin or film. Extensive use of this property is made in the paint and varnish trades. The *semi-drying* oils absorb oxygen more slowly than the drying oils and are, therefore, useless as paint oils; still, in course of time, sufficient oxygen is absorbed to produce distinct thickening. The oxidation of the semi-drying oils is accelerated by spreading such oils over a large surface, notably over woollen or cotton fibres, when oxygen absorption may proceed so rapidly that spontaneous inflammation ensues. Many fires in cotton and woollen mills have been caused in this way. The *non-drying* oils, of which olive oil is typical, do not become oxidised readily on exposure to the air, although gradually changes take place, including slow hydrolysis (splitting to fatty acids and glycerol) and subsequent oxidation; the oils thicken slightly and acquire the peculiar disagreeable smell and acrid taste defined by the term "rancidity." The chemical reactions involved in the development of rancidity have not yet been fully explained. If the action of the air and moisture is allowed free play, the hydrolysis of the oils and fats may become so complete that only the insoluble fatty acids remain, the glycerol being washed away. This is exemplified by *adipocere* (corpse fat) and also by Irish bog butter, which consists chiefly of free fatty acids.

The property of the fats of being readily hydrolysed is most important, and extensive use of it is made in the arts (soap-making, candle manufacture, etc., and recovery of their by-products). If treated with water alone under high pressure (corresponding to a temperature of about 220° C), or in the presence of water with caustic alkalies, alkaline earths, or basic metallic oxides (which act as catalysers), at lower pressures, they are converted in the first instance into free fatty acids and glycerol, *e.g.*: If bases sufficient in amount to combine with the fatty acids be present, the corresponding salts of these acids are formed, such as the sodium salts of fatty acids (hard soap), or potassium salts (soft soaps), soaps of the alkaline earths (lime soap) or of the metallic oxides (zinc soap), etc. For detailed descriptions of the methods employed in commercial hydrolysis, *see* CANDLE, SOAP.

**Extraction.**—Since the oils and fats have always served the human race as one of the most important articles of food the oil and fat industry may well be considered to be as old as the human race itself. The methods of preparing oils and fats range

themselves under three heads: (1) Extraction by "rendering," *i.e.*, boiling out with water; (2) extraction by expression, and (3) extraction by means of solvents.

*Rendering.*—The crudest method of rendering oil from seeds, still practised in Central Africa, in Indo-China and on some of the South Sea Islands, consists in heaping up oleaginous fruits and exposing them to the heat of the sun, when the exuding oil runs off and is collected. In a somewhat improved form this process of rendering is practised in the preparation of palm oil (*q.v.*) and the rendering of the best (Cochin) coconut oil by boiling the fresh kernels with water. Naturally these processes can only be applied to those seeds which contain large quantities of fatty matter, such as coconuts and olives. The rendering process is, however, applied on a very large scale to the production of animal fats, such as tallow (*q.v.*), lard, bone fat and whale oil (*q.v.*). The method consists essentially in cutting up the fatty matter into small fragments, which are transferred to vessels containing water, wherein the comminuted mass is heated by steam, either under atmospheric pressure in open vats or under higher pressure in digesters. The fat gradually exudes and collects on top of the water, whilst the membranous matter, "greaves," falls to the bottom. The fat is drawn off the aqueous (gluey) layer and strained through sieves or filters. The greaves are placed in hair or woollen bags and submitted to hydraulic pressure, by which a further portion of fat is obtained (cf. *Pressing*). In the case of animal fats intended for edible purposes, such as lard, suet for margarine, etc., the greatest cleanliness must, of course, be observed, and the temperature kept as low as possible in order to obtain a perfectly sweet and pure material. To obtain a harder product, fats, such as tallow, are frequently subjected to pressing to squeeze out the more liquid portions, which are sold as oleo oil, lard oil, etc.

*Pressing.*—The boiling out process cannot be applied to small seeds, such as linseed, rapeseed, etc. Whilst, perhaps, the most primitive method of expression was to crush the seed in mortars until the oil should exude, in the East, where vegetable oils form an important article of food and serve also for other domestic purposes, various ingenious applications of lever and of wedge presses have been used from the remotest times. A detailed description is given by Pliny of the screw presses used by the Romans for the production of olive oil. At an early stage in history the Chinese employed the same series of operations which are followed in the most advanced mills of modern times, viz., bruising and reducing the seeds to meal under edge-stones, heating the meal in open pans and pressing out the oil in a wedge press. This primitive process is still carried out in Manchuria, in the production of soya bean cake and oil, one of the staple industries of that country. The Dutch or stamper press, invented in Holland in the 17th century, was almost exclusively employed in Europe for pressing oil-seeds until the early years of the 19th century; it yielded place to the hydraulic press which has practically superseded all other appliances for expression. The sequence of operations in treating oil-seeds, oil-nuts, etc., is as follows: As an important preliminary operation the seeds, etc., are freed from dust, sand, and other impurities by sifting; in the case of seeds amongst which are found pieces of iron (hammer heads among palm-kernels, etc.), the seeds are passed over magnetic separators. The seeds and nuts are then decorticated (where requisite), the shells removed and the kernels ("meats") converted into a meal by grinding between finely grooved rollers. The comminuted mass, forming a more or less coarse meal, is either expressed in this state, or subjected to preliminary heating according to the quality of product required. For the preparation of *edible* oils, the meal is packed in bags and expressed in hydraulic presses in the cold, under a pressure of 300 atmospheres or more. The cakes remain under pressure for about seven minutes. Oil expressed in the cold dissolves the least amount of colouring matter, etc., and hence has suffered least in quality; oils so obtained are known in commerce as "cold-drawn oils," "cold pressed oils," "salad oils," "virgin oils."

By pressing in the cold only part of the oil is recovered. A further quantity is obtained by pressing the meal at a somewhat elevated temperature, either after the cold-drawn oil has been taken off, or in the case of oleaginous seeds of low value, *e.g.*, cottonseed, coconut, where it is of importance to extract as much oil as possible in one operation, immediately after the meal has left the mill. The process, which is general in application to all oil-seeds is described in some detail, with illustrations of typical hydraulic presses, in the article COCO-NUT OIL AND CAKE. Oil obtained from heated meal is usually more highly coloured and harsher to the taste than cold-drawn oil, more of the extractive substances being dissolved and intermixed with the oil. Such oils are hardly suitable for edible purposes and are chiefly used in manufacturing processes. According to the care exercised by the manufacturer and the range of temperature to which the seed is heated, various grades of oil are obtained. The residual meal is used as cattle-food, or if from poisonous seeds such as castor beans, as manure.

*Extraction by Solvents.*—The cakes obtained in the foregoing process still retain considerable proportions of oil, usually about 10%. If it be desired to obtain larger quantities than are yielded by the methods described above, the extraction of the seeds must be performed by the use of volatile solvents. Extraction by carbon disulphide was first introduced in 1843 by Jesse Fisher of Birmingham. For several years the process made little advance, for the colour of the resulting oils was dark and the taste sharp. The oil retained traces of sulphur, causing a disagreeable smell in soaps made from it, and the blackening of substances with which it was used. The meal was so tainted with carbon disulphide that it was absolutely out of the question to use it as cattle-food. With improvement in the manufacture of carbon disulphide these drawbacks have been surmounted to a large extent, and the practice of extraction with this solvent has especially gained extension for waste olive marc in France, Italy and Spain. Modern methods largely use petroleum ether (shale naphtha is more usual for the oil extraction of bone-fat); benzene and the non-inflammable hydrocarbons such as trichlorethylene, have been used, but have not proved so satisfactory, and in the latter case the risk of physiological action on the workmen, has militated against their wider utilisation. The methods of operation have been improved so that losses of solvent do not amount to more than 1%. Good quality oils can be obtained, and the processes are able to compete with expression, the choice of method resting mainly on considerations of the particular seed to be treated and the type of meal desired.

The apparatus employed on the large scale depends on the temperature at which the extraction is to be carried out. In the main two types of plant are differentiated, viz., for extraction in the cold, and for hot extraction. The seed is prepared as for pressing, but the grinding is coarser. In cold extraction the meal is placed in a series of closed vessels, and the solvent allowed to percolate by displacement (upward, in a recent process) on the "counter-current" system. The solution of extracted fat is then transferred to a steam-heated still, where the solvent is driven off and recovered by condensation to be used again. The last remnants of volatile solvent in the oil are driven off by a current of steam blown through the oil in the warm state. The hot-extraction process is carried out in apparatus, the principle of which is exemplified in the well-known Soxhlet extractor. The comminuted seed, spread on trays, is placed inside a vessel containing the solvent and fitted with a reflux condenser. On heating the solvent by means of a steam-coil or jacket the vapours rise through and around the meal, passing into the condenser, whence the solvent drops back as liquid on to the hot meal, percolating through it, and reaches the bottom of the vessel as a more or less saturated solution of oil in the solvent. The solvent is again evaporated, leaving the oil behind, the process proceeding continuously until the extraction is deemed finished. The oil solution is run into a still and the oil freed from solvent as already described. The solvent remaining in the meal is removed by a similar steaming process. It is true that on the European continent extracted meal, especially rape meal from good Indian seed and palm kernel meal, is somewhat largely used as cattle-food in admixture with press-cake; in England extracted meal is not

so employed, but finds its proper use in manuring the land.

**Refining and Bleaching.**—The oils and fats prepared from fresh ("sweet") material by any of the methods detailed above are practically neutral. Carefully rendered or cold-drawn oils are, as a rule, sufficiently pure to be delivered to the consumer, after a preliminary settling has allowed any mucilaginous matter, animal or vegetable fibres, etc., to separate. The clarification process may be shortened by filtering the oils, or otherwise brightening them, *e.g.*, by blowing with air. In many cases these methods still suffice for the production of commercial fats. Oils intended for use as salad oils, or as lubricants, which deposit "stearine" in the cold are "demargerinated" (*see* p. 749).

In special cases, such as the preparation of edible oils and fats, a further improvement in colour and greater purity is obtained by filtering the oils over absorbent materials such as charcoal, fuller's earth, etc. As in the case of coconut and palm-kernel oils, a preliminary purification in a current of steam may be employed. For refining oils and fats intended for edible purposes, only the foregoing methods, which may be summarized by the name of physical methods, can be used; the only chemicals permissible are alkalies or alkaline earths to remove free fatty acids. The practice of refining by caustic soda has gained considerable extension; the fatty acids are neutralised by caustic soda and removed in the form of soaps by washing, but technically, the process is complicated by the formation of emulsions. Treatment with other chemicals renders the fats unfit for consumption. Hence, all bleaching and refining processes involving other means than those enumerated can only be used for technical oils and fats. There is no universal method of oil refining applicable to any and every oil and fat. Not only must each kind of fat be considered as a special problem, but frequently even varieties of one and the same fat are apt to cause the same difficulties as would a new individual. In many cases purification by sulphuric acid is still usefully applied. The oil is treated with a small proportion of concentrated sulphuric acid; this acts on the suspended impurities, carbonising them to some extent, and causes them to coagulate in the form of a flocculent mass, which settles out carrying with it mechanically other impurities that have not been acted upon. This method is chiefly used in the refining of linseed and rape oils. After treatment with sulphuric acid or caustic soda the oils must be thoroughly washed; the water is allowed to settle out and the oils finally filtered.

A large variety of reagents are in use for bleaching technical oils intended for soaps, lubricants, paints, etc. In general, besides treatment with absorbent media, or exposure to air and light (olive oil), bleaching methods involve the use of oxidising agents such as sodium dichromate and acid, permanganate, hypochlorites, metallic per-salts, peroxides, etc.

**Fat-hardening.**—There is great demand in the arts for hard fats, and a great development of the fats and oils industry took place in the early years of the present century as a result of the invention of a successful method for converting the liquid unsaturated fatty acids and glycerides into the corresponding solid saturated bodies. The change ("hardening," "hydrogenation") which consists in the addition of hydrogen to the unsaturated bonds, *e.g.*,

$$\underset{\text{oleic acid}}{CH_3(CH_2)_7HC = CH(CH_2)_7COOH} + H_2 = \underset{\text{stearic acid}}{CH_3(CH_2)_7CH_2CH_2(CH_2)_7COOH}$$
$$+ \text{hydrogen} =$$

proved to be difficult of practical realisation. Many attempts had been made; stearolactone had been prepared by the action of concentrated sulphuric acid on oleic acid, and palmitic acid by treatment with potash, while the conversion into stearic acid itself had been effected by heating oleic acid under pressure with small quantities of iodine, or by subjecting it to the action of hydrogen under the influence of the silent electric discharge. None of these processes, however, proved economically successful on the commercial scale. The problem was solved by the application of the general reaction discovered by Sabatier and Senderens, namely, that hydrogen could be assimilated by unsaturated compounds in the presence of a metallic catalyst. The principle was found to be readily applicable, not only to fatty acids, but also to the glycerides. The metal in general use is nickel; platinum and palladium are active catalysts, and by their use the reaction can be effected at much lower temperatures, but their high cost and susceptibility to poisoning by traces of impurities preclude their commercial use.

The usual process consists in passing hydrogen through the oil, which is intimately mixed with the catalyst; this consists of finely divided metallic nickel, which, as a rule, has been deposited on an inert support, such as kieselguhr or fuller's earth. The reaction is conducted at temperatures between 140° and 200° C, according to conditions. After hydrogenation the oil has to be filtered to free it from powdered catalyst; the nickel from the latter is recovered. A recent innovation, designed to allow of continuous working, and to obviate the tedious processes of filtration and recovery of the nickel from the oil-saturated residue, employs fine nickel turnings. The turnings are placed in perforated cages in the reaction vessel. The pre-heated oil and the hydrogen flow over them on the counter-current system. The oil delivered is free from nickel and does not require filtration; when the activity of the catalyst becomes reduced, as a result of gradual poisoning, it is easily regenerated by electrolytic oxidation and subsequent reduction. The mechanism of oil-hydrogenation, and the way in which the nickel assists the reduction, has not been fully explained; it appears that the reduction takes place in stages, the most unsaturated acids being first attacked. As the hardening process is always accompanied by a certain amount of deodorisation, more especially in the case of whale and fish oils, it has rendered possible the utilisation of these oils for the manufacture of hard soap, and has led to the substitution of cheaper vegetable oils, hydrogenated to the required consistency, for the more expensive tallow and lard.

The detection of hardened fats in a mixture is a difficult, if not an insoluble, problem. Indications may be furnished by the detection of fatty acids of high molecular weight, *e.g.*, behenic acid from hardened rape or marine animal oils, or of considerable proportions of iso-oleic acid, which is a transition product in the conversion of oleic into stearic acid.

**Applications.**—It is almost impossible to enumerate the many applications of the fats: in the table above the principal uses of some typical oils and fats are given. Almost all the best quality fats, including hardened whale oil, etc., can be used for edible purposes (margarine, cooking fats, salad oils, etc.), and some constitute a staple article of diet for native races, for instance, palm oil in W. Africa, soya bean oil in Manchuria.

In the arts the fats are used for soap-making (*q.v.*), candle stearine manufacture (*q.v.*) and leather-dressing; the latter industry provides an outlet for fish-oils and other low grade fats. Linseed oil, tung oil, and to a less extent other drying oils, are employed as the basis of paints, varnishes and for linoleum. Many of the non-drying oils (*e.g.*, neat's foot oil, sperm oil, etc.), are employed as lubricants, either alone or compounded with mineral oils (rape, castor oil), while lubricating greases are made from metallic soaps. Rape oil (colza) and other oils are still used as burning oils in remoter districts. Castor, and "tournant" olive oils provide the turkey-red oils used in dyeing textiles (*see* also GLYCERINE).

*In medicine.*—Some of the oils possess peculiar properties for which they are valued medicinally. Castor (*q.v.*) and curcas oils have a strong purgative action, while chaulmoogra oil, and others of the same group, have recently attracted attention as specifics for leprosy. Lard, olive, almond and other oils find application in pharmacy as vehicles for various medicaments (*see* also COD LIVER OIL).

*Commerce.*—In the table the principal countries of origin of the sources (seeds, etc.) of the fats are given. In a great many cases the oils are not extracted in their country of origin; the raw materials are shipped to European countries and America; thus Marseilles becomes the centre of the coconut oil trade, Liverpool and Hull centres of oil-seed expression, etc. Recent

development of industry in tropical countries, together with the war-time need for economy in freightage, has led, however, to increased production of oils and fats in the native countries; thus we find exports of copra from the Philippines decreasing, while the exports of oil increase. Statistics for the production of fats are very scanty; estimations based on available import and export returns take no account of the consumption in the countries of origin, which may be considerable, *e.g.*, coco-nut oil in the Philippines, palm oil in W. Africa. For the available data, the reader is referred to the trade returns (U.K., U.S.A., etc.) and to the publications of the International Institute of Agriculture, Rome—*Oleaginous Products and Vegetable Oils* and the *Year Book of Agricultural Statistics*.

**Production.**—The production of oils is liable to considerable fluctuation, but the following estimates may be taken as representative. On the whole the production and consumption of oils and fats has steadily augmented since World War I, the increase being especially marked in the case of soya-bean, coco-nut, palm-kernel and groundnut (peanut) oils.

TABLE II.

*Production of Oil-seeds, Nuts, etc. (reduced to Oil-equivalent), and Oils*

| Oil | 1924* | 1926† | 1937‡ |
|---|---|---|---|
| | 1,000 quintals | Tons | Tons |
| Cottonseed | 19,260 | 931,963 | 1,044,000 |
| Copra | 13,000 | 733,431 | 940,450 |
| Groundnut (peanut) | 12,366 | 527,441 | 1,010,000 |
| Linseed | 10,000 | 694,292 | 750,000 |
| Olive | 7,653 | 626,000 | 800,000 |
| Rapeseed | 4,652 | 73,786 | 280,000 |
| Soya | 4,000 | 398,961 | 618,000 |
| Sunflower | .. | 136,730 | 375,000 |
| Palm and palmkernel | .. | 408,891 | 561,000 |
| Other vegetable oils | .. | .. | 228,000 |
| Lard | .. | .. | 400,000 |
| Tallow | .. | .. | 320,000 |
| | Barrels | Barrels | Tons |
| Whale oil production | 641,583 | 1,166,857 | 400,000 |

*From "*Oleaginous Products and Vegetable Oils.*"

†From "*Review of the Oilseed and Oil Markets for 1927*," issued by Frank Fehr & Co.

‡From Dr. Reginald Child, director, Ceylon Coco-nut Research Scheme.

## WAXES

The *waxes* consist chiefly of the fatty acid esters of the higher monohydric alcohols, with which are frequently associated free alcohols as also free fatty acids. Important among the acids found are palmitic acid, occurring in beeswax and spermaceti (*q.v.*), cerotic acid, $C_{25}H_{51}COOH$, in beeswax, wool-wax and other waxes, and melissic acid, $C_{29}H_{59}COOH$, of beeswax.

The hydroxylated lanopalmic, $C_{15}H_{30}(OH)COOH$, and lanoceric, $C_{29}H_{57}(OH)_2COOH$, acids also occur in wool-wax. The alcohols cetyl alcohol, $C_{16}H_{33}(OH)$ ("ethal" of the older writers) of spermaceti, and myricyl (melissyl) alcohol, $C_{30}H_{61}(OH)$, of beeswax and carnaüba wax are the most important, while the cyclic sterols, cholesterol and isocholesterol, occur in considerable amounts in wool-wax.

Spermaceti consists practically of cetyl palmitate, Chinese wax of ceryl palmitate. The other waxes, especially wool-wax, are of more complex composition.

The waxes can be simply classified, similarly to the fats, as follows:—

I. Liquid waxes
II. Solid waxes
  A. Vegetable waxes
  B. Animal waxes.

The table enumerates the most important waxes (*see* also separate articles, SPERMACETI, etc.).

The occurrence and physiological importance of the waxes have been discussed above. In their physical properties the natural waxes resemble the fats. They behave similarly towards solvents, and in the liquid condition leave a grease-spot on paper.

TABLE III.

| Wax | Occurrence | Iodine value | Principal use |
|---|---|---|---|
| *Liquid waxes* | | | |
| Sperm oil | Atlantic, Pacific | 81–90 | Lubricant |
| Arctic sperm oil | Arctic | 67–82 | " |
| *Solid waxes* | | | |
| Vegetable waxes: | | | |
| Carnaüba wax | Brazil | 13 | Polishes, phonograph mass |
| Sugar cane wax | .. | 60 | Polishes |
| Montan wax (distilled from peat) | Germany, Ireland, etc. | 12–16 | " phonograph mass |
| Animal waxes: | | | |
| Wool-wax | As mutton-tallow | 30–35 (Wijs) | Ointment ("lanolin") |
| Beeswax | General | 8 | Candles, polishes |
| Spermaceti | As sperm oil | 0–4 | Candles, surgery |
| Insect wax, Chinese wax | China | 0–1.4 | Candles, polishes, sizes |

An important property is easy formation of emulsions with water, of which large quantities can be incorporated (lanolin [*q.v.*]).

Only a few vegetable waxes are found in sufficiently large quantities to be of commercial importance; so far carnaüba and sugar-cane waxes are practically the only plant waxes of importance in the world's markets. The most important animal wax is beeswax (*q.v.*), collected in almost all parts of the world. An exceptional position is occupied by wool-wax, the main constituent of the natural wool fat that covers the hair of sheep, which is obtained as a by-product in scouring raw wool. Wool-fat is purified on a large scale and brought into commerce, under the name *lanolin*, as an ointment, which is valued for its property of easy assimilation by the skin.

BIBLIOGRAPHY.—T. P. Hilditch, *Fats and Waxes* (*Industrial Chemistry Series*, 1927); J. Lewkowitsch, *Chemical Technology and Analysis of Oils, Fats and Waxes* (1922); L. Ubbelohde, *Handbuch der Chemie u. Technologie der Oele u. Fette* (1909, new ed. in press); C. A. Mitchell, *Oils* (*Pitman's Common Commodities of Commerce*, 1924, popular) C. Ellis, *Hydrogenation of Oils* (1919); J. Fritsch, *Fabrication de la margarine et des graisses alimentaires* (Paris, 1927); for Physiology, J. B. Leathes and H. S. Raper, *The Fats* (2nd ed. 1925); E. F. Armstrong, *Presidential Address to the Society of Chemical Industry* (1924); M. Toch, *Chemistry and Technology of Paints* (New York, 1925).

*See* also articles and bibliographies on ESSENTIAL OILS, SOAP, PAINTS, etc., and separate articles on various fats and waxes, PALM OIL, COCONUT OIL, etc. (E. L.; G. H. W.)

**OIRAT (OR OIROT) AUTONOMOUS AREA,** an autonomous administrative division of the Russian S.F.S.R., created in 1922, within the Siberian area, bounded by Kazakstan on the southwest and Mongolia, with the Mongolian Tannu Tuva republic on the south and east, and by the Siberian area on the north. Area 35,934 sq.mi. Pop. (1939) 161,431. It lies between 49° 5′ and 52° 4′ N. and 84° and 89° 55′ E., and is entirely rural, the administrative centre Oirat Tura, on Katun river, with 5,726 inhabitants in 1926. The area is mountainous, lying in the Altai region of West Siberia, which forms part of the Alpine highlands bordering the Mongolian plateau. Within it lies Mount Byelukha, whose summits rise to 14,890 ft. and 14,560 ft. respectively, and on which several glaciers exist.

Numerous spurs strike from the Sailughem mountains towards the Siberian plain in all directions, amongst which are the Chuya Alps, average altitude 9,000 ft., with peaks rising to 12,000 ft., and at least 10 glaciers on the northern slope, and the snow clad Katun Alps (10,000 ft.).

The Katun river rises in a glacier in a wild gorge on the southwest slope of Byelukha and, after making a wide curve, pierces the Katun range and flows to the north. The upper course of the Biya, which with the Katun later forms the Ob, lies in the Oirat area. The Biya flows from the beautiful alpine Lake Teletskoye, to the south of which are the high Bashkaus, Chulyshman and Chulcha valleys all draining into the lake. The Kok-su and the Argut are the chief among the numerous tributaries of

the Katun.

The climate is severe, average winter temperature −13° to −16° C, summer 16° to 18° C. The maximum rainfall is in the Chernevoi district of the northeast, on the right bank of the Katun river, thickly forested with Siberian cedar and fir. In the northwest the conifers are mixed with birch, poplar and aspen. The Chuya, Kurai and Chulyshman Alps lie above the tree limit and have much tundra. The soils are mainly bog, meadow, rubble and forest clays; their poor character, the short vegetation period and the drought of the region under the influence of winds from Mongolia make cultivation difficult. Wheat and oats, with a little barley, rye, millet, flax, hemp, buckwheat and potato are grown, but only a small part of the area is under cultivation.

Primitive irrigation channels had rendered crop production possible especially in the Uimonsk district in the bend of the Katun river. Besides many of the natives depend on transport in connection with the trade between Kobdo in Mongolia and Biisk in Siberia for supplementary income.

Forest fires and reckless exploitation for army purposes diminished the timber in accessible places and also reduced the number of fur-bearing animals, already diminishing in pre-war times through intensive hunting. Squirrel, bear, fox, ermine and sable are the chief fur-bearing animals of the region. The collection of cedar nuts for the oil pressing factories of Siberia, formerly an important occupation, was also affected by the causes given above. Timber, in any case, is difficult to exploit in the absence of transport facilities in a wild and rocky country. The chief occupation of the people is stock raising, horses, working and dairy cattle, sheep, goats and pigs being bred. War conditions, followed by a period when troops of bandits infested the region, not only destroyed many of the best breeds, but caused the herdsmen to cross into Mongolia, with their remaining cattle and flocks.

Epizootic diseases are prevalent, possibly because of their spread along the road from Mongolia. Milk and meat, with fermented mare's milk (kumiss) form the staple diet of the people. Raw leather with butter from the farms of the Russian settlers, are exported to a small extent. Meat and wool are used locally, for peasant industries have to supply local needs of homespun, felt, wooden and leather articles and flour and cheese. There is no factory industry.

Beekeeping is profitable among the Russian settlers, and is increasing. The maral deer, from whose horns a substance called *panty,* used as a medicine in China, is obtained, is kept by the natives.

Of the population about 50% are Russians, partly descendants of the Old Believers who took refuge here from religious persecution from 1761 onwards. Colonization began in the 19th century, the settlers being mainly peasants from the crown lands, but no attempt was made to organize Russian colonization until 1874–1879. The colonists have occupied the areas suitable for cultivation, especially the Uimonsk region. Disputes between the Russian tillers of the soil and the nomad herdsmen of the hills were frequent and sharp before the creation of the autonomous area. The etymology of the word Oirat or Uirad is uncertain. Remusat and Pallas considered the term Durben Uirad, by which name Chinese writers speak of the Kalmucks, to mean The Four Allies, referring to the confederacy of four Kalmuck tribes which existed in the middle ages. Schmidt states that the Volga Kalmucks call themselves Uirad or Mongol Uirad, and the term Uirad Buriat also occurs in the records. Howorth after at first inclining to the view of Pallas and Remusat and considering that the term had no racial significance, later decided that Uirad was an indigenous term among the Kalmucks. Marco Polo says that Jenghiz Khan allowed the Horiads, out of gratitude for a victory they had won for him, to share the milk of his private herd of white mares, and Yule identifies the Horiads with the Uirads. According to Vambéry the term means grey mare.

The Uirads are recorded as living in the region of the "eight rivers," *i.e.,* the sources of the Kem or Upper Yenisei, at the accession of Jenghiz Khan. Apparently they were Mongols with a Turkish admixture. They submitted to Jenghiz Khan without any struggle and their chieftain Kara Kiragho was one of the nine famous generals or *orloks* who commanded divisions of Jenghiz Khan's army. A long struggle afterwards ensued between the Uirads and the Mongols, and in the 15th century the greater part of the western Mongols were under Uirad overlordship. Towards the end of the 16th century the Uirad power decayed and the Mongols recovered their supremacy. The Dzungarians later overran the Uirad territory, but were themselves conquered by the Chinese in the 18th century, when many took refuge with the Kirghiz in Russian territory. The non-Russian population of the Oirat autonomous area is thus composed of the descendants of these various Turkish, Kalmuck and Mongol tribes and includes also some Kirghiz shepherds. These Altai hill tribes are all nomad herdsmen, supplementing their income by hunting and by undertaking transport along the road from Kobdo to Biisk which passes through the Oirat area. It should be noted that the Telengets of the district north of Kusnetsk, lying outside the Oirat area, call themselves Oirat and that their language and poetry is similar to that of the Altaians, Howorth suggests that they may have been closely allied. Another division of the Uirads in 1296 deserted the Khan of Persia and went to Damascus. Among Altai mountain peoples are the Mountain or Black Forest Tatars, living in the cedar forest region between the Katun and Lake Teletskoye and supplementing their semi-nomad herding by collecting cedar nuts and roots and hoeing the soil in a primitive way for wheat and barley cultivation. The Kumandins live on both banks of the Biya from the mouth of the Lebed downwards, and are taking to settled agriculture. Another Tatar group lives along the Lebed shores and is mainly occupied in hunting.

*See* Henry Howorth, *The History of the Mongols* (1876), and in Russian *Atlas of the U.S.S.R.* (1928).

**OISE,** a department of northern France, three-fourths of which belonged to Île-de-France and the rest to Picardy, bounded north by Somme, east by Aisne, south by Seine-et-Marne and Seine-et-Oise, and west by Eure and Seine-Inférieure. Pop. (1936) 402,569; area 2,273 sq.mi. As its name implies, the department includes a good deal of the lower basin of the Oise and its tributaries, forming a broad basin dissected from the outlying zone of the Eocene deposits. To the south-east of the Oise the Eocene forms a plateau with a considerable amount of forest, especially towards the north. To the north-west of the Oise the Eocene is capped along various south-east–north-west ridges by Pliocene, forming the hills of the Pays de Bray (770 ft.). The valley of the Oise itself is a sunny region, with less than 24 in. of rain per annum, and a range of seasonal averages of temperature from about 38° to 64° F.

Clay for bricks and earthenware, sand and building-stone are among the mineral products of Oise, and peat is also worked. Pierrefonds, Gouvieux, Chantilly and Fontaine Bonneleau have mineral springs. Wheat, oats and other cereals, potatoes and sugar beet are the chief agricultural crops. Cattle are reared especially in the western districts, where dairying is actively carried on. Bee-keeping is general. Racing stables are numerous in the neighbourhood of Chantilly and Compiègne. The chief industries of the department are manufactures of sugar and alcohol from beetroot. The manufacture of furniture, brushes (Beauvais) and other wooden goods and of toys, fancy-ware, buttons, fans and other articles in wood, ivory, bone or mother-of-pearl are important. There are also woollen and cotton mills, and manufactories of woollen fabrics, blankets, carpets (Beauvais), hosiery and lace (Chantilly and its vicinity). Creil and the neighbouring Montataire form an important metallurgical centre. Oise is served by the Northern railway, on which Creil is an important junction, and the Oise and its lateral canal and the Aisne afford about 70 m. of navigable waterway.

There are three arrondissements—Beauvais, Compiègne and Senlis—with 35 cantons and 701 communes. The department forms the diocese of Beauvais (province of Reims) and part of the region of the II army corps and of the *académie* (educational division) of Paris. Its court of appeal is at Amiens.

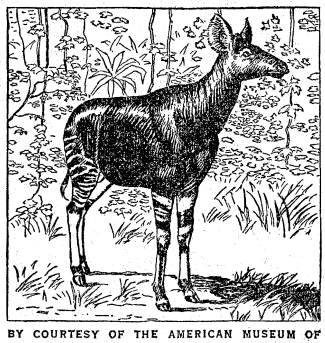
**OISE,** a river of northern France, 187 mi. long, flowing south-

west from the Belgian frontier to join the Seine 39 miles below Paris. It drains the north-eastern part of the Paris basin. Rising in Belgium, 5 m. S.E. of Chimay at a height of 980 ft., the river enters France after a course of little more than 9 m. It divides below Guise into several arms and is joined by the Serre (left), near La Fère. Thence as far as the Ailette (left), it flows through well-wooded country to Compiègne, above which it receives the Aisne (left). Skirting the forests of Compiègne, Halatte and Chantilly (all left), and receiving near Creil the Thérain and the Brèche (both right), the river flows past Pontoise to reach the Seine. Its channel is canalized (depth 6 ft. 6 in.) from Janville to its mouth. Above Janville a lateral canal continued by the Sambre-Oise canal accompanies the river to Landrecies. It is connected by canal with the canal system of Flanders and with the Somme and the Eastern canal systems. (*See* SEINE.)

**OISIN** (pronounced *Usheen*), reputed to be the son of Finn mac Cumhaill (*q.v.*), a heroic warrior and bard. He figures to but a small extent in the earlier literature of the Finn cycle, being eclipsed by his father and by his son Oscar. But in the later "Ossianic" literature he is prominent as the narrator of the events through which he claims to have lived. According to the legend, he remained alive after the Battle of Gabhra (Garristown, Co. Dublin) in which Cairbre Liffechair, son of Cormac mac Airt, destroyed Finn and his followers (A.D. 283), and survived long enough to meet St. Patrick (who arrived in Ireland in A.D. 432) and to tell him the ancient traditions of his youth. This prolonged existence was accounted for by his having been carried off by a fairy maiden to the Happy Otherworld; a tale not found in any ancient manuscript, but preserved orally, and successfully versified by the 18th-century Irish poet Michael Comyn. In a very valuable prose tract, *Agallamh na Senórach* ("The Colloquy of the Elders"), Patrick is described as making a circuit of Ireland, with Oisin and his old companion in arms, Caeilte, as *ciceroni.* The same formula was afterwards adopted in verse, but with the difference that whereas in the prose narrative the pagan warriors and the saint treat each other with courtesy, in the verses they argue with a petulance often descending to ribaldry on both sides. The poet's name, in the form "Ossian," was popularized by James Macpherson; but his version of the tales and poems is so much manipulated as to be practically a new work.

*Agallamh na Senórach* is published with a translation in O'Grady's *Silva Gadelica* (1890). For the chief Ossianic poems *see* the publications of the Ossianic Society (1856, 1858); also Eoin MacNeill, *Duanaire Finn* (Irish Texts Society, 1908). *See* also L. C. Stern, *Die Ossianischen Heldenlieder* (English Translation in *Transactions of the Gaelic Society of Inverness,* xxii., p. 257). (R. A. S. M.)

**OJIBWA.** The Ojibwa or Chippewa form a large, loosely knit group of Algonkin Indians, said to have held originally the northern shores of lakes Huron and Superior, but extending in the historic period also westward across northern Minnesota and into Manitoba as far as Turtle mountain. Their expansion was largely at the expense of the Dakota, whom they bested with firearms obtained from the French. They were friendly to the French, and later to the British against the Americans, but have never been aggressive in warfare, at least not unitedly so, although esteemed brave. They were a timber people, farming only in part, and subsisting largely on game and wild rice. They are a large and widely spread group, numbering 30,000 or more, about equally divided between Canadian and American soil. (A. L. K.)



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

MALE OKAPI (OKAPIA JOHNSTONI), FOUND MOSTLY IN THE CONGO DISTRICTS

**OKAPI** (ō-kah'pĭ), large animal allied to giraffes, inhabiting the Semliki forest between Lakes Albert and Albert Edward in Central Africa. First obtained by Sir H. H. Johnston, in 1900, the okapi (*Okapia johnstoni*) has shorter legs and neck than the giraffe, standing 5 ft. at the shoulder. In colour it is purplish, with the sides of the face puce and the limbs barred with black and white. The horns, only present in the males, are capped with a small polished tip which alone penetrates the covering skin. The skull is intermediate between that of the giraffe and that of the extinct *Samotherium* of the Lower Pliocene of Europe. The okapi dwells in the densest parts of the primeval forest, feeding on leaves of trees, shrubs and epiphytes. Its colouring renders it practically invisible at a short distance. It belongs to the family Giraffidae (*see* PECORA).

*See* for further details Ray Lankester, *Trans. Zool. Soc. of London* (xvi., 6, 1902).

**OKEGHEM, JOANNES** (also OCKEGHEM, OCKENHEIM, OKERGAN, JEAN DE) (early 15th cent.–*c.* 1495), was born early in the 15th century at Termonde, East Flanders. He was a chorister at Antwerp in 1443 and is generally supposed to have been a pupil of Binchois. The latter part of his life was spent at Tours, where he held the coveted post of treasurer to St. Martin's church under Louis XI. He stands out in the early history of music as one of the greatest of teachers and is by common consent regarded as the founder of the second Netherlands school of contrapuntists, covering the latter half of the 15th century. Josquin des Près and De la Rue were but two among the many famous pupils who carried his teaching into all countries. His skill and ingenuity in counterpoint were considered extraordinary even in that age of elaboration. He wrote, among others, a transposing mass, the *Missa cujusvis toni,* which could be sung in any of the church modes, and a complicated motet for 36 voices. In fugue he introduced the *stretto,* a now familiar device by which the answer follows the subject at a closer interval than in the original statement, and in addition to the usual form of canon in unison he added the canon at the fourth below. Much of his work was destroyed in the wars, or lost, and he lived too early to see his works in print. The masses and motets were not published till after his death. Two masses (Trent codices) have been published by the *Gesellschaft sur Herausgäbe von Denkmälern der Tonkunst in Osterreich* (Vienna) and 4 Chansons are in A. W. Ambros, *Geschichte der Musik* (5 vols., Leipzig, 1862–82. The 5th vol. containing examples of music, has not been re-issued).

*See* also A. de Marsy, *Un musicien flamand: Jean de Ockeghem* (1895); Dragan Plauenocz, *J. Ockeghem als Motett- und Chansons-Komponist* (Vienna, 1925).

**OKEN, LORENZ** (1779–1851), German naturalist, whose real name was Ockenfuss, was born at Bohlsbach, Baden, on Aug. 1, 1779. He studied at Würzburg and Göttingen, where he became *Privatdozent.* In 1807 he was appointed professor extraordinarius of medical sciences at Jena. His inaugural discourse on the signification of the bones of the skull, based upon a discovery he had made in the previous year, was delivered in the presence of Goethe, as privy-councillor and rector of the university, and was published in the same year, with the title, *Ueber die Bedeutung der Schädelkrochen.* In 1816 he began to publish at Weimar the periodical *Isis, eine encyclopädische Zeitschrift, vorzüglich für Naturgeschichte, vergleichende Anatomie und Physiologie.* Comments on the politics of other German States led to a remonstrance from the court of Weimar, which demanded either the suppression of the *Isis* or resignation. Oken resigned, and continued to publish the *Isis* at Rudolstadt until 1848.

In 1821 Oken promulgated the idea of annual general meetings of German naturalists and medical practitioners, the first meeting being held in Leipzig in 1822. The British Association for the Advancement of Science was first organized after the Okenian model.

In 1828 Oken resumed his duties as privat-docent in the newly-established University of Munich, and soon afterwards was appointed professor in the same university. In 1832, on the proposal by the Bavarian Government to transfer him to a professorship in a provincial university of the State, he resigned his appointments and left the kingdom. He was appointed in 1833 to the professorship of natural history in the then recently-established University of Zurich, where he resided until his death, on Aug. 11, 1851.

All Oken's writings are eminently deductive illustrations of a foregone and assumed principle, which, with other philosophers

of the transcendental school, he deemed equal to the explanation of all the mysteries of nature. According to him, the head was a repetition of the trunk—a kind of second trunk, with its limbs and other appendages; this sum of his observations and comparisons—few of which he ever gave in detail—ought always to be borne in mind in comparing the share taken by Oken in homological anatomy with the progress made by other cultivators of that philosophical branch of the science. Oken's axiom that "all the parts of higher animals are made up of an aggregate of infusoria or animated globular nomads" is of the same order as his proposition that the head is a repetition of the trunk. This latter proposition was claimed to have been discovered by Goethe. He stated this in his *Morphologie* in 1820. A controversy followed; Oken replied with an able statement in *Isis* (Part 7, 1847).

The following is a list of Oken's principal works: *Grundriss der Naturphilosophie, der Theorie der Sinne; und der darauf gegründeten Classification der Thiere* (1802); *Die Zeugung* (1805); *Abriss der Biologie* (1805); *Beiträge zur vergleichenden-Zoologie, Anatomie und Physiologie* (along with Kieser, 1806–07); *Ueber die Bedeutung der Schädelknochen* (1807); *Ueber das Universum als Fortsetzung des Sinnensystems* (1808); *Erste Ideen zur Theorie des Lichts, der Finsterniss, der Farben und der Wärme* (1808); *Grundzeichnung des natürlichen Systems der Erze* (1809); *Ueber den Werth der Naturgeschichte* (1809) *Lehrbuch der Naturphilosophie* (1809–11; 2nd ed., 1831; 3rd ed., 1843; Eng. trans., *Elements of Physiophilosophy,* 1847); *Lehrbuch der Naturgeschichte* (1813, 1815, 1825); *Handbuch der Naturgeschichte zum Gebrauch bei Vorlesungen* (1816–20); *Naturgeschichte für Schulen* (1821); *Esquisse d'un Système d'Anatomie, de Physiologie, et d'Histoire Naturelle* (1812); *Allgemeine Naturgeschichte* (1833–42, 14 vols.).

*See* also A. Ecker, *L. Oken* (1880); C. Güttler, *L. Oken und sein Verhälbais zur Modernen Entwicklungslehre* (1884).

**OKHOTSK, SEA OF,** a part of the western Pacific Ocean, lying between the peninsula of Kamchatka, the Kurile Islands, the Japanese island of Yezo, the island of Sakhalin, and the Amur province of East Siberia. The Sakhalin Gulf and Gulf of Tartary connect it with the Japanese Sea on the west of the island of Sakhalin, and on the south of this island is the La Pérouse Strait.

**OKI,** a group of islands belonging to Japan, lying due north of the prefecture of Shimane, of which they form a part, 36° N. and 133° E. The group consists of one large island called Dogo, and three smaller isles—Chiburi-shima, Nishi-no-shima, and Naka-no-shima—which are collectively known as Dozen. These four islands have a coast line of 182 mi., an area of 130 sq.mi., and a pop. (1940) of 31,794. The island of Dogo has two high peaks, Daimanji-mine (2,185 ft.) and Omine-yama (2,128 ft.). The chief town is Saigo in Dogo, distant about 40 mi. from the port of Sakai in Shimane. The name Oki-no-shima signifies "islands in the offing," and the place is celebrated in Japanese history not only because the possession of the islands was much disputed in feudal days, but also because an ex-emperor and an emperor were banished thither by the Hojo regents in the 13th century.

**OKLAHOMA** is a west south central State of the United States of America, lying between 33° 35′ and 37° N. lat. and 94° 29′ and 103° W. long. It is bounded north by Colorado and Kansas; east by Missouri and Arkansas; south by Texas, from which it is separated in part by the Red river; and west by Texas and New Mexico. It has a total area of 69,919 sq.mi., of which 636 sq.mi. are water surface. Although the extreme western limit of the state is the 103rd meridian, the only portion W. of the 100th meridian is a strip of land about 35 mi. wide in the present Beaver, Texas and Cimarron counties, and formerly designated as "No Man's Land." Oklahoma is called the "Sooner State" because those who entered on April 22, 1889, with the rush, found some of the best land taken up by those who had evaded the guards and entered the territory in advance of the official opening. These persons who evaded the regulations and thus secured the best land were known as "Sooners."

**Physical Features.**—The topographical features of the State exhibit considerable diversity, ranging from wide treeless plains in the west to rugged and heavily-wooded mountains in the east. Elevations above the sea range from 4,800 ft. (Black Mesa) in the extreme north-west to 300 ft. in McCurtain county in the south-east. The State has a mean elevation of 1,300 ft., with 34,930 sq.m. below 1,000 ft.; 25,400 sq.m. between 1,000 and 2,000 ft.; 6,500 sq.m. between 2,000 and 3,000 ft.; and 3,600 sq.m. between 3,000 and 5,000 feet.

The western portion of the Ozark mountains enters Oklahoma near the centre of the eastern boundary, and extends west-south-west half way across the State in a chain of hills gradually decreasing in height. In the south central part of the State is an elevated table-land known as the Arbuckle mountains. In its western portion this table-land attains an elevation of about 1,350 ft. above the sea and lies about 400 ft. above the bordering plains. At its eastern termination, where it merges with the plains, it has an elevation of about 750 feet. Sixty miles north-west of this plateau lie the Wichita mountains, a straggling range of rugged peaks rising about 1,500 ft. above the plain, but on account of their steep and rugged slopes they are difficult to ascend. A third group of hills, the Chautauqua mountains, lie in the west in Blaine and Canadian counties, their main axis being almost parallel with the North Fork. The north-western part of Oklahoma is a lofty table-land forming part of the Great Plains region east of the Rocky mountains.

The prairies north of the Arkansas and west of the Neosho rivers are deeply carved by small streams, and in the western portion of this area, where the formation consists of alternating shales and sandstones, the easily eroded rocks have been carved into canyons, buttes and mesas. South of the Arkansas river these ledges of sandstone continue as far as Okmulgee, but the evidences of erosion are less noticeable. East of the Neosho river the prairies merge into a hilly woodland. In the north-west four salt plains form a striking physical feature. Of these, the most noted is the Big Salt plain of the Cimarron river, in Woodward county, which varies in width from ½ m. to 2 m. and extends along the river for 8 miles. The plain is almost perfectly level.

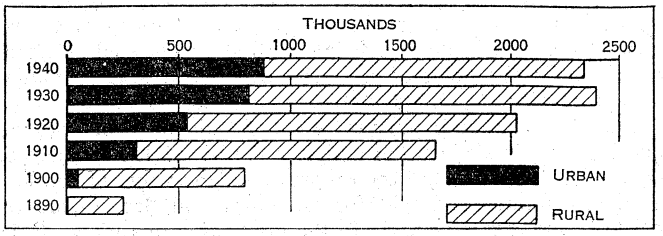
Following the slope of the land, the important streams flow from north-west to south-east. The Arkansas river enters the State from the north near the 97th meridian, and after following a general south-easterly course, leaves it near the centre of the eastern boundary. Its tributaries from the north and east—the Verdigris, Grand or Neosho and Illinois—are small but important; and from the south and west it receives the waters of much longer streams—the Salt Fork, Cimarron and the Canadian, with its numerous tributaries. The extreme southern portion of the State is drained by the Red river, which forms the greater part of the southern boundary, and by its tributaries, the North Fork, the Washita and the Kiamichi.

**Climate and Soils.**—The climate of the State is of a continental type, with light rainfall. The western and central portions of the State are in general cooler and drier than the east. Thus, at Beaver, in the extreme north-west, the mean annual temperature is 57° F and the mean annual rainfall 18·9 in.; while at Lehigh, in the south-east these figures are respectively 62° and 35·1 inches. At Oklahoma City, in the centre of the State, the mean annual temperature is 59·4°; the mean for the summer (June, July and August) is 78·8°, with an extreme recorded of 108°; the mean for the winter (December, January and February) is 38·4°, with an extreme recorded of −17°. At Mangum, in the south-west, the mean annual temperature is 61°; the mean for the summer is 81° and for the winter 41°, while the highest and lowest temperatures ever recorded are respectively 114° and −17°. The mean annual precipitation for the State is 31·7 in.; the variation between the east and the west being about 12 inches.

The prevailing type of soil is a deep dark red loam, sometimes (especially in the east central part of the State) made up of a decomposed sandstone, or (in the north-central part) of shales and decomposed limestone. Not infrequently there are a belt of red sandy loam on uplands north of a river, a rich deposit of black alluvium on valley bottom lands, a belt of red clay loam on uplands south of a river, and a deposit of wind-blown loess

on the water parting.

**Population.**—The population of Oklahoma in 1890 was 258,657; in 1910, 1,657,155; and in 1940, 2,336,434, which was 2·5% less than in 1930. The population per square mile was 33·7, as compared with 44·2 for the United States as a whole. Of the 1940 population, 879,663, or 37·6%, lived in urban places; that is, in




BY COURTESY OF THE U. S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF OKLAHOMA, 1890–1940

cities of 2,500 or more. The number of occupied dwelling units returned in the housing census of 1940 was 610,424, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 4·2 in 1930 to 3·8 in 1940. The population of the state and its principal cities is summarized in the following table:

| Area | Population | | | Per cent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 2,336,434 | 2,396,040 | 2,028,283 | −2·5 | 18·1 |
| Urban | 879,663 | 821,681 | 539,480 | 7·1 | 52·7 |
| Rural | 1,456,771 | 1,574,359 | 1,488,803 | −7·5 | 5·6 |
| Per cent urban | 37·6 | 34·3 | 26·6 | .. | .. |
| Principal cities: | | | | | |
| Oklahoma City | 204,424 | 185,389 | 91,295 | 10·3 | 103·1 |
| Tulsa | 142,157 | 141,258 | 72,075 | 0·6 | 96·0 |
| Muskogee | 32,332 | 32,026 | 30,277 | 1·0 | 5·8 |
| Enid | 28,081 | 26,399 | 16,576 | 6·4 | 59·3 |

**Government.**—The constitution now in operation was adopted in Sept. 1907, and is that with which the state was admitted into the union in November of the same year. Amendments may be submitted through a majority of the members elected to both houses of the legislature or through a petition signed by 15% of the electorate, and a proposed amendment becomes a part of the constitution if the majority of the votes cast at a popular election are in favour of it. The right of suffrage is conferred on all citizens of the United States, 21 years of age or over, who have resided in the state for one year, in the county six months, and in the precinct for the 30 days preceding the election. General elections are held in even-numbered years; party candidates for state, district, county and municipal offices, and U.S. senators and congressmen are chosen at primary elections.

The executive authority of the state is divided among 13 elected officials, including the governor, lieutenant governor, secretary of state, treasurer, auditor, attorney-general, superintendent of public instruction, examiner and inspector, commissioner of labour, commissioner of insurance, chief mine inspector, commissioner of charities and corrections and president of the state board of agriculture. They are elected for a term of four years, and the governor, secretary of state, auditor and treasurer are ineligible for the next succeeding term. Other elected state officials are the three members of the corporation commission (one elected every two years for a six-year term), the clerk of the supreme court and four assistant mine inspectors. Administrative work is also done by more than 60 other officers, commissions, departments and boards. The governor is a member of some important administrative boards, but the number of officers whom he appoints is rather limited and for most of his appointments the confirmation of the senate is required. His right of veto extends to items in appropriation bills, and to pass a bill over his veto a vote of two-thirds of the members elected to each house is required.

The legislative authority is vested in a senate of 44 members and a house of representatives (120 members in 1940), limited to 120 members. Half of the senators and all the representatives are elected every two years, senators by districts and representatives by counties. Sessions are held biennially in odd-numbered years and begin the first Tuesday after the first Monday in January. Oklahoma has put into its constitution many things which in the older states were left to legislation.

For the administration of justice there have been established a supreme court, composed of nine justices elected for a term of six years; the supreme court commission of nine members appointed by the governor was discontinued after its work was completed; a criminal court of appeals composed of three justices elected one each two years, for a term of six years; 31 district courts, each with one or more justices elected for a term of four years; superior courts in certain of the more populous counties, with a judge elected for a term of four years; a county court in each county, with one judge elected for a term of two years; justice of the peace courts held by justices elected for a term of two years; and municipal courts in the cities. The supreme court has appellate jurisdiction in all civil cases, but its original jurisdiction is restricted to a general control of the lower courts. The supreme court commission, created by the legislature in 1927 to assist the supreme court in civil cases, has been discontinued, as already explained. The criminal court of appeals has jurisdiction in all criminal cases appealed from the district and county courts. The district courts have exclusive jurisdiction in civil actions for sums exceeding $1,000, concurrent jurisdiction with the county courts in civil actions for sums greater than $500, and original or appellate in criminal cases. The superior courts were created to relieve the district courts and have a similar jurisdiction. The county courts have, besides the concurrent jurisdiction above stated, original jurisdiction in all probate matters, original jurisdiction in civil actions for sums greater than $200 and not exceeding $500, concurrent jurisdiction with the justices of the peace in misdemeanour cases, and appellate jurisdiction in all cases brought from a justice of the peace or a police court.

**Local Government.**—The general management of county affairs is entrusted to three commissioners elected by districts. The other county officers are a sheriff, attorney, judge, clerk, court clerk, treasurer, assessor, surveyor, superintendent of public instruction and public weigher. They are chosen for a term of two years at the general elections in November. Since 1919 only 21 counties have township government. The municipalities of Oklahoma may be classified as incorporated towns and as cities (over 2,000 inhabitants).

**Finances.**—The revenues for state and for local purposes are derived almost wholly from separate sources. The greater part of the state's revenue is derived from a gross production tax on minerals, motor vehicle licences, a gasoline tax, insurance fees, an inheritance tax, an income tax, the sales tax and departmental collections. Revenue for local purposes is obtained chiefly from tax levies on personal and real property. The valuation and assessment of personal and real property and of public service corporations for 1936 was $1,119,676,179. This, however, did not include mineral property which is taxed on gross production only. There were no state levies on property in 1940, tax levies being made only by the counties, townships, or cities and towns, and school districts. The total revenue receipts for the year ending June 30, 1940, were $80,331,224, of which $43,576,571 were returned to local governments, and $36,754,653 retained for state purposes. The chief state expenditures were for highways, education, debt amortization and service, and penal institutions. The total bonded indebtedness of the state on that date was $23,602,681.

A feature of the banking system is a fund for the guaranty of deposits in banks operating under state charters. The bank guarantee law was held to be valid by the U.S. supreme court in 1908 after the U.S. attorney-general had decided that it was illegal. There were 380 banking institutions operating within the state on Dec. 31, 1940. Their combined resources were $527,240,000; and their total deposits were $466,046,000. Of the total number of banks, 208 were national and 172 state banks.

**Education.**—Oklahoma has an excellent system of public edu-

cation, and especially is this true for specialized and advanced instruction. The public school system is administered by a state superintendent of public instruction, the co-ordinating board for higher institutions, several state boards of regents, the state board of agriculture, a state board of education, county superintendents and district boards. The state board of education, which is composed of the state superintendent and eight appointed members, apportions the various state school-aid funds. The scholastic enumeration in 1940 showed 694,477 children of school age. Of this number 629,028 were enrolled in the public schools and 485,290 were in average daily attendance. The average number of days attended per enrolled pupil was 135; nearly all of the pupils were, however, enrolled in schools which were open 160 days or more. The number of pupils enrolled in the state high schools was 138,725, and in the private and parochial schools, 3,936. The total expenditure for schools in 1940 was $31,507,590. Of the total revenue receipts, the state contributed $11,500,000; the rest came from local, county and benevolent sources. This was exclusive of aid from the federal government. The higher educational institutions supported by the state are the University of Oklahoma at Norman; the Agricultural and Mechanical college, a land-grant college with experiment stations, at Stillwater; the Oklahoma College for Women, teaching especially domestic science and the fine arts, at Chickasha; the Panhandle Agricultural and Mechanical college at Goodwell; six state colleges at Durant, Edmond, Ada, Weatherford, Alva and Tahlequah; and the Coloured Agricultural and Normal university at Langston. Among the institutions of higher learning neither maintained nor controlled by the state are Phillips university at Enid; Oklahoma City university at Oklahoma City; the Catholic College of Oklahoma for Women at Guthrie; the University of Tulsa at Tulsa; and Oklahoma Baptist university at Shawnee.

**Charities and Corrections.**—Under the constitution the supervision and inspection of charities and institutions of correction are in the hands of a state commissioner of charities and corrections, elected by the people.

The state-maintained institutions in 1940 were hospitals for the insane at Norman, Vinita and Supply; the University hospital at Oklahoma City; tubercular sanatoriums at Clinton and Talihina; a Confederate soldiers' home at Ardmore—one for Union soldiers at Oklahoma City has been discontinued; orphanages for white children at Pryor and Helena; an institute for the feeble-minded at Enid; and a home for deaf, blind and orphan Negro children at Taft. The state penal institutions consisted of four training schools, for Negro girls at Taft, for Negro boys at Boley, for white girls at Tecumseh and for white boys at Pauls Valley; the Oklahoma State reformatory at Granite; and the state penitentiary at McAlester.

**Agriculture and Stock Raising.**—Prior to the first opening to settlement by white men in April 1889, the territory now comprising Oklahoma was a cattle country, and since then, although the opening was piecemeal, the agricultural development has been remarkably rapid. By 1900, 51·1% of the total land surface was included in farms; and by 1930 the farm area was 33,791,000 ac., or approximately 76% of the total. The farm acreage in 1935 had increased to 35,335,000 or 79·6% of the total land area. The average size per farm then was 165·6 acres. The total number of farmers in 1935 was 213,325 as compared with 203,866 in 1930, and 191,988 in 1920. Of the total number of farm operators (203,866) in 1935, 195,501 were whites and 17,824 Negroes. In 1935, 81,889 farms were worked by owners or part owners, 775 by managers, and 130,661 by tenants. The percentage of tenancy then was 61·2 as compared with 61·5 in 1930. The total population residing on farms in 1935 was 1,015,562, or about 44% of the state's total.

The value of land and buildings in 1930 was $1,242,724,000; by 1935 it had decreased to $784,394,000. The average value per farm then was $4,096.

The total value of all crops in 1930 was $134,573,000; but, chiefly because of the decline in prices, the total value in 1935 was $80,900,000; it was $74,823,000 in 1940.

In the production of wheat in 1940, Oklahoma ranked third among states of the U.S.A., the state's production being exceeded by Kansas and North Dakota. The 1,846,000 ac. of cotton harvested in 1940 had a yield of 805,000 bales of lint and 358,000 tons of seed. The 3,885,000 ac. of wheat harvested in 1940 yielded 56,332,000 bu. Other important crops were Indian corn, 40,356,000 bu.; oats, 32,269,000 bu.; grain sorghums, 17,160,000 bu.; barley, 5,780,000 bu., and rye, 400,000 bu. The hay crop of 1,505,000 tons was harvested from 680,000 ac. of cultivated hay and 497,000 ac. of wild hay. The potato crop consisted of 2,550,000 bu. of white potatoes and 1,600,000 bu. of sweet potatoes. The production of peanuts in 1940 was 39,600,000 lb.

The livestock and poultry products of Oklahoma, in 1934, according to the state board of agriculture, had a value of $66,500,000. Of this total $38,588,000 represented the value of the livestock slaughtered and sold for slaughter, and $27,912,000 the chickens and eggs produced. In the production of turkeys, Oklahoma comes fifth in the nation. The livestock in the state on Jan. 1, 1940, consisted of 2,359,000 cattle, of which 1,123,000 were kept for dairy purposes; 990,000 swine; 305,000 sheep; 341,000 horses; and 157,000 mules.

The estimated value was $112,442,000.

**Minerals, Lumber and Timber Products.**—Oklahoma, which ranks 17th in size among the states, ranked fourth in the value of mineral products for 1938. The state in 1934 produced 7·82% of the total mineral wealth of the U.S. as compared with 18·03% produced by Pennsylvania. The principal minerals, in the order of value in 1938, were petroleum, natural gas, natural-gas gasoline, zinc, coal, lead and stone. Ranked by value in 1934, Oklahoma was first among the states in the production of zinc and asphalt; second in petroleum, chats, magnesium salts and tripoli; and third in natural gas, natural-gas gasoline and calcium-magnesium chloride. The mineral production of the state in 1938 had a value of $272,860,078. The petroleum and natural gas producing regions of Oklahoma extend over about 43 counties in the north-central and southwestern parts of the state. In 1938 the greater number of Oklahoma's 250 oil and gas fields were still producing. Tulsa, the oil capital of the state, is situated in about the centre of the north-central producing area. The petroleum production in 1933 was 182,251,000 bbl. valued at $120,800,000; in 1937 it was 228,839,000 bbl., valued at $283,500,000. The 1938 production was estimated at 174,994,000 bbl. The 468,499,000 gal. of natural-gas gasoline produced in 1938 had a value of $14,373,000; and the 263,164,000,000 cu.ft. of natural gas was valued at $27,391,000. The industry fourth in importance, ranked by value of product, was the mining of zinc ore in Ottawa county. The 1938 production was 112,924 tons, valued at $10,840,704. The same region produced 21,104 tons of lead, valued at $1,932,368. The bituminous coal mining industry was fifth in importance in the state in 1938 on the basis of value of products. The Oklahoma coal fields lie in the eastern part of the state and extend over a very wide territory from which more than ten counties ordinarily report production. The principal mining centres are McAlester, Henryetta, Wilburton, Hartshorne, Coalgate and Phillips.

The merchantable timber is mostly in the eastern part of the state, and consists largely of yellow pine, oak, red gum, elm, cottonwood and other hardwoods. In 1933, according to the census of manufactures, there were 19 active sawmills within the state, and the cut for the year was 105,000,000 board feet. Of this total about 100,000,000 bd.ft. were soft woods, chiefly pine, and about 5,000,000 bd.ft. were hardwoods, of which oak and red gum were most important.

The lumber industry in 1933 gave employment to 1,852 persons. The value of production was $1,961,000. The cut of timber in 1937 was 159,000,000 bd.ft.

**Manufactures and Transport.**—Oklahoma ranks high among

| Industry | Number of establishments | Number of wage earners | Value of product |
|---|---|---|---|
| State total | 1,428 | 29,551 | $366,088,721 |
| Petroleum refining | 30 | 5,310 | 144,474,915 |
| Wholesale meat-packing | 20 | 2,198 | 38,555,703 |
| Flour and grain mill products | 42 | 934 | 33,119,822 |
| Butter | 57 | 635 | 15,149,654 |
| Zinc smelting and refining | 3 | 1,318 | 13,537,488 |
| Newspapers and periodicals | 178 | 1,790 | 12,066,319 |
| Bread and bakery products | 224 | 2,016 | 10,787,412 |
| Boiler-shop products | 9 | 822 | 7,527,539 |

the states of the union in the production of raw materials; *i.e.*, products of farms, forests and mines. The total factory output was valued at $366,088,721 in 1937. The table on page 756 shows the chief industries, the number of wage earners employed and the value of their product in 1937.

The chief industrial centres of the state in 1940 were Oklahoma City, Tulsa and Muskogee.

The first railway in Oklahoma was that of the Missouri, Kansas and Texas, which completed a line across the territory to Denison, Texas, in 1872. The railway mileage, however, increased slowly until the territory was opened to white settlement (1889), and then, in a period of decades, increased by more than 4,600 miles. By 1937 the steam railway mileage had increased to 6,631, and had touched every county in the state except Cimarron. The principal lines crossing the state from north to south are the Missouri, Kansas and Texas, the St. Louis and San Francisco, the Atchison, Topeka and Santa Fe, two lines of the Chicago, Rock Island and Pacific, and the Kansas City, Mexico and Orient. The Chicago, Rock Island and Pacific also crosses the middle of the state from east to west. The street and interurban electric railway companies operating in the state in 1937 had 325 mi. of main track. Oklahoma has over 130,000 mi. of public roads. Of this total 8,507 mi. are included in the state-maintained highway system. By Jan. 1, 1940, 7,283 mi. of the state highways had been surfaced.

**History.**—With the exception of the narrow strip north of the most northern section of Texas the territory comprising the present State of Oklahoma was set apart by Congress in 1834, under the name of Indian Territory, for the possession of the five southern tribes (Cherokees, Creeks, Seminoles, Choctaws and Chickasaws) and the Quapaw Agency. Early in 1809 some Cherokees in the south-eastern States made known to President Jefferson their desire to remove to hunting grounds west of the Mississippi, and at first they were allowed to occupy lands in what is now Arkansas, but by a new arrangement first entered into in 1828 they received instead, in 1838, a patent for a wide strip extending along the entire northern border of Indian Territory with the exception of the small section in the north-eastern corner which was reserved to the Quapaw Agency. By treaties negotiated in 1820, 1825, 1830 and 1842, the Choctaws received for themselves and the Chickasaws a patent for all that portion of the Territory which lies south of the Canadian and Arkansas rivers, and by treaties negotiated in 1824, 1833 and 1851 the Creeks received for themselves and the Seminoles a patent for the remaining or middle portion. Many of the Indians of these tribes brought slaves with them from the Southern States and during the Civil War some supported the Confederacy, but when that war was over the Federal Government demanded not only the liberation of the slaves but new treaties, partly on the ground that the tribal lands must be divided with the freedmen. By these treaties, negotiated in 1866, the Cherokees gave the United States permission to settle other Indians on what was approximately the western half of their domain; the Seminoles, to whom the Creeks in 1855 had granted as their portion the strip between the Canadian river and its North Fork, ceded all of theirs, and the Creeks, Choctaws and Chickasaws ceded the western half of theirs back to the United States for occupancy by freedmen or other Indians. In the eastern portion of the lands thus placed at its disposal by the Cherokees and the Creeks, the Federal Government within the next 17 years made a number of small grants as follows: to the Seminoles in 1866, to the Sacs and Foxes in 1867, to the Osages, Kansas, Pottawatomies, Absentee Shawnees and Wichitas in 1871–72, to the Pawnees in 1876, to the Poncas and Nez Percés in 1878, to the Otoes and Missouris in 1881, and to the Iowas and Kickapoos in 1883; in the south-western quarter of the Territory, also, the Kiowas, Comanches and Apaches were located in 1867 and the Cheyennes and Arapahoes in 1869. There still remained unassigned the greater part of the Cherokee Outlet besides a tract embracing 1,887,800 ac. of choice land in the centre of the Territory, and the agitation for the opening of this to settlement by white people increased until in 1889 a complete title to the central tract was purchased from the Creeks and Seminoles. Soon after the purchase President Benjamin Harrison issued a proclamation announcing that this land would be opened to homestead settlement at 12 o'clock noon, on April 22, 1889. At that hour, no less than 20,000 people were on the border, and when the signal was given there ensued a remarkably spectacular race for homes. In the next year that portion of Indian Territory which lay south of the Cherokee Outlet, and west of the lands occupied by the five tribes, together with the narrow strip north of Texas which had been denied to that State in 1850, was organized as the Territory of Oklahoma.

In the meantime negotiations were begun for acquiring a clear title to the unoccupied portion of the Cherokee Outlet for individual allotments to the members of the several small tribes who had received tribal allotments since 1866, and for the purchase of what remained after such individual allotments had been made. As these negotiations were successful most of the land between the tract first opened and that of the Creeks was opened to settlement in 1891, a large tract to the west of the centre was opened in 1892, a tract south of the Canadian river and west of the Chickasaws was opened in 1901, and by 1904 the entire Territory had been opened to settlement with the exception of a tract in the north-east which was occupied by the Osages, Kaws, Poncas and Otoes. By the treaties with the five southern tribes they were to be permitted to make their own laws so long as they preserved their tribal relations, but since the Civil War many whites had mingled with these Indians, gained control for their own selfish ends of such government as there was, and made the country a refuge for fugitives from justice. Consequently, in 1893, Congress appointed the Dawes Commission to induce the tribes to consent to individual allotments as well as to a government administered from Washington, and in 1898 the Curtis Act was passed for making such allotments and for the establishment of a Territorial Government. When the allotments were nearly all made Congress in 1906 authorized Oklahoma and Indian Territories to qualify for admission to the Union as one State. As both Territories approved, a constitutional convention (composed of 100 Democrats and 12 Republicans) met at Guthrie on Nov. 20, 1906. The Constitution framed by this body was approved by the electorate on Sept. 17, 1907, and the State was admitted to the Union on Nov. 16.

In politics Oklahoma has been consistently Democratic, but with a strong Republican minority. In the election of 1920 the Republican Party gained control of the house of representatives, while the senate, with half of its members holding over, remained Democratic. The Republicans were also successful in electing their candidate to the U.S. Senate. Governor Walton's excessive use of martial law in 1923 in suppressing alleged activities of the Ku Klux Klan brought about a movement for his impeachment. He was found guilty and removed from office after having served only a few months of the four year term. Governor Johnston was similarly impeached and removed in 1929. The spectacular Governor W. H. ("Alfalfa Bill") Murray, inaugurated in 1931, also showed an addiction to the use of militia in his attempt to force the opening of a free bridge over the Red River and later in compelling oil operators to restrict their production. In the national election of 1928, the State went Republican; but it resumed its normal Democratic position in 1932 with a popular ratio of 3 to 1, and again in 1936 and 1940.

BIBLIOGRAPHY.—C. N. Gould, *Geography of Oklahoma* (Ardmore, 1909); the *Biennial Reports* (1904 *seq.*) of the Oklahoma department of geology and natural history; the *Bulletins* of the Oklahoma Geological Survey; C. N. Gould, *Geology and Water Resources of Oklahoma* (Washington, 1905) being water supply and irrigation paper No. 148 of the U.S. Geological Survey; and *Mineral Resources of the United States*, annual reports published by the U.S. Bureau of Mines. For government *see* F. F. Blachly and M. E. Oatman, *Government of Oklahoma* (Oklahoma City, 1924); the *Oklahoma Directory*, published biennially by the Oklahoma Election Board; and the *Reports* of the various State officials, departments and boards. Information about population, occupations, etc., can be had from the *Sixteenth U.S. Census*. For history *see* S. J. Buck, *The Settlement of Oklahoma* (Madison, 1907), reprinted from the *Transactions of the Wisconsin Academy of Sciences, Arts and Letters;* Luther B. Hill, *A History of the State of Oklahoma* (1910); Joseph B. Thoburn, *Oklahoma, A History of the State and Its People* (1929); Roy Gittinger, *The Formation of the State of Oklahoma* (1939). *See* also the publications of the Oklahoma Historical Society, *Historia* (1909–22); *Chronicles of Oklahoma* (1921 *seq.*); and M. F. Burritt—*A Socio-Economic Atlas of Oklahoma* (1934). (R. GIT.)

**OKLAHOMA CITY,** capital and largest city of Oklahoma, U.S.A., and county seat of Oklahoma county; on the North Cana-

dian river, near the centre of the state. It is on federal highways 62, 66, 77, 270 and 277, and the airway from New York to Mexico; and is served by the Fort Smith and Western, the Frisco, the Missouri-Kansas-Texas, the Oklahoma City-Ada-Atoka, the Rock Island, the Santa Fe and two belt railways. The population in 1930 by federal census was 185,389; in 1940 it was 204,424, a gain of 9·7% in a decade.

The site covers 49.8 sq.mi. about 1,200 ft. above sea level. The state capitol (completed in 1917 at a cost of $4,500,000) is an impressive colonnaded structure of white limestone, in 100 ac. of gardens and parkland.

The large, modern public and business buildings are beautified with borders of turf and shrubbery. The residential streets are tree-lined and most of the houses set in spacious lawns and gardens.

The city's parks and playgrounds cover 2,900 ac. Its water is supplied from Lake Overholser (10 mi. N.W.), a reservoir of 1,700 ac. with two or three years' supply, built (1917–24) at a cost of $6,000,000, and planned as the centre of a great park. At the southeast corner of the city are the state fair grounds of 160 ac. The city operates under a city-manager form of government, adopted in 1927. It is the seat of Oklahoma City university (Methodist; established at Guthrie in 1911, superseding Epworth university) and of the medical school and hospital of the University of Oklahoma, which has its main seat at Norman (*q.v.*), 18 mi. south.

Equally accessible is the Central State Teachers' college at Edmond, 15 mi. north.

The city's public-school system represents an investment of $18,000,000.

Oklahoma City is the commercial and financial metropolis of the state, the seat of a branch of the Federal Reserve bank, the home of insurance offices writing 75% of the policies in the state, and of wholesale houses distributing 75% of all the goods, 95% of the automobiles, trucks, and tractors, and 100% of the farm machinery and farm implements used throughout the state. It gins and markets a large part of the state's cotton crop ($\frac{1}{13}$ of the total grown in the U.S.A.), and makes large quantities of cottonseed oil, meal, and cake; is an important market for horses (notably registered Percherons) and mules, and is the home of the great Junior Livestock show; and has stockyards (at Packingtown, just outside the city limits) with a capacity of 31,000 head daily, and packing plants with an annual output valued at over $70,000,000. There are producing oil wells in the heart of the city; many large operating companies have their headquarters there, and there are many supply houses doing a large business. The manufacturing industries had an output in 1937 valued at $76,407,595. Building permits in 1940 represented values totalling $6,007,925. Bank debits in 1940 aggregated $1,249,817,244.

The site of Oklahoma City was opened to settlement on April 22, 1889. By night it had a population of 10,000 under tents. The city was chartered in 1890 and became the capital of the state in 1910.

In less than 52 years from its birthday it had 66 public-school buildings, 209 churches, 310 mi. of paved streets, 38,930 water meters, over 60,540 telephones, 325 manufacturing plants, with salaries for the year of $6,676,706; post-office receipts amounting in a year (1940) to $1,917,904.99, and bank deposits (April 1, 1941), $131,601,705.

**OKMULGEE,** a city of eastern Oklahoma, U.S.A., on federal highway 75 and the Frisco and Okmulgee Northern railways; the county seat of Okmulgee county. Pop. (1920) 17,430 (78% native white and 19% Negroes); 1940, 16,051, federal census. It is the centre of one of the greatest oil-producing regions of the world. Within an area of 2,123 sq.mi. are some 6,000 producing wells, which supply 16% of the total output of the United States. The city has refineries using 20,000 bbl. of crude oil daily, plants making 200,000 gal. of gasoline daily from natural gas, window-glass plants employing 1,000 men and numerous other manufacturing industries. In a square in the heart of the city stands the Council house which was the capital of the Creek nation for half a century. Okmulgee was settled about 1900. In 1910 it was still a little cattle town of 4,176 inhabitants. In the next decade the population increased more than fourfold. It was incorporated in 1912 under a commission-manager form of government.

**OKRA:** *see* GUMBO.

**OKU, YASUKATA,** MARSHAL, COUNT (1845–1930), Japanese general, was born in Fukuoka-ken. He commanded the II army in the Russo-Japanese War. In 1906–1912 he was chief of the general staff, and was made count in 1907 and marshal in 1911.

**OKUBO TOSHIMITSU** (1830–1878), Japanese statesman, a samurai of Satsuma, was one of the five great nobles who led the revolution in 1868 against the shogunate. He became one of the mikado's principal ministers, and in the Satsuma troubles which followed he was the chief opponent of Saigo Takamori. But the suppression of the Satsuma rebellion brought upon him the personal revenge of Saigo's sympathizers, and in the spring of 1878 he was assassinated by six clansmen. Okubo was one of the leading men of his day, and in 1872 was one of the Japanese mission which was sent round the world to get ideas for organizing the new régime.

**OKUMA (SHIGENOBU),** MARQUIS (1838–1922), Japanese statesman, was born in the province of Hizen in 1838. His father was an officer in the artillery. He was able to acquire in his youth a knowledge of English and Dutch, and by the help of missionaries he obtained books in those languages on scientific and political subjects. These works effected a complete revolution in his mind. He had been designed by his parents for the military profession, but he was determined to devote his energies to the abolition of the existing feudal system and to the establishment of a constitutional government. Though he took no active part in the revolution of 1868, the weight of his opinions was felt in the struggle. Already he was recognized as a coming man and no sooner was the government reorganized, with the mikado as the sole wielder of power, than he was appointed chief assistant in the department of foreign affairs. In 1869 he succeeded to the post of secretary of the joint departments of the interior and of finance, and for the next fourteen years he devoted himself to politics. In 1870 he was made a councillor of state, and a few months later became president of the commission which represented the Japanese government at the Vienna Exhibition. In 1872 he was again minister of finance, and was president of the commission appointed to supervise the Formosa campaign of 1874. The Japanese nation had supported him up to a certain point, but opinion now turned against him. When Okuma resigned office in the early 'eighties he established the Semmon Gakko, or school for special studies, and subsequently other schools.

In 1896–97 he was a member of the Matsukata cabinet. An attempted assassination by bomb necessitated the amputation of one of his legs. On Ito's retirement in 1898 he took office as premier and minister of foreign affairs. He resigned after a few months and retired into private life, cultivating his beautiful garden at Waseda near Tokyo. He emerged from his retirement in 1914 to become prime minister, in which capacity he guided the country through the opening months of the World War. In 1916, Count Okuma retired from office owing to his failing health. In the same year he was raised to a marquessate. He died at Tokyo on Jan. 10, 1922.

**OLAF** or **ANLAF** (d. 981), king of the Danish kingdoms of Northumbria and of Dublin, was a son of Sitric, king of Deira, and was related to the English king Aethelstan. He was of Norse descent, and he married a daughter of Constantine II., king of the Scots. When Sitric died about 927 Aethelstan annexed Deira, and Olaf took refuge in Scotland and in Ireland until 937, when he was one of the leaders of the formidable league of princes which was destroyed by Aethelstan at the famous battle of Brunanburh. Again he sought a home among his kinsfolk in Ireland, but just after Aethelstan's death in 940 he or Olaf Godfreyson was recalled to England by the Northumbrians. Both crossed over, and in 941 the new English king, Edmund, gave up Deira to the former. The peace between the English and the Danes did not, however, last long. Wulfstan, archbishop of York, sided with Olaf; but in 944 this king was driven from Northumbria by

Edmund, and crossing to Ireland he ruled over the Danish kingdom of Dublin. From 949 to 952 he was again king of Northumbria, until he was expelled once more, and he passed the remainder of his active life in warfare in Ireland. But in 980 his dominion was shattered by the defeat of the Danes at the battle of Tara. He went to Iona, where he died probably in 981, although one account says he was in Dublin in 994. This, however, is unlikely. In the sagas he is known as Olaf the Red.

This Olaf must not be confused with his kinsman and ally, OLAF (d. 941), also king of Northumbria and of Dublin, who was a son of Godfrey, king of Dublin. The latter Olaf became king of Dublin in 934; but he was in England in 937, as he took part in the fight at Brunanburh. After this event he returned to Ireland, but he appears to have acted for a very short time as joint king of Northumbria with Olaf Sitricsson. It is possible that he was the "Olaf of Ireland" who was called by the Northumbrians after Aethelstan's death, but both the Olafs appear to have accepted the invitation. He was killed in 941 at Tyningham near Dunbar.

*See* W. F. Skene, *Celtic Scotland* (1876); J. R. Green, *The Conquest of England* (1899).

**OLAF I. TRYGGVESSÖN** (969–1000), king of Norway, was born in 969, and began his career in exile. It is even said that he was bought as a slave in Estonia. After a boyhood spent in Novgorod under the protection of King Valdemar, Olaf fought for the emperor Otto III. under the Wendish king Burislav, whose daughter he had married. On her death he raided the coasts of France and the British Isles, until he was converted to Christianity by a hermit in the Scilly Islands, and his marauding expeditions ceased since he would not harry those of his new faith. He married Gyda, sister of Olaf Kvaran, king of Dublin, and administered her property in England and Ireland for some time before he sailed for Norway, then restive under its ruler Earl Haakon. He was unanimously accepted as king of Norway (995), and began the conversion of the country to Christianity. Possibly Olaf's ambition was to rule a united, as well as a Christian, Scandinavia. He made overtures of marriage to Sigrid, queen of Sweden, and increased his fleet, but she clung to her heathen faith. He made an enemy of her, and involved himself in a quarrel with King Sveyn of Denmark by marrying his sister Thyre, who had fled from her heathen husband Burislav in defiance of her brother's authority. Both his Wendish and his Irish wife had brought Olaf wealth and good fortune, but Thyre brought him ill luck; in an expedition (1000) to wrest her lands from Burislav he was waylaid off the island Svöld, near Rügen, by the combined Swedish and Danish fleets, together with the ships of Earl Haakon's sons.

The battle ended in the annihilation of the Norwegians. Olaf fought to the last on his great vessel, the "Long Snake," the mightiest ship in the North, and finally leapt overboard and was no more seen. Full of energy and daring, skilled in the use of every kind of weapon, genial and open-handed to his friends, implacable to his enemies, Olaf's personality was the ideal of the heathendom which he repudiated and oppressed. After his death he remained the hero of his people, who looked for his return. "But however that may be," says the story, "Olaf Tryggvessön never came back to his kingdom in Norway."

**OLAF (II.) HARALDSSÖN** (995–1030), king of Norway from 1016–1029, called during his lifetime "the Fat," and afterwards known as St. Olaf, was born in 995, the year in which Olaf Tryggvessön came to Norway. After some years' absence in England, fighting the Danes, he returned to Norway in 1015 and declared himself king, obtaining the support of the five petty kings of the Uplands. In 1016 he defeated Earl Sveyn, hitherto the virtual ruler of Norway, at the battle of Nesje, and within a few years had won more power than had been enjoyed by any of his predecessors. He had annihilated the petty kings of the South, had crushed the aristocracy, enforced the acceptance of Christianity throughout the kingdom, asserted his suzerainty in the Orkney Islands, had humbled the king of Sweden and married his daughter in his despite, and had conducted a successful raid on Denmark. But in 1029 the Norwegian nobles, seething with discontent, rallied round the invading Knut the Great, and Olaf fled to Russia. On his return a year later he fell at the battle of Stiklestad, where his own subjects were arrayed against him. After his death his cunning and cruelty which marred his character were forgotten, and his services to his church and country remembered. Miracles were worked at his tomb, and in 1164 he was canonized and was declared the patron saint of Norway, whence his fame spread throughout Scandinavia and even to England, where churches are dedicated to him. The Norwegian order of knighthood of St. Olaf was founded in 1847 by Oscar I., king of Sweden and Norway, in memory of this king.

**ÖLAND,** an island in the Baltic sea, next to Gotland the largest belonging to Sweden, stretching for 85 m. along the east coast of the southern extremity of that country, from which it is separated by Kalmar Sound which is from 5 to 15 m. broad. The greatest breadth of the island is 10 m., and its area 519 sq.m. The centre of the island is more densely populated than either end. The only large town is Borgholm, with 2,041 inhabitants.

For administrative purposes the island of Öland is included in the Kalmar *län.* From the raid of Ragnar Lodbrok's sons in 775 Öland is frequently mentioned in Scandinavian history, and especially as a battleground in the wars between Denmark and the northern kingdoms. In the middle ages it formed a separate legislative and administrative unity. A number of monuments of unknown age exists, including stones (*stensättningar*) arranged in groups to represent ships. Borgholm has one of the finest castle ruins in Sweden. The town was founded in 1817, but the castle, dating at least from the 13th century, was one of the strongest fortresses, and afterwards one of the most stately palaces in the country. The inhabitants were formerly styled Öningar, and show considerable diversity of origin in the matter of speech, local customs and physical appearance.

The island consists for the most part of Silurian limestone, and thus forms a striking contrast to the mainland with its granite and gneiss. Down the west side runs a limestone ridge, rising usually in terraces, but at times in steep cliffs, to a height of 200 ft.; and along the east side there is a parallel ridge of sand, resting on limestone, never exceeding 90 feet. These ridges, known as the Western and Eastern Landborgar, are connected towards the north and the south by belts of sand and heath; and the hollow between them is occupied by a desolate and almost barren tract: the southern portion, or Alfvar (forming fully half of the southern part of the island), presents a surface of bare red limestone characteristically weathered. The northern portion is covered with hazel bushes. Outside the ridges, however, Öland is well wooded, while the narrow strip of alluvial coast-land is good agricultural country. There are a few small streams in the island and one lake, Hornsjö, about 3 m. long.

**OLAUS MAGNUS** or MAGNI (1490–1558) (Magnus, *i.e., Stora,* great, being the family name, and not a personal epithet), Swedish ecclesiastic and author, followed his brother, Johannes Magnus, archbishop of Uppsala, to Rome in 1527. Most of his life, after his brother's death, seems to have been spent in the monastery of St. Brigitta in Rome, where he subsisted on a pension assigned him by the pope. He wrote the famous *Historia de Gentibus Septentrionalibus* (Rome, 1555), a work which long remained for the rest of Europe the chief authority on Swedish matters and is still a repertory of much curious information.

The *Historia* was translated into Italian (Venice, 1565), German (Strassburg, 1567), English (London, 1658) and Dutch (Amsterdam, 1665); abridgments of the work appeared also at Antwerp (1558 and 1562), Paris (a French abridged version, 1561), Amsterdam (1586), Frankfort (1618) and Leiden (1652). Olaus also wrote a *Tabula terrarum septentrionalium* . . . (Venice, 1539).

**OLBERS, HEINRICH WILHELM MATTHIAS** (1758–1840), German astronomer, was born on Oct. 11, 1758, at Arbergen, a village near Bremen, where his father was minister. He studied medicine at Göttingen, 1777–80, attending at the same time Kaestner's mathematical course. In 1779 he devised a new method of calculating cometary orbits. The treatise containing this important invention was made public by Baron von Zach under the title *Ueber die leichteste und bequemste Methode die Bahn eines Cometen zu berechnen* (Weimar, 1797). A table of 87

calculated orbits was appended, enlarged by Encke in the second edition (1847) to 178, and by Galle in the third (1864) to 242. In 1781, Olbers settled as a physician in Bremen, where he practised till his retirement on Jan. 1, 1823. The greater part of each night was meantime devoted to astronomy, the upper portion of his house being fitted up as an observatory. He paid special attention to comets, and that of 1815 (period 74 years) bears his name in commemoration of its detection by him. He also took a leading part in the discovery of the minor planets, rediscovering Ceres on Jan. 1, 1802, and discovering Pallas on March 28 following. His hypothesis of their origin by the disruption of a primitive large planet (*Monatliche Correspondenz,* vi. 88), seemed to gain confirmation by the finding of Juno by Harding, and of Vesta by himself, in regions indicated by the hypothesis. Olbers was deputed by his fellow-citizens to assist at the baptism of the king of Rome on June 9, 1811, and he was a member of the *corps législatif* in Paris (1812–13). He died on March 2, 1840. He was twice married, and one son survived him.

See *Biographische Skizzen verstorbener Bremischer Aerzte,* by Dr. G. Barkhausen (Bremen, 1844); *Allgemeine geographische Ephemeriden,* iv. 283 (1799); *Abstracts Phil. Trans.* iv. 268 (1843); *Astronomische Nachrichten,* xxii. 265 (Bessel), also appended to A. Erman's *Briefwechsel zwischen Olbers und Bessel* (2 vols., Leipzig, 1852); *Allgemeine deutsche Biographie* (S. Günther). The first two volumes of Dr. C. Schilling's exhaustive work, *Wilhelm Olbers, sein Leben und seine Werke,* appeared at Berlin in 1894 and 1900, a third and later volume including his personal correspondence and biography. A list of Olbers's contributions to scientific periodicals is given at p. xxxv. of the 3rd ed. of his *Leichteste Methode,* and his unique collection of works relating to comets now forms part of the Pulkowa library.

**OLD AGE PENSIONS.** The royal commission on the Aged Poor was appointed in 1893 "to consider whether any alterations in the system of poor law relief are desirable, in the case of persons whose destitution is occasioned by incapacity for work resulting from old age, or whether assistance could otherwise be afforded in these cases." The commission considered three main schemes for the provision of old age pensions, viz., pensions paid from imperial taxation, compulsory insurance and the system of state-aided voluntary insurance supported by Joseph Chamberlain. The commission, which reported in 1895, was unable to recommend the adoption of any of these proposals. Several committees were afterward set up to consider the question but little progress was made.

Such was the position when H. H. Asquith (afterwards Lord Oxford) in his budget speech of 1907 pledged the Liberal Government to deal with the question in the following session, fulfilling that pledge in the Old Age Pensions Act of 1908.

**The Act of 1908.**—Under that act, which was admittedly of an experimental and tentative character, the statutory conditions for the receipt of an old age pension were (*a*) the person must have attained the age of 70: (*b*) he must have been a British subject for the last 20 years and have had his residence during that period in the United Kingdom and (*c*) his yearly means must not exceed £31.10. The following persons were disqualified even if the statutory conditions were fulfilled: (1) persons who were in receipt of Poor Law relief (other than medical or surgical relief); (2) persons who have been convicted of any offence and ordered to be imprisoned without the option of a fine—while in prison and for a further period of 10 years; (3) persons convicted in certain cases under the Inebriates Act, 1898: (4) persons detained in any asylum within the meaning of the Lunacy Act, or maintained in any place as pauper or criminal lunatics: (5) persons who had habitually failed to work according to their ability, opportunity and need for their maintenance and the maintenance of their dependants. The maximum rate of pension was 5/– a week and was payable when the yearly means did not exceed £21. The rate fell by 1/– a week for every £2.12.6. by which the means exceeded £21, the minimum rate of 1/– a week being payable when the means exceeded £28.17.6. but did not exceed £31.10.0. When the claimant was one of a married couple living together in the same house, his means were to be taken as not less than half the total means of the couple.

The abnormal conditions existing during the Great War led to certain administrative modifications in the scheme; an additional allowance of 2/6d. a week was made to every pensioner and pensions were not subject to adjustment on account of an increase of means arising from (1) separation allowances and allotments, (2) allowances from voluntary sources not exceeding 5/– a week and (3) earnings so long as the total means did not exceed 30/– a week. These emergency arrangements were terminable as soon as legislation could be obtained amending the statutory scheme, and in 1919 a departmental committee, with Sir W. Ryland Adkins, M.P., as chairman, was appointed "to consider and report what alterations, if any, as regards rates of pension or qualification should be made in the existing statutory scheme of old age pensions."

While the committee decided not to recommend any modification of the age at which a pension should become payable, this section of their report is of interest because it involved consideration of the relationship between the old age pensions scheme and the national health insurance scheme which was instituted in 1912. (*See* NATIONAL INSURANCE: *Health.*) The committee expressed the opinion that on financial and other grounds it was desirable to deal with the problem of lowering the pensionable age by an adaptation of the contributory system of insurance, and in this respect foreshadowed the scheme which was ultimately embodied in the Contributory Pensions Act, 1925. The committee unanimously recommended that the receipt of outdoor relief should not be a disqualification for the receipt of a pension and that the maximum rate of pension should be increased to 10/– a week, so that the pre-war purchasing power of the pension should be restored.

**The Act of 1919.**—The Old Age Pension Act, 1919, was passed to give effect to such of the recommendations of the committee as were adopted by the Government. The abolition of the means test did not find a place in the act. Apart from the important modifications made by the act of 1924 (*see* below) the conditions attaching to old age pensions at 70, where title does not arise by virtue of the Contributory Pensions Act, 1925, have remained unchanged up to 1928. These conditions are that the applicant has (1) reached the age of 70; (2) been a British subject for the last 10 years; (3) been resident in the United Kingdom for a period, in the case of natural-born British subjects, of at least 12 years since attaining the age of 50 and, in the case of naturalised British subjects, of 20 years in the aggregate; (4) the yearly means

| | £. | s. | d. | | | |
|---|---|---|---|---|---|---|
| Must not exceed | 26 | 5 | 0 | for a | 10– | pension |
| " " " | 31 | 10 | 0 | " | 8– | " |
| " " " | 36 | 15 | 0 | " | 6– | " |
| " " " | 42 | 0 | 0 | " | 4– | " |
| " " " | 47 | 5 | 0 | " | 2– | " |
| " " " | 49 | 17 | 6 | " | 1– | " |

In calculating the means from investments, etc., the first £25 of the value of the investments, etc., is allowed free, the means from the next £375 are calculated at 5%, and from the balance (if any) at 10%.

A person is disqualified for receiving a pension (*a*) while he is an inmate of a poor law institution, unless he has become an inmate for the purpose of obtaining medical or surgical treatment, when there is no disqualification up to a maximum period of three months from date of admission so long as treatment continues; (*b*) while he is serving a sentence of imprisonment without the option of a fine or of penal servitude; (*c*) while he is detained in an asylum within the meaning of the Lunacy Acts or is being maintained in any place as a pauper or criminal lunatic.

**The Act of 1924.**—A short act passed by the Labour Government in 1924 made an important modification in the means test and was directed to meet certain of the criticisms which had led the Ryland Adkins committee to recommend universal old age pensions. This act provided that from the means of a claimant as calculated under the earlier acts a deduction should be made up to a maximum of £39 of such part as was not derived from earnings. As a result of this act a claimant's means may amount to £65.5.0. without his suffering any reduction of pension provided his earnings do not exceed £26.5.0. while the minimum pension of 1/– a week may be drawn by a person whose means do not

exceed £88.17.6. if not more than £49.17.6. comes from earnings.

The Blind Persons Act, 1920, provided pensions at the age of 50 for persons who are so blind as to be unable to perform any work for which eyesight is essential on the same terms and conditions, apart from age, as are applicable to old age pensions.

**Administration.**—Claims for old age pensions under the Acts of 1908 to 1924 are decided by local pensions committees appointed for every county and for every borough and urban district. Every claim is investigated by the pension officer, an official of the Customs and Excise department who recommends to the local committee that the claim be admitted or rejected. An aggrieved claimant has a right of appeal to the minister of health.

The pension is paid weekly at the post office selected by the pensioner.

**Statistics.**—On March 31, 1911, the number of pensioners was 705,678. Three years later this number had grown to 781,929. During the war years the number of pensioners declined slightly as a consequence of the scarcity of civilian labour and the high rates of wages current, but by March 31, 1920, there were 785,833 pensioners. From this year onwards the number increased with regularity, and by March 31, 1924, it had grown to 916,771. As a consequence of the Act of 1924 the increases in the following years were abnormal and by March 31, 1926, the number of pensioners had become 1,071,093. On March 31, 1928, the number of pensions under the Acts of 1908–1924 had fallen to 995,978 (of which 972,621 were at the rate of 10/– a week). The reasons for this decline were the new qualifications embodied in the act of 1925.

The insistent demand for the lowering of the pensionable age, the rapidly mounting cost of old age pensions, and the agitation for the removal of the means test combined to direct attention to the principle of contributory insurance and as a result the Conservative Government in the Widows', Orphans', and Old Age Contributory Pensions Act, 1925 (*see* NATIONAL INSURANCE: *Widows' and Orphans' Pensions*), adopted that method.

**Widows', Orphans' and Old Age Contributory Pensions Act, 1925.**—The persons within the scope of the old age pensions scheme embodied in the act are those who are insured, whether as employed or as voluntary contributors under the national health insurance scheme. (*See* NATIONAL INSURANCE: *Health.*) In addition a certain number of persons whose employment is excepted from health insurance are compulsorily insured for old age pensions, although the majority of persons in "excepted employment" are excepted from insurance for old age pensions. Persons who cease to be compulsorily insurable have the option of continuing to be insured as voluntary contributors provided certain conditions are satisfied.

The normal rate of contribution under the act—9d. for a man and 4½d. for a woman—includes the contribution for widows' and orphans' pensions. Every person who is insured for old age pensions is insurable for widows' and orphans' pensions but certain persons are insured for the latter purposes only and pay a reduced contribution, man 7d. woman 3½d., so that 2d. in the case of a man and 1d. in the case of a woman is the share of the combined contribution which is attributable to old age pensions between the ages of 65 and 70. (The contribution arrangements under the act of 1925 are explained in greater detail in the article NATIONAL INSURANCE: *Widows' and Orphans' Pensions.*)

The act provides old age pensions at the uniform rate of 10/– a week, to insured men and insured women while between the ages of 65 and 70, and to the wives between these ages of insured men who are themselves entitled to pensions. An insured person claiming a pension must show (*a*) that he has been continuously insured for 5 years at the date when he attained the age of 65; (*b*) that 104 contributions have been paid; (*c*) that over the last three "contribution years"—running from July to June—preceding his 65th birthday an average of 39 contributions a year was paid (for this purpose weeks of incapacity and weeks of genuine unemployment are counted as weeks for which contributions were paid; (*d*) that he has been resident in Great Britain for the two years immediately preceding his 65th birthday and that his last employment (excluding temporary employment) was in Great Britain. Special provision is made for a person who on attaining the age of 65 has not been continuously insured for five years. He becomes entitled to a pension at the expiration of five years from the date of his entry into insurance if he is then under the age of 70, provided the other conditions, which are applied with reference to the date on which he completes five years of insurance and not to his 65th birthday, are satisfied. Although contributions cease to be paid by him when he attains 65, the employer's contribution continues to be payable so long as he is employed and these contributions will count for the purposes of conditions (*b*) and (*c*) above.

The provisions of the act relating to the payment of old age pensions to persons between the ages of 65 and 70 took effect from Jan. 2, 1928, two years after the date when the Act came into operation. The initial group of pensioners consisted of persons who on Jan. 2, 1928, were over the age of 65 and under the age of 70 with certain modifications of the statutory conditions.

The disqualifications for the receipt of a pension are the same as those under the acts of 1908 to 1924. (*See* p. 760 under act of 1919).

**Unrestricted Old Age Pensions at 70.**—A person who is entitled under the Act of 1925 to an old age pension while between the ages of 65 and 70 becomes, on attaining 70, entitled by virtue of the act to an old age pension at the rate of 10/– a week without regard to his means. The act also provides an unrestricted old age pension at 70 for a woman who has been receiving a widow's pension.

For insured persons who attained the age of 70 before Jan. 2, 1928, the date when old age pensions to persons between the ages of 65 and 70 began to be payable, the act also granted unrestricted old age pensions at 70. The wife or widow of an insured person entitled to one of these pensions was herself entitled to an unrestricted old age pension on attaining 70. To secure the benefit of this provision, which took effect from July 2, 1926, it had to be shown that the claimant had been insured under the National Health Insurance Act on April 29, 1925, the date of the introduction of the Pensions bill, and remained insured until he attained 70. As a person who was insured on attaining 70, at which age contributions ceased to be payable under the National Health Insurance Act, remained an insured person for life, all persons who attained 70 before April 29, 1925, and were insured on reaching that age possessed the necessary insurance qualification and became entitled to unrestricted old age pensions as from July 2, 1926. Thus one important effect of the act of 1925, in the case of persons within its scope, including the wives and widows of insured men, is to remove the means test imposed by the acts of 1908 to 1924 as regards old age pensions at 70. In the last week of March, 1928, 287,531 persons who had established their title on an insurance basis were in receipt of pensions.

**Administration.**—In England and Wales the old age pension scheme embodied in the act of 1925 is administered by the minister of health and in Scotland by the Scottish Board of Health. Claim forms are obtainable at all post offices and claims may be made within four months before attaining pensionable age. Unsuccessful applicants have a right of appeal to an independent body of referees. By the end of March, 1928, 524,828 pensions had been awarded to persons between the ages of 65 and 70.

Reciprocal arrangements have been made between Great Britain and Northern Ireland under which qualifications acquired in one country are of equal value in the other on change of residence.

**Decennial Increases of Contributions.**—The contribution payable under the Act of 1925—9d. for a man and 4½d. for a woman—is based on the amount actuarially required to provide widows' and orphans' pensions and old age pensions between the ages of 65 and 70 in the case of a person entering insurance at the age of 16, the excess cost arising in the case of persons entering at higher ages being borne by the exchequer. The cost of unrestricted old age pensions at 70 to which insured persons become entitled by virtue of the act remains an exchequer charge, but the act contains a provision under which, ultimately, the persons entering into insurance at the age of 16 will, with their employers, pay a contribution of equal value with the benefits provided for them, including the pension at 70. Provision is made

for three decennial increases of contributions. In Jan. 1936, the contribution is to be increased by 2d. a week for a man and 1d. a week for a woman, and similar increases are to be made at the beginning of 1946 and 1956, so that from the latter year the contribution will be 1s. 3d. for a man and 7½d. for a woman.

**British Dominions.**—In the Irish Free State the non-contributory scheme identical with that of Great Britain which was in existence before the severance was continued but certain modifications were made in 1924 in the rates of pension and in the amount of means entitling to pension. The maximum rate of pension was fixed at 9/– a week and is payable where the yearly means of the pensioner do not exceed £18.5.

As regards the oversea Dominions New Zealand was in advance of the mother country in establishing a scheme of non-contributory old age pensions, her scheme having been inaugurated in 1898. A non-contributory scheme operates also in Australia. In Australia the pensionable age is 65, in New Zealand 65 for men and 60 for women. The maximum rate of pension is £1 a week in Australia and 17/6 a week in New Zealand. In both cases a means test is applied, while in Australia the scheme is combined with a scheme of invalidity pensions. In 1927 the Dominion parliament of Canada passed an Act which provided for the payment by the Dominion Government of one-half of the cost of old age pensions in any province which adopted a scheme in accordance with the provisions of the act. The pensionable age is 70. British Columbia was the first province to establish a scheme and pensions have been paid in that province since Sept. 1927. Saskatchewan and Manitoba have also set up schemes in accordance with the Act. An announcement has been made by the Government of South Africa that it proposes to set up a non-contributory scheme of old age pensions on Jan. 1, 1929, with 65 as the pensionable age.

**European Countries.**—Non-contributory schemes are in force in Denmark, France and Norway. In Denmark the pensionable age is 65 and in France and Norway 70. Contributory schemes are, however, more prevalent. Germany led the way by establishing a contributory scheme in 1889 under which workman and employer paid the premium, the State adding a subvention. Her example was generally followed by those countries which established schemes after World War I. Separate schemes of old age pensions exist in Belgium and Spain but in the majority of countries the old age pension scheme is combined with a scheme of invalidity pensions. (*See* INVALIDITY PENSIONS.) Combined schemes are in operation in Bulgaria, Czechoslovakia, France (which, as stated above, has also a non-contributory scheme), Germany, Holland, Greece, Italy, Luxemburg, Poland, Portugal, Rumania, Serb-Croat-Slovene kingdom, Sweden and in the Canton of Glarus in Switzerland.

The age of 65 has been adopted by many countries as the age at which the old age pension becomes payable but in Bulgaria, France and Poland the pensionable age is 60, in Sweden 67, and in Holland and the Serb-Croat-Slovene kingdom 70.

**America.**—Of the South American countries, Chile has a contributory scheme of old age pensions combined with invalidity pensions. Old age pension is payable at the age of 65. Uruguay has a non-contributory scheme combining old age and invalidity pensions, the old age pension being payable at 60. (*See* PENSIONS: THE UNITED STATES.)

BIBLIOGRAPHY.—The *Report* of the Departmental Committee on Old Age Pensions (Cmd. 410, H.M. Stationery Office) reviews the position from the commencement of the Act of 1908 and considers various suggestions for amendment. The *Report* of the Government Actuary on the Financial Provisions of the Contributory Pensions Bill, 1925 (Cmd. 2,406, H.M. Stationery Office) contains a detailed explanation of the financial basis and an appendix on the statistical basis of the estimate. *General Problems of Social Insurance* (International Labour Office of League of Nations) reviews the position and principles of social insurance. (J. M. H.)

**OLDBURY,** a municipal borough (1935) in the Stourbridge parliamentary division of Worcestershire, England, 5 mi. W. of Birmingham. It is served by the L.M.S. and G.W. railways. Pop. (est. 1938) 45,450. Area 5.2 sq.mi. It is in the south Staffordshire coalfield; and coal, iron and limestone are worked extensively. There are also chemical, tube, tool, wagon and brick works.

**OLDCASTLE, SIR JOHN** (d. 1417), English Lollard leader, son of Sir Richard Oldcastle of Almeley, Herefordshire, served in the expedition to Scotland in 1400. Next year he was in charge of Builth castle in Brecon, and serving all through the Welsh campaigns won the friendship and esteem of Henry, the prince of Wales. Oldcastle represented Herefordshire in the parliament of 1404. Four years later he married Joan, the heiress of Cobham, and was thereon summoned to parliament as Lord Cobham in her right. Oldcastle held a high command in the expedition which the young Henry sent to France in 1411. Oldcastle had adopted Lollard opinions before 1410, when the churches on his wife's estates in Kent were laid under interdict for unlicensed preaching. In the convocation which met in March 1413, shortly before the death of Henry IV., Oldcastle was at once accused of heresy. But his friendship with the new king prevented any decisive action till evidence was found in a book belonging to Oldcastle, which was discovered in a shop in Paternoster row. He was convicted as a heretic Sept. 25. Henry granted a respite of 40 days in the hope of saving his old friend.

Before that time had expired Oldcastle escaped from the Tower by the help of one William Fisher, a parchment-maker of Smithfield (Riley, *Memorials of London,* 1868). He now put himself at the head of a widespread Lollard conspiracy. The design is said to have included the seizure of the king and his brothers during a Twelfth-night mumming at Eltham. Henry, forewarned, removed to London, and when the Lollards assembled in force in St. Giles's Fields on Jan. 10, they were easily dispersed. Oldcastle himself escaped into Herefordshire, and for nearly four years avoided capture. He took part in several conspiracies. In November 1417 he was captured by the Lord Charlton of Powis. On Dec. 14, he was formally condemned, on the record of his previous conviction, was hanged that same day in St. Giles's Fields, and burnt "gallows and all." Oldcastle died a martyr. At the same time his execution can be justified on political grounds. His opinions and early friendship with Henry V. created a traditional scandal which long continued. In the old play *The Famous Victories of Henry V.,* written before 1588, Oldcastle figures as the prince's boon companion. When Shakespeare adapted that play in *Henry IV.,* Oldcastle still appeared; but when the play was printed in 1598 Falstaff's name was substituted, in deference, as it is said, to the then Lord Cobham. Though the fat knight still remains "my old lad of the Castle," the stage character has nothing to do with the Lollard leader.

BIBLIOGRAPHY.—The record of Oldcastle's trial is printed in *Fasciculi Zizaniorum* (Rolls series) and in Wilkins's *Concilia,* iii. 351–357. The chief contemporary notices of his later career are given in *Gesta Henrici Quinti* (Eng. Hist. Soc.) and in Walsingham's *Historia Anglicana.* There have been many lives of Oldcastle, mainly based on *The Actes and Monuments* of John Foxe, who in his turn followed the *Briefe Chronycle* of John Bale, first published in 1544. For notes on Oldcastle's early career, consult J. H. Wylie, *History of England under Henry IV.* For literary history *see* the Introductions to Richard James's *Iter Lancastrense* (Chetham Soc., 1845) and to Grosart's edition of the *Poems of Richard James* (1880). *See* also W. Barske, *Oldcastle-Falstaff in der englischen Literatur bis zu Shakespeare* (Palaestra, I. Berlin, 1905); and W. T. Waugh in the *English Historical Review,* vol. xx.

**OLD CATHOLICS,** the designation assumed by those members of the Roman Catholic Church who refused to accept the decrees of the Vatican Council of 1870 defining the dogma of papal infallibility (*see* VATICAN COUNCIL and INFALLIBILITY) and ultimately set up a separate ecclesiastical organization on the Episcopal model. The Old Catholic movement, at the outset at least, differed fundamentally from the Protestant Reformation of the 16th century in that it aimed not at any drastic changes in doctrine but at the restoration of the ancient Catholic system, founded on the diocesan episcopate, which under the influence of the ultramontane movement of the 19th century had been finally displaced by the rigidly centralized system of the papal monarchy. In this respect it represented a tendency of old standing within the Church and one which, in the 18th century, had all but gained the upper hand (*see* FEBRONIANISM and GALLICANISM).

The proceedings of the Vatican council and their outcome

had at first threatened to lead to a serious schism in the Church. The minority against the decrees included many of the most distinguished prelates and theologians of the Roman communion, but in the end all the recalcitrant bishops gave in their adhesion to the decrees.

**Initial Steps.**—The universities, being less directly under the control of the Church, were prepared to show a bolder front. Dr. J. F. von Schulte, professor at Prague, was one of the first to publish a formal protest. A meeting of Catholic professors and distinguished scholars convened at Nuremberg (August 1870) recorded a like dissent, and resolved on the adoption of measures for bringing about the assembling of a really free council north of the Alps. The *Appel aux Evêques Catholiques* of M. Hyacinthe Loyson (better known as "Père Hyacinthe") appealed to the Catholic bishops throughout the world to put an end to the schism by declaring whether the recent decrees were or were not binding on the faith of the Church. This appeal, on its appearance in *La Libertà* early in 1871, was suppressed by the order of the king of Italy. On the 28th of March Döllinger, in a letter of some length, set forth the reasons which compelled him also to withhold his submission alike as "a Christian, a theologian, an historical student and a citizen." The publication of this letter was shortly followed by a sentence of excommunication pronounced against Döllinger and Professor Johann Friedrich and read to the different congregations from the pulpits of Munich. The professors of the university, on the other hand, had shortly before evinced their resolution of affording Döllinger all the moral support in their power by an address (April 3, 1871) in which they denounced the Vatican decrees with unsparing severity. (Friedberg, *Aktenstücke z. ersten vaticanischen Concil,* p. 187.) In the following September the demand for another and a free council was responded to by the assembling of a congress at Munich. It was composed of nearly 500 delegates, convened from almost all parts of the world; but the Teutonic element was now as manifestly predominant as the Latin element had been at Rome. The proceedings were presided over by Professor von Schulte, and lasted three days. Among those who took a prominent part in the deliberations were Döllinger, Reinkens, Maassen (professor of canon law at Vienna), Friedrich and Huber. The arrangements finally agreed upon were mainly provisional; but one of the resolutions plainly declared that it was desirable if possible to effect a reunion with the Oriental Greek and Russian Churches, and also to arrive at an "understanding" with the Protestant Episcopal communions. Döllinger, in delivering his inaugural address as rector of the university of Munich, expressed his conviction that theology had received a fresh impulse and that the religious history of Europe was entering upon a new phase.

Other circumstances contributed to invest Old Catholicism with additional importance. It was evident that the relations between the Roman Curia and the Prussian government were becoming extremely strained. In February, 1872, appeared the first measures of the Falk ministry, having for their object the control of the influence of the clergy in the schools, and in May the pope refused to accept Cardinal Hohenlohe, who during the council had opposed the definition of the dogma, as Prussian minister at the Vatican. Congregations of Old Catholics were formed at numerous towns and villages in Bavaria, Baden, Prussia, German Switzerland, and even in Austria. At Warnsdorf in Bohemia a congregation was collected which still represents one of the most important centres of the movement. In September the second congress was held at Cologne. It was attended by some 500 delegates or visitors from all parts of Europe, and the English Church was represented by the bishops of Ely and Lincoln and other distinguished members.

**Organization.**—The movement thus entered a new phase, the congress occupying itself mainly with the formation of a more definite organization and with the question of reunion with other Churches. The immediate effect was a fateful divergence of opinion; for many who sympathized with the opposition to the extreme papal claims shrank from the creation of a fresh schism. Prince Chlodwig Hohenlohe, who as prime minister of Bavaria had attempted to unite the governments against the definition of the dogma, refused to have anything to do with proceedings which could end only in the creation of a fresh sect, and would make the prospect of the reform of the Church from within hopeless; more important still, Döllinger refused to take part in setting up a separate organization, and though he afterwards so far modified his opinion as to help the Old Catholic community with sympathy and advice, he never formally joined it.

Meanwhile, the progress of the quarrel between the Prussian government and the Curia had been highly favourable to the movement. In May, 1873, the celebrated Falk laws were enacted, whereby the articles 15 and 18 of the Prussian constitution were modified, so as to legalize a systematic state supervision over the education of the clergy of all denominations, and also over the appointment and dismissal of all ministers of religion. The measure, which was a direct response to the Vatican decrees, inspired the Old Catholics with a not unreasonable expectation that the moral support of the government would henceforth be enlisted on their side. On the 11th of August Professor J. H. Reinkens of Breslau, having been duly elected bishop of the new community, was consecrated at Rotterdam by Bishop Heykamp of Deventer, the archbishop of Utrecht, who was to have performed the ceremony, having died a few days before. In the meantime the extension of the movement in Switzerland had been proceeding rapidly, and it was resolved to hold the third congress at Constance. The proceedings occupied three days (12th to 14th September), the subjects discussed being chiefly the institution of a synod as the legislative and executive organ of the Church, and schemes of reunion with the Greek, the African and the Protestant communions.

**The First Synod.**—The following year (1874) was marked by the assembling of the first synod and a conference at Bonn, and of a congress at Freiburg-im-Breisgau. At the congress Bishop Reinkens spoke in hopeful terms of the results of his observations during a recent missionary tour throughout Germany. The conference, held on the 14th, 15th and 16th of September, had for its special object the discussion of the early confessions as a basis of agreement, though not necessarily of fusion, between the different communions above-named. The meetings, which were presided over by Döllinger, successively took into consideration the *Filioque* clause in the Nicene creed, the sacraments, the canon of Scripture, the episcopal succession in the English Church, the confessional, indulgences, prayers for the dead, and the eucharist (*see* DÖLLINGER). The synod (May 27–29) was the first of a series in which the doctrine and discipline of the new Church were gradually formulated. The tendency was, naturally, to move further and further away from the Roman model; and though the synod expressly renounced any claim to formulate dogma, or any intention of destroying the unity of the faith, the "Catholic Catechism" adopted by it in 1874 contained several articles fundamentally at variance with the teaching of Rome. At the first synod, too, it was decided to make confession and fasting optional, while later synods pronounced in favour of using the vernacular in public worship, allowing the marriage of priests, and permitting them to administer the communion in both kinds to members of the Anglican Church attending their services.

The new alliance between Bismarck and Pope Leo XIII. against revolutionary Socialism, deprived the Old Catholics of the special favour which had been shown them by the Prussian government; they continued, however, to enjoy the legal status of Catholics, and their communities retained the rights and the property secured to them by the law of the 4th of July 1875. In Bavaria, on the other hand, they were in March, 1890, after the death of Döllinger, definitely reduced to the status of a private religious sect, with very narrow rights. When Bishop Reinkens died in January, 1896, his successor Theodor Weber, professor of theology at Breslau, elected bishop on the 4th of March, was recognized only by the governments of Prussia,

Baden and Hesse.

BIBLIOGRAPHY.—An outline of the whole movement up to the year 1875 will be found in *The New Reformation,* by "Theodorus" (J. Bass Mullinger); and an excellent résumé of the main facts in the history of the movement in each European country, as connected with other developments of liberal thought, and with political history, is given in the second volume of Dr. F. Nippold's *Handbuch der neuesten Kirchengeschichte,* vol. ii. (1883). *See* also A. M. E. Scarth, *The Story of the Old Catholic and Kindred Movements* (London, 1883); Bühler, *Der Altkatholicismus* (Leiden, 1880); J. F. von Schulte, *Der Altkatholicismus* (Giessen, 1887); and article in Herzog-Hauck's *Realencyk. für prot. Theol. und Kirche,* i. 415. For details the following sources may be consulted: (*a*) For the proceedings of the successive congresses: the *Stenographische Berichte,* published at Munich, Cologne, Constance, etc.; those of the congress of Constance were summarized in an English form, with other elucidatory matter, by Professor John Mayor; (*b*) the series of the *Catholique national* (Berne, 1898–1908) and the series of the *Revue Internationale de théologie* (Berne, 1893–1910).

**OLDENBARNEVELDT, JOHAN VAN** (1547–1619), Dutch statesman, was born at Amersfoort on Sept. 14, 1547. After studying law at Louvain, Bourges and Heidelberg, and travelling in France and Italy, Oldenbarneveldt settled down to practise in the law courts at The Hague. In religion a moderate Calvinist, he became a zealous adherent of William the Silent. He served as a volunteer for the relief of Haarlem (1573) and again at Leiden (1574). In 1576 he became pensionary of Rotterdam. He was active in promoting the Union of Utrecht (1579) and the acceptance of the countship of Holland and Zeeland by William (1584). On the assassination of William it was at the proposal of Oldenbarneveldt that the youthful Maurice of Nassau was at once elected stadtholder, captain-general and admiral of Holland. During the governorship of Leicester he was the leader of the strenuous opposition offered by the States of Holland to the centralizing policy of the governor.

In 1586 he was appointed, in succession to Paul Buys, to the post of Land's Advocate of Holland. Nominally the servant of the States of Holland he made himself politically the personification of the province which bore more than half the entire charge of the union, and as its mouthpiece in the states-general he practically dominated that assembly.

During the two critical years which followed the withdrawal of Leicester, he prevented the disintegration of the United Provinces, which might otherwise have fallen an easy conquest to the army of Alexander of Parma. Fortunately for the Netherlands the attention of Philip of Spain was at that time riveted upon his contemplated invasion of England, and Oldenbarneveldt had time to gather into his own hands the control of administrative affairs. He was wholeheartedly supported by Maurice of Nassau, who, after 1589, held the Stadholderate of five provinces, and was likewise captain-general and admiral of the union. The first rift between them came in 1600, when Maurice was forced against his will by the states-general, under the advocate's influence, to undertake an expedition into Flanders, which was only saved from disaster by desperate efforts which ended in victory at Nieuwport. In 1598 Oldenbarneveldt took part in special embassies to Henry IV. and Elizabeth, and again in 1605 in a special mission sent to congratulate James I. on his accession.

The opening of negotiations by Albert and Isabel in 1606 for a peace or long truce led to a great division of opinion in the Netherlands. The archdukes having consented to treat with the United Provinces "as free provinces and states over which they had no pretensions." Oldenbarneveldt, who had with him the States of Holland and the majority of burgher regents throughout the country, was for peace, provided that liberty of trading was conceded. Maurice and his cousin William Louis, stadtholder of Frisia, with the military and naval leaders and the Calvinist clergy, were opposed to it, on the ground that the Spanish king was merely seeking an interval of repose in which to recuperate his strength for a renewed attack on the independence of the Netherlands. For some three years the negotiations went on, but at last after endless parleying, on April 9, 1609, a truce for twelve years was concluded. All that the Dutch asked was directly or indirectly granted, and Maurice gave a reluctant assent to the favourable conditions obtained by Oldenbarneveldt.

**Religious Differences and the Sequel.**—The now "free and independent State" was rent by internal differences between the Remonstrants (Arminians) and Contra-Remonstrants (Gomarists); the States of Holland under the influence of Oldenbarneveldt supported the former, and refused to sanction the summoning of a purely church synod (1613). They likewise (1614) forbade the preachers in the Province of Holland to treat of disputed subjects from their pulpits. Obedience was difficult to enforce without military help, riots broke out in certain towns, and when Maurice was appealed to, as captain-general, he declined to act. He did more, though in no sense a theologian; he declared himself on the side of the Contra-Remonstrants, and established a preacher of that persuasion in a church at The Hague (1617).

The advocate now took a bold step. He proposed that the States of Holland should, on their own authority, as a sovereign province, raise a local force of 4,000 men (*waardgelders*) to keep the peace. The states-general meanwhile by a bare majority (4 provinces to 3) agreed to the summoning of a national church synod. The States of Holland, also by a narrow majority, refused their assent to this, and passed (Aug. 4, 1617) a strong resolution (*Scherpe Resolutie*) by which all magistrates, officials and soldiers in the pay of the province were required to take an oath of obedience to the states on pain of dismissal, and were to be held accountable not to the ordinary tribunals, but to the States of Holland. It was a declaration of sovereign independence on the part of Holland, and the states-general took up the challenge and determined on decisive action. A commission was appointed with Maurice at its head to compel the disbanding of the *waardgelders.* On July 31, 1618 the stadtholder appeared at Utrecht, which had thrown in its lot with Holland, at the head of a body of troops, and at his command the local levies at once laid down their arms. His progress through the towns of Holland met with no opposition. The states party was crushed without a blow being struck. On Aug. 23, by order of the states-general, the advocate and his chief supporters, de Groot and Hoogerbeets, were arrested.

Oldenbarneveldt was with his friends kept in the strictest confinement until November, and then brought for examination before a commission appointed by the states-general. He appeared more than 60 times before the commissioners, and was, most unjustly, allowed neither to consult papers not to put his defence in writing. On Feb. 20, 1619 he was arraigned before a special court of twenty-four members, only half of whom were Hollanders, and nearly all of them his personal enemies. It was in no sense a legal court, nor had it any jurisdiction over the prisoner, but the protest of the advocate, who claimed his right to be tried by the sovereign province of Holland, whose servant he was, was disregarded. He was allowed no advocates, nor the use of documents, pen or paper. It was in fact not a trial at all, and the packed bench of judges on Sunday, May 12, pronounced sentence of death. On the following day the old statesman, at the age of seventy-one, was beheaded in the Binnenhof at The Hague.

Not a shred of evidence has ever been produced to throw suspicion upon the patriot statesman's conduct. All his private papers fell into the hands of his foes, but not even the bitterest and ablest of his personal enemies, Francis Aarssens (*q.v.*), could extract from them anything to show that Oldenbarneveldt at any time betrayed his country's interests. His high-handed course of action in defence of what he conceived to be the sovereign rights of his own province of Holland to decide upon religious questions within its borders may be challenged on the ground of inexpediency, but not of illegality. The harshness of the treatment meted out by Maurice to his father's old friend, the faithful counsellor and protector of his own early years, leaves a stain upon the stadtholder's memory. That the prince should have felt compelled in the last resort to take up arms for the Union against the attempt of the province of Holland to defy the authority of the Generality may be justified by the plea *reipublicae salus suprema lex.* To eject the advocate from power was one thing, to execute him as a traitor quite another. The condemnation of Oldenbarneveldt was carried out with Maurice's consent and approval, and he cannot be acquitted of a prominent share in what posterity has pronounced to be a judicial murder.

Oldenbarneveldt was married in 1575 to Maria van Utrecht.

He left two sons, the lords of Groeneveld and Stoutenburg, and two daughters. A conspiracy against the life of Maurice, in which the sons of Oldenbarnêveldt took part, was discovered in 1623. Stoutenburg, who was the chief accomplice, made his escape and entered the service of Spain; Groeneveld was executed.

BIBLIOGRAPHY.—L. v. Deventer, *Gedenkstukken van Johan v. Oldenbarneveldt en zijn tijd* (1577–1609; 3 vols., 1860–65); J. van Oldenbarneveldt, *Histoirie Warachtige van de ghevanckennise . . . leste wonder ende droevige doot van J. v. O. . . . uyt de verklaringe van Z. E. dienaar Johan Francken* (1620); *Histoire van het leven en sterven van den Heer Johan van Olden Barneveldt* (1648); Groen van Prinsterer, *Maurice et Barneveldt* (1875); J. L. Motley, *Life and Death of John of Barneveldt* (2 vols., 1874). (G. E.; X.)

**OLDENBURG,** a *Land* of Germany, with an area of 2,084 sq.mi. It consisted until 1937 of three widely separated provinces —(1) Oldenburg, (2) Lübeck, and (3) Birkenfeld. It had one vote in the German reichsrat.

**Oldenburg** proper was bounded on the north by the North sea and on the other three sides by Hanover, with the exception of a small strip on the east, where it was conterminous with the territory of the free city of Bremen. It formed part of the north-western German plain lying between the Weser and the Ems. The climate is temperate and humid; the mean temperature of the coldest month at the town of Oldenburg is 26° F, of the warmest 66°. Storms are numerous and fogs and ague are prevalent in the marsh lands. The chief rivers are the Hunte, flowing into the Weser, and the Hase and Leda flowing into the Ems. The Weser itself formed the eastern boundary for 42 mi., and internal navigation is facilitated by a canal connecting the Hunte and the Leda. On the north there are several small coast streams conducted through the dikes by sluices. Large tracts of moorland, however, are useful only as producing peat for fuel, or as affording pasture to the flocks of small coarse-woolled Oldenburg sheep. The rich soil of the marsh lands produces good crops of wheat, oats, rye, hemp and rape, but is especially adapted for grazing. The mineral wealth of Oldenburg is very small. Woollen and cotton fabrics, stockings, jute and cigars are made at Varel, Delmenhorst and Lohne; cork-cutting is extensively practised in some districts, and there are a few iron-foundries. Trade is relatively of more importance, chiefly owing to the proximity of Bremen.

**Lübeck.**—The former principality of Lübeck had an area of 209 sq.mi. and shared in the general physical characteristics of east Holstein, within which it lies. The population was 47,494. In 1937, by an exchange of territories for the sake of administrative simplification, the Lübeck territories enclaved in Oldenburg were annexed to Oldenburg, and the rest of the Lübeck lands, including the Hanseatic city itself, were annexed to the Prussian province of Schleswig-Holstein. The Birkenfeld enclave in Prussia was annexed to the Prussian Rhine province.

**Birkenfeld.**—The former principality of Birkenfeld, 312 sq.mi. in extent, lies in the midst of the Prussian province of the Rhine, about 30 mi. W. of the Rhine at Worms and 150 mi. S. of the duchy of Oldenburg. The population was 55,649.

**General Features.**—The total population of the *Land* of Oldenburg in 1939 was 582,402. The bulk of the inhabitants are of Saxon stock, but to the north and west of the *Land* there are numerous descendants of the ancient Frisians. Low German (*Platt-deutsch*) is universally spoken, except in one limited district, where a Frisian dialect has maintained itself.

Oldenburg is mainly a Protestant country, but Roman Catholicism preponderates in the south-western provinces, which formerly belonged to the bishopric of Münster, and Oldenburg Roman Catholics are under the sway of the bishops of Münster.

The constitution of 1919 provided for a single representative chamber (*Landtag*), elected by universal suffrage and exercising rights of legislation and taxation. The chamber which consisted of 48 members, was elected every three years.

**History.**—The descendants of Elimar (d. 1108), the first historical count of Oldenburg, attained the dignity of princes of the empire when the emperor Frederick I. dismembered the Saxon territory in 1180. The free city of Bremen and the bishop of Münster were frequently at war with the counts of Oldenburg.

Count Christian, who in 1448 was chosen king of Denmark as Christian I., became king of Norway in 1450, and in 1457 king of Sweden. In 1460 he inherited the duchy of Schleswig and the county of Holstein, an event of high importance for the future history of Oldenburg. In 1454 he handed over Oldenburg to his brother Gerhard (*c.* 1430–99). Count Anton Günther (1583–1667), who succeeded in 1603, proved himself the wisest prince who had yet ruled Oldenburg. By his prudent neutrality during the Thirty Years' War he secured for his dominions an immunity from the terrible devastations to which nearly all the other states of Germany were exposed. He also obtained from the emperor the right to levy tolls on vessels passing along the Weser, a lucrative grant which soon formed a material addition to his resources. From 1702 to 1773 the county was ruled by the kings of Denmark, this period being on the whole one of peaceful development. In the latter year Frederick Augustus, bishop of Lübeck, a kinsman of the Emperor Paul of Russia, became count, and in 1777 the county was raised to the rank of a duchy. In 1815 the title of grand duke was allowed to the reigning duke, in consideration of his services to the allies, but was not taken up till 1829. In 1871 Oldenburg became a state of the new German empire and in 1918 the Grand Ducal family was expelled by the German revolution.

For the history of Oldenburg *see* Runde, *Oldenburgische Chronik* (Oldenburg, 1863); E. Pleitner, *Oldenburg im 19 Jahrhundert* (Oldenburg, 1899–1900); and *Oldenburgisches Quellenbuch* (Oldenburg, 1903). *See* also the *Jahrbuch für die Geschichte des Herzogtums Oldenburg* (1892 *seq.*).

**OLDENBURG,** a town of Germany, and capital of the province of Oldenburg, situated 27 mi. by rail W. of Bremen, on the navigable Hunte and the Hunte-Ems canal. Pop. (1939), including the suburbs, 78,506. According to popular tradition Oldenburg was founded by Walbert, grandson of the Saxon hero, Widukind, and was named after his wife Altburga, but the first historical mention of it occurs in a document of 1108. It was fortified in 1155, and received a municipal charter in 1345. The Evangelical Lambertikirche, though dating from the 13th century, was transformed in 1874–86. The former palaces of the grand-duke and the old town-hall are Renaissance buildings of the 17th and 18th centuries. The picture gallery includes works by Veronese, Velasquez, Murillo and Rubens.

**OLDESLOE:** *see* BAD OLDESLOE.

**OLDFIELD, ANNE** (1683–1730), English actress, was born in London, the daughter of a soldier. She was apprenticed to a sempstress, but, fortunately, she attracted George Farquhar's attention by reciting some lines from a play in his hearing. She was engaged at Drury Lane in 1692, and ten years later she was generally acknowledged as the best actress of her time. Mrs. Oldfield's beauty and generosity found innumerable eulogists, as well as sneering detractors. Alexander Pope, in his *Sober Advice from Horace,* wrote of her—

> "Engaging Oldfield, who, with grace and ease,
> Could join the arts to ruin and to please."

She died at 47 on Oct. 23, 1730, and was buried in Westminster Abbey.

**OLD FORGE,** an anthracite-mining borough of Lackawanna county, Pennsylvania, U.S.A., on the Lackawanna river, 4 mi. S.W. of Scranton; served by the Erie and the Lackawanna railways. Pop. (1930) 12,661; in 1940 it was 11,892. Old Forge was settled in 1789 and incorporated as a borough in 1899.

**OLDHAM, JOHN** (1653–1683), English satirist, son of a Presbyterian minister, was born at Shipton Moyne, near Tetbury, Gloucestershire, on Aug. 9, 1653. He graduated from St. Edmund Hall, Oxford, in 1674, and was for three years an usher in Whitgift's School, at Croydon. In 1681 he became tutor to the grandsons of Sir Edward Thurland, near Reigate. *Garnet's Ghost* was published as a broadside in 1679, but the other *Satires on the Jesuits,* although written at the same time, were not printed until 1681. His undoubted services to the Country Party brought no reward from its leaders. Eventually he became chaplain to William Pierrepont, earl of Kingston. He died at Holme-Pierrepoint, near Nottingham, on Dec. 9, 1683.

Oldham took Juvenal for his model, and in breadth of treat-

ment and power of invective surpassed his English predecessors. Thomas Garnet, who suffered for supposed implication in the Gunpowder Plot, rose from the dead to encourage the Jesuits in the first satire, and in the third Ignatius Loyola is represented as dictating his wishes to his disciples from his death-bed. Oldham's verse is rugged, and his rhymes often defective, but he met with a generous appreciation from Dryden.

The best edition of his works is *The Compositions in Prose and Verse of Mr. John Oldham . . .* (1770), with memoir and explanatory notes by Edward Thompson; *see* also *Poems,* ed. w. memoir by R. Bell (1891).

**OLDHAM, THOMAS** (1816–1878), British geologist, was born in Dublin on May 4, 1816. He studied at Dublin and Edinburgh, and in 1839 became chief assistant in the geological department of the Ordnance Survey, where he helped to prepare the *Report on the Geology of Londonderry* (1843). Appointed professor of geology in Dublin university in 1845, he became director of the geological survey of Ireland in 1846, and two years later, F.R.S. The fossil named *Oldhamia* was discovered by him in the Cambrian rocks of Bray Head in 1849. In 1850 he was put in charge of the geological survey of India, which led him to publish, in 1864, a report on the coal resources of India. He retired in 1876, and died at Rugby on July 17, 1878.

**OLDHAM,** municipal, county, and parliamentary borough, Lancashire, England, 7 mi. N.E. of Manchester, on the L.M.S. and L.N.E. railways and the Oldham canal. Pop. (est. 1938) 126,100. The principal railway station is called Mumps, but there are several others. The town lies high, near the source of the small river Medlock. Its growth as a manufacturing centre gives it a wholly modern appearance. The oldest church dates from the later 18th century. The principal buildings and institutions include the town-hall, with tetrastyle portico, the reference library, art gallery and museum, the Union street baths, and the county court. The Lyceum contains schools of art and science, and an observatory; the largely-endowed blue-coat school was founded in 1808 by Thomas Henshaw. The Alexandra park, opened in 1865, stands on a picturesquely undulating and terraced site. Oldham is one of the most important centres of the cotton manufactures. The principal manufactures are fustians, velvets, cords, shirtings, sheetings and nankeens. There are also large foundries, mill and cotton machinery works and engineering works of various kinds. Oldham, incorporated in 1849, became a county borough in 1888. The parliamentary borough has returned two members since 1832. Area 7.4 sq.mi.

A Roman road, of which traces are still left, passes through the township. It is not mentioned in Domesday; but in the reign of Henry III. Alwardus de Aldholme is referred to as holding land in Vernet (Werneth). A daughter of this Alwardus conveyed Werneth hall and its manor to the Cudworths, a branch of the Yorkshire family, with whom it remained till the 18th century. From the Oldhams was descended Hugh Oldham, who died bishop of Exeter in 1519. It appears that linens were manufactured in Oldham as early as 1630. Watermills were introduced in 1770, and with the adoption of Arkwright's inventions the cotton industry grew with great rapidity.

**OLDMIXON, JOHN** (1673–1742), English historian, was a son of John Oldmixon of Oldmixon, near Bridgwater. He wrote a number of miscellaneous works, but his most important book is his *Critical History of England* (1724–1726) which contains attacks on Clarendon and a defence of Bishop Burnet. Its publication led to a controversy between Dr. Zachary Grey and the author, who replied to Grey in his *Clarendon and Whitlock compared* (1727). In his *History of England during the Reigns of the Royal House of Stuart* (1730) he charged Bishop Atterbury and other of Clarendon's editors, unjustly, with tampering with the text of the *History.* He completed a continuous history of England by writing the *History of England during the Reigns of William and Mary, Anne and George I.* (1735); and the *History of England during the Reigns of Henry VIII., Edward VI., Mary and Elizabeth* (1739). Oldmixon died on July 9, 1742.

**OLD OREGON TRAIL,** an American pioneer route, from Independence, Mo., to The Dalles, Columbia River, Oregon, about 2000 mi. long, long used by the immigrants from the Mississippi Valley to the north-west. Blazed in part by trappers, the Lewis and Clarke Expedition and the Frémont Survey, between 1805 and 1842, it followed the North Platte and its tributary the Sweetwater, went through South Pass in the Rocky Mountains and proceeded by way of Fort Laramie, Independence Rock, and Great Salt Lake to the vicinity of Oregon City.

The name Oregon Trail is given to a modern highway following a somewhat different route.

**OLD POINT COMFORT,** a summer and winter resort, in Elizabeth City county, Virginia, U.S.A., at the southern end of a narrow, sandy peninsula projecting into Hampton Roads (at the mouth of the James river), about 12 mi. N. by W. of Norfolk. It is served indirectly by the Pennsylvania railroad, passengers and freight being carried by steamer from the terminus at Cape Charles; by steamboat lines connecting with the principal cities along the Atlantic coast, and with cities along the James river; and by ferry, connecting with Norfolk and Portsmouth.

There is a U.S. garrison at Ft. Monroe, one of the most important fortifications on the Atlantic coast of the United States. The fort lies within a tract of 252 ac. and was first regularly garrisoned in 1823; in 1824 the Artillery School of Practice (now called the U.S. Coast Artillery school) was established to provide commissioned officers of the coast artillery with instruction in professional work and to give technical instruction to the non-commissioned staff. During the Civil War the fort was the rendezvous for several military expeditions, notably those of Gen. B. F. Butler to Hatteras inlet, in 1861; of Gen. A. E. Burnside, to North Carolina, in 1862; and of Gen. A. H. Terry, against Ft. Fisher, in 1865. Jefferson Davis was a prisoner there for two years. The expedition which settled Jamestown rounded this peninsula (April 26, 1607), opened its sealed instructions there and named the peninsula "Poynt Comfort," in recognition of the sheltered harbour.

The "Old" was added subsequently to distinguish it from a Point Comfort settlement at the mouth of the York river on Chesapeake bay.

**OLD SLAVONIC.** By the language called Old Bulgarian or Old (Church) Slavonic, and here abbreviated as O.B., is meant that first fixed in writing towards the end of the 9th century, when, at the request of the Moravian prince Rostislav, the Byzantine emperor, Michael III., decided to send emissaries (Constantine, afterwards called Cyril—d. 869—and Methodius, his brother —d. 887) to convert the population of Moravia to Christianity. The term, Old Slavonic, frequently used by French and Czech scholars, is liable to misinterpretation as it may be confused with Common Slavonic, the postulated ancestral form of all the Slav languages, or be taken to refer to the earlier form of any particular Slavonic language. The expression Old Church Slavonic, used by many authorities, has the disadvantage of giving no clue to the area where the language was spoken. Almost all the early manuscripts which are held to represent most accurately the language of the Slavonic apostles or that of their disciples show the phonetic features which we should expect in an earlier form of Bulgarian, more particularly in Macedonian Bulgarian.

The more important of these features are: (1) The Common Slav groups *tj* and *dj* appear as *št* and *žd* respectively, a development which exists in Bulgarian only; (2) the sound transcribed as *ě* (derived from I.E. *ē* or a diphthong ending in *i*) was a palatal *a* (probably like that in English "sand"), and it still occurs in the dialects of precisely that neighbourhood from which the brothers came; (3) the affricate *dz,* which in most Slavonic languages has become *z,* was characteristic of O.B. and is still found in Macedonian dialects.

We do not possess the actual translations made by Cyril and Methodius, but only copies, the earliest dating from the end of the 10th century, the work of those disciples who were engaged in spreading the Gospel in the Balkans. Although dialectical modifications betray the linguistic usage of the various scribes, modern research has been able to restore in great part the exact language of the brothers.

This ideal Old Bulgarian has preserved most of the archaic

features of the Slavonic spoken a few hundred years earlier, before the differentiation into several languages had occurred. It offers, however, such characteristically South Slav features as: (1) the change of *or, ol* and *er, el* between consonants, to *ra, la* and *rě, lě* respectively, (2) the simplification of *tl* and *dl* to *l*, and (3) the change of *kv* and *gv* before front vowels (still preserved in the Western group) to *cv* and *dzv*. The language is of the synthetic type and contains few foreign elements in its vocabulary. The Christian terminology is mainly Greek; the Latin words which occasionally occur are concessions to the Moravians and Pannonians, to whom they had become known through the proselytizing activity of the Western clergy.

O.B. underwent in course of time considerable modifications, both phonetic and structural, in the various countries in which it had become the liturgical language, and the various mss. are consequently classified as Serbian-Slavonic, Croatian-Slavonic, Russian-Slavonic and Bulgarian-Slavonic, according to the different recensions.

The mss. are preserved in two alphabets. In the older, Glagolitic, alphabet we have:

1. The so-called Kiev Leaves—a fragment of a missal—published in Cyrillic transcription by Jagić, under the title of *Glagolitica: Würdigung neuentdeckter Fragmente* (Vienna, 1900). Linguistically and historically, this monument is of great importance and may go back to the end of the 10th century.
2. Codex Zographensis, published by Jagić under a Latin title (Berlin, 1879).
3. Codex Marianus. The edition by Jagić, Berlin, 1883, contains a full critical apparatus.
4. Codex Assemanianus, published in a Latin transcription by J. Črnčić (Rome, 1878).
5. Psalterium Sinaiticum, published by L. Geitler (Zagreb, 1883).
6. Euchologium Sinaiticum, published by Geitler (Zagreb, 1882).
7. Glagolitica Clozianus, published by V. Vondrák (Prague, 1893).

There are also a few other fragments.

The other monuments are written in the Cyrillic alphabet and are:

1. A short burial inscription, dated 993.
2. The Sava Gospel (*Savvina Kniga*), published by V. Ščepkin (St. Petersburg, 1903).
3. Codex Suprasliensis, published by Severjanov (St. Petersburg, 1904).

BIBLIOGRAPHY.—*Entstehungsgeschichte der kirchenslavischen Sprache,* by V. Jagić (Berlin, 1913), gives a mass of reliable miscellaneous information. The best grammars are: V. Vondrák, *Altkirchenslavische Grammatik* (Berlin, 1912); A. Leskien, *Grammatik der altbulgärischen (altkirchenslavischen) Sprache* (Heidelberg, 1909), which is more comparative and historical than his *Handbuch d. altb. (altk.) Sprache* (Heidelberg, 1922). There is also an excellent manual in Polish by J. Łoś (Lwów-Warszawa-Kraków, 1922) and a Czech translation (Prague, 1928), by B. Havránek, of S. Kul'bakin's ms. grammar, which will soon appear in French as one of the publications of the Institut d'Etudes slaves of Paris. Vondrák's *Kirchenslavische Chrestomathie* (Göttingen, 1910) is invaluable as a collection of extracts. The dictionary of F. Miklosich, *Lexicon palaeoslovenico-graeco-latinum emendatum auctum* (Vienna, 1862–65), has not been replaced, but it must be used with caution, as many words belonging to the later ecclesiastical language of the Slavs are quoted.

**Bulgarian Language.**—Out of Old Slavonic emerged the modern Bulgarian language. Most authorities hold that Bulgarian, together with Serbo-Croat and Slovene, belongs to the Southern branch of the Slavonic languages, but its precise affinities are disputed. Leskien, in his Serbian Grammar (1914), while admitting certain special affinities with Serbo-Croat, regards it as an independent branch. Belić asserts that it belongs to the Southern branch only because of its geographical position. The most noteworthy South Slav development which it shows, is the change of Common Slavonic (C.S.) *or* and *ol,* either in initial position or between consonants, to *ra* and *la,* and a parallel transposition of consonant and vowel for *er* and *el;* but even this characteristic is not conclusive, as it is also partly shared by Czechoslovak, which belongs to the Western branch. As to phonetics, we may note the following features of the literary language: C.S. *tj* and *dj* become *št* and *žd* respectively (a development found in no other modern Slav language); the nasal vowels *ǫ* but *ę* have become oral, the first having changed into a sound (roughly like that of the vowel in English *but*), which does not occur in any cognate language; the softening of consonants before front vowels has been, as also in Serbo-Croat, largely given up, nor have the old distinctions of quantity and intonation survived. In this last feature Bulgarian agrees with Russian, although the accented syllable often varies in the two languages, and is in marked contrast to Serbo-Croat, where length and intonation are preserved in almost all the dialects of the Kingdom. No less remarkable are the peculiarities in other domains of the grammar, the analytical character of which runs counter to the general trend of Slavonic and shows distinct points of resemblance to the development undergone by the languages of Western Europe. Thus, whereas the cases are retained in every other Slav language and dialect, Bulgarian has discarded them almost as completely as the Romance languages and contents itself with a single case, the nominative, the others being expressed by means of prepositions. Bulgarian has a definite article and has lost the infinitive. Parallels are to be found in the other Balkan languages, both Rumanian and Greek, for example, having fewer cases than the classical languages from which they are descended: Rumanian and Albanian have a postpositive article, the uses of which largely agree with that of Bulgarian; lastly, the infinitive has entirely disappeared in Greek and has nearly gone both in Rumanian and Albanian.

This agreement with other Balkan languages has led many scholars to believe that Bulgarian has received the impress of a specifically Balkan type. This would seem incontrovertible if the modern language only were in question, but once we consider the earlier stages of the language we encounter difficulties. The language of the first translators of the Bible (*see* above), the ancestor of present-day Bulgarian, shows no trace whatever of "balkanization." It has a complete case system, no articles, and makes full use of the infinitive. It is therefore best to regard modern Bulgarian as having undergone a development parallel with, but not dependent on, that of its neighbours. Some of the other Slav languages show in embryo the same tendencies which Bulgarian has so completely carried through. Serbian, the nearest neighbour of Bulgarian, has not only almost entirely abandoned the infinitive in the spoken language, but makes one case in the plural do duty for three (locative, dative and instrumental).

The dialects are numerous, chiefly distinguished by phonetic differences. The most usual division is into an Eastern and a Western group, according to how C.S. *ě* is pronounced. In the West, the sound—which in O.B. is thought to have been that of *a* in "sand," with palatalization of the preceding consonant—is *e,* as in Serbian, but in the East the old sound has been maintained before non-palatal consonants. East Bulgarian is further divided into two zones, according to whether the articulated noun ends in *o* or *ъt*. In the main the modern literary language is based on the *ъt* dialects of East Bulgarian.

The Slav dialects spoken in Macedonia represent a transitional stage between Bulgarian and Serbo-Croat. None of them is used for literary purposes, but they have been carefully investigated in recent years, with a view to determining to what extent they have preserved characteristics of their lineal ancestor, the old ecclesiastical language (O.B.). A feature shared by many of them, but not occurring in O.B., is the development of C.S. *tj* and *dj* to fronted *k* and *g,* in place of literary Bulgarian *št* and *žd*.

In some Bulgarian dialects, notably those in the neighbourhood of Salonica and Castoria, there are distinct traces of the O.B. nasal vowels, which are not elsewhere preserved except in Polish and, also in traces, in some Slovene dialects.

In the vocabulary of modern Bulgarian there are many foreign elements, chiefly Turkish and Greek, but also some Rumanian and Albanian words. Russian supplied literary models, and its vocabulary has been very freely drawn upon, although there is now a tendency to restrict the loan words to expressions belonging to more abstract thought. The phraseology of Russian, French and German has had considerable influence on the sentence con-

struction.

BIBLIOGRAPHY.—For the linguistic affinities of Bulgarian consult V. Vondrák, *Vergleichende Slavische Grammatik* (Göttingen, 1924) and B. Conev, *History of the Bulgarian Language* (in Bulgarian—Sofia, 1919). G. Weigand's *Balkan-Archiv* (Leipzig, 1925) also is valuable for the comparative study of the Balkan languages. *Das Ostbulgarische* by L. Miletič (Vienna, 1903) and A. Mazon's *Contes slaves de la Macédoine sud-occidentale* (Paris, 1923) are excellent introductions to the study of the dialects.

*Dictionaries:* N. Gerov, *Rečnik na blgarskyj jazyk* (Dictionary of the Bulgarian Language, 5 vols., Philippopolis, 1895–1904); C. Stephanove, *Complete English-Bulgarian Dictionary* (Sofia, 1914), is the best work for English users. For those able to read Bulgarian the *Sbornik za narodni umotvorenija i narodopis,* published by the Bulgarian Academy, is the standard publication, and the *Bulgarska Reč,* a monthly linguistic periodical published at Sofia since 1921, will prove useful.

There are no scientific grammars, nor annotated and accented texts in English, but beginners able to read German will find G. Weigand's grammar and addition of *Baj Ganja* of great assistance. (N. B. J.)

**OLD SPANISH TRAIL,** an American highway skirting the southern border of the United States from St. Augustine, Fla., the oldest city in the United States, to San Diego, Calif., a distance of 2,743 miles. It passes through the parts of the United States that were first permanently settled by white men and its historic background therefore affords unusual interest. From the Atlantic to San Antonio, Tex., the roadway is more than half paved and the remainder improved except in a few short stretches. Other cities touched by the highway are Mobile, Ala., New Orleans, La., Houston and El Paso, Texas, and Tucson and Phoenix, Ariz.

**OLD TESTAMENT:** *see* BIBLE.

**OLD TOWN,** a city of Penobscot county, Maine, U.S.A., on the Penobscot river, 12 mi. above Bangor. It is served by Bangor and Aroostook bus and the Maine Central railway. Pop. (1940), 7,688. The city occupies Marsh island, formed by a tributary of the Penobscot which unites with it at two points 9 mi. apart, and considerable land on the west bank of the Penobscot. Opposite, on Indian island, is the principal settlement of the Penobscot Indians, who are wards of the State. The Abbé Louis Pierre Thury was sent here from Quebec about 1687 and built a mission church. Permanent settlement began when John Marsh (about 1774) bought the "island" now occupied by the city. Old Town was incorporated as a town in 1840, and chartered as a city in 1891. The first railroad in Maine was built from Bangor to Old Town in 1836.

**OLDYS, WILLIAM** (1696–1761), English antiquary and bibliographer, natural son of Dr. William Oldys, chancellor of Lincoln, was born on July 14, 1696, probably in London. He devoted most of his life to the collection of rare books and papers. In 1731 he sold his collections to Edward Harley, earl of Oxford, who appointed him his literary secretary in 1738. Three years later his patron died, and from that time he worked for the booksellers. In April 1755 he was appointed Norroy king-at-arms by the duke of Norfolk. He died on April 15, 1761.

Oldys's chief works are: *The British Librarian,* a review of scarce and valuable books in print and in manuscript (1737–38); the *Harleian Miscellany* (1744–46), a collection of tracts and pamphlets in the earl of Oxford's library, undertaken in conjunction with Dr. Johnson; twenty-two articles contributed to the *Biographia Britannica* (1747–60); an edition of Raleigh's *History of the World,* with a *Life* of the author (1736); *Life of Charles Cotton* prefixed to Sir John Hawkins's edition (1760) of the *Compleat Angler.* In 1727 Oldys began to annotate another Langbaine to replace the one he had lost. This valuable book, with a MS. collection of notes by Oldys on bibliographical subjects, is preserved in the British Museum.

**OLEACEAE,** the olive family, dicotyledonous shrubs and trees of warm, temperate and tropical regions, especially abundant in the East Indies. *Fraxinus* includes the ash (*q.v.*) and flowering ash (*F. Ornus*). *Olea* includes the olive (*q.v.*) and the black ironwood tree (*O. laurifolia*). The family includes also numerous valuable ornamental trees and shrubs, as privet, jasmine, lilac, golden-bells, and fringe-tree. There are 21 genera and about 500 species, some 40 of which occur in North America.

**OLEAN,** a city of Cattaraugus county, New York, U.S.A., on the Allegheny river, at the mouth of Olean creek, 70 m. S.S.E. of Buffalo. It is served by the Erie, the Pennsylvania and the Pittsburgh, Shawmut and Northern railways. Pop. (1920) 20,506 (84% native white); in 1930, 21,790; in 1940, 21,506. The city lies in a valley 1,440 ft. above sea-level, almost encircled by hills. The surrounding country is rich in oil and gas. Six miles S.W. is "Rock City," a group of immense rocks, strangely regular in shape, covering 40 acres. At Allegany, a village 3 mi. W., is St. Bonaventure's college (Roman Catholic; 1859). The city has railroad shops, oil refineries and various other manufacturing industries, with an output in 1935 valued at $14,906,455. It is an important centre of rural public health work, originally started in 1923 with financial help from the Milbank Memorial fund. Settlement in this region began in 1804. The city was incorporated in 1893.

**OLEANDER,** the common name for any shrub of the genus *Nerium.* The best known is *N. oleander,* often called rose bay, a native of the Mediterranean region, and is characterized by its tall shrubby habit and its thick lance-shaped opposite leaves, which exude a poisonous milky juice when punctured. The flowers are borne in terminal clusters, and are of a rose colour, rarely white. The hairy anthers adhere to the thickened stigma. The fruit or seed-vessel consists of two long pods, which liberate a number of seeds, each of which has a tuft of silky hairs. The genus *Nerium* belongs to the family Apocynaceae (*q.v.*). The oleander was known to the Greeks under three names, viz. *rhododendron, nerion* and *rhododaphne,* and is well described by Pliny (xvi 20), who mentions its rose-like flowers and poisonous qualities. The oleander has long been cultivated in greenhouses, being, as Gerard says, "a small shrub of a gallant shewe"; numerous varieties, differing in the colour of their flowers, which are often double, have been introduced. In warm countries, it is widely grown outdoors.

**OLEASTER** (*Elaeagnus angustifolia* family Elaeagnaceae), a handsome deciduous Eurasian tree, 15 to 20 ft. high, commonly cultivated for its edible fruit, often under the names of Trebizond date or Russian olive. The brown smooth branches are more or less spiny; the narrow leaves have a hoary look from the presence of a dense covering of star-shaped hairs; the small fragrant yellow flowers, which are borne in the axils of the leaves, are scaly on the outside.

**OLEFINE,** in organic chemistry (*q.v.*), the generic name given to a hydrocarbon containing one or more pairs of doubly linked carbon atoms. The simplest olefines or monolefines, containing only one of these pairs, are represented by ethylene (*q.v.*), $CH_2{:}CH_2$, the simplest member of the series, which is prepared by dehydrating ethyl alcohol and is used in manufacturing ethylene glycol (*see* GLYCOLS) and in producing "mustard gas." (*See* CHEMICAL WARFARE.) The word olefine is derived from the French *oléfiant* (from *oléfier,* to make oil) and was given to ethylene by four Dutch chemists J. R. Deiman, Paets van Troostwyk, N. Bondt and A. Lauwerenburgh in 1795 owing to the fact that the gas yielded an oily liquid when mixed with chlorine.

**Simple Olefines** (Monolefines).—The simple olefines, which have the general formula $C_nH_{2n}$, are now produced on a manufacturing scale by the thermal decomposition ("cracking") of petroleum oils. These oils, which are mixtures of saturated hydrocarbons (paraffins), when heated at a temperature higher than the normal boiling points of their constituents (approximately a range of 300° to 550° C.), break up into mixtures of simpler paraffins and olefines. Thus decane breaks up into pentane and amylene

$$CH_3[CH_2]_8CH_3 = CH_3[CH_2]_3CH_3 + CH_3[CH_2]_2CH{:}CH_2.$$

Other similar mixtures arise, and the olefines can be removed by absorption in strong sulphuric acid. The acid is added on to the double linking in such a way as to form a terminal methyl group, the ester from the above example being $CH_3[CH_2]_2CH(HSO_4)\cdot CH_3$. The crude liquid, when diluted with water and distilled, gives rise to a series of secondary alcohols, $R\cdot CH(OH)\cdot CH_3$. In this way *iso*propyl alcohol (2-propanol), $(CH_3)_2\cdot CHOH$; secondary butyl alcohol (2-butanol), $CH_3\cdot CH_2\cdot CH(OH)\cdot CH_3$; secondary amyl alcohol (2-pentanol), $CH_3[CH_2]_2CH(OH)\cdot CH_3$, and higher secondary alcohols are now being produced commercially. From these alcohols the corresponding pure olefines can be regenerated by dehydration with such agents as sulphuric acid, zinc chloride, phosphoric oxide or acid, and anhydrous

oxalic acid.

The higher olefines are found in the tar from bituminous shales, in illuminating gas, and in the products formed by distilling paraffin under pressure (T. E. Thorpe and J. Young, 1873).

**Physical Properties.**—The lower members of the monolefinic series (carbon content $C_2$ to $C_4$) are inflammable gases and the members with carbon content $C_5$ to $C_{14}$ are liquids insoluble in water. The formulae and boiling points of the series of normal olefines, $R{\cdot}CH{:}CH_2$, are shown in the following table:—

| Name | Formula | M.p. | Boiling point |
|---|---|---|---|
| | | °C | °C |
| Ethylene | $CH_2{:}CH_2$ | −169 | −102·7 (757 mm.) |
| Propylene | $CH_3CH{:}CH_2$ | .. | −48·2 (749 mm.) |
| Butylene | $C_2H_5{\cdot}CH{:}CH_2$ | .. | −5 |
| Amylene | $C_3H_7{\cdot}CH{:}CH_2$ | .. | 39–40 |
| Hexylene | $C_4H_9{\cdot}CH{:}CH_2$ | .. | 68–70 |
| Heptylene | $C_5H_{11}{\cdot}CH{:}CH_2$ | .. | 95 |
| Octylene | $C_6H_{13}{\cdot}CH{:}CH_2$ | .. | 122–123 |
| Decylene | $C_8H_{17}{\cdot}CH{:}CH_2$ | .. | 172 |
| Undecylene | $C_9H_{19}{\cdot}CH{:}CH_2$ | .. | 84 (18 mm.) |
| Duodecylene | $C_{10}H_{21}{\cdot}CH{:}CH_2$ | −31 | 96 (15 mm.) |

**Chemical Properties.**—In chemical properties the monolefines differ profoundly from the paraffins. Owing to the unsaturation typified in the foregoing table by the double linking, hydrogen is absorbed at the ordinary temperature in the presence of platinum black with formation of paraffins. Chlorine and bromine combine directly with olefines giving dihalogen addition compounds, the halogen hydrides also combine to yield alkyl halides; hydrogen iodide reacts most readily, hydrogen chloride least. With hypochlorous acid the olefines form chlorohydrins. The higher members of the olefines readily polymerize in the presence of dilute sulphuric acid, zinc chloride, etc. For example, gaseous *iso*butylene, $(CH_3)_2C{:}CH_2$ (b.p. −5° C), polymerizes to *iso*dibutylene, $C_8H_{16}$, and *iso*tributylene, $C_{12}H_{24}$, liquid products which boil at 110–113° C and 178–181° C respectively.

*Diolefines.*—The most important of the diolefines, $C_nH_{2n-2}$, are those containing the two double linkings separated by one single linking (conjugated double linkings). 1:3-Butadiene (Erythrene), $CH_2{:}CH{\cdot}CH{:}CH_2$, the simplest member of this type, is an easily liquefiable gas (b.p. −5° C) formed by chlorinating *n*-butyl chloride and passing the product over heated soda lime (W. H. Perkin, junr., *J. Soc. Chem. Ind.*, 1912).

(G. T. M.)

**OLEIC ACID:** *see* OILS, FATS AND WAXES.

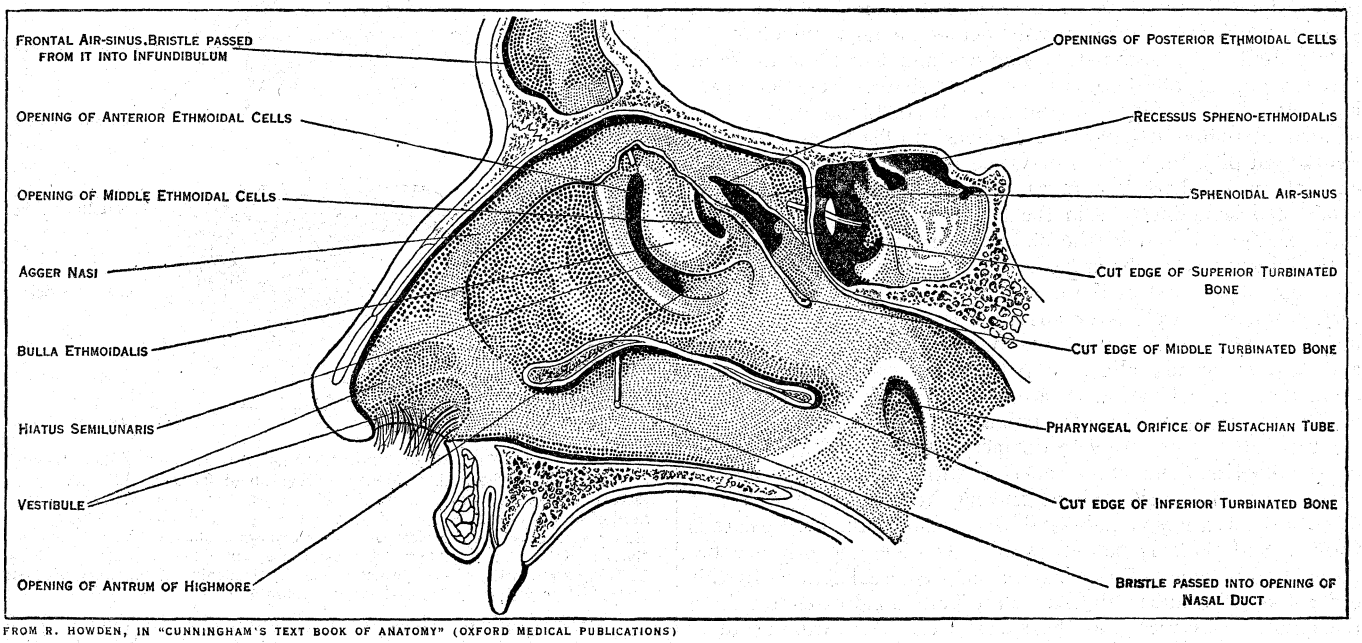
**OLEN,** a legendary poet and prophet, reputed author of certain hymns to Apollo, sung at Delos in historical times (Gr. Ὠλήν) Boio, a Delphic poetess, made him a Hyperborean (*see* HYPERBOREANS), founder of the oracular shrine at Delphi, first prophet there, and inventor of the hexameter. Herodotus makes him a Lycian (as follower of Apollo Λύκειος). Whether any real person lies behind these stories is unknown.

**OLEOMARGARINE:** *see* MARGARINE.

**OLÉRON,** an island lying off the west coast of France, opposite the mouths of the Charente and Seudre, and included in the department of Charente-Inférieure. Population 15,363. Oléron, the *Uliarus Insula* of Pliny, formed part of the duchy of Aquitaine, and came into the possession of the French Crown in 1370. It is about 18 mi. in length from north-west to south-east, and 7 mi. in extreme breadth; area 66 sq.mi.; the strait (*Pertuis de Maumusson*) separating it from the mainland is at one point less than a mile wide. The chief places are St. Pierre (pop. 1,309 in 1936), Le Château d'Oléron (1,651), and the watering-place of St. Trojan-les-Bains (1,534).

**OLFACTORY SYSTEM.** In anatomy, the olfactory system consists of the nose and the nasal cavities which support the olfactory mucous membrane for the perception of smell in their upper parts, and act as respiratory passages below.

The bony framework of the nose is part of the skull (*q.v.*), but the outer nose is only supported by bone above; lower down its shape is kept by cartilaginous plates. The expanded lower part of the side of the nose, the "ala," is only formed of skin, both externally and internally, with fibro-fatty tissue between the layers. The nasal cavities are separated by a septum covered in its lower two-thirds by thick, highly vascular mucous membrane composed of columnar ciliated epithelium with masses of acinous glands embedded in it, while in its upper part it is covered by the less vascular but more specialized olfactory membrane. Near the front of the lower part of the septum a slight opening into a short blind tube, which runs upward and backward, may sometimes be found; this is the vestigial remnant of "Jacobson's organ." The supporting framework of the septum is made up of ethmoid above, vomer below, and the "septal cartilage" in front. The outer wall of each nasal cavity is divided into three meatus by the overhanging turbinated bones (*see* fig. 2). Above the superior turbinated is a space between it and the roof known as the "recessus spheno-ethmoidalis," into the back of which the "sphenoidal air sinus" opens. Between the superior and middle turbinated bones is the "superior meatus," containing the openings of the "posterior ethmoidal air cells," while between the



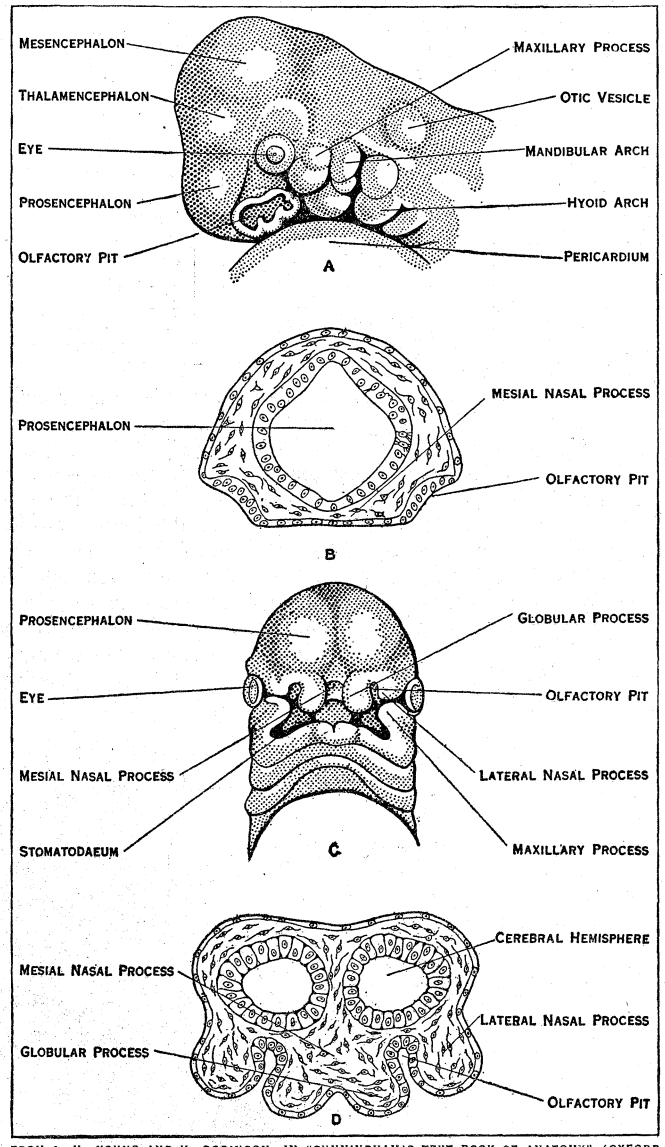

FROM R. HOWDEN, IN "CUNNINGHAM'S TEXT BOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 1.—VIEW OF THE OUTER WALL OF THE NOSE, THE TURBINATED BONES HAVING BEEN REMOVED

middle and inferior turbinateds is the "middle meatus," which is the largest of the three and contains a rounded elevation known as the "bulla ethmoidalis." Above and behind this is often an opening for the "middle ethmoidal cells," while below and in front a deep sickle-shaped gutter runs, the "hiatus semilunaris," which communicates above with the "frontal air sinus" and below with the opening into the "antrum of Highmore" or "maxillary antrum." The "inferior meatus" is below the inferior turbinated bone, and, when that is lifted up, the valvular opening of the nasal duct (*see* EYE) is seen. The roof of the nose is narrow, and here the olfactory nerves pass in through the cribriform plate. The floor is wider so that a coronal section through each nasal cavity has roughly the appearance of a right-angled triangle.

**Embryology.**—In the third week of intra-uterine life two nasal pits appear on the under side of the front of the head; they are the first appearance of the true olfactory region of the nose, and some of their epithelial lining cells send off axons (*see* NERVOUS SYSTEM) which arborize with the dendrites of the cells of the olfactory lobe of the brain and so form the olfactory nerves. Between the olfactory pits the broad median fronto-nasal process grows down from the forehead region to form the dorsum of the nose (*see* fig. 2), and the anterior part of the nasal septum, while outside them the lateral nasal processes grow down, and later on meet the maxillary processes from the first visceral arch. In this way the nasal cavities are formed, but are separated from the mouth by a thin bucco-nasal membrane which eventually is broken through; after this the mouth and nose are one cavity until the formation of the palate in the third month (*see* MOUTH AND SALIVARY GLANDS). In the third month Jacobson's organ may be seen as a well-marked tube lined with respiratory mucous membrane; no explanation of the function of Jacobson's organ in man is known, and it is probably entirely atavistic. At birth the nasal cavities are shallow from above downward, but rapidly deepen till the age of puberty.

**Comparative Anatomy.**—In Amphioxus among the Acrania there is a ciliated pit above the anterior end of the central nervous system, which is probably a rudiment of an unpaired olfactory organ. In the Cyclostomata (lampreys and hags) the pit is at first ventral, but later becomes dorsal and shares a common opening with the pituitary invagination. It furthermore becomes divided internally into two lateral halves. In fishes there are also two lateral pits, the nostrils of which open sometimes, as in the elasmobranchs (sharks and rays), on to the ventral surface of the snout, and sometimes, as in the higher fishes, on to the dorsal surface. Up to this stage the olfactory organs are mere pits, but in the Dipnoi (mud-fish) an opening is established from them into the front of the roof of the mouth, and so they serve as respiratory passages as well as organs for the sense of smell. In the higher Amphibia the nasal organ becomes included in the skull and respiratory and olfactory parts are distinguished. In this class, too, turbinal ingrowths are found, and the naso-lachrymal duct appears. In the lizards, among the Reptilia, the olfactory and respiratory parts are very distinct, the latter being lined only by stratified epithelium unconnected with the olfactory nerves. There is one true turbinal bone growing from the outer wall, and close to this is a large nasal gland. In crocodiles the hard palate is formed, and there is henceforward a considerable distance between the openings of the external and internal nares. In this order, too (Crocodilia) air sinuses are first found extending from the olfactory cavities into the skull-bones. The birds' arrangement is very like that of the reptiles; olfactory and respiratory chambers are present, and into the latter projects the true turbinal, though there is a pseudo-turbinal in the upper or olfactory chamber. In mammals the olfactory chamber of the nose is variously developed; most of them are "macrosmatic," and have a large area of olfactory mucous membrane; some, like the seals, whalebone whales, monkeys and man are "microsmatic," while the toothed whales have the olfactory region practically suppressed in the adult, and are said to be "anosmatic." There are generally five turbinal bones in macrosmatic mammals, so that man has a reduced number. The lowest of the series or "maxillo-turbinal" is the equivalent of the single true turbinal bone of birds and reptiles, and in most mammals is a double scroll, one leaf turning upward and the other down. Jacobson's organ first appears in amphibians, where it is found as an anteroposterior gutter in the floor of the nasal cavity. In reptiles the roof of the gutter closes in on each side, and a tube is formed lying below and internal to the nasal cavity, opening anteriorly into the mouth and ending by a blind extremity, posteriorly to which branches of the olfac-




FROM A. H. YOUNG AND H. ROBINSON, IN "CUNNINGHAM'S TEXT BOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

FIG. 2.—VIEWS OF THE DEVELOPMENT OF HUMAN EMBRYONIC HEADS
A. Side views of the head of human embryo about 27 days old, showing olfactory pit and visceral arches and clefts. B. Transverse section through head of an embryo, showing relation of olfactory pits to forebrain and to roof of stomatodaeal space. C. Head of human embryo about 29 days old, showing division of lower part of mesial frontal process into two globular processes. D. Transverse section of embryo head, showing deepening of olfactory pits and their relation to hemisphere vesicles of forebrain

tory and tri-geminal nerves are distributed. In the higher reptiles (crocodiles and chelonians) the organ is suppressed in the adult, and the same applies to birds; but in the lower mammals, especially the monotremes, it is very well developed, and is enclosed in a cartilaginous sheath, from which a turbinal process projects into its interior. In other mammals, with the exception of the Primates and perhaps the Chiroptera, the organ is quite distinct, though even in man, as has been shown, its presence can be demonstrated in the embryo.

*See* J. Symington on the organ of Jacobson in the Ornithorynchus, *P. Zool. Soc.* (1891), and in the kangaroo, *J. Anat. and Phys.*, vol. 26 (1891); also G. Eliot Smith on Jacobson's organ, *Anatom. Anzeiger*, xi. Band No. 6 (1895). For general literature on the comparative anatomy of the olfactory system, *see* R. Wiedersheim's *Comparative*

*Anatomy of Vertebrates,* translated and adapted by W. N. Parker (London, 1907). (F. G. P.)

**OLGA,** wife of Igor, prince of Kiev, and afterwards (from 945) regent for Sviatoslav her son, was baptized at Constantinople about 955 and died about 969. She was canonized in the Russian church; her feast is on July 11.

**OLGIERD** (d. 1377), grand-duke of Lithuania, was one of the seven sons of Gedymin, grand-duke of Lithuania, among whom on his death in 1341 he divided his domains, leaving the youngest, Yavnuty, in possession of the capital, Vilna, with a nominal priority. With the aid of his brother Kiejstut, Olgierd in 1345 drove out the incapable Yavnuty and declared himself grand-duke. His reign (1345–1377) saw the development and extension of Lithuania to one of the greatest states in Europe of that time. The Teutonic knights in the north and the Tatar hordes in the south were equally bent on the subjection of Lithuania, while Olgierd's eastern and western neighbours, Muscovy and Poland, were far more frequently hostile competitors than serviceable allies. Olgierd not only held his own, but acquired influence and territory at the expense of both Muscovy and the Tatars, and extended the borders of Lithuania to the shores of the Black sea. He desired to establish the Lithuanian power in those Russian lands which had formed part of the ancient grand-duchy of Kiev. He procured the election of his son Andrew as prince of Pskov, and a powerful minority of the citizens of the republic of Novgorod held the balance in his favour against the Muscovite influence, but his ascendancy in both these commercial centres was precarious. But he acquired the principalities of Smolensk and Bryansk in central Russia. His relations with the grand-dukes of Muscovy were friendly, and twice he married orthodox Russian princesses; nevertheless, he besieged Moscow in 1368 and again in 1372, both times unsuccessfully.

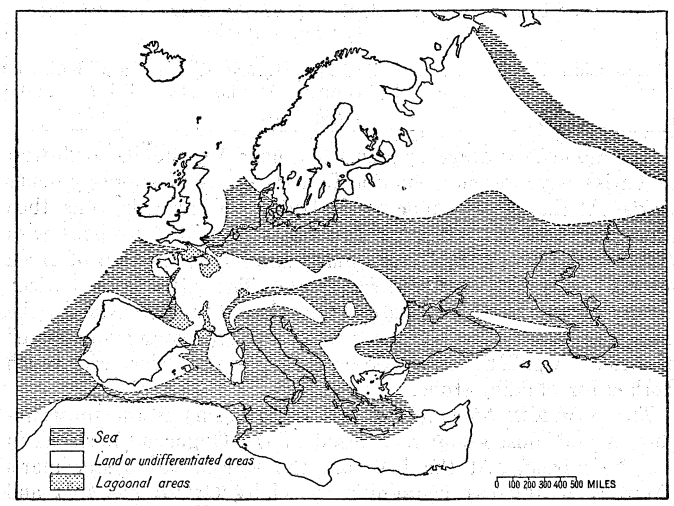
Olgierd won a great victory over the Tatars at Siniya Vodui on the Bug in 1362, which practically broke up the great Kipchak horde and compelled the khan to migrate farther south and make his headquarters for the future in the Crimea. Indeed, but for the unceasing simultaneous struggle with the Teutonic knights, the burden of which was heroically borne by Kiejstut, Russian historians frankly admit that Lithuania, not Muscovy, must have become the dominant power of eastern Europe. Olgierd died in 1377, accepting both Christianity and the tonsure shortly before his death. His son Jagiello ultimately ascended the Polish throne, and founded the dynasty which ruled Poland nearly 200 years.

*See* Kazimierz Stadnicki, *The Sons of Gedymin* (Pol.) (Lemberg, 1849–53); Vladimir Bonifatevich Antonovich, *Monograph on the History of Western Russia* (Rus.), vol. i. (Kiev, 1885). (R. N. B.; X.)

**OLIGARCHY,** in political philosophy, the term applied to a government exercised by a relatively small number of the members of a community (Gr. *oligoi,* few, *arche,* rule).

**OLIGOCENE** (Gr. ὀλίγος, few, and καινός, recent), in geology, the name given to the second period of the Tertiary era. The Oligocene system thus includes those strata which occur above the Eocene and below the Miocene. These rocks were originally classed by Sir Charles Lyell as Older Miocene, the term Oligocene being proposed by H. E. Beyrich in 1854 and again in 1858. The Oligocene is thus the upper division of the older Tertiary period or Palaeogene. (*See* TERTIARY, EOCENE.)

**Conditions During the Oligocene.**—The Oligocene deposits are of fresh-water, brackish, marine and terrestrial origin; they include sands, soft sandstones, grits, marls, shales, limestones, conglomerates and lignites. Here and there, as in northern Germany, the sea gained ground that had been unoccupied by Eocene waters, but important changes were in progress, and a general relative uplifting took place which caused much of the Eocene sea-floor to be occupied at this time by lake basins and lagoons. Thus there is a general tendency for marine Oligocene deposits to occupy a more restricted area than the marine Eocene. Amongst the earliest of the Tertiary mountain chains to arise were the Pyrenees and the mountains of Provence (the Alpine chain properly speaking) which were already in existence at the end of the Eocene. Thus relatively unfolded Oligocene sediments are found on the flanks of belts of folded Eocene strata. In some areas the folding of the margins of Eocene gulfs resulted in the deepening of the centre of the trough and permitted huge thicknesses of Oligocene to be deposited. This, for example, is the case in the Burmese gulf where Oligocene sediments reach a thickness of over 10,000 feet. As in the Eocene period, minor oscillations of level gave rise to cycles of sedimentation. Perhaps




MAP OF THE OLIGOCENE PERIOD

the most striking change from Eocene topography in Europe, shown on the accompanying map, is the extension of the Oligocene sea over north Germany, whence it extended eastward through Poland and Russia to the Aral-Caspian region, communicating thence with Arctic waters by way of a Ural depression. It was later in the period when the widespread emersion set in.

**Life of the Period.**—In its general features the life of the period resembles that of the Eocene (*q.v.*); foraminifera were abundant; nummulites were still numerous but of smaller size and are characteristically associated with lepidocyclines. Corals and bryozoa were abundant in the clear waters of southern seas but echinoids rather less numerous. Cephalopods were still fewer but gastropods and lamellibranchs assumed more and more their present-day importance, and the genera are those already noted in the Eocene. Amongst vertebrates, rays and dog-fish were the dominant marine fish; tortoises were abundant and the genus *Rana* made its appearance. The most interesting feature of the land fauna is the great variety of mammals, especially from the interior of North America and the continental Oligocene of Europe and Asia. The mammals are the most important fossils for distinguishing subdivisions of the period. Whilst many of the mammals were of mixed types, others are clearly representatives of modern groups and forerunners of existing genera. Thus it is possible to distinguish carnivores (*Canidae* and *Felidae*), insectivores, rodents, ruminants and camels. Forerunners of the rhinoceros, elephant and horse are all clearly separable. An account of the flora will be found in the article dealing with PALAEOBOTANY. The abundance of *Chara,* associated with such molluscan genera as *Limnaea* and *Planorbis* in fresh-water deposits is especially noteworthy.

**Oligocene Stratigraphy.**—Neither the lower nor the upper limit of the Oligocene is well defined. As mentioned in the article on the Eocene (*q.v.*), the lower limit is usually taken as the top of the Bartonian stage (including the Ludian). The *Aquitanian stage* is classed sometimes with the Oligocene, sometimes with the Miocene. The first opinion is adopted by those who pay first attention to the mammalian faunas—the Aquitanian fauna is an impoverished representative of preceding faunas and is not marked by the appearance of new forms. On the other hand the Aquitanian deposits seem to mark the feeble beginning of the Miocene transgression.

The type areas for Oligocene stratigraphy lie mainly in France—among the lagoons left by the retreat of the Eocene seas. The following is the classification of the Oligocene now generally

adopted (reading downwards):—

| Marine stages | Mammalian faunas |
|---|---|
| Aquitanian | Impoverished Stampian fauna; true *Anthracotherium* absent. |
| Stampian — Upper or Chattian | Numerous large *Anthracotherium* and *Aceratherium;* first tapirs. |
| Stampian — Lower | *Anthracotherium; Aceratherium;* the last Palaeotherids. |
| Sannoisian | The first *Anthracotherium* and Rhinoceratids; the last *Anoplotherium* and *Xiphodon.* |

The *Sannoisian Stage* (Sannois hill, near Argenteuil, north-west of Paris) is represented by the famous series of supra-gypseous marls. At the base are blue marls, laid down in salt lagoons, then white marls with fresh-water horizons represented by beds with *Limnaea strigosa,* then *Cyrena* marls and finally a group of green marine marls with *Cytherea incrassata.* The latter is an horizon distinguishable over wide areas. South-east of the Marne, the marls are replaced by the fresh-water limestones and "meulière" of Brie. "Meulière" is a porous, siliceous rock, formerly much worked for building stone.

The *Stampian Stage* (Étampes, Paris basin) is the most important and most easily recognized of the Oligocene horizons in the Paris basin. At the base are the widespread oyster marls (Marnes à Huîtres) containing especially *Ostrea cyathula* and *O. longirostris,* followed by the well-known Fontainebleau sands with an average thickness of 125 feet. These are the "sables supérieurs" of the older French geologists. They are generally white and very pure, and are exploited as glass-sands. Except at a few points in the neighbourhood of Étampes (Jeurre, Morigny, Pierrefitte, etc.) they are rarely fossiliferous but there contain *Pectunculus obovata, Cytherea splendida.* Consolidated blocks (grès de Fontainebleau) comparable with the "sarsens" of the English Eocene are common. After the deposition of the marine Fontainebleau sands, the sea left the Paris basin; a huge lake covered the south-west of the Paris basin. In this were deposited the fresh-water Beauce limestones, representing both the Chattian and Aquitanian. The lower part (Chattian) of this limestone is now usually called the Étampes limestone of which the Meulière de Montmorency is a lateral equivalent.

The *Aquitanian Stage* (Aquitaine, France) owes its name to its development in the great Aquitaine basin of south-western France where there are marine limestones and brackish water intercalations in a series of shelly sands with *Melongena,* the whole passing southwards into a mass of conglomerates (poudingues de Palasson).

In Britain, if one excepts the possible Oligocene age of the beds of the Bovey Tracey basin in Devonshire and of some of the sediments intercalated with the lavas of the west of Scotland (leaf beds of Mull), Oligocene beds are found only in the Hampshire basin. The classic exposures are in the cliffs of the Isle of Wight. The base is ill-defined and may be taken perhaps at the base of the Middle Headon beds (brackish and marine). These are succeeded by the fresh-water clays, marls and limestones of the upper Headon beds, then the Osborne and Bembridge beds (a series of brackish and fresh-water sands, clays, marls, and limestones) and finally the Hamstead beds, estuarine and fresh-water below and marine above. The correlation of the Hampshire sequence with the French stages is still uncertain; probably the highest marine Hamstead beds are equivalent to the Oyster marls of the lower Stampian. In this case the whole of the Hampshire Oligocene, except the highest beds, is Sannoisian.

In Belgium the Sannoisian sands and clays are important and extensive and known as the Tongrian. The Stampian is represented by a thick series of clays—the Argiles de Boom (Rupelian) whilst the Chattian seems to be absent unless represented by pockets of marine sands in the Ardennes massif. There is no deposit corresponding to the Aquitanian. In northern Germany and Denmark the Oligocene is, in contrast to the Eocene, thick, important, and fossiliferous. The Sannoisian (or Lattorfian) is represented by marine sands with *Nummulites germanicus;* the Stampian continues the Sannoisian transgression and occurs in the Mainz basin and even as far south as Alsace. The Chattian (or Casselian) derives its name from the Chattes, an ancient tribe of the Cassel country and consists of fine glauconitic sands well developed in the Cassel gulf. In the Mainz basin are *Cyrena* marls and *Cerithium* limestones. The Aquitanian is, probably, represented by the "Littorinellenkalk" of the Mainz basin, difficult to separate from the overlying Miocene. Brown coal is important in the Oligocene of Germany. Continental Oligocene beds are found in several basins of the central European continent, notable in the Rhone basin (deposits of Alais, Aix, Marseille, etc.) and in the trenches of the Loire and Allier.

In the alpine geosyncline it is probable that the only Oligocene are Sannoisian—notably the sandstones with small nummulites above the Priabonian and the higher beds of the Flysch. Oligocene deposits occur in the Carpathian region and the Tirol, in the Spanish Pyrenees and the flanks of the Cantabrian mountains, in Calabria, Dalmatia, Istria, and Bosnia. Glauconitic sands occur in south Russia, Flysch in the Caucasus, marine deposits in the Aral-Caspian region, Armenia, and Persia. Oligocene rocks are known also in north Africa, Algeria, Tunis and Egypt. In general Oligocene beds succeed Eocene in the epicontinental and geosynclinal gulfs around the continents of Asia (including the Nari series of India and the lower Peguan of Burma) and the Americas Of special interest are the continental Oligocene deposits of North America, including the White River beds of South Dakota. (*See* references given under EOCENE.) (L. D. S.)

**OLIGOCHAETA,** a class of segmented worms (Annelida *q.v.*), including the earthworms (*q.v.*) and certain small fresh-water forms.

**OLIGOCLASE,** a rock-forming mineral of the plagioclase (*q.v.*) group of felspars. (Gr. ὀλίγος, little, and κλᾶν, to break, in allusion to a supposed less perfect cleavage than that of the related albite.) The name is usually reserved for those mixed crystals of the albite-anorthite series ranging from $Ab_{90}An_{10}$ to $AB_{70}An_{30}$. The best known specimens of oligoclase are the iridescent, aventurine or "sunstone" crystals occurring in gneiss at Tvedestrand in southern Norway. The mineral is a common constituent of acid and alkaline igneous rocks as granite, syenite, trachyte, etc., and also in metamorphosed felspathic sediments. (C. E. T.)

**OLIPHANT, LAURENCE** (1829–1888), British author, son of Anthony Oliphant (1793–1859), was born at Cape Town. His father was then attorney-general in Cape Colony, but was soon transferred as chief-justice to Ceylon. The boy's education was of the most desultory kind. In the years 1848 and 1849 he accompanied his parents on a tour on the continent of Europe. In 1851 he accompanied Jung Bahadur from Colombo to Nepal and found material for his first book, *A Journey to Katmandu* (1852). From Nepal he returned to Ceylon, and thence to England, then to Russia, after which he wrote *The Russian Shores of the Black Sea* (1853). Between 1853 and 1861 he was successively secretary to Lord Elgin during the negotiation of the Canada Reciprocity treaty at Washington, the companion of the duke of Newcastle on a visit to the Circassian coast during the Crimean War, and Lord Elgin's private secretary on his expedition to China. Each of these experiences produced a pleasant book of travel. In 1861 he was appointed first secretary in Japan, and might have made a successful diplomatic career if it had not been interrupted, almost at the outset, by a night attack on the legation, in which he nearly lost his life. It seems probable that he never properly recovered from this affair. He returned to England and resigned the service, and was elected to parliament in 1865 for the Stirling Burghs.

Oliphant did not show any conspicuous parliamentary ability, but made a great success by his vivacious and witty novel, *Piccadilly* (1870). He fell, however, under the influence of the spiritualist prophet Thomas Lake Harris, who about 1861 had organized a small community, the Brotherhood of the New Life, which at this time was settled at Brocton on Lake Erie where Oliphant spent many years living as a farm labourer. As late

as December 1878 he continued to believe that Harris was an incarnation of the Deity.

In 1879 he visited Palestine and in 1881 he crossed again to America. On this visit he finally broke with Harris. He and his wife (Miss Alice Le Strange) settled at Haifa in Palestine.

There they wrote together the strange book called *Sympneumata: Evolutionary Forces now active in Man* (1884), and in the next year Oliphant produced there his novel *Masollam,* which may be taken to contain its author's latest views with regard to the personage whom he long considered as "a new Avatar." One of his cleverest works, *Altiora peto,* had been published in 1883. In 1886 his wife died of fever. He was persuaded that after death he was in much closer relation with her than when she was still alive and conceived that it was under her influence that he wrote his *Scientific Religion.* In November 1887 he went to England to publish that book. By the Whitsuntide of 1888 he had completed it and started for America. Oliphant married, as his second wife, a granddaughter of Robert Owen. They were starting for Haifa, when he died, at Twickenham, on Dec. 23, 1888. Oliphant was a brilliant writer and talker and a notable figure in any society.

*See* Mrs. (Margaret) Oliphant, *Memoir of the Life of Laurence Oliphant and of Alice Oliphant his Wife* (1892). (M. G. D.; X.)

**OLIPHANT, MARGARET OLIPHANT** (1828–1897), British novelist and historical writer, daughter of Francis Wilson, was born at Wallyford, near Musselburgh, Midlothian, in 1828. Her childhood was spent at Lasswade (near Dalkeith), Glasgow and Liverpool. She had long been a regular contributor to *Blackwood's* and had written some novels when she married, in 1852, her cousin, Frank Wilson Oliphant. They settled at Harrington square in London. Her husband was an artist, principally in stained glass. Two of their children died in infancy, while the father himself developed alarming symptoms of consumption. They moved in Jan. 1859 to Florence and thence to Rome, where Frank Oliphant died. His wife, left almost entirely without resources, returned to England and worked with amazing industry to maintain her children. She experienced heavy bereavement, losing all three children. After the death of the third, in 1894, her own health declined, and she died at Wimbledon on June 25, 1897. Her *Autobiography* gives a touching picture of her domestic life. Mrs. Oliphant was one of the most popular writers of her time. She wrote more than 120 books. Among the best known are the novels *Adam Graeme* (1852), *Miss Marjoribanks* (1866) and the short stories collected in the *Chronicles of Earlingford.*

**OLIPHANT** or **OLIFANT,** the large signal horn of the middle ages, made, as its name indicates, from the tusk of an elephant. The oliphant was the instrument of knights and men of high degree and was usually ornamented with scenes of hunting or war. Its loss in battle was considered as shameful as the loss of sword or banner.

**OLIVARES, GASPAR DE GUZMAN,** count of Olivares and duke of San Lucar (1587–1645), Spanish royal favourite and minister, born at Rome, Jan. 6, 1587. He kept his inherited title of count in combination with the new honour of duke granted him by Philip IV: hence he was commonly spoken of as *el conde-duque.* During the life of Philip III he was appointed to a post in the household of the heir-apparent and obtained such influence over the young prince that Philip IV on his accession ordered that all papers requiring the royal signature should first be sent to the count-duke. For 22 years Olivares directed the policy of Spain. It was a period of disaster abroad and of rebellion at home. The Spaniards, too thoroughly monarchical to blame the king, held his favourite responsible for the country's misfortunes, and the count-duke became the accepted model of a grasping and incapable favourite, but under the inspiration of Canovas, there was a certain reaction in his favour.

It would be unjust to blame Olivares alone for the decadence of Spain. The gross errors of his policy—the renewal of the war with Holland in 1621, the persistence of Spain in taking part in the Thirty Years' War, the lesser wars undertaken in Sicily and the entire neglect to promote the unification of the different states forming the peninsular kingdom—were shared by him with the king, the church and the commercial classes. His fall was immediately due to the revolts of Portugal and Catalonia in 1640. The king parted with him reluctantly and only under the pressure of a strong court intrigue headed by Queen Isabella. Driven from office in 1643, Olivares by the king's order retired to Toro, where he composed the apology, *El Nicandro,* written, some say, by an agent, but undeniably inspired by the fallen minister. The *Nicandro* was denounced to the Inquisition, and it is not impossible that Olivares might have ended in the prisons of the Holy Office, if he had not died on July 22, 1645.

*See* A. Canovas, *Estudios del reinado de Felipe IV.* (Madrid, 1889); F. Silvela, introduction to the *Cartas de Sor Maria de Agreda y del rey Felipe IV.* (Madrid, 1885–86).

**OLIVE** (*Olea europaea*), the plant that yields the olive oil of commerce, belonging to a section of the family Oleaceae, of which it has been taken as the type. The genus *Olea* includes about 35 species, very widely scattered, chiefly over the old world, from the Mediterranean basin to south Africa and New Zealand. The wild olive is a small tree or bush of rather straggling growth, with thorny branches and opposite oblong pointed leaves, dark greyish-green above and, in the young state, hoary beneath with whitish scales; the small white flowers, with four-cleft calyx and corolla, two stamens and bifid stigma, are borne on the last year's wood, in racemes springing from the axils of the leaves. In the cultivated forms (*O. europaea,* var. *sativa*) the tree acquires a more compact habit, the branches lose their spinous character, while the young shoots become more or less angular; the leaves are always hoary on the underside and are generally lanceolate in shape. The fruit may be globular, oblong or even crescent shaped and when ripe is usually purplish black in colour. The wild olive is found in most countries around the Mediterranean but is probably a native of Syria and the maritime parts of Asia Minor. It shows a marked preference for calcareous soils and the proximity of the sea.

The olive tree is of rather slow growth, but after long years of natural development the trunk often attains a considerable diameter. De Candolle records one exceeding 23 ft. in girth, its age being estimated at 700 yr. The tree in cultivation seldom exceeds 30 ft. in height and is generally kept much smaller by frequent pruning. The wood, of a yellow or light greenish-brown hue, is often finely veined with a darker tint and, being very hard and close grained, is valued by the cabinetmaker and turner.

**Distribution.**—At what remote period of human progress the wild olive became the fruitful garden olive it is impossible to conjecture. Some trees yielded with little labour a valuable oil, and this product became a symbol of peace and goodwill among the warlike barbarians. At a later period, the oil was conveyed, as an article of trade, to neighbouring nations; and the plant doubtless soon followed. In the Homeric world, as depicted in the *Iliad,* olive oil is known only as a luxury of the wealthy, an exotic product prized chiefly for its value in the heroic toilet, but there is no mention of the cultivation of the tree. Whenever it may have been introduced, tradition points to the limestone hills of Attica as the seat of its first cultivation on the Greek peninsula. By the time of Solon the olive had so spread that he found it necessary to enact laws to regulate the cultivation of the tree in Attica, from which country it was probably distributed gradually to all the Athenian allies and tributary states.

In Latin Italy the cultivation seems to have spread slowly, for it was not until the consulship of Pompey that the production of oil became sufficient to permit of its exportation. In Pliny's time it was already grown abundantly in the two Gallic provinces and in Spain; indeed, in the earlier days of Strabo the Ligurians supplied the Alpine barbarians with oil, in exchange for the wild produce of their mountains. Along the southern shore of the Mediterranean the tree was carried by the Phoenicians, at a remote period, to their numerous colonies in Africa and then into Spain.

Yielding a substitute for the butter and animal fats consumed by the races of the north, the olive, among the southern nations of antiquity, became an emblem not only of peace but of national wealth and domestic plenty; the branches borne in the Panathenaea, the wild olive spray of the Olympic victor and the olive

crown of the Roman conqueror at ovation, alike typified gifts of peace that, in a barbarous age, could be secured by victory alone. Among the Greeks the oil was valued as an important article of diet as well as for its external use. The Roman people employed it largely in food and cookery—the wealthy as an indispensable adjunct to the toilet; and in the luxurious days of the later empire it became a favourite axiom that long and pleasant life depended on two fluids, "wine within and oil without." The *gourmet* of the empire valued the unripe fruit, steeped in brine, no less than his modern representative; and pickled olives have been found among the buried stores of Pompeii.

OLIVE (OLEA EUROPAEA)

In modern times the olive has been spread widely over the world. The tree has been introduced into Chinese agriculture and has become an important addition to the resources of the Australian planter. It has likewise been successfully introduced into parts of Cape Colony.

The olive is grown mainly for the production of oil, the average annual world output between 1934 and 1939 being 959,000 tons. Olive oil weighs about 7.6 lb. per gal. Spain leads with 41% of the total production, followed in order of importance by Italy, Greece, Portugal, Tunisia and Turkey. Olives and olive products form about 6% of the total agricultural production of Spain, $\frac{3}{4}$ of the total area in olives being in the southern provinces, such as Jaén, Córdoba and Sevilla. Only 1.5% of Spanish olives are used for green pickles, the rest being pressed for oil. Of the twenty or more varieties grown in southern Spain, the Sevillano and Manzanillo are preferred for pickling, while the Zorzalena is principally used for oil.

In Italy the olive is second only to the grape as a horticultural crop. Specialized olive culture, where olive trees occupy the major portion of the land, constitutes 2.6% of the area of Italy; associated olive culture, with olives only a secondary crop, covers another 4.4% of the area. The province of Puglia is credited with 721,000 ac. of specialized olive orchards—over twice that of Calabria, the next in importance. Sicily leads in the total area devoted to mixed olive culture. Over 85% of Italian olive trees are grown on hills and mountainsides rather than on the plains. Almost the entire production of olives in Italy is used for oil, a very small percent being used for table olives as dried, salted and pickled fruit. The number of olive varieties grown is from 150 to 300, depending upon the authority consulted, each zone or region having its favourites such as Corregiolo, Leccino and Morinello in the central provinces.

Specialized olive culture is an important industry on hillsides throughout Greece, where in 1937 olives represented 18.6% of all agricultural production. While olives in Greece are grown mostly for oil, this country is also one of the principal exporters of table olives, consisting of black fruit dried, processed in oil or salted, the last being well known in world trade as Greek olives.

In Portugal olive trees are of first importance, the chestnut, fig and carob following in order. Olive culture is mainly concentrated in the central provinces, which possess about $\frac{2}{3}$ of the total area planted to this fruit tree. Ninety per cent of Portuguese olive oil is usually consumed in the country, the remainder going to Brazil and the colonies.

In Tunisia, olive culture reached its highest development during the Roman occupation of North Africa. It is estimated that the olive orchards covered 2,500,000 ac. when the Arabs conquered the country about A.D. 700. Ancient Rome taxed this province 300,000 gal. of olive oil yearly, and one of the cities near the eastern coast is reputed to have built a conduit solely for the purpose of transporting oil to its seaport. Remains of more than 1000 oil mills are said to exist in the 100 sq.mi. around Suffetula alone. In the region of Sfax are found optimum conditions for development of olive trees and fruit, so that 30% of all Tunisian olives are grown in that vicinity. More than 90% of the olive production of Tunisia is pressed for oil. The Chemlali is the most common variety and has a high oil content. Tunisia ordinarily supplies many markets with oil for direct consumption, including France, Great Britain and the United States. Algeria is also an important producer of olives for oil.

Olives form the most important tree crop of Anatolia in Turkey, especially on the seaward slopes. The government took steps to promote the industry and to encourage the grafting of fruitful varieties on wild olive trees.

Olives are grown to some extent in the arid regions of South America, and interest in olive culture has been stimulated in various ways. In the United States commercial olive culture is confined to Arizona and California, mostly to the latter state. The California industry is based mostly upon the production of large-sized olives for pickles rather than oil. Thus California olive oil output is normally less than 1% that of Spain, although World War II greatly stimulated the pressing of oil. The average annual production of all olives in the state for the period 1934 to 1938 was 29,800 tons, of which about half was pressed for oil, the output representing 4.9% of the United States consumption of olive oil. The varieties, all from old world countries, are, in order of importance, Mission, Manzanillo, Sevillano, Ascolano. The canned ripe olive pack of California averages somewhat over 600,000 cases a year with sizes of fruit in the cans ranging from small to large, mammoth, giant, colossal and even to super-colossal. A ton of ripe olives produces about 70 cases of pickles. Ripe olive prices to the grower are based upon the size of fruit and increase rapidly with increase in size. Crops of five tons to the acre are not uncommon, but it is the aim of the grower to get moderate production of large-sized fruit annually rather than alternate heavy and light crops.

**Propagation and Culture.**—In some Mediterranean countries the desired varieties are grafted on wild olive trees which grow naturally on the hillsides. Seedling stocks are sometimes grown in nurseries, then grafted, but olive trees so propagated may not be any more fruitful than trees of the same variety growing on their own roots. Cuttings are therefore almost universally used for olive tree propagation. These may be of branches several inches in diameter and five to six feet long, planted in the ground where the tree is to remain, or of shorter and smaller pieces planted in nursery rows. The large knots or ovoli which naturally grow at the base of olive trees are sometimes chiselled off and planted, their sprouts being treated as cuttings. In California the trees are grown either from hard- or soft-wood cuttings. Cuttings of mature wood placed in sand with bottom heat in February form roots and make a short growth by fall. Soft-wood olive cuttings are made in October of mature terminal twigs about five inches long, and placed close together in sand for rooting. The following May the rooted cuttings are set in nursery rows where they grow for two years, after which they can be transplanted to the orchard.

In unirrigated orchards of the old world the trees are widely spaced, as much as 75 ft. apart in Tunisia. In California, where irrigation is the rule, the trees are spaced 30–40 ft. apart, depending upon the variety. Trees come into bearing at 5 yr. of age but are not in full production until 15 or 20 yr. old. In Spain and Italy olive trees are pruned rather heavily each year or every other year in order to promote new growth. Experiments in California, however, show that Mission olive trees unpruned during the first 4 or 5 yr. develop much more rapidly and have a larger trunk than trees pruned each year. Furthermore, pruning of bearing trees has neither increased the yield nor substantially improved the sizes of fruit. The advantage of pruning appears to be the greater convenience in harvesting and the more effective control of pests and diseases. Olives intended for oil are sometimes beaten from the trees with poles, but this method of harvesting is injurious both to tree and fruit. Olives for pickling are carefully harvested by hand and transported in boxes to the pickling plants. Both animal manures and commercial fertilizers are commonly used in European olive orchards. Fertilizer experiments in California show that nitrogen is the only element which has appreciably increased the yield of olives.

The extraction of oil from olives is largely a mechanical process. As soon after harvesting as possible the fruit is first crushed beneath stone or steel rollers, then placed in press cloths which are stacked one above the other somewhat like broad flat cheeses. Hydraulic presses are commonly used, the first oil secured being known as virgin oil. Olives vary considerably in oil content, which ranges from 50%–60% of the dry weight of pit-free pulp. Ripe olives contain a bitter principle which, in order to make the fruit palatable, is commonly neutralized by submersion in a lye solution. The natural black colour of the fruit is retained by aeration during the pickling process. Pickled olives are packed in cans in a salt solution and sterilized with steam under

pressure for one hour at 116° C. Green olives are pickled in barrels where they go through a slow process of lactic acid fermentation.

BIBLIOGRAPHY.—Mario Costa, "Olives and Olive Products," *Intern. Institute of Agr. Publ. No. 6* (Rome, 1940); W. V. Cruess, "Olive Pickling in Mediterranean Countries," *California Agr. Exp. Sta. Circ. 278* (1924), "The Preparation and Refining of Olive Oil in Southern Europe," *California Agr. Exp. Sta. Circ. 279* (1924); Francesco Francolini, *Olivicoltura* (Rome, 1923); J. Bonnet, *L'Olivier et les Produits* (Paris, 1924). (I. J. Cr.)

**OLIVEIRA MARTINS, JOAQUIM PEDRO DE** (1845–1894), Portuguese writer, was born in Lisbon, and in 1870 was appointed manager of the mine of St. Eufemia near Cordova. In Spain he wrote *O Socialismo,* and developed that sympathy for the industrial classes of which he gave proof throughout his life. Returning to Portugal in 1874, he became administrator of the railway from Oporto to Povoa, residing in Oporto. He entered parliament in 1886, became minister of finance on Jan. 17, 1892, and later vice-president of the Junta do Credito Publico. He died on Aug. 24, 1894. A psychologist, a profound sociologist, a stern moralist and an ardent patriot, Oliveira Martins deserved his European reputation. His *Bibliotheca das sciencias sociaes,* a veritable encyclopaedia, comprises literary criticism, socialism, economics, anthropology, histories of Iberian civilization, of the Roman Republic, Portugal and Brazil. Towards the end of his life he specialized in the 15th century and produced two notable volumes, *Os fithos de D. João I.* (1891) and *A vida de Nun' Alvares* (1893), leaving unfinished *O principe perfeito* (1896), a study on King John II., which was edited by his friend Henrique de Barros Gomes. The chief characteristics of the man—psychological imagination combined with realism and a gentle irony—make his strength as a historian and his charm as a writer. He drew admirable portraits; in his *Historia de Portugal* and *Portugal Contemporaneo* (1881) those of King Pedro I. and Herculano are among the best known.

*See* Moniz Barreto, *Oliveira Martins, estudo de psychologia* (Paris, 1887), a remarkable study; F. Diniz D'Ayalla, *Os Ideaes de Oliveira Martins* (1897), which contains an admirable statement of his ideas, philosophical and otherwise; Anthero de Quental, *Oliveira Martins* (1894) and *Diccionario bibliographico portuguez,* xii. 125.

**OLIVENITE,** a mineral consisting of basic copper arsenate with the formula $Cu_2(OH)AsO_4$. It crystallizes in the orthorhombic system, and is sometimes found in small brilliant crystals of simple prismatic habit terminated by domal faces. More usually, however, it occurs as globular aggregates of acicular crystals, these fibrous forms often having a velvety lustre. A characteristic feature, and one to which the name alludes, is the olive-green colour, which varies in shade from blackish-green in the crystals to almost white in the variety known as "wood-copper."

**OLIVE OIL.** An oil expressed from the fleshy part (pericarp) of the fruit of the olive tree, which is chiefly cultivated in the countries bordering on the Mediterranean, and recently with some success in California, South Africa and Australia. The ripe fruit contains from 20 to 60% of oil, depending on climatic conditions and on the care exercised in cultivation. Californian and North African olives usually contain less oil than those grown in France or Italy.

The fruit intended for oil production should be gathered just before it is fully ripe. The finest quality oil, termed "virgin oil," is prepared from hand-picked fruits by gentle pressing; in some cases the pulp is stripped from the pits before treatment; this oil is not exported. The apparatus used in expressing the oil varies from the most primitive form of press, consisting of two boards weighted with stones, to the most modern types of hydraulic presses (*see* Coco-Nut Oil; also Copra). In order to obtain the best quality edible oil it is essential that the oil be removed from contact with the putrescible marc (pulp) as soon as possible, particularly if the fruit was bruised; otherwise rancidity sets in with consequent formation of free fatty acids. In practice the pulp is pressed twice, yielding first and second grade edible oils; it is then mixed with hot water and subjected to further pressure, yielding technical oils. The press residues are ground up with hot water and run into settling tanks; the oil which rises to the top, termed "huile de ressence," is skimmed off. A still lower quality oil, "sulphur olive oil," is obtained by extracting the residue with a volatile solvent, usually carbon disulphide.

The product known as "Tournant oil" is obtained by allowing the expressed marc to ferment, whereby the cells are ruptured and more oil is liberated. As this oil contains a large amount of free fatty acids it forms a stable emulsion with sodium carbonate which is used as a Turkey-red oil.

Olive oil for edible purposes, which should be practically devoid of free fatty acids, varies in colour from water-white to golden yellow, and possesses a smooth bland taste, varying with the district in which the olive is grown and also the degree of ripeness of the fruit. In general the oils from North Africa and Greece have a harsher taste than those from Provence and Tuscany. Olive oils intended for use in cold climates should remain limpid at 10° C, and are prepared by cooling the oil to below that temperature and settling-out the deposited "stearine." Olive oil is extensively adulterated, chiefly with tea-seed, arachis and sesame oils. The bulk of the oil produced is used for comestible purposes (preserving sardines, etc.); it is also used for oiling wool and for the manufacture of high-class toilet and textile soaps (*q.v.*), known as Castile soap. The production of oil in the principal olive growing countries for 1937 is given below:—

| Country | Gallons | Average % 1932–36 |
|---|---|---|
| Spain | 111,701,000 | 108 |
| Italy | 68,343,400 | 113 |
| Greece | 41,153,000 | 117 |
| Portugal | 19,841,000 | 133 |
| Tunis | 16,167,200 | 105 |
| Turkey | 8,818,500 | 107 |
| Algeria | 4,685,600 | 104 |
| Syria & Lebanon | 3,527,400 | 105 |
| All Countries | 284,537,600 | 113 |

From *International Institute of Agriculture Review.*

*See* also Oils. (E. L.; G. H. W.; X.)

**OLIVER, ISAAC** (*c.* 1566–1617), English miniature painter, was probably born in London, as in 1571 a certain Peter Olivier of Rouen was residing in London with his wife and one "chylde" named "Isake." He died in 1617 and lies buried in the church of St. Anne, Blackfriars. He was probably a pupil of Nicholas Hilliard, and connected through his wife, whose name is unknown, with the artists Gheeraerts and De Critz. Examples of his work are at Montagu House, Windsor Castle, Sherborne Castle and in the collections of Mr. J. Pierpont Morgan and the late Baroness Burdett-Coutts, also in the British Museum.

His eldest son, Peter Oliver (1594–1648), also became a miniature painter and achieved greater fame than his father. He lived at Isleworth and on his death in 1648 was buried beside his father at St. Anne's, Blackfriars. Several of his works were bought from his widow by Charles II. and some of his water-colour copies from old masters are still in Windsor Castle. His most important work is the group of the three grandsons of the 1st Viscount Montacute with their servant, belonging to the marquess of Exeter. His miniatures are found in the private collection of the Queen of Holland and in English collections.

**OLIVES, MOUNT OF,** the ridge, 2,680ft. above sea-level, facing the Temple mount at Jerusalem on the east and separated from it by the vale of Kidron: Arabic, *Jebel et-Tōr.* Of the four distinct elevations on the ridge the southernmost is the scene of Solomon's idolatrous worship. The mount is referred to four times only in the Old Testament. Jesus crossed it on his entry into Jerusalem. The Ascension took place "over against Bethany" (Lk. xxiv.–50), probably in one of the secluded ravines of the eastern slope. The tradition that the Ascension was from the central eminence of the hill dates from Eusebius Caesarea, and over a sacred cave in that place there has been built a succession of sanctuaries. The chapel at present on the site was built by the crusaders and modified by the Muslims, its present holders, who erected beside the entrance to the *harām* a minaret. Close by is the grotto of St. Pelagia (d. 457) and a short way down the hill the rock-cut cave with columbaria called the "Tomb of the Prophets." A tradition of the middle ages identified Olivet with

the Mount of Transfiguration. At its foot was the Garden of Gethsemane (*q.v.*).

At the present day there stands on Mt. Scopus, a continuation of the Mt. of Olives, the new Hebrew university opened by Lord Balfour in 1925. The German hospice, opened in 1910, is now used by the British administration in Palestine as Government house. The earthquake of July 11, 1927, was particularly severe in the area of the mount. (E. Ro.)

**OLIVETANS,** one of the lesser monastic orders following the Benedictine Rule, founded by St. Bernard Tolomei, a Sienese nobleman. At the age of forty, when the leading man in Siena, he retired along with two companions to live a hermit's life at Accona, a desert place fifteen miles to the south of Siena, 1313. Soon others joined them, and in 1324 John XXII. approved of the formation of an order, the Benedictine Rule being taken as the basis of the life. Partly from the olive trees that abound there, and partly out of devotion to the Passion, Accona was christened Monte Oliveto, whence the order received its name. By the end of the 14th century, there were upwards of a hundred monasteries, chiefly in Italy; and in the 18th there still were eighty, one of the most famous being San Miniato at Florence. The Olivetans have a house in Rome and in a few other cities.

**OLIVIER OF RAMSDEN, SYDNEY OLIVIER,** 1ST BARON, cr. 1924 (1859–1943), English statesman and writer, was educated at Tonbridge and Corpus Christi college, Oxford. He entered the colonial office in 1882 and was governor of Jamaica from 1907 to 1913. After his return from Jamaica he was permanent secretary of the board of agriculture (1913–17), and assistant comptroller of the exchequer (1917–20). In 1924 Olivier received a barony, and took office in the Labour government as secretary for India. He wrote books on colonial questions. He was created K.C.M.G., 1907. He died Feb. 15, 1943.

**OLIVINE,** a rock-forming mineral composed of magnesium and ferrous orthosilicate, the formula being $(Mg,Fe)_2SiO_4$. The name alludes to its olive-green colour and is often applied incorrectly by jewellers to various green stones. The transparent varieties, or "precious olivine" used in jewellery, are known as chrysolite (*q.v.*) and peridot.

Olivine crystallizes in the orthorhombic system, but distinctly developed crystals are comparatively rare, the mineral more often occurring as compact or granular masses or as grains and blebs embedded in the igneous rocks of which it forms a constituent part. The hardness is 6½; the sp. gr. 3·27–3·37, but reaching 3·57 in the highly ferruginous variety known as hyalosiderite. The amount of ferrous oxide varies from 5% (about 9% in the gem varieties) to 30% in hyalosiderite. The depth of the green, or yellowish-brown colour, also varies with the amount of iron. The lustre is vitreous. The indices of refraction (1·66 and 1·70) and the double refraction are higher than in many other rock-forming minerals; and these characters, together with the indistinct cleavage, enable it to be readily distinguished in thin rock-sections under the microscope. The mineral is decomposed by hot hydrochloric acid with separation of gelatinous silica; it often contains small amounts of nickel and titanium dioxide; the latter replaces silica, and in the variety known as titan-olivine reaches 5%.

Olivine is a common constituent of many basic and ultrabasic rocks, such as basalt, dolerite, gabbro and peridotite; and the dunite, of Dun mountain near Nelson in New Zealand, is an almost pure olivine-rock. It also occurs as an accessory constituent of some granular dolomitic limestones and crystalline schists. With enstatite it forms the bulk of the material of meteoric stones; and in another type of meteorites large blebs of glassy olivine fill spaces in a cellular mass of metallic iron.

Olivine is especially liable to alteration into serpentine (hydrated magnesium silicate); the alteration proceeds from the outside of the crystals and grains or along irregular cracks in their interior, and gives rise to the separation of iron oxides and an irregular net-work of fibrous serpentine, which in rock-sections presents a very characteristic appearance. Large greenish-yellow crystals from Snarum in Buskerud, Norway, at one time thought to be crystals of serpentine, really consist of serpentine pseudomorphous after olivine. Many of the large rock-masses of serpentine have been derived by the serpentinization of olivine-rocks. Olivine also sometimes alters, especially in crystalline schists, to a fibrous, colourless amphibole, to which the name pilite has been given. By weathering processes it alters to limonite and silica.

Closely related to olivine are several other species, which are included together in the olivine group: they have the orthosilicate formula $R''_2SiO_4$, where R″ represents calcium, magnesium, iron, manganese and rarely zinc; they all crystallize in the orthorhombic system, and are isomorphous with olivine. These include: monticellite, $CaMgSiO_4$, a rare mineral occurring as yellowish-grey crystals and grains in granular limestone at Monte Somma, Vesuvius; Forsterite, $Mg_2SiO_4$, as colourless or yellowish grains embedded in many crystalline limestones; Fayalite, $Fe_2SiO_4$, or iron-olivine, a dark brown or black variety occurring as nodules in volcanic rock; Tephroite, $Mn_2SiO_4$, a grey (*τεφρὸς*, ash-coloured), mineral occurring in Sweden and New Jersey. (L. J. S.)

**OLLIVIER, OLIVIER ÉMILE** (1825–1913), French statesman, was born at Marseilles on July 2, 1825. On the establishment of the Second Republic his father, DEMOSTHENES OLLIVIER (1799–1844), secured for him the position of commissary-general of the department of Bouches-du-Rhône. His repression of a socialist outbreak at Marseilles commended him to General Cavaignac, who made him prefect of the department. His removal to the prefecture of Chaumont (Haute-Marne) he ascribed to his father's enemies. He therefore resigned from the civil service to take up practice at the bar.

He re-entered political life in 1857 as deputy for the 3rd circumscription of the Seine. His candidature had been supported by the *Siècle,* and he joined the constitutional opposition. With Alfred Darimon, Jules Favre, J. L. Hénon and Ernest Picard he formed the group known as *Les Cinq,* which wrung from Napoleon III. some concessions in the direction of constitutional government. The imperial decree of Nov. 24, permitting the insertion of parliamentary reports in the *Moniteur,* and an address from the Corps Législatif in reply to the speech from the throne, were welcomed by him as a first instalment of reform. This acquiescence marked a considerable change of attitude, for only a year previously a violent attack on the imperial government, in the course of a defence of Étienne Vacherot, brought to trial for the publication of *La Démocratie,* had resulted in his suspension from the bar for three months. He gradually separated from his old associates, who grouped themselves around Jules Favre, and during the session of 1866–1867 Ollivier helped to form a third party, which definitely supported the principle of a Liberal Empire. This led to a struggle of personal rivalry between Ollivier and Rouher, the minister of state, who attempted, by the issue of his *Senatus-consulte* (July 1866), to uphold the constitution of 1852. On Jan. 19, 1867, an imperial decree was issued, restoring the right of interpellation to the deputies. A promise was also inserted in the *Moniteur* of a relaxation of the stringency of the press laws and of concessions in respect of the right of public meeting. On June 28, 1869, the third party, which consisted of 116 members, with the support of the Left, obtained a majority in the chamber for their demand for a responsible ministry "and the right of the Legislative Body to regulate the essential conditions of its own activity." The emperor prorogued the legislative body on July 13, and on the same day appointed Rouher president of the Senate. The *sénatus-consulte* of Sept. 8, 1869, gave the two chambers the ordinary parliamentary rights. On Nov. 29 the chambers again met and on Dec. 28 the emperor was obliged to give in to the Third party's demands. He dismissed Rouher and entrusted Ollivier with the formation of a responsible ministry of which Ollivier was really premier, although that office was not nominally recognized by the constitution. The new cabinet, known as the ministry of the 2nd of January, had a hard task before it, complicated a week after its formation by the hostile manifestation following the shooting of Victor Noir by Prince Pierre Bonaparte. Ollivier immediately summoned the high court of justice for the judgment of Prince Bonaparte and Prince Joachim Murat. His ministry included 4 members of the Right Centre and 4 of the Left Centre. In March his position obliged him to propose a revision of the Constitution, and on April 20, a *sénatus-consulte*

was issued which accomplished the transformation of the Empire into a constitutional monarchy. Ollivier, however, still had to face violent opposition from the Republicans and Socialists. He had arrested Rochefort on Feb. 9 for his presence at the funeral of Victor Noir, and he arrested also the editors of the *Marseillèien.* Neither concessions nor firmness sufficed to appease the "Irreconcilables" of the opposition, who since the relaxation of the press laws were able to influence the electorate. On May 8, however, the amended constitution was submitted to a plebiscite, which resulted in a vote of nearly seven to one in favour of the government. The most distinguished members of the Left in his cabinet—L. J. Buffet, Napoléon Daru and Talhouët Roy—resigned in April on the question of the plebiscite. Ollivier himself held the ministry of foreign affairs for a few weeks, until Daru was replaced by the duc de Gramont.

The revival of the candidature of Prince Leopold of Hohenzollern-Sigmaringen for the throne of Spain early in 1870 disconcerted Ollivier's plans. The French government, following Gramont's advice, instructed Benedetti to demand from the king of Prussia a formal disavowal of the Hohenzollern candidature. Ollivier allowed himself to be gained by the war party. The story of Benedetti's reception at Ems and of Bismarck's manipulation of the Ems telegram is told elsewhere. (*See* BISMARCK.) It is unlikely that Ollivier could have prevented the eventual outbreak of war, but he might perhaps have postponed it at that time, if he had taken time to hear Benedetti's account of the incident. He was outmanoeuvred by Bismarck, and on July 15 he made a hasty declaration in the Chamber that the Prussian government had issued to the powers a note announcing the rebuff received by Benedetti. He obtained a war vote of 500,000,000 francs, and used the fatal words that he accepted the responsibility of the war "with a light heart," saying that the war had been forced on France. On Aug. 9, with the news of the first disaster, the Ollivier cabinet was driven from office, and its chief sought refuge in Italy. He returned to France in 1873, and occupied himself with writing the apology for his government, *L'Empire libéral* (1895 *seq.*). His first wife, Blandine Liszt, was the daughter of the Abbé Liszt by Mme. d'Agoult (Daniel Stern). She died in 1862, and Ollivier married in 1869 Mlle. Gravier. He died at St. Gervais-les-Bains on Aug. 30, 1913.

His other works include *Démocratie et liberté* (1867), *Le Ministère du 2 janvier, mes discours* (1875), *Principes et conduite* (1875), *L'Église et l'État au concile du Vatican* (2 vols., 1879), *Solutions politiques et sociales* (1893), *Nouveau Manuel du droit ecclésiastique français* (1885).

*See* M. T. Ollivier, *Emile Ollivier; sa jeunesse d'apres son journal et sa correspondance* (1918).

**OLMEDO, JOSÉ JOAQUÍN DE** (1780–1847), Ecuadorian poet and politician, was born in Guayaquil on March 20, 1780. Sent to Europe in 1825 as Peruvian diplomatic representative, he returned in 1828 and in 1830 was elected vice president of the recently created (1830) independent republic of Ecuador, but declined the honour. In 1845 he headed a successful revolt and, having been chosen first member of the provisional government, was a candidate for the presidency, but was not elected. He died in Guayaquil on Feb. 19, 1847. A neo-classicist, Olmedo has been called by a distinguished Spanish critic "one of the three or four great Spanish-American poets, if not the first." He is best known for his ode *La Victoria de Junín, Canto a Bolívar* (1825), commemorating the final overthrow of Spain in America, and the ode *Al General Flores, Vencedor en Miñarica* (1835), written after the defeat of a revolt against the government.

*See* M. L. Amunátegui, *Juicio crítico de algunos poetas hispanoamericanos* (Santiago de Chile, 1861); P. Herrera, *Apuntes biográficos de Don José Joaquín Olmedo* (Quito, 1887); J. L. Mera, *Ojeada histórico-critico sobre la poesía ecuatoriana* (2nd ed. Barcelona, 1893); J. J. Olmedo, *Poesías* (ed. by C. Ballén, Paris, 1896); V. M. Rendón, *Olmedo* (Paris, 1904); E. Piñeyro, *Biografías americanas* (Paris, 1907); A. Coester, *The Literary History of Spanish-America* (New York, 1916); E. C. Hills, ed., *The Odes of Bello, Olmedo and Heredia* (New York, 1920). The *Enciclopedia Universal Ilustrada* (Barcelona, 1919), has a full bibliography. (W. B. P.)

**OLMSTED, FREDERICK LAW** (1822–1903), American landscape architect, was born in Hartford (Conn.), on April 27, 1822. He already had an adventurous career when he published his *Journeys and Explorations in the Cotton Kingdom* (1861), which gave a picture of the conditions surrounding American slavery that had great influence on British opinion, and was much quoted in the controversies at the time of the Civil War. During the war he was the untiring secretary of the U.S. sanitary commission.

When Central Park, New York city, was projected, he, in conjunction with Vaux, proposed the plan which, in competition with more than 30 others, won first prize. Olmsted was made superintendent to carry out the plan. This was practically the first attempt in the United States to apply art to the improvement or embellishment of nature in a public park; it attracted great attention, and the work was so satisfactorily done that he was engaged thereafter in most of the important works of a similar nature in America—Prospect park, Brooklyn; Fairmount park, Philadelphia; South park, Chicago; Riverside and Morningside parks, New York; Mount Royal park, Montreal; the grounds surrounding the Capitol at Washington, and at Leland Stanford University at Palo Alto (Calif.), and many others. He developed the bare stretch of lake front at Chicago into the World's Fair grounds, contributing much to the architectural beauty and the success of the exposition. He was greatly interested in the Niagara reservation, made the plans for the park there, and also did much to influence the State of New York to provide the Niagara park.

He was the first commissioner of the national park of the Yosemite and the Mariposa grove, directing the survey and taking charge of the property for the State of California. He also held directing appointments under the cities of New York, Boston, Philadelphia, Baltimore, Wilmington and San Francisco, the joint committee on buildings and grounds of Congress, the Niagara Falls Reservation commission, the trustees of Harvard, Yale, Amherst and other colleges and public institutions. After 1886 he was largely occupied in laying out an extensive system of parks and parkways for the city of Boston and the town of Brookline, and on a scheme of landscape improvement of Boston harbour. He died on August 28, 1903.

**OLMÜTZ:** *see* OLOMOUC.

**OLNEY, RICHARD** (1835–1917), American statesman, was born at Oxford, Mass., on Sept. 15, 1835. He graduated at Brown university in 1856, and at the law school of Harvard university in 1858. In 1859 he began the practice of law at Boston, Mass., and attained a high position at the bar. He served in the State House of Representatives in 1874, and in March 1893 became attorney-general of the United States in the cabinet of President Cleveland. In this position, during the strike of the railway employees in Chicago in 1894, he instructed the district attorneys to secure from the Federal courts writs of injunction restraining the strikers from acts of violence, and thus set a precedent for "government by injunction." He also advised the use of Federal troops to quell the disturbances in the city, on the ground that the Government must prevent interference with its mails and with the general railway transportation between the States. Upon the death of Secretary W. Q. Gresham (1832–95), Olney succeeded him as secretary of State on June 10, 1895. He became specially prominent in the controversy with Great Britain concerning the boundary dispute between the British and Venezuelan Governments (*see* VENEZUELA), and in his correspondence with Lord Salisbury gave an extended interpretation to the Monroe Doctrine which went considerably beyond previous statements on the subject. In 1897, at the expiration of President Cleveland's term, he returned to the practice of the law. He died in Boston, Mass., on April 8, 1917.

**OLNEY,** a market town of Buckinghamshire, England, on the Ouse, 59 mi. N.N.W. of London on the L.M.S. railway. Pop. (1931) 2,438. The church of St. Peter and St. Paul is Decorated. William Cowper lived here from 1767 until 1786. John Newton, curate of Olney, had the assistance of Cowper in the production of the Olney hymns. The trade of Olney is principally agricultural, but boots and shoes are manufactured.

**OLNEY,** a city of Young county, Texas, U.S.A., 90 mi. N.W. of Fort Worth, on the Chicago, Rock Island and Pacific, the Wichita Falls and Southern railways. The population was 1,164 in

1920; 4,138 in 1930; 3,497 in 1940. It is in a rich agricultural, stock-raising and oil-producing section. More than 2,000 producing wells are within a ten-mile radius.

**OLOMOUC** (German, *Olmütz*), a town in Moravia, at the confluence of the Bystrice and the Morava. Pop. (1930) 66,442, of which 15,017 are Germans. Near the head of a fertile gulf, floored with sandy loam and loess, and having a sheltered climate, it is a market for cereals and cattle and such prepared materials as malt, meal, beer, spirits, starch and sugar.

Until 1640 Olomouc was the recognized capital of Moravia. Originally fortified by Maria Theresa it was, until 1886, one of the strongest fortresses in Central Europe and withstood a seven-weeks' attack of Frederick the Great in 1758, but the site of the fortification is now occupied by park, gardens and promenade. Notable buildings are the 14th century cathedral in Gothic style, with a 328 ft. tower, the 15th century Mauritius church, also Gothic, and the 15th century town-hall and museum. Olomouc was made the see of a bishop in 1073 and in 1777 was raised to the rank of an archbishopric. It was occupied by Germany in 1939.

**OLONA** (*Touchardia latifolia*), a shrub of the nettle family (Urticaceae), native to the Hawaiian islands, where it has long been cultivated as a fibre plant. The bast fibre obtained from the young shoots possesses remarkable tensile strength, being three times as strong as that of the finest grades of abacá fibre (*q.v.*). Because of its great pliability olona fibre is readily woven into cloth or made into cordage. Another valuable quality is its unusual durability in water, making it especially suitable for fish nets.

**OLONETS,** a former government of north-western Russia (*see* KARELIA).

**OLORON-SAINTE-MARIE,** a town of south-western France, capital of an arrondissement in the department of Basses-Pyrénées, 21 mi. S.W. of Pau on a branch of the Southern railway. Pop. (1936) 8,899. It lies at the confluence of the mountain torrents (locally known as *gaves*) Aspe and Ossau, which, after dividing it into three parts, unite to form the Oloron, a tributary of the Pau. A Celtiberian and then a Gallo-Roman town, known as *Iluro,* occupied the hill on which the old feudal town of Sainte-Croix now stands, still surrounded by remnants of its 14th century ramparts; between the two rivers; Sainte-Marie lies on the left bank of the Aspe, and the new town on the right bank of the Ossau. Oloron is the seat of a sub-prefect. The town carries on a thriving trade with Spain by way of the passes of Somport and Anso, chiefly in wool and skins, salt pork and hams, cattle and horses.

**OLTEN** (1,312 ft.), a town in the canton of Solothurn, Switzerland, at the south foot of the Jura. An important railway centre at the junction of the railways Basle-Luzern (Lucerne), Berne-Zürich and Solothurn-Zürich. Pop. (1941) 15,282.

**OLUSTEE,** a village of Baker county, Fla., U.S.A., in the precinct of Olustee, about 46 mi. W. by S. of Jacksonville. Population of the precinct (1940) 705. The village is served by the Seaboard railway. The battle of Olustee, or Ocean Pond (the name of a small body of water in the vicinity), one of the most sanguinary engagements of the Civil War in proportion to the numbers engaged, was fought on Feb. 20, 1864, about 2 mi. east of Olustee, between about 5,500 federal troops, under Gen. Truman Seymour (1824–91), and about 5,400 Confederates, under Gen. Joseph Finegan, the federal forces being decisively defeated, with a loss, in killed and wounded, of about one-third of their number, including several officers. The Confederate losses, in killed and wounded, were about 940.

**OLYBRIUS,** Roman emperor of the West from July 11, to Oct. 23, 472, was a member of a noble family and a native of Rome. After the sack of the city by Gaiseric in 455, he fled to Constantinople, where, about 464, he married Placidia, daughter of Valentinian III. This afforded Gaiseric the opportunity of claiming the empire of the West for Olybrius. In 472 Olybrius was sent to Italy by the emperor Leo to assist the emperor Anthemius against his son-in-law Ricimer, but, having entered into negotiations with the latter, was himself proclaimed emperor and on the murder of his rival ascended the throne unopposed.

*See* Gibbon, *Decline and Fall,* ch. xxxvi.; J. B. Bury, *Later Roman Empire.*

**OLYMPIA,** the scene of the Olympic games, is in western Peloponnese on the N. bank of the Alpheus (mod. Ruphia), about 11 m. E. of modern Pyrgos, where the ancient Cladeus tributary flows in from the north. Olympia is bounded on the W. by the Cladeus, on the S. by the Alpheus, on the E. by the ancient racecourses and on the N. by low heights. Here a conical hill, about 400 ft. high, cut off from the rest by a cleft, descends abruptly on Olympia. This is the *Cronion* hill sacred to Cronus.

## HISTORY

The importance of Olympia in the history of Greece is religious and political. Religious associations date from the prehistoric age, when a centre of worship is attested by house-remains and early votive offerings found beneath the Heraeum. The earliest extant building is the temple of Hera, which may date in its original form from about 1000 B.C. and retained till Pausanias' time one original column of wood. There were various traditions as to the origin of the games. According to one the first race was between Pelops and Oenomaus, who used to challenge the suitors of his daughter Hippodameia and then slay them. Another attributed the festival to Heracles, either the well-known hero or the Idaean Dactyl of that name. In early times the control of the festival belonged to Pisa, but Elis seems to have claimed some share in it. Sixteen women, representing eight towns of Elis and eight of Pisatis, wove the festal robe for the Olympian Hera. Olympia thus became the centre of an amphictyony (*q.v.*), or federal league under religious sanction, for the west coast of Peloponnese. It suited the interests of Sparta to join this amphictyony; and, before the list of Olympic victors begins in 776 B.C., Sparta had formed an alliance with Elis. Aristotle saw in the temple of Hera a bronze disk, recording the traditional laws of the festival, on which the name of Lycurgus of Sparta stood next to that of Iphitus, king of Elis. Whatever may have been the age of this disk, the relation which it indicates is well attested. Elis and Sparta, making common cause, had no difficulty in excluding the Pisatans from their proper share in the management of the Olympian sanctuary. Pisa had, indeed, a brief success, when Pheidon of Argos celebrated the 28th Olympiad under its presidency. But this festival, from which Eleans and Spartans were excluded, was afterwards struck out of the official register. The destruction of Pisa (before 572 B.C.) by Sparta and Elis put an end to the rivalry: Pisatis, and also Triphylia to the south of it, becoming dependent on Elis. On the religious side of the festival the Eleans had unquestioned supremacy. All candidates were tested at Elis, in the gymnasium, before they were admitted to the athletic competitions at Olympia, and training (usually of ten months) at Elis was regarded as the most valuable preparation. Elean officials, who not only adjudged the prizes, but decided who should be admitted to compete, assumed the title of *Hellanodicae.*

Long before the overthrow of Pisa the list of contests had been so enlarged as to give the celebration a Panhellenic character. Exercises of Spartan type—testing endurance and strength with an especial view to war—had almost exclusively formed the earlier programme. But as early as the 25th Olympiad the four-horse chariot-race was added, an invitation to wealthy competitors from every part of the Hellenic world, and the recognition of a popular spectacular element, as distinct from athletic or military. Horse-races were added later. For such contests the *hippodrome* was set apart. Meanwhile the list of contests on the old racecourse, the *stadium,* had been enlarged. Besides the original foot-race in which the course was traversed once only, there were the double course (*diaulos*) and the "long" foot-race (*dolichos*). Wrestling and boxing were combined in the *pancration;* leaping, quoit-throwing, javelin-throwing, running and wrestling in the *pentathlon.* Under the protection of the Spartans, the festival acquired new importance for, having failed in their plans of actual conquest in the Peloponnese, they sought at least acknowledged predominance. While therefore the Eleans were the religious supervisors of Olympia the Spartans constituted

themselves its political protectors, enforcing the sanction which the Olympian Zeus gave to the amphictyones, whose federal bond was symbolized by common worship, and punishing violation of that "sacred truce" which was indispensable if Hellenes from all cities were to have peaceable access to the Olympian festival.

Olympia thus became a recognized Panhellenic institution after the establishment of Elean supremacy in 572 B.C.; and to the last remained a central expression of the Greek ideas that the body of man has a glory as well as his intellect and spirit, that body and mind should alike be disciplined, and that it is by the harmonious discipline of both that men best honour Zeus. The significance of Olympia was larger and higher than the political fortunes of the Greeks who met there, and it survived the overthrow of Greek independence. In the Macedonian and Roman ages the temples and contests of Olympia still interpreted the ideal at which free Greece had aimed. Philip of Macedon and Nero are among those who have record in the Altis. According to Cedrenus, a Greek writer of the 11th century (*Synopsis*, i. 326), the Olympian festival ceased to be held after A.D. 393, the first year of the 293rd Olympiad. The list of Olympian victors, which begins in 776 B.C. with Coroebus of Elis, closes with the name of an Armenian, Varastad, who is said to have belonged to the race of the Arsacidae. In the 5th century desolation had set in. The chryselephantine statue of the Olympian Zeus, by Pheidias, was carried to Constantinople, and perished in a great fire, A.D. 476. The Temple of Zeus was dismantled, either by Goths or by Christian zeal, in the reign of Theodosius II. (A.D. 402–450). The temple of Zeus, probably thrown down by earthquakes in the 6th century A.D., and the region south of it became a fortress, constructed from materials found among the ancient buildings.

**Excavations.**—The German excavations were begun in 1875, and completed in 1881. The deposit of earth over the Altis from the overflowing of the Cladeus had an average depth of 16 ft.; it was also necessary to excavate, especially on the west, the south and the east, several ancient buildings not included within the sacred precinct. Moreover in many places early Greek work had later Greek on top of it, or late Greek work had been overlaid with Roman.

The form of the Altis is not regularly rectangular. The west side is about 215 yd.; the south side is about equally long; the east side, about 200 yd.; the north side, behind the treasure-houses, about 275 yd.

## REMAINS WITHIN THE ALTIS

Within the Altis are three main groups of buildings:—(A) chief centres of religious worship; (B) votive buildings; (C) buildings connected with the administration or with the reception of visitors.

A. **Chief Centres of Religious Worship.**—1. There are traces of an altar near the Heraeum older than the great altar of Zeus, and probably the original centre of worship. The great altar of Zeus was of elliptic form; imposed on this basis, in two tiers, and also, lozenge-shaped, was the famous "ash-altar" at which the Iamidae, the hereditary family of seers, practised rites of divination by fire in virtue of which Olympia is saluted by Pindar as "mistress of truth."

2. The *Pelopium*, to the west of the Altar of Zeus, was a small walled precinct in which sacrifices were offered to the hero Pelops. In the middle was a low tumulus of elliptic form. A Doric gateway with three doors gave access on the south-west side.

The three temples of the Altis were those of Zeus, Hera and the Mother of the gods. All were Doric and completely surrounded by a colonnade.

3. *The Temple of Zeus*, south of the Pelopium, stood on a high substructure with three steps. It was probably built about 470 B.C. The colonnades at the east and west ends were of six columns, the north and south sides of thirteen. The cella had a prodomos on the east and an opisthodomos on the west. It was itself divided longitudinally by a double row of columns. The central, and widest, partition was in three sections; the western containing the throne and image of the Olympian Zeus; the middle section, a table and stelae, where, probably, the wreaths were presented to the victors; the eastern was open to the public. On the east pediment was represented in twenty-one colossal figures the moment before the contest between Oenomaus and Pelops; on the western the fight of the Lapithae and Centaurs. The statement of Pausanias that the two pediments were made by Paeonius and Alcamenes is now generally supposed to be an error. On the metopes of the prodomos and opisthodomos were depicted the Twelve Labours of Heracles.

Near this temple was found the statue of a flying goddess of victory—the Nike of Paeonius. (*See* GREEK ART.)

4. *The Temple of Hera* (Heraeum), north of the Pelopium, was on two steps. It is the oldest of extant Greek temples, and may date from about 1000 B.C. It was smaller than the temple of Zeus, and of unusual length relatively to its breadth. It has colonnades of six columns at east and west, and of sixteen at north and south. When Pausanias saw it, one of the two columns of the opisthodomos was of wood; and for long, probably, all the columns of this temple had been wooden, gradually replaced as they decayed in progressively later styles. Only the lower part of the cella wall was of stone, the rest of unbaked brick; the entablature was of wood covered with terra-cotta. The cella—divided, like that of Zeus, by a double row of columns—had four small screens, projecting at right angles from its north and south walls. In the third niche thus formed, from the east, on the north side, was found the Hermes of Praxiteles still preserved in the local museum. (*See* GREEK ARCHAEOLOGY.)

5. *The Temple of the Great Mother of the Gods* (Metroum) was smaller than the Heraeum. It stood to the east of it and had a different orientation. It was on three steps, and had six columns east and west by eleven north and south. The cella had prodomos and opisthodomos. It was probably built in the 4th century, and underwent a Roman restoration.

B. **Votive Edifices.**—These were erected, either by states or by individuals.

1. Twelve *Treasure-houses* on the north side of the Altis, immediately under the Cronion, have the same general character of a Doric temple *in antis*, facing south. Of several the fragments are sufficient for reconstruction. The 2nd and 3rd from the west had been dismantled early for a roadway winding upward towards the Cronion, which is itself older than A.D. 157. This explains the fact that, though we can trace twelve, Pausanias names only ten. Each treasure-house was erected by a Greek state, either as a thank-offering for Olympian victories gained by its citizens, or as a general mark of homage to Olympian Zeus, and to contain the dedicated gifts in which the wealth of the sanctuary consisted. Temple inventories discovered at Delos and at Lindus in Rhodes illustrate how such possessions accumulated at a shrine of Panhellenic celebrity. The treasure-houses were founded by the following states, in order from the west: 1. Sicyon; 2, 3, unknown; 4, Syracuse (referred by Pausanias to Carthage); 5, Epidamnus; 6, Byzantium; 7, Sybaris; 8, Cyrene; 9, Selinus; 10, Metapontum; 11, Megara; 12, Gela. While the majority are the Greek colonies, from Libya to Sicily, from the Euxine to the Adriatic, Greece proper is represented only by Megara and Sicyon. The dates of the foundations cannot be fixed. The Megarian treasury had pedimental figures of gods fighting with giants; others supplemented stonework with painted terra-cotta.

2. The *Philippeum* near the north-west corner of the Altis was dedicated by Philip of Macedon, after his victory at Chaeronea (338 B.C.), illustrating how his position and power enabled him without risking any revolt of Hellenic feeling to erect a monument of the overthrow of Greek freedom in the very heart of the Panhellenic sanctuary. The building had a circular Ionic colonnade about 15 metres in diameter, raised on three steps enclosing a circular cella, with fourteen Corinthian half-columns. It contained portraits by Leochares of Philip, Alexander and other members of their family, in gold and ivory.

3. The *Exedra of Herodes Atticus* at the north limit of the Altis by the N.E. angle of the Heraeum consisted of a half-dome of brick (54 ft. diam.), containing twenty-one marble statues, representing the family of Antoninus Pius, of Marcus Aurelius and of the founder. In front was a drinking trough, its ends adorned by very small temples with circular colonnade.

C. **Official Buildings** for the management of the sanctuary or the accommodation of guests.

1. Olympia, besides its religious character, originally was the centre of a political amphictyony. So, like a Greek city, it should have a public hearth, where fire should always burn, and where Olympia should exercise hospitality. The *Prytaneum* was at the N.W. corner of the Altis, close to the Heraeum. It was a square building containing a chapel of Hestia at the front.

2. The *Porch of Echo,* also called the "Painted Porch," extended 100 yd. along the east Altis wall. A single Doric colonnade, on three steps, open towards the Altis, afforded a place from which to view processions and the sacrifices at the great altar. Built in the Macedonian period, it replaced an earlier portico. In front were pedestals for votive offerings.

3. The *Agora* was that part of the Altis which had the Porch of Echo on the E., the Altar of Zeus on the W., the Metroum on the N., and the precinct of the Temple of Zeus on the S.W. Here stood altars of Zeus Agoraios and Artemis Agoraia.

4. The *Zanes* were bronze images of Zeus, erected out of the fines exacted for breaches of the rules of the contests. They stood at the N. side of the Agora, in a row, from the Metroum to the gate of the private entrance into the Stadium. Sixteen pedestals were here discovered *in situ.*

### REMAINS OUTSIDE THE ALTIS

A. *West Side.*—The wall bounding the Altis of the time of Nero has two gates, at its N. and S. ends. Each had on the west a portico of four columns. A smaller gate is nearly opposite the Pelopium.

West of this wall, between the Altis and the Cladeus, the following buildings succeed each other from north to south.

1. *The Gymnasium,* a large open space, enclosed on two sides at least by Doric colonnades, on the east by a double portico, more than a stadium in length (220 yd.), served as a racecourse for practice in bad weather. At the south-east corner was a Corinthian doorway, leading to the N.W. gate of the Altis. The gymnasium was used by competitors during the last month's training.

2. *The Palaestra,* for wrestlers and boxers, about 70 yd. square, containing rooms of different sizes, and enclosing a building surrounded by a Doric colonnade.

3. *A Byzantine Church* occupies the site of an older brick building, perhaps the "workshop of Pheidias" seen by Pausanias. Among adjacent structures an inscribed altar marks the *Heroum,* where worship of heroes was practised. The *Theocoleon,* a large building of Roman age, was probably the house of the priests. A long narrow building S. of the church may have been occupied by those alleged "descendants of Pheidias" (Pausanias v. 14) whose privilege it was to keep the statue of Zeus clean. The so-called "workshop of Pheidias" evidently continued to be used for actual work, and a lodging was required for the artists.

4. *The Leonidaeum,* dedicated by an Elean in the 4th century B.C., for the reception of distinguished visitors. Its orientation is from W.S.W. to E.N.E. An outer Ionic colonnade encloses suites of rooms, round a small interior Doric peristyle. In Roman times it was altered to distribute the rooms into four suites. The porticos show traces of much carriage traffic.

B. *South Side.*—The limits of the Altis towards the Alpheus can only be traced approximately, since architectural changes were numerous down to the latest times.

1. The *Council Hall* (*Bouleuterium*), nearly at the middle of the south wall, comprised two Doric buildings of different date but identical oblong form, divided by a single row of columns, terminating to W. in an apse. In the space between stood a small square building. In front, on the E. a portico covered the front of all three with a large fore-hall, enclosed by a colonnade.

2. *The South Colonnade,* a late but handsome structure, closed on the north side, with Doric colonnade to S.E. and W., and Corinthian columns within, served as a promenade and to view the processions.

3. *A Triumphal Gateway* of Roman age, with triple entrance, opens on the Altis, a little E. of the *Bouleuterium.*

C. *East Side.*—The line of the east wall can be followed from the N.E. corner of the Altis till it breaks off at the remains known as Nero's house.

1. *Nero's House* is a building of 4th-century date and uncertain purpose, afterwards absorbed into a Roman house, to make room for which the S. part of the E. Altis wall was destroyed. A leaden water-pipe bears NER. AVG., and since only a Roman master could have dealt thus with a building within the sacred precinct, it cannot be doubted that the Roman house—from which three doors gave access to the Altis—was that occupied by Nero when he visited Olympia. Later the building, further enlarged, may have been occupied by Roman officials.

2. *The Stadium* extends E. of the Altis from W.S.W. to E.N.E., and is entered from the N.E. angle. This position was due simply to the curve of the slopes which bound the valley. The Stadium is only cleared so far as was necessary for ascertainment of essential points. Low embankments had been built on W., E. and S., the N. boundary being formed by the natural slope. The space thus defined was about 234 yd. long by 35 broad. There were no artificial seats. From 40,000 to 45,000 spectators could have found sitting room. The exact length of the Stadium itself—which was primarily the course for the foot-race—was 192·27 metres (about 210 yd.), and consequently the Olympian foot was 0·3204 metre or 1·05 English foot. In the Heraeum, however, the unit adopted was not this Olympian foot, but an older one of 0·297 metre, and in the temple of Zeus an Attic foot of 1·08 English foot. The starting-point and the goal in the Stadium were marked by limestone thresholds. Drainage was by a marginal channel. The Stadium was used not only for foot-races, but for boxing, wrestling, leaping, quoit-throwing and javelin-throwing. The entrance from the N.E. corner of the Altis was reserved for the judges, competitors and heralds. It was a vaulted tunnel, 100 Olympian feet in length, probably constructed in Roman times. To the W. the Altis was entered by a gateway and vestibule.

3. *The Hippodrome,* in which chariot-races and horse-races were held, can no longer be accurately traced, owing to the overflowings of the Alpheus. But it is clear that it lay south and south-east of the Stadium, parallel with it, though stretching beyond it to the E. Its length was probably 770 metres or 4 Olympic stadia.

D. *North Side.*—A wall running E.–W. immediately N. of the Treasuries protects them from landslides off the *Hill of Cronus,* and carries the water channel of Herodes Atticus. Further W. it is doubtful whether the Altis was ever marked off from the "Hill of Cronus," which is associated with the oldest worship here.

*See* the official *Die Ausgrabungen zu Olympia* (5 vols., 1875–81); Laloux and Monceaux, *Restauration de l'Olympie* (1889); Curtius and Adler, *Olympia die Ergebnisse der Ausgrabungen* (1890–97), I. "Topographie und Geschichte," II. "Baudenkmäler," III. "Bildwerke in Stein und Thon," IV. "Bronzen," V. "Inschriften"; K. Boetticher, *Olympia* (1890); Daremberg-Saglio iv. (1904–05) *s.v.;* E. N. Gardiner, *Olympia, its History and Remains* (1925).

**OLYMPIA,** the capital city of Washington, U.S.A., and the county seat of Thurston county, at the extreme southern end of Puget Sound, 61 mi. S.S.W. from Seattle. It is on Federal highways 99, 101 and 410; has an airport of 205 ac. on the Pacific airway, 10 min. drive from the heart of the city; and is served by the Northern Pacific and the Union Pacific railways, motor-coach lines and steamboats. Pop. (1920) 7,795 (88% native white); 1930, 11,733; 1940, 13,254. The city occupies 6.5 sq.mi., and is surrounded on the landward sides by low green hills. On the south the Deschutes river flows through a rocky canyon to the sound. The snow-capped Olympics form the northern horizon, and to the east rises Mount Rainier. The streets are wide and straight; the public buildings stately. On a fir-clad promontory jutting into the sound stands the beautiful group of new state buildings, built of white stone in classic design, at a cost of $17,000,000. The trade of the port, valued (1941) at $10,000,000, consisted largely of floated logs, lumber and lumber products, sand and gravel, oysters and oyster shells, canned fruits, sugar, salt. The annual output of the factories is valued at $20,000,000. The city has a commission form of government. Assessed valuation of property in 1941 was $5,888,315. Olympia is the

gateway to the Olympic peninsula, and is headquarters of the Olympia National Forest service. The first settlement on Puget sound was made in 1846 at the falls of the Deschutes river, on the site of Tumwater, a mile south of Olympia, under the leadership of Michael T. Simmons, from Kentucky, but in 1849 it was practically deserted when the men left for the California goldfields. In 1851 a town (at first called Smithfield) was laid out where Olympia now stands. In 1852 the first newspaper north of the Columbia was established here (the *Columbian*) and in 1853 the town became the capital of the newly created Territory of Washington. It was chartered as a city in 1859. A tablet indicates the site of the first capitol and first governor's mansion. A monument in Capitol park marks the terminus of the Old Oregon trail.

**OLYMPIAD,** in Greek chronology, a period of four years, used as a method of dating for literary purposes. The four years were reckoned from one celebration of the Olympian games to another, the first Olympiad beginning with 776 B.C., the last with A.D. 394, when they were abolished during the reign of Theodosius the Great. The system was first regularly used by the Sicilian historian Timaeus (352–256 B.C.) (*see* CHRONOLOGY).

**OLYMPIAS,** daughter of Neoptolemus, king of Epirus, wife of Philip II. of Macedon, and mother of Alexander the Great. The marriage took place in 359 B.C., shortly after Philip's accession, and Alexander was born in 356. Philip married a new wife, Cleopatra, in 337, and Olympias and Alexander withdrew into Epirus, whence they both returned in the following year, after the assassination of Philip, which Olympias is said to have countenanced. During the absence of Alexander, with whom she regularly corresponded on public as well as domestic affairs, she had great influence, and on Alexander's death in 323 withdrew to Epirus, owing to her hostility to Antipater the regent. In 319 she allied herself with Polyperchon, Antipater's successor, and became ruler of Macedonia. Cassander, Antipater's son, hastened from Peloponnesus, and, after an obstinate siege, compelled the surrender of Pydna, where she had taken refuge. One of the terms of the capitulation had been that her life should be spared; but she was brought to trial for the numerous executions which she had ordered during her reign. Condemned without a hearing, she was put to death in 316 by the friends of those she had slain, the promise to spare her life being disregarded.

*See* Plutarch, *Alexander,* 9, 39, 68; Justin, vii. 6, ix. 7, xiv. 5, 6; Arrian, *Anab.* vii. 12; Diod. Sic. xviii. 49–65, xix. 11–51; also the articles ALEXANDER III. THE GREAT and MACEDONIAN EMPIRE.

**OLYMPIC GAMES** (*see* ATHLETIC SPORTS, STADIUM, and GAMES, CLASSICAL). The modern revival of the Olympic Games is due to Baron Pierre de Coubertin (1863–1937), who on Jan. 15, 1894, addressed a circular to all the governing bodies of sport in which he pointed out the educational value of sport to modern peoples, if practised in accordance with the ancient Greek ideals.

**The Modern Revivals.**—The instauration of the Olympic Games took place at Athens in 1896, on the site where the ancient festivals had concluded 1,500 years before. Subsequent celebrations were held at Paris (1900), St. Louis, U.S.A. (1904), London (1908), Stockholm (1912), Antwerp (1920), Paris (1924), Amsterdam (1928), Los Angeles (1932) and Berlin (1936). The first three celebrations were largely experimental. The Games of the Vth Olympiad (Berlin) in 1916 were not celebrated. The 1940 Games, scheduled for Tokyo, then Helsinki, were cancelled because of World War II.

**Organization.**—Of the International Olympic committee Baron Pierre de Coubertin was for many years president, being succeeded by Count Baillet-Latour (1876–1942). It is the central policy-making body of the Olympic movement.

Besides this central committee, on which all nations are represented, each nation has its own Olympic association and its own Olympic council. The British Olympic council, which may be taken as typical of most of the rest, has one or more members of every association governing the sports in which Great Britain is represented at the games, and a few other co-opted members chosen for their special knowledge or experience in organization.

As regards the American organization, its most important aspect is its continuing character as exemplified in the structure of the American Olympic Association. The American Olympic Committee is created by the American Olympic Association in the second year before each meeting. Of the committee, the initial members are the President of the United States as honorary president; five honorary vice-presidents, the Secretaries of State, of War and of the Navy, the Ambassador or Minister of the United States to the country in which the Games are to be held, the Ambassador or representative of such country to the United States; the honorary and regular officers of the Association and the officers of former American Olympic committees. The Executive Committee of the Association adds to the committee from representatives of members of the Association and the public at large. The committee chooses its own active officers, who carry out the details of organization.

**Records.**—Records obtained at the Olympic Games from 1896 to 1936 in the various athletic events are shown in Table I. and for purposes of comparison the corresponding world records are shown in Table II.

It should be noted that 100 metres = 109·3 yards; 200 metres = 218·7 yards; 400 metres = 2·6 yards less than a quarter of a mile; 1,500 metres = 119·6 yards less than a mile. 110 metres (hurdles) is nearly 11 inches over 120 yards. The marathon race is 42·263 kilometres or 26 miles 385 yards.

TABLE I. *Olympic Records*

| Event | Games | Holder | Country | Time or distance |
|---|---|---|---|---|
| 100 metres | Los Angeles 1932 | E. Tolan | U.S.A. | 10.3s. |
| | Berlin 1936 | J. Owens | U.S.A. | 10.3s. |
| 200 metres | Berlin 1936 | J. Owens | U.S.A. | 20.7s. |
| 400 metres | Los Angeles 1932 | W. Carr | U.S.A. | 46.2s. |
| 400 metres relay | Berlin 1936 | U.S.A. | | 39.8s. |
| 800 metres | Los Angeles 1932 | T. Hampson | Gt. Britain | 1–49.8s. |
| 1,500 metres | Berlin 1936 | J. E. Lovelock | N. Zealand | 3–47.8s. |
| 1,600 metres relay | Los Angeles 1932 | U.S.A. | | 3–8.2s. |
| 3,000 metres steeplechase | Berlin 1936 | V. Isohollo | Finland | 9–3.8s. |
| 5,000 metres | Berlin 1936 | G. Hoeckert | Finland | 14–22.8s. |
| 10,000 metres | Los Angeles 1932 | J. Kusocinski | Poland | 30–11.4s. |
| Hurdles (110 metres) | Berlin 1936 | F. Towns | U.S.A. | 14.1 s. |
| Hurdles (400 metres) | Los Angeles 1932 | G. Hardin | U.S.A. | 52.0 s. |
| Marathon (26m. 385 yds.) | Berlin 1936 | K. Son | Japan | 2.29–19.2s. |
| Road walk 50 kilometres (31m. 220 yds.) | Berlin 1936 | H. Whitlock | Gt. Britain | 4.30–41.0 s. |
| High jump | Berlin 1936 | C. Johnson | U.S.A. | 6ft. 8.0 in. |
| Long jump | Berlin 1936 | J. Owens | U.S.A. | 26ft. 5.31 in. |
| Hop, step and jump | Berlin 1936 | N. Tajima | Japan | 52ft. 6.0 in. |
| Pole vault | Berlin 1936 | E. Meadows | U.S.A. | 14ft. 3.25in. |
| Shot | Berlin 1936 | H. Woellke | Germany | 53ft. 1.25in. |
| Hammer | Berlin 1936 | W. Hein | Germany | 185ft. 4.9in. |
| Javelin | Los Angeles 1932 | M. Jarvinen | Finland | 238ft. 7.0 in. |
| Discus | Berlin 1936 | K. Carpenter | U.S.A. | 165ft. 5.39in. |
| Decathlon* | Berlin 1936 | G. Morris | U.S.A. | 7,900 pts. |

*Scoring in accordance with new Finnish Table adopted by I.A.A.F. in 1934.

The events in Tables I. and II. all occur in track and field athletics, which is only one division of the games. In 1908 the United Kingdom, with 839 entries, scored 57 first places and five more went to the Dominions; the United States with 160 entries scored 22 first places. The remaining 22 first places went to the 1,529 entries from all other nations. In 1912 the United Kingdom, with 526 entries, scored ten first places and eight more went to the Dominions; the United States with 572 entries scored 24 first places; the remaining 36 first places went to the 3,651 entries from other nations. The post-War celebrations have been noteworthy, first, for the growth of amity and the decrease of "incidents," and, secondly, for the steady improvement in the standard of performance and consequent breaking of records.

TABLE II. *World's Records*

| Event | Date | Holder | Time or distance |
|---|---|---|---|
| 100 metres | 6.8.34. | E. Peacock, U.S.A. | 10.3s. |
| | 26.8.34. | C. Berger, Holland | |
| | 15.9.34. | R. Metcalfe, U.S.A. | |
| | 25.9.34. | R. Metcalfe, U.S.A. | |
| 200 metres | 25.5.35. | J. Owens, U.S.A. | 20.3s. |
| 400 metres | 19.6.36. | A. Williams, U.S.A. | 46.1 s. |
| 400 metres relay | 9.8.36. | U.S.A. (J.Owens, R.Metcalfe, F.Wykoff, F.Draper) | 39.7s. |
| 800 metres | 2.8.32. | T. Hampson, Gt. Britain | 1–49.8s. |
| | 16.6.34. | B. Eastman, U.S.A. | |
| 1,500 metres | 6.8.36. | J. E. Lovelock, N.Zealand | 3–47.8s. |
| 1,600 metres relay | 7.8.32. | U.S.A. (I.Fuqua, E.Ablowich, K.Warner, W.Carr) | 3–08.2s. |
| 3,000 metres s'chase | 8.8.36. | V. Isohollo, Finland | 9–03.8s. |
| 5,000 metres | 19.6.32. | L. Lehtinen, Finland | 14–17.0 s. |
| 10,000 metres | 31.8.24. | P. Nurmi, Finland | 30–06.2s. |
| Hurdles (110m.) | 19.6.36. | F. Towns, U.S.A. | 14.1 s. |
| | 6.8.36. | F. Towns, U.S.A. | |
| Hurdles (400m.) | 26.7.34. | G. Hardin, U.S.A. | 50.6s. |
| Marathon 26 mi. 385 yds. | 9.8.36. | K. Son, Japan | 2.29–19.2s. |
| Road walk. 50 Km. (31 mi. 220yds.) | 5.8.36. | H. Whitlock, Gt. Britain | 4.30–41.0 s. |
| High jump | 12.7.36. | C. Johnson, U.S.A. | 6ft. 9¾in. |
| | | D. Albritton, U.S.A. | |
| Long jump | 25.5.35. | J. Owens, U.S.A. | 26ft. 8¼in. |
| Hop, step & jump | 6.8.36. | N. Tajima, Japan | 52ft. 6in. |
| Pole vault | 4.7.36. | G. Varoff, U.S.A. | 14ft. 6½in. |
| Shot (16 lbs.) | 5.8.34. | J. Torrance, U.S.A. | 57ft. 1 in. |
| Hammer (16 lbs.) | 17.8.13. | P. Ryan, U.S.A. | 189ft. 6½in. |
| Javelin | 7.9.34. | M. Jarvinen, Finland | 251ft. 6in. |
| Discus | 28.4.35. | W. Schroder, Germany | 174ft. 2½in. |
| Decathlon* | 7&8.8.36 | G. Morris, U.S.A. | 7,900 pts. |

*Points scored according to the new system adopted by the I.A.A.F. in 1934.

In 1920 the United States won 22 first places; Great Britain took 8; the Dominions 4; Belgium, the organizing country, 1; and the remaining 65 first places were divided among all the other nations. In 1924, with 424 entries, the United States won 27 first places; Great Britain, with 443 entries, won 6; and the Dominions 4; France, the organizing country, won 4. The remaining 69 first places (without counting winter sports, in which Norway won easily with Finland second) were divided among all the other nations. These figures are not taken from victories in the athletic sections only, but from the full programme.

In 1928 America scored 24 first places, Finland and Germany 10 each and Sweden 9. France, Italy, Holland and Norway came next, then Canada and Switzerland, Great Britain scoring only 3 firsts, as did Argentina.

Women's athletics were for the first time included at this Olympiad. Great Britain refrained from entering a team. Canada, with 2 victories, beat America, Germany and Poland, each of which scored one first place.

These results include the winter sports, in which Scandinavian athletes were pre-eminent.

The IXth Olympiad, at Amsterdam, was carried through in the best sporting spirit which had up to then prevailed at any celebration of the Games since their revival at Athens in 1896, particular credit being due to the Americans for the sporting way in which they accepted their unexpected reverses on the track and in the hurdle races. The much more even distribution of premier honours in all classes of competition, combined with the fact that the IXth Olympiad was almost entirely free from unpleasant or untoward incidents, proves clearly that the Olympic Games are performing admirably their function of spreading the cult of sport and sportsmanship throughout the whole world, while the successes of such countries as Egypt, Japan and the South American republics, previously regarded as non-athletic nations, were entirely satisfactory. The roughness of the water polo matches, the discontent with the boxing decisions and the demand of the Association football players for payment as compensation for broken time, seemed to indicate clearly, however, that all sports involving personal physical contact, or in which the element of professionalism largely prevails, might possibly be expunged from the schedule of Olympic contests.

**The Games in 1932.**—The Winter Games of the Xth Olympiad were held at Lake Placid, U.S.A., and among the 17 nations taking part first places were scored by U.S.A. 6, Norway 3, and Canada, Sweden, Finland, Austria and France 1 each. Great Britain and Japan alone failed to secure even a sixth place. Canada again won the Ice Hockey Tournament; America predominated in speed skating and bobsleighing, and Norway in ski-jumping.

The Summer Games were celebrated at Los Angeles, U.S.A. from July 30 to August 14. Entries were limited to 3 competitors in each individual event and 1 team per relay race. The programme comprised 14 sports, *i.e.* athletics, swimming, boxing, wrestling, fencing, rowing, cycling, yachting, shooting, modern pentathlon, weight-lifting, gymnastics, equestrianism and field hockey. In these events 37 countries, represented by 1,429 actual competitors, took part.

The athletic programme, comprising 23 events, was contested by 330 men representing 34 nations, and 20 World's or Olympic records were broken. In the 6 women's events there were 54 entries from 11 countries, and all 6 World's records were broken.

Olympic records were equalled or beaten in all 5 weight-lifting events. In fencing 15 nations took part, the U.S.A. swordsmen showing marked improvement. British India remained invincible in field hockey. Track honours in cycling were equally divided between Australia, France, Holland and Italy, but the latter country predominated in the road race. Sweden came first of the 18 nations contesting the 124 wrestling bouts, but U.S.A. was well in the picture.

The modern pentathlon, comprising 5 widely different events, drew a total entry of 25 all-round athletes, the representatives of 11 nations. Never before had this epic event been so keenly contested, and Sweden maintained her time-honoured supremacy with a veteran team which included Lindman, victor at Paris, 1924, and 2nd at Amsterdam, 1928; Thofelt, the 1928 champion; and Count Oxenstierna, a newcomer who, although not placed first in any of the 5 events, yet won the modern pentathlon title.

The yachting events took place in the Pacific Ocean off the Port of Los Angeles. There were 4 classes in which 11 nations made 24 entries. France took 2 first places, Sweden and America 1 each.

The aquatic events were notable for the phenomenal success of Japan. Japanese competitors won every race except one, which went to America. U.S.A. was outstanding in diving for both men and women and also won 4 of the 5 women's races, the other going to Australia. Records were lowered constantly.

**The Games in 1936.**—Organization and record breaking at Los Angeles have been held to be something that would never be surpassed. The XIth Olympiad at Berlin, however, showed organization at least as efficient as at Los Angeles and even more wonderful achievements in sport. The standardized Olympic programme was contested without "incidents."

The Winter Games of the XIth Olympiad were opened by Herr Hitler in a blizzard at Garmisch-Partenkirchen on Feb. 6, 1936. Approximately 1,000 men and women, representing 28 nations, took part, 307 representatives of 17 countries being the highest previous total. Before the Games closed on February 16, Norway

had established a clear supremacy with 8 wins, no other nation scoring more than 2 first places. Great Britain wrested the ice hockey title from Canada. Many records were broken.

No less than 53 nations took part in the summer session of the Games, held at Berlin from August 1 to August 16, 1936. The Germans, on their own soil, achieved the highest honours; for in the total of 120 odd events they achieved 31 first places. U.S.A. came next with 25 wins, Hungary being a poor third with 9 wins. Great Britain, scoring only 4 victories, was 10th in total reckoning. Twenty-one nations won medals for first places. World's records were set up in athletics (6), shooting (2) and swimming (1); Olympic records being established in athletics (19), swimming (10), weight-lifting (6) and shooting (2).

The preponderant nations in the various sports were: athletics, U.S.A. 14 first places, followed by Germany 5; weight-lifting, Egypt and U.S.A. 2 each; boxing, Sweden 4, Hungary 3; cycling, France 3, Germany 2; fencing, Italy 4, Hungary 3; canoeing (a new Olympic event) Austria 3, Germany and Czechoslovakia 2 each; shooting, Germany, Norway and Sweden 1 each. The team games resulted in wins for British India, hockey; Italy, Association football; Germany, handball; U.S.A. basketball and Argentina, polo. In the modern pentathlon Sweden's supremacy was at last broken, the result being Germany 1st, U.S.A. 2nd and Italy 3rd.

A significant circumstance of the last two celebrations of the Games has been the advance of negro athletes. At Los Angeles Tolan, Metcalfe, Johnson and Gordon, U.S.A. and Edwards, Canada, were outstanding; at Berlin, J. Owens, U.S.A. who has made 4 World's records in one afternoon, was pre-eminent, while his fellow negroes, Williams, Metcalfe, Luvalle, Robinson, Pollard, Woodruff, Johnson and Albritton (U.S.A.) and Edwards and Richardson (Canada), all attained distinction. The Japanese were hardly less remarkable in athletics and more so in swimming.

Of the 23 Olympic records given in Table I., not a single one of these standing when the Olympic Games were held at Amsterdam in 1928 now remains unbroken.

At the Xth Celebration at Los Angeles in 1932, 19 new Olympic records were made. Those which remained unbroken in the now standardized Olympic Programme were the high jump, 6 ft. 6 ins., H. M. Osborn, U.S.A., 1924; broad jump, 25 ft. $4\frac{3}{4}$ ins., E. B. Hamm, U.S.A., 1928, and 16 lb. hammer, 179 ft. 8·4 ins., M. McGrath, U.S.A., 1912.

At the XIth Olympic Games, Berlin, 1936, the last of the pre-1932 records was disposed of. Of the records made in 1932, that for 100 metres was equalled and 16 new records were made.

As regards World's records (Table II.):—Of those given for comparison with the Olympic records, only that for throwing the hammer (P. Ryan, U.S.A., 189 ft. $6\frac{1}{2}$ ins.) dates from the pre-War period, and this was closely approached by W. Hein, Germany, throwing over 185 ft. for his Olympic title in 1936. None of the other records is older than the celebration of the Olympic Games at Los Angeles in 1932.

In the course of the 1932 Olympic Games 8 new World's records, and at Berlin, 1936, 6 new World's records were made, and two of the older World's records were equalled.

That the Olympic movement is fulfilling the ideals of its founder there can be no doubt. Early celebrations of the Games were sometimes marred by undignified squabbles and unpleasant incidents. In those days the number of competitors was small and unrepresentative of a world-wide movement. In the days of ancient Greece competitive athletics were confined to the cities, islands and colonies of the eastern end of the Mediterranean. Today the sport is followed throughout the world, and all five continents and the islands of the seven seas send their competitors to the modern Olympic Games. There is no distinction of creed, class or colour, and by comparison with the modern festivals the ancient celebrations must appear parochial.

The world has become sport-minded through the example set and the sporting education provided by the English-speaking races. In individual sports unpleasantness at the Olympic Games is now unknown. It is, moreover, significant that, except for the bad behaviour of a South American water polo team at Los Angeles in 1932, and some small bickering among Association football players in Berlin in 1936, the last two celebrations of the Games have been entirely free from incidents of an unpleasant character in team events.

The celebrations at Los Angeles and Berlin, in the matter of organization, management, equipment and housing, were surprisingly efficient. The XIIth Celebration of the Games was scheduled to take place in 1940. The festival was to be held in Tokyo, was later planned for the Finnish capital of Helsinki, and was finally cancelled entirely because of World War II.

BIBLIOGRAPHY—Official reports of each session of the Olympic Games from 1908 onwards have been issued by the U.S.A. and British Olympic Associations. F. A. M. Webster, *The Evolution of the Olympic Games* (1914); W. Keizan, *The Olympic Games* (1936).

(F. A. M. W.)

**OLYMPIODORUS,** the name of several Greek authors, of whom the chief are: (1) An historical writer (5th century A.D.), born at Thebes in Egypt, who was sent on a mission to Attila by the emperor Honorius in 412, and later lived at the court of Theodosius. He was the author of a history (Ἱστορικοὶ Λόγοι) in 22 books of the Western Empire from 407 to 425. The original is lost, but an abstract is given by Photius. A MS. on alchemy ascribed to him and preserved in the National Library in Paris, was printed with a translation by P. E. M. Berthelot in his *Collection des alchimistes grecs* (1887–88).

(2) A Neoplatonist philosopher, also of Alexandria, who flourished in the 6th century A.D., during the reign of Justinian. He seems to have carried on the Platonic tradition after the closing of the Athenian School in 529. He is important as a critic and a commentator, and preserved much that was valuable in the writings of Iamblichus, Damascius and Syrianus. He made a close and intelligent study of the dialogues of Plato, and his notes, formulated and collected by his pupils (*ἀπὸ φωνῆς Ὀλυμπιοδώρου τοῦ μεγάλου φιλοσόφου*), are extremely valuable. In one of his commentaries he makes the interesting statement that the Platonic succession had not been interrupted by the numerous confiscations it had suffered. Zeller points out that this refers to the Alexandrian, not to the Athenian, succession; but internal evidence makes it clear that he does not draw a hard line of demarcation between the two schools. The works which have been preserved are a life of Plato, an attack on Strato and Scholia on the *Phaedo, Alcibiades I., Philebus* and *Gorgias*.

*See* Überweg, *Grundriss der Gesch. der Philosophie,* Bd. I. (1926).

**OLYMPUS,** the name of many mountains in Greece and Asia Minor, and of the fabled home of the gods; also a city name and a personal name.

I. Of the mountains (1) the most famous is the lofty ridge (mod. Gk. *Elympo*) on the borders of Thessaly and Macedonia; nearly 10,000 ft. high, covered with snow for a great part of the year. The great gorge of Tempe close below the south-eastern end separates it from Mount Ossa. Olympus is of massive appearance, rising in precipices broken by ravines, above which is the summit of naked rock concave toward the north-west. The lower parts are densely wooded. (2) The peak of Mount Lycaeus in the south-west of Arcadia. (3) East of Olympia, on the north bank of the Alpheus; (4) beside Sellasia in Laconia. The name was even commoner in Asia Minor; a lofty chain in Mysia (Keshish Dagh), a ridge east of Smyrna (Nif Dagh), other mountains in Lycia, in Galatia, in Cilicia and in Cyprus.

II. In the *Iliad* the gods are described as dwelling on a lofty peak, rising high above the clouds of the lower atmosphere into the clear ether; in the *Odyssey* Olympus is more remote and less definite; the notions of later poets vary from a definite mountain to a vague conception of heaven. In literary mythology, though each deity had special haunts, all had residence at the court of Zeus on Olympus; here were their assemblies and feasts.

**OLYNTHUS,** an ancient city at the head of the Gulf of Torone, in Chalcidice, near the neck of the peninsula of Pallene, about 60 stadia (7 or 8 m.) from Potidaea. It may have been a colony of Chalcis, and struck coins early, but the district belonged to a Thracian tribe, the Bottiaeans, who held the town

till 479 B.C., when the Persian general Artabazus, on his return from escorting Xerxes to the Hellespont, suspecting that a revolt from the great king was meditated, slew the inhabitants and handed the town over to Greeks from Chalcidice. Olynthus thus became a Greek *polis,* but it remained insignificant in the lists of the Delian league until 432. King Perdiccas of Macedon added to its population the inhabitants of Chalcidian towns in the neighbourhood (Thucyd. i, 58). Henceforward the chief Hellenic city west of the Strymon, it revolted from Athens, formed a base for Brasidas' expedition (424) and was never again reduced. In the 4th century it was the head of the Chalcidic league which may be traced back to the peace of Nicias (421), when the Chalcidians acted in common and were enrolled as allies of Argos. The motive for its formation is almost certainly to be found in fear of Athens. Coins of the league can be dated as early as 405; one specimen may go back to 415–420. After the Peloponnesian war the league concluded an important treaty, about 390, with Amyntas, king of Macedon (the father of Philip), and by 382 it had absorbed most of the Greek cities west of the Strymon, and even held Pella, the chief city in Macedonia. But in this year Sparta was induced by an embassy from Acanthus and Apollonia, not yet included by the league, to attack; and Olynthus, after three years of indecisive warfare, formally dissolved the confederacy (379). Chalcidians, however, appear among the Athenian naval confederacy of 378–377. Twenty years later, in the reign of Philip, the power of Olynthus is asserted by Demosthenes to have been much greater than before the Spartan expedition, and the league included 32 cities. When war broke out between Philip and Athens (357), Olynthus was at first in alliance with Philip. Subsequently, it concluded an alliance with Athens; but in spite of all the efforts of the Athenians and their orator, Demosthenes, Philip razed it in 348.

BIBLIOGRAPHY.—Herodotus viii, 127; Thucydides i, 58; Xenophon, *Hell.* v, 2; Demosthenes *Olynthiacs* and *De fals. leg.,* 263–6; Diodorus xvi, 53, 2; Hicks *Manual of Greek Inscriptions* Nos. 74, 81; Head, *Historia Numorum, s.v.;* British Museum *Catalogue of Greek Coins, s.v.* Excavations by an American mission are in progress.

**OLYPHANT,** an anthracite-mining borough of Lackawanna county, Pennsylvania, U.S.A., on the Lackawanna river, six mi. N.N.E. of Scranton; served by the Delaware and Hudson and the New York, Ontario and Western railways, and for freight also by the Erie and the Lackawanna. Pop. (1920) 10,236 (29% foreign-born white); (1940) 9,252.

**OMAGH** (ō′mah), a market town, urban district and county town of Co. Tyrone, Northern Ireland, on the Strule, 66 mi. W. of Belfast by the G.N.R. Pop. (1937) 5,741. Area, 1.6 sq.mi. The town is situated on a steep slope above the river. There are milling and linen industries, and a monthly fair is held. The castle, of which there are scanty remains, was besieged in 1509 and 1641, being rebuilt after its total destruction in the first case.

**OMAHA.** This Siouan tribe of Nebraska, closely associated with the Ponca, combined agriculture with seasonal buffalo hunting. Since 1829 they have numbered between 1,200 and 1,500. They were organized into moieties and ten patrilineal clans. *See* J. O. Dorsey, *Bur. Am. Ethn. Rep.* xv, (1897); A. C. Fletcher and F. La Flesche, *ibid.* xxvii (1911).

**OMAHA,** the largest city of Nebraska, U.S.A., a port of entry, and the seat of Douglas county; on the west bank of the Missouri river, 500 mi. W. by S. of Chicago. It is on federal highways 6, 30, 73, 75 and 275; is served by bus lines and is on one of the four coast-to-coast air lines and has direct connections with the others. It has a municipal airport of 839 ac.

Omaha is the fourth largest rail centre and is served by the Burlington, the Chicago and North Western, the Chicago Great Western, the Chicago, Milwaukee, St. Paul and Pacific, the Chicago, St. Paul, Minneapolis and Omaha, the Illinois Central, the Missouri Pacific, the Rock Island, the Union Pacific and the Wabash. The population was 214,006 in 1930 (13·5% foreign-born white and 5·2% Negroes) and was 223,844 in 1940, an increase of 4·6%.

Omaha has an altitude ranging from 940 to 1,270 ft. The original town site of 270 blocks, an elongated terrace above the river, is now entirely a business quarter, and gradually the city has extended over the hills and bluffs beyond, until it covers 40 sq.mi. The stockyards and packing plants are on the south side (formerly an independent municipality, with a population in 1910 of 26,259), which was annexed in 1915. There are 45 parks, with an aggregate area of 2,100 ac., connected by 125 mi. of boulevard; 31 supervised playgrounds for children, 5 municipal golf courses and 4 country clubs. Fontenelle Forest Reserve covers 1,800 ac. and is the largest unbroken tract of native forest in the state. Ft. Crook (10 mi. S.) and Ft. Omaha, in the northern part of the city, are important military posts. Ft. Crook is the site of the $13,000,000 Martin bomber assembly plant built by the government and operated by the Glenn L. Martin Co. of Baltimore. The plant has a productive capacity of $11,000,000 per month. The public school system comprises 55 elementary and 5 high schools, representing an investment of $20,000,000 and an annual expenditure of $4,000,000 for salaries and maintenance. The parochial system adds 34 elementary and 9 high schools. Among the other educational institutions are Nebraska School for the Deaf (1867); the University of Nebraska college of medicine; Creighton university (1878; enrolment 2,500 in 1941, conducted by the Jesuits), comprising seven colleges and a high school; the University of Omaha (originally a Presbyterian institution, now municipal, founded 1908, enrolment 3,555, 1941); and the Presbyterian Theological seminary (1891). Principal newspaper is the Omaha *World-Herald,* formed in 1889. Among the 60 other periodical publications is the *Daily Journal Stockman* devoted to the livestock industry. Omaha has a community playhouse, a drama club and ten musical organizations. Ak-Sar-Ben (Nebraska spelled backwards) is a civic organization with 7,200 members (formed in 1895 to promote interest in the history and progress of the city and the state) which is nationally famous for its livestock shows, horse shows, racing meets, coronation balls, ice hockey and ice revues.

Omaha is the see of Roman Catholic and Protestant Episcopal bishoprics and a district headquarters of the Methodist Church and the Presbyterian Church, and is Baptist state headquarters. There are more than 200 churches and missions in the city. Omaha has 11 hospitals. Thirty of the charitable organizations are financed jointly through a community chest which has an annual budget of about $540,000. The proportion of homes owned by their occupants is high and is increasing (39·8% in 1910; 51·7% in 1930). The percentage of illiteracy is low. Boys Town, site of the internationally famous Father Flanagan's boys' home, is located 11 miles west of Omaha. Hundreds of thousands visit the modern farm and plant each year. The home has facilities for 500 boys. Joslyn Memorial, a $4,000,000 art museum, is per capita the nation's second most popular art centre.

There is a telephone for every 3·4 persons, and an automobile for every 4·6. The city operates under a "home rule" charter of 1923, providing for a commission form of government, with elections every three years. The assessed valuation of property for 1940 was $239,002,678.

Omaha is the headquarters of the 7th corps area of the U.S. army; 2nd military area, U.S. army; the Northwestern Bell Telephone company, the Union Pacific railway system, and the western division of the Chicago, Burlington and Quincy and the Chicago and North Western lines. It has the largest federal land bank in the U.S.A. (on the basis of loans granted) and is the seat of a branch bank of the Federal Reserve system. It is one of the principal railroad centres of the country. The ten trunk-line roads entering the city have 62,547 mi. of track. With bank clearings of $1,613,983,021 in 1940, Omaha ranks 23rd among the cities of the United States, though 39th (1940) in population. It is the largest retail centre between Chicago and Denver; an important insurance centre, with 33 home-office companies and branches of many others, and one of the leading manufacturing and wholesale distributing centres of the country. The total output of its 372 manufacturing firms in 1939 was valued at $193,500,000 (about three-fourths of the total for the state), of which $100,000,000 represented packing-house products. Its 678 wholesale houses distributed merchandise valued at $390,754,000 in 1939. It ranks first in the production of butter,

is a primary grain market and milling market, and one of the largest general livestock markets and meat-packing centres.

**History.**—In 1804 Meriwether Lewis and William Clark camped on the Omaha plateau, and in 1825 a licensed Indian trading post was established here. Fur traders and trappers frequented the region through the first half of the 19th century. In 1846 the Mormons settled at "Winter Quarters" (called Florence after 1854, and annexed to Omaha in 1917), but in 1848 they were obliged to move, as it was within the Indian reservation. Some 12,000 of them built camps in this vicinity, on both sides of the Missouri, in 1846 and 1847, from which gradually they emigrated to Utah, but their local influence was strong for nearly a decade. Speculative "squatters" intruded on the Indian lands in 1853, and a rush of settlers followed the opening of Nebraska Territory in 1854. Omaha (named from the Omaha Indians) was laid out in 1854 and chartered as a city in 1867. Prairie freighting and river traffic were important before the construction of the Union Pacific railroad, which was begun in Dec. 1863. The city was an important outfitting point during the rush to the Colorado gold-fields. Connection by telegraph was established with San Francisco in 1861, with Chicago and St. Louis in 1863. The Union Pacific Railroad bridge across the Missouri was completed in 1869. The Rock Island, the Burlington, and the North Western railways entered the city in 1867 and 1868. Meat packing began as early as 1871, and grew rapidly after 1884, when the Union Stock Yards company was formed and yards established in South Omaha. In 1860 the population was 1,883; 16,083 in 1870; and 30,518 in 1880. In the next 20 years it increased 236%, and between 1900 and 1920, 87%. In the first quarter of the 20th century receipts of grain increased about threefold, the value of the manufactures almost fourfold; the volume of the wholesale business was multiplied (roughly) by 8; bank clearings by 7; and the city's assessed valuation by $4\frac{1}{2}$.

**OMALIUS D'HALLOY, JEAN BAPTISTE JULIEN D'** (1783–1875), Belgian geologist, was born on Feb. 16, 1783, at Liége, and educated in Liége and Paris. He became *maire* of Skeuvre in 1807, governor of the province of Namur in 1815, and from 1848 senator. He died on Jan. 15, 1875. His chief works were: *Mémoires pour servir à la description géologique des Pays-Bas, de la France et de quelques contrées voisines* (1828); *Eléments de géologie* (1831, 3rd ed. 1839); *Abrégé de géologie* (1853, 7th ed. 1862); *Des races humaines, ou éléments d'ethnographie* (5th ed., 1869).

**OMAN, SIR CHARLES WILLIAM CHADWICK** (1860– ), British historian, was born at Mozufferpore, India, the son of a tea planter, on Jan. 12, 1860. Educated at Winchester and at New college, Oxford, he was made a fellow of All Souls in 1883. In 1905 he became Chichele professor of modern history at Oxford and he was chosen a fellow of the British Academy in the same year. He was president of the Royal Historical Society 1917–21. In 1919 he was elected M.P. for the University of Oxford and in 1920 he was knighted. His most important work was done in military history. His works include: *History of the Art of War in the Middle Ages* (1898, new ed. 1924); *History of Greece* (1890); *A Short History of England* (1895, new ed. 1920); *A History of the Peninsular War 1807–13* (7 vols., 1902–30); and *Napoleonic Studies* (1929).

**OMAN** ('Umān), a nominally independent state in southeastern Arabia, extending from Ras Musandam, on the Gulf of Oman, to the eastern limits of Hadhramaut at Ras Sajar (lat. 16° 8″ N.) on the Indian ocean. Inland the state is bounded by the Empty Quarter. The population is about 795,000, chiefly Arabs, with a strong Negro element in the coastal regions and the area about 82,000 sq.mi. The prevailing religion is Ibadhite Moslem.

Oman is a mountainous district forming part of the ancient land mass of Arabia, granite and limestone rocks being most in evidence. The high ground culminates in Jabal Akhdar (9,900 ft.), which is flanked by steps of the old mountain block down to the coast. In this way access from the harbours (of which that of Muscat [*q.v.*] is alone important) to the interior is very difficult. The lateral valleys between the various steps are often fertile and cultivated, especially where a good supply of water is available. The wadis of Oman, which cut across the mountainous area to the coast, are merely torrential channels, dry for the greater part of the year, often flowing in narrow precipitous gorges, the only means of entering the interior. Of these ways, always difficult, the best known are those by the Wadi Qahza, from the port of Matrah; by the Wadi Hail from the port of Quryat, and by the Sama'il valley, leading into the Wadi Munsab from a point 50 mi. N.W. of Muscat. Northwest of Muscat lies the coastal plain known as al-Batinah; it is fertile, prosperous and well populated.

The climate is tropical, with a mean annual rainfall of under 10 in., and a mean annual temperature of 80° or more. The vegetation is, however, abundant; tamarisks, oleanders, euphorbias, the milk-bush, rhamus and acacias being the most common.

Muscat, the capital, was in Portuguese hands from 1508 to the middle of the 17th century. In 1741 it was recovered by Ahmed bin Sa'id, a descendant of those Yemenite imams who consolidated Arab power in Zanzibar and on the East African coast. His family has ruled Oman ever since. It was the most powerful state in Arabia during the first half of the 19th century, but subsequent raids by the nomadic tribes of the interior, as in 1913–14, and the opportunities for foreign intervention reduced the country to a dependency of the government of India. A treaty of friendship and commerce between Britain and the sultan, signed Feb. 5, 1939, reaffirmed the close ties which had existed for nearly a century and a half.

The State is best known for its date cultivation, which has reached a high level in the interior. It is cultivated alongside cereals and vegetables, as well as vines, peaches, apricots, oranges, mangoes and melons.

The trade of Oman is mainly to and from India. Dates, pomegranates and dried fish are exported, while rice, coffee and cotton goods are the chief imports. Its riding camels are considered the best in the world. The little port of Gwadar, on the coast of Baluchistan, the outlet for most of the trade of Makran, is still a dependency of Oman.

**OMAR** (*c.* 581–644), in full 'OMAR IBN AL-KHAṬṬAB, the second of the Mohammedan caliphs. (*See* CALIPHATE.) Originally opposed to Mohammed, he became later one of the ablest advisers both of him and of the first caliph, Abu Bekr. His own reign (634–644) saw Islam's transformation from a religious sect to an imperial power. The chief events were the defeat of the Persians at Kadisiya (637) and the conquest of Syria and Palestine. The conquest of Egypt followed (*see* EGYPT and AMR IBN EL-ASS) and the final rout of the Persians at Nehāvend (641) brought Iran under Arab rule. Omar was assassinated by a Persian slave in 644, and though he lingered several days after the attack, he appointed no successor, but only a body of six Muhajirun who should select a new caliph. Omar was a wise and far-sighted ruler and rendered great service to Islam. He is said to have built the so-called "Mosque of Omar" ("the Dome of the Rock") in Jerusalem, which contains the rock regarded by Mohammedans as the scene of Mohammed's ascent to heaven, and by the Jews as that of the proposed sacrifice of Isaac.

**'OMAR KHAYYĀM** [GHIYATHUDDĪN ABULFATH 'OMAR IBN IBRĀHĪM AL-KHAYYĀMĪ], the great Persian mathematician, astronomer, free thinker and epigrammatist, who derived the epithet Khayyām (the tentmaker) most likely from his father's trade, was born in or near Nīshāpūr, where he is said to have died in A.H. 517 (A.D. 1123). His standard work on algebra, written in Arabic, and other treatises of a similar character raised him at once to the foremost rank among the mathematicians of that age, and induced Sultān Malik-Shāh to summon him in A.H. 467 (A.D. 1074) to institute astronomical observations on a larger scale, and to aid him in his great enterprise of a thorough reform of the calendar. The results of 'Omar's research were—a revised edition of the *Zīj* or astronomical tables, and the introduction of the Ta'rīkh-i-Malikshāhī or Jalālī, that is, the so-called Jalālian or Seljūk era, which commences in A.H. 471 (A.D. 1079, 15th March).

'Omar's great scientific fame, however, is eclipsed in the West, by his still greater poetical renown, which he owes to his *rubā'īs* (made famous in the west by FitzGerald's translation, *The Rubáiyát*) or quatrains, a collection of about 500 epigrams Although

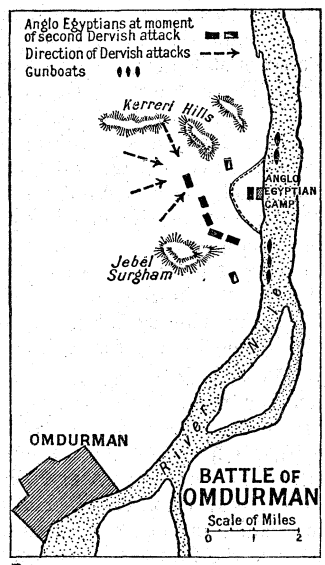
some of his quatrains are purely mystic and pantheistic, most of them bear quite another stamp; they are the breviary of a radical freethinker, who protests in the most forcible manner both against the narrowness, bigotry and uncompromising austerity of the orthodox ulemā and the eccentricity, hypocrisy and ravings of advanced Sūfīs.

BIBLIOGRAPHY.—The Leyden copy of 'Omar Khayyām's work on algebra was noticed as far back as 1742 by Gerald Meerman in the preface to his *Specimen calculi fluxionalis;* further notices of the same work by Sédillot appeared in the *Nouv. Jour. As.* (1834) and in vol. xiii. of the *Notices et extraits des MSS. de la Bibl. roy.* The complete text, together with a French translation (on the basis of the Leyden and Paris copies, the latter first discovered by M. Libri, *see* his *Histoire des sciences mathématiques en Italie,* i. 300), was edited by F. Woepcke, *L'Algebrè d'Omar Alkhayyāmi* (Paris, 1851). Articles on 'Omar's life and works are found in Reinaud's *Géographie d'Aboulféda,* pref., p. 101; *Notices et extraits,* ix. 143 *seq.;* Garcin de Tassy, *Note sur les Rubā'iyāt de 'Omar Hhaïyām* (Paris, 1857); Rieu, *Cat. Pers. MSS. in the Br. Mus.,* ii. 546; A. Christensen, *Recherches sur les Rubā'iyāt de 'Omar Hayyām* (Heidelberg, 1905); V. Zhukovski's *'Umar Khayyām and the "Wandering" Quatrains,* translated from the Russian by E. D. Ross in the *Journal of the Royal Asiatic Society,* xxx. (1898); E. G. Browne, *Literary History of Persia,* ii. 246. The quatrains have been edited at Calcutta (1836) and Teheran (1857 and 1862); in English verse, by Edward FitzGerald (London, 1859, 1872 and 1879). FitzGerald's translation has been edited with commentary by H. M. Batson (1900), and the 2nd ed. of the same (1868) by E. Heron Allen (1908). A new English version was published in Trübner's "Oriental" series (1882) by E. H. Whinfield, and the first critical edition of the text, with translations, by the same (1883). Important later works are N. H. Dole's variorum edition (1896), J. Payne's translation (1898), E. Heron Allen's edition (1898) and the Life by J. K. M. Shirazi (1905); but the literature in new translations and imitations has recently multiplied exceedingly. *See* A. G. Potter, *A bibliography of printed editions of the quatrains of Omar Khayyám in foreign languages* (Needham, Mass., 1923).

**OMBRE,** a card game, very fashionable at the end of the 18th century, but now practically obsolete. It was played with a pack of 40 cards (8, 9, 10 being omitted) and bore some similarity to whist.

*See* T. Palmer, *The Royal game of the Ombre, written at the request of divers Honorable Persons* (1665).

**OMDURMAN,** a town of the Anglo-Egyptian Sudan, opposite Khartum on the west bank of the Nile and immediately north of the junction of the White and Blue Niles. Pop. (1941 estimate) 116,196. The town covers a large area, being over 5 m. long and 2 broad. It consists for the most part of mud-huts, but there are some houses built of sun-dried bricks. Save for two or three wide streets which traverse it from end to end the town is a network of narrow lanes. In the centre facing an open space are the ruins of the tomb of the Mahdi and behind is the house in which he lived. The Khalifa's house (a two-storeyed building), the mosque, the Beit el Amana (arsenal) and other houses famed in the history of the town also face the central square, Omdurman is the headquarters of the native traders in the Anglo-Egyptian Sudan, the chief articles of commerce being ivory, ostrich feathers and gum arabic from Darfur and Kordofan. There is also an important camel and cattle market. The town is connected with Khartum by a bridge and an electric tramway. The government maintains elementary and technical schools. Mission work is undertaken by various Protestant and Roman Catholic societies.



PLAN OF THE BATTLE OF OMDURMAN, SEPT. 2, 1898

Omdurman, then an insignificant village, was chosen in 1884 by the Mahdi Mahommed Ahmed as his capital and so continued after the fall of Khartum in January 1885. Its growth was rapid, the Khalifa (who succeeded the Mahdi) compelling large numbers of disaffected tribesmen to live in the town under the eye of his soldiery. Here also were imprisoned the European captives of the Mahdists—notably Slatin Pasha and Father Ohrwalder. On Sept. 2, 1898 the Anglo-Egyptian army under Lord Kitchener totally defeated the forces of the Khalifa at Kerreri, 7 m. N. of the town. A marble obelisk marks the spot where the 21st Lancers made a charge.

*See* EGYPT: *Egypt and Sudan Campaigns* (1882–1900).

**OMEN,** a sign in divination, favourable or unfavourable as the case may be (*see* DIVINATION, AUGURS and ORACLE).

**OMICHUND** (d. 1767), an Indian whose name is indelibly associated with the treaty negotiated by Clive before the battle of Plassey in 1757. His real name was Amir Chand; and he was not a Bengali, as stated by Macaulay, but a Sikh from the Punjab. It is impossible now to unravel the intrigues in which he may have been engaged, but some facts about his career can be stated. He had long been resident at Calcutta, where he had acquired a large fortune by providing the "investment" for the Company, and also by acting as intermediary between the English and the native court at Murshidabad. Several houses owned by him in Calcutta are mentioned in connection with the fighting that preceded the tragedy of the Black Hole in 1756, and it is on record that he suffered heavy losses at that time. He had been arrested by the English on suspicion of treachery, but afterwards he was forward in giving help to the fugitives and also valuable advice. On the recapture of Calcutta he was sent by Clive to accompany Mr. Watts as agent at Murshidabad. It seems to have been through his influence that the nawab gave reluctant consent to Clive's attack on Chandernagore. Later, when the treaty with Mir Jafar was being negotiated, he put in a claim for 5% on all the treasure to be recovered, under threat of disclosing the plot. To defeat him, two copies of the treaty were drawn up: the one, the true treaty, omitting his claim; the other containing it, to be shown to him, which Admiral Watson refused to sign, but Clive directed the admiral's signature to be appended. When the truth was revealed to Omichund after Plassey, Macaulay states (following Orme) that he sank gradually into idiocy, languished a few months, and then died. As a matter of fact, he survived for ten years, till 1767; and by his will he bequeathed £2,000 to the Foundling Hospital (where his name may be seen in the list of benefactors as "a black merchant of Calcutta") and also to the Magdalen Hospital in London.

(J. S. Co.)

**OMNIBUS.** A term often shortened to "'bus," signifying a public passenger-carrying vehicle of large seating capacity. It has become synonymous in popular use with the word "motorbus." Horse drawn and steam driven omnibuses have been superseded by motor propelled omnibuses.

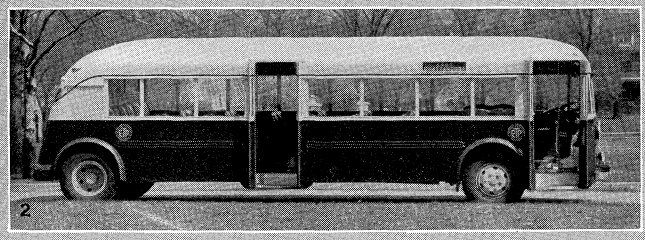
In several particulars an omnibus must conform with regulations laid down by public authorities, especially in connection with dimensions and weights. The carried load, consisting of the passengers and the omnibus body, will at most be less than the regulation weight by a figure termed the chassis weight. The proportion borne by the carried load to the total weight, is largely determined by the speed, hill climbing and other performances characteristic of the omnibus and such proportion is always made as large as possible to obtain the maximum earning power. For any specified purpose, designers have in recent years been able to increase this proportion without prejudicing either the reliability of the vehicles or the lowness of their running costs.

Body design aims at making the proportion borne by the passenger load to the carried load as great as possible, and is influenced very greatly by public requirements in the matter of comfort and safety. This proportion tends to become less as more exacting conditions have to be met in the provision of seating, shelter, ventilation and lighting. Passengers may be taken to weigh on an average one sixteenth of a ton each, but so soon as an omnibus body is provided to carry them, the weight that must be credited to each passenger becomes much greater.

The almost universal practice in omnibus design in 1928 was to employ two axles, the rear wheels being used for driving and braking, and the front wheels being used for steering. The weight

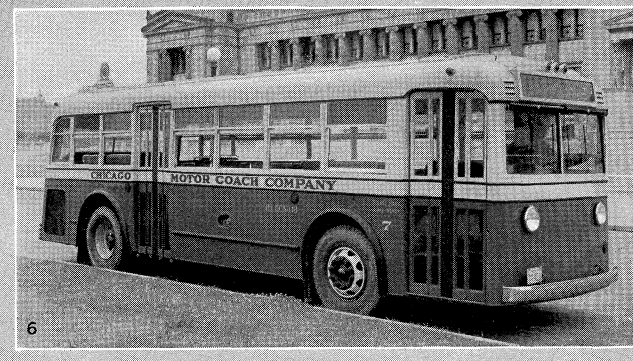
1

4


2

5

3



6

BY COURTESY OF (1, 3) LONDON PASSENGER TRANSPORT BOARD, PHOTO BY TOPICAL PRESS, (2) TWIN COACH COMPANY, (4) GREYHOUND LINES, (5, 6) CHICAGO MOTOR COACH COMPANY

## AMERICAN AND ENGLISH MOTOR COACHES FOR PUBLIC TRANSPORT

1. Trolley Bus seating 70. These vehicles are replacing the tram-car on many London routes. They are electrically driven by means of poles running along overhead wires and not running on rails are easy to manoeuvre on congested city streets
2. 30 passenger, city type coach with rear mounted motor
3. 35-seater single deck type bus for working on country routes where there are narrow roads and low bridges
4. Modern streamlined long distance transportation bus for the Greyhound Lines, equipped with reclining chairs. The baggage is carried in compartments underneath. Capacity, 36 passengers
5. Double deck bus with seats for 72 passengers. Engine in rear
6. Single deck bus with seats for 32 passengers. Engine in rear

distribution, as indicated by the front and rear axle weights, must be such as to give the adhesion necessary for rapid acceleration and good braking on normal road surfaces. Skidding and inferior performance are the natural consequences of bad weight distribution. The limit is set to front axle weight by the consideration that the driver must be able to turn the front wheels easily in order to steer the vehicle. This limit is reached before the other, which otherwise would affect both axles alike (but which, in consequence of the earlier limit on the front axle, affects the rear axle alone), viz. the limiting axle weight tolerated by local authorities.

**Low Centre of Gravity.**—In the complete omnibus, under all conditions of loading, the centre of gravity must be so low in relation to the width of the vehicle as to render exceedingly remote the possibilities of over-turning. Where conditions permit, the centre of gravity should occupy a position even lower than that which gives the desired stability. All deviations of a 'bus from uniform motion in a straight line will bring about changes in the loading of every wheel, and these changes become smaller as the centre of gravity approaches the plane of the road. With a low centre of gravity, it will be usual to work very close to the adhesion figures calculated for the stationary omnibus, since the greatest acceleration and braking effects that these figures allow, can be actually approached in practice under all conditions. Where the centre of gravity is high, braking is liable to promote skidding at corners, and on cambered surfaces; rapid acceleration will give rise to the same tendency. Since the carried load in a modern omnibus forms the large proportion of the total weight, and since the carried load comprises very nearly everything which is above floor level, it follows that the problem of making further reductions in the height of the centre of gravity, resolves itself simply into the problem of reducing the floor height.

To obtain the lowest possible floor height, omnibus designers have developed the double reduction driving axle. In this axle, the driving shafts do not transmit the torque direct to the road wheels, but communicate their motion to them through gearing. Each wheel bears a drum coaxial with the brake drum, but of smaller diameter, on which teeth are cut internally. Pinions on the ends of the driving shafts engage with these drums at their lowest points. This arrangement permits the use of full size driving wheels with an axle whose height is considerably less than that of the wheel centres. It permits, moreover, the use of a smaller housing for the right angled drive in the centre of the axle. This drive no longer effects the whole torque multiplication, but only a part of it; whereas the whole multiplication may be nearly 10 to 1, the right angled drive may be called upon to give a multiplication of only 2 to 1, and may therefore be much more compact than one giving the full multiplication.

The centre of gravity is lower in the "N.S." omnibus than in other types. Under the worst conditions, when the upper deck is laden and the lower deck is unladen, the ground may tilt to the extent of 28° beneath the car before over-turning can occur. The best figure obtained with the more usual construction, and without a top cover, was 25°. With the advent of cross seating, omnibus axle weights became so great as to approach the limit tolerated by road authorities. Rear axle weights, reaching that limit, could no longer be increased, and the need arose, as bigger omnibus weights were required, for throwing the weight forward. To this end the forward drive omnibus was introduced in London, and subsequently in all parts of the world.

The modern 'bus body is continued forward to a point only an inch or two behind the rear cylinder block. The driver sits forward alongside the engine, and is actually in a much more favourable position to steer his vehicle round blind corners than formerly. The drawbacks to the forward drive omnibus, are, firstly, the heaviness of steering consequent upon the increased front axle loading, and secondly, the difficulty of access to the engine on the off-side. Neither of these drawbacks has, however, proved serious. There is a tendency among vehicle builders of six wheelers to return to the conventional driving position of many years ago, but the day cannot long be postponed when forward drive will be forced upon designers of six wheelers, as it has been forced upon designers of four wheelers.

**Transmission Problem.**—Common to all road vehicles employing the internal combustion engine, is the problem of transmitting the power developed by a relatively inflexible prime mover to the road wheels. In the omnibus, above all other vehicles, this problem is one of great difficulty to which no entirely satisfactory solution has yet been found. The high power weight ratio of an ordinary car makes possible the employment of a lightly constructed clutch and gearbox, since the car will normally run in top or direct gear. Only motoring enthusiasts care for driving on the gears and obtaining thereby a splendid performance out of a small capacity engine. Nevertheless, the omnibus driver is called upon to do this, and in consequence, the transmission must be of great robustness and be simple to manipulate. In addition to the need for gear changing, ever present on undulating roads, with the relatively low powered omnibus there is the constant stopping to let down and take up passengers which also calls for gear manipulation. With the very heavy omnibus used in services necessitating a great many stops, it has become impossible to achieve, without high maintenance costs, the propulsion of the load through the agency of the clutch and gearbox. It is probably only a matter of a year or two before other forms of transmission—electric transmission in particular—will live down their many drawbacks, and show on the whole a saving in costs.

For the right angled drive in an omnibus rear axle, bevel, and other forms of gearing have yet to be proved superior to worm gearing. Within recent years, the old fashioned motion communicating screw and wheel has been developed to meet modern automobile and industrial requirements, and in its original form it can scarcely claim a relationship with the highly efficient reversible worm gearing of the present day. The difficulties inherent in the many forms of bevel drive are to make them compact and also silent.

**Suspension.**—The suspension of an omnibus is effected through longitudinally disposed semi-elliptic leaf springs mounted on the axles, supplemented by rubber buffers, steel volute springs, or other energy absorbing devices over the axles. The latter augment the stiffness of the suspension to meet exceptional load or road conditions.

Rear springs are often allowed to take the driving and braking torque reactions of the rear axle. Where this is not permissible, a torque arm is provided, and the rear springs are shackled at both ends. Tractive effects are often communicated to the vehicle through the rear springs also, though, where a torque arm is provided, the springs must, in view of their being shackled at both ends be relieved of this duty. Where it is provided, the torque arm usually swings from a well braced frame cross-member that has sufficient strength to withstand the pushing and tugging in a horizontal plane to which it will be subjected by the driving and braking exertions of the rear axle. Some vehicles are made with a torque tube surrounding the propeller shaft.

No effort is made by designers to produce completely rigid chassis frames for omnibuses. All things carried on the frame are mounted so as to flex with it or be able to take up a new position without strain. Such rigid structures as engine, gearbox and radiator, are mounted on frame attachments or bearers with rubber or other resilient pads interposing and permitting small relative movements. Where severe conditions must be met, the engine and gearbox are mounted on three such bearers only. Three points of support, however, situated, remain always in a plane, and there can be no distortion from twisting with three point suspension. The drive between units, disposed none too rigidly in relation to one another, is effected by means of shafts bearing flexible couplings or universal joints at their extremities.

The enormous mileages accomplished by the omnibus as compared with the light car, prohibit the adoption by omnibus engineers of light car greasing methods. There is no part of an omnibus which can be packed with grease and left to itself from one year's end to another. Grease nipples and filler caps are provided everywhere in accessible positions, and positive action grease feeding guns which can be relied upon to urge lubricant where

lubrication is necessary, are used under service conditions at frequent intervals.

Tyre-makers, anticipating the call for higher omnibus speeds which had been heard for some considerable time, developed the pneumatic tyre that will carry heavy loads. With higher running speed, better braking must be provided on all vehicles. Rear wheel adhesion becomes insufficient and all four wheels must be fitted with drums and brake shoes. Four wheel braking is, in any event, often forced upon designers by the difficulty of accommodating two sets of brake drums on the very small wheel centres that accompany these deep section tyres.

**OMRI,** an Israelite general, chosen by the army as ruler when, during a campaign against the Philistines, reports came that Zimri, a captain of the chariots, had murdered the king, Elah, in the royal city of Tirzah and proclaimed himself king. Omri promptly marched against Zimri, and captured Tirzah; Zimri, recognizing the hopelessness of his position, set fire to the palace and perished in the flames. A rival party set up Tibni—with whom the Greek versions associate his brother Joram—as king, but Omri defeated this faction and became undisputed king of Israel *c.* 884 B.C. The one deed of his reign recorded in I Kings xvi. 24 is his purchase of the hill of Samaria, upon which he founded a new royal city. But Mesha of Moab mentions him as "having afflicted Moab many days." In spite of the fact that he suffered some reverses at the hand of Syria (I Kings xx. 34), he must have been an accomplished statesman who consolidated his kingdom and made it respected, because for generations after his death Israel is known to the cuneiform writers as "House (or Land) of Omri," and the Israelite Jehu as a "son of Omri." He reigned twelve years and was succeeded by his son AHAB (*q.v.*).

**OMSK,** a town in the Omsk region of the Russian S.F.S.R., in lat. 55° N., long., 73° 38′ E., on the right bank of the Irtysh, where the Om joins it. It is in the midst of a treeless steppe; violent winds bring snow, often to a depth of 6 ft., in winter, and sandstorms in summer. Average January temperature 5° F, July 68° F; annual rainfall 12·4 in.; altitude 285 ft. It is on the trans-Siberian railway, and has a branch linking with Sverdlovsk through Ishim and Tyumen. Steamer routes connect it with the Ob northwards along the Irtysh, and southwards with the Altai towns and Lake Zaisan, and caravan routes from the Central Asiatic republics and Kazakstan converge upon it. Its population has grown from 37,376 in 1897 to 280,716 in 1939, but its appearance is still that of a frontier town, with one-storeyed wooden huts and unpaved streets, through which Kirghiz ponies and camel caravans thread their way. Stone buildings have been constructed and the cathedral is built of stone; there is a municipal electricity, water and bus service. Its industries include the making of agricultural and other machinery, distilling, brewing, cloth manufacture and foodstuffs, especially sausage. It is a centre for the collection and export of meat, butter, hides and skins. The Russian Geographical society has a museum here and there is much educational and dramatic activity.

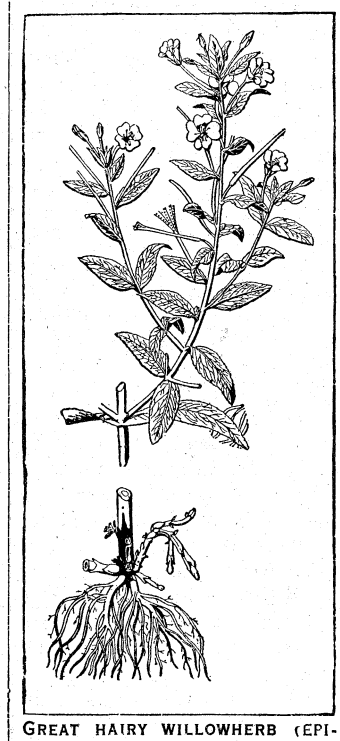
A fort was established here in 1716 to protect the Russian settlers from Kirghiz raids. Later, with the increasing colonization of the area and the coming of the railway, the town developed rapidly and became a military centre, with large barracks. After the 1917 revolution, it was the nucleus of Siberian political activity and various governments rapidly succeeded one another; Admiral Kolchak declared himself Dictator of Siberia at Omsk. With the advance of the Bolshevik army, refugees from the west crowded into the town and the insanitary conditions resulted in a plague of spotted fever and typhus. On the capture of the town the refugees fled further eastwards carrying infection with them, though many died of cold, hunger and disease.

**ONA,** an Indian tribe who once occupied the interior of Tierra del Fuego except the south-western corner, which was uninhabited, and the south-eastern corner, where dwelt a related tribe known as the Haush. The Ona in speech, physique and culture were similar to the giant Tehuelche of Patagonia. They subsisted by hunting and were expert archers. Their chief food was the flesh of the guanaco, a wild camel related to the llama. In addition they ate birds, fish, shellfish, berries and fungi. Ona culture was very primitive. Their dress was a large robe of guanaco fur, moccasins, a petticoat for the women and a fur diadem for the men. In spite of their cold environment they rarely used houses, and habitually slept behind a windbreak of hides. Their manufactures included bows and arrows, short fishing spears, slings, baskets, braided necklaces, wristlets and anklets and a few simple tools. Ona society was organized into hunting groups of relatives. Each group controlled a well-defined territory which it vigorously defended from poachers. As a result blood feuds were common. At times each hunting group assembled to perform initiation ceremonies. Candidates were taught tribal lore, were terrified by masked apparitions and were forced to live in solitude for two years that they might become strong and self-reliant. Ona religion consisted in a fear of certain malevolent spirits and belief in a supreme deity. Ona mythology is rich. The tribe has almost died out.

*See* S. K. Lothrop, "The Indians of Tierra del Fuego" (Museum of the American Indian, Heye Foundation, *Contributions,* vol. x. 1928); J. M. Cooper, *Analytical and Critical Bibliography—of Tierra del Fuego* (Bureau of American Ethnology, Bulletin 63, 1917).

(S. K. L.)

**ONAGRACEAE** or **OENOTHERACEAE,** a family of dicotyledons belonging to the order Myrtiflorae, to which belongs also the myrtle family, Myrtaceae. It contains about 40 genera and 500 species, and occurs chiefly in the temperate zone of the new world, especially on the Pacific side. It is represented in Britain by several species of *Epilobium* (willow-herb), *Circaea* (enchanter's nightshade), and *Ludwigia* (false loosestrife), a small perennial herb very rare in boggy pools in Sussex and Hampshire. In the United States, especially in the Pacific states, the family is well represented, the principal genera being *Oenothera* (containing as a native the evening primrose, now naturalized in certain parts of Europe), *Epilobium* and *Ludwigia.* The plants are generally herbaceous, sometimes annual, as species of *Epilobium, Clarkia, Godetia,* or biennial, as *Oenothera biennis*—evening primrose—or sometimes become shrubby or arborescent, as *Fuchsia* (*q.v.*). The simple leaves are generally entire or inconspicuously toothed, and are alternate, opposite or whorled in arrangement; they are generally exstipulate. The flowers are often solitary in the leaf-axils, as in many species of *Fuchsia, Clarkia,* etc., or associated, as in *Epilobium* and *Oenothera,* in large showy terminal spikes or racemes; in *Circaea* the small white or red flowers are borne in terminal and lateral racemes. The regular flowers have the parts in fours, the typical arrangement as illustrated by *Epilobium, Oenothera* and *Fuchsia* being as follows: 4 sepals, 4 petals, two alternating whorls of 4 stamens, and 4 inferior carpels. The floral receptacle is produced above the ovary into the so-called calyx-tube, which is often petaloid, as in *Fuchsia,* and is sharply distinguished from the ovary, from which it separates after flowering.



GREAT HAIRY WILLOWHERB (EPILOBIUM HIRSUTUM)

In *Clarkia* the inner whorl of stamens is often barren, and in *Eucharidium* it is absent. In *Circaea* the flower has its parts in two's. Both sepals and petals are free; the former are valvate in bud, and reflexed in the flower; in *Fuchsia* they are petaloid. The petals are generally convolute in bud; they are entire (*Fuchsia*) or bilobed (*Epilobium*); in some species of *Fuchsia* they are small and scale-like, or absent (*F. apetala*). The stamens are free, and those of the inner whorl are generally shorter than those of the outer whorl. The flowers of *Lopezia* (Central

America) have only one fertile stamen. The large spherical pollen grains are connected by viscid threads. The typically quadrilocular ovary contains numerous ovules on axile placentas; the 1-to-2-celled ovary of *Circaea* has a single ovule in each loculus. The long slender style has a capitate (*Fuchsia*), 4-rayed (*Oenothera, Epilobium*) or 4-notched (*Circaea*) stigma. The flowers, which have generally an attractive corolla and honey secreted by a swollen disk at the base of the style or on the lower part of the "calyx-tube," are adapted for pollination by insects, chiefly bees and lepidoptera; sometimes by night-flying insects when the flowers are pale and open towards evening, as in evening primrose. The fruit is generally a capsule splitting into four valves and leaving a central column on which the seeds are borne as in *Epilobium* and *Oenothera*—in the former the seeds are scattered by aid of a long tuft of silky hairs on the broader end. In *Fuchsia* the fruit is a berry, which is sometimes edible, and in *Circaea* a nutlet bearing recurved bristles. The seeds are exalbuminous. Several of the genera are well known as garden plants, *e.g., Fuchsia, Oenothera, Clarkia* and *Godetia.* Evening primrose (*Oenothera biennis*), a native of North America, occurs apparently wild as a garden escape in Britain. *Jussieua,* a tropical genus of 50 species of water- and marsh-herbs, shows a development of well-developed aerating tissue in certain species.

**ONATAS,** a Greek sculptor of the time of the Persian wars, a member of the flourishing school of Aegina. Many of his works are mentioned by Pausanias; they included a Hermes carrying the ram, and a strange image of the Black Demeter made for the people of Phigaleia; also some groups in bronze at Olympia and Delphi, including a bronze chariot for Hieron I. of Syracuse. From Pausanias' descriptions we may assume that the figures on the pediments of Aegina represent his style. They are manly, vigorous, athletic, showing great knowledge of the human form, but somewhat stiff and automaton-like.

**ON-COSTS:** *see* OVERHEAD CHARGES.

**ONEGA** (ŏn'e-gah), the largest lake in Europe next to Ladoga, area, 3,764 sq.m. and coast line 870 m. in length. It lies mostly in the Karelian A.S.S.R., though its southern portion is in the province of Leningrad. The lake basin extends north-west and south-east, the direction characteristic of the lakes of Finland and the line of glacier-scoring observed in that region. The southern coast is comparatively regular and has few islands, but the north is broken into inlets, the largest being Povyenets bay, and is crowded with islands (*e.g.,* Klimetsk) and submerged rocks. The north-western shore between Petrozavodsk and the mouth of the river Lumbosha consists of dark clay slates, generally arranged in horizontal strata and broken by protruding, parallel ridges of diorite, which extend far into the lake. The eastern shore, as far as the mouth of the Andoma, is for the most part alluvial, with outcroppings of red granite and in one place (the mouth of the Pyalma) diorite and dolomite. To the south-east are sedimentary Devonian rocks, and the general level of the coast is broken by Mt. Andoma and Cape Petropavlovskiy (160 ft. above the lake); to the south-west a quartz sandstone (used as a building and monumental stone in Leningrad) forms a fairly bold rim. Lake Onega lies 125 ft. above the sea. The greatest depths, 318 to 408 ft., occur at the entrance to the double bay of Lizhemsk and Unitsk. On the continuation of this line the depth exceeds 240 ft. in several places. In the middle of the lake the depth is 120 to 282 ft., and less than 120 ft. in the south. The lake is 145 m. long, with an average breadth of 50 m. The most important affluents, the Vodka, the Andoma and the Vytegra, come from the east. The Kumsa, a northern tributary, is sometimes represented as if it connected the lake with Lake Seg, but at the present time the latter drains to the White sea. The Onega canal (45 m. long) was constructed in 1818–51 along the southern shore in order to connect the Svir (and hence Lake Ladoga and the Baltic) with the Vytegra, which connects with the Volga. In 1928 an electric station was constructed on the Svir river. Lake Onega remains free from ice for 209 days in the year (middle of May to second week of December). The water is at its lowest level in the beginning of March; by June it has risen 2 ft. A considerable population is scattered along the shores of the lake, mainly occupied in the timber trade, fisheries and mining industries. The opening of the Murmansk railway along the western shore in 1917 is developing settlement. Salmon, *palya* (a kind of trout), burbot, pike, pike perch and perch are among the fish caught in the lake.

The River Onega rises in Lake Vozhe, and is navigable for boats and rafts to Kargopol on Lake Lacha to the Gulf of Onega, an inlet of the White sea. It flows through the provinces of Vologda and Archangel and has no connection with Lake Onega. At the mouth of this river (on the right bank) in 63° 55′ N., 38° 55′ E., in the province of Archangel, stands the town and port of Onega. Pop. (1926) 5,254. It dates from settlements made by the people of Novgorod in the 15th century, known in history as Ustenskaya or Ustyanskaya. It has a saw-milling industry, and has summer steamer routes to Soroka, Kem and Archangel, but the season is short owing to the persistence of land floes and loose pack. Telegraphic communication is by the Archangel railway.

**ONEIDA,** the only city of Madison county, New York, U.S.A., on Oneida creek, 6 m. S.E. of Oneida lake, midway between Utica and Syracuse. It is served by the New York Central and the New York, Ontario and Western railways. Pop. (1920), 10,541; 10,558 in 1930 and 10,291 in 1940. Adjoining Oneida on the west is the village of Wampsville (pop. 282 in 1940), the county seat. Across the creek, to the southeast, is the village of Oneida Castle (pop. 556 in 1940), formerly the gathering place of the Oneida Indians. Oneida is the headquarters of the Oneida Community (*q.v.*), which controls important industries (notably the manufacture of silver-plated ware) here and elsewhere. The city also manufactures caskets and furniture, chucks and bottle caps. The aggregate factory output in 1940 was $6,370,685. Oneida was founded by Sands Higginbotham, who bought the site in 1829–30. It was incorporated as a village in 1848 and as a city in 1901.

**ONEIDA** (a corruption of their proper name *Oneyotka-ono,* "people of the stone," in allusion to the Oneida stone, a granite boulder near their former village, which was held sacred by them), a tribe of North American Indians of Iroquoian stock, forming one of the Six Nations. They lived around Oneida Lake in New York state, in the region southward to the Susquehanna. They were not loyal to the League's policy of friendliness to the English, but inclined towards the French, and were practically the only Iroquois who fought for the Americans in the War of Independence. As a consequence they were attacked by others of the Iroquois under Joseph Brant and took refuge within the American settlements till the war ended, when the majority returned to their former home, while some migrated to the Thames river district, Ontario. Early in the 19th century they sold their lands, and most of them settled on a reservation at Green Bay, Wisconsin, a few remaining in New York state. In 1926 the Oneidas in the United States numbered 3,238 persons, of whom 2,976 were in Wisconsin and 262 in New York state. They are civilized and prosperous. *See* NORTH AMERICA: *Ethnology.*

**ONEIDA COMMUNITY,** an American communistic society at Oneida, New York. It was founded at Putney, Vt., in 1842, by John Humphrey Noyes (1811–86), a graduate of Dartmouth college. "Converted" at a revival, he entered Yale Theological seminary. Bible studies convinced him that Christ came a second time in 70 A.D. and absolved Christians from *necessity* of sin. Called a "Perfectionist," he barely escaped expulsion from the seminary before graduation, and later was deprived of his licence as a Congregational minister. He and his followers established a commune, eventually pooling all property, renouncing all religious observances, and instituting "complex marriage." Monogamy was antagonistic to their ideals. In 1847, dissension having brought them before the courts and their theories and practices before the public, they were forced to leave Putney. They purchased, near Oneida, N.Y., 600ac. of forest-land which proved extremely productive. They planted orchards, lumbered, blacksmithed, farmed and made steel traps—their most profitable industry. In Jan., 1847, their first annual inventory revealed them to be worth about $67,000.

They were mostly New England farmers and mechanics. They had the reputation of being excellent citizens only remarkable for

their earnest interest in eugenics. They sought to make practical application of what scientific information they possessed endeavouring by change and experiment to produce the best possible offspring.

Owing to increasing pressure of public sentiment, which had been anticipated though for 25 years it was unexpressed, Noyes, with a few adherents, removed to Canada in 1880 and the community at Oneida voluntarily dissolved as a communistic experiment and formed a stock company known as the Oneida Community, Limited. At that time it manufactured sewing and embroidery silk, steel traps and silverware, and canned large quantities of fruits and vegetables, but has gradually confined itself to the manufacturing of silverware. The present company has "no connection with the old beyond the personnel and traditions which it inherited from its 40 years' experience as a community."

Among the chief writings of J. H. Noyes dealing with the origin, principles and history of the Oneida Community are *The Berean* (1847), a manual for the use of members; *Salvation from Sin the End of Christian Faith* (1869); *History of American Socialisms* (1870); *Home-Talks* (1875); *Essay on Scientific Propagation* (*c.* 1875). *See* also *Bible Communism* (1853), a compilation of the community's theories; George Noyes, comp. and ed., *Religious Experiences of John Humphrey Noyes* (1923); Robert A. Parker, *A Yankee Saint* (1935); Pierrepont B. Noyes, *My Father's House* (1937). (P. B. N.)

**O'NEILL,** the name of an Irish family descended from Niall, king of Ireland in the 5th century, and known as Niall of the Nine Hostages. He is said to have made war against rulers in Ireland, Britain and Gaul, stories of his exploits being related in the *Book of Leinster* and the *Book of Ballymote*. This king had 14 sons, one of whom was Eoghan (Owen), from whom the O'Neills were descended. The descendants of Niall were divided into two main branches, the northern and the southern Hy Neill, to one or other of which nearly all the high-kings (ard-ri) of Ireland from the 5th to the 12th century belonged; the descendants of Eoghan being the chief of the northern Hy Niell[1]. Eoghan was grandfather of Murkertagh (Muircheartach) (d. 533), said to have been the first Christian king of Ireland, whose mother, Eirc or Erca, became by a subsequent marriage the grandmother of St. Columba. Of this monarch, known as Murkertagh MacNeill (Niall), and sometimes by reference to his mother as Murkertagh Mac Erca, the story is told, illustrating an ancient Celtic custom, that he emphasized the inviolability of a treaty with a tribe in Meath by having it written with the blood of both clans mixed in one vessel. Murkertagh was chief of the great north Irish clan, the Cinel Eoghain, and after becoming king of Ireland in 517, he seized a tract in the modern Co. Derry, which remained till the 17th century in the possession of the Cinel Eoghain. The inauguration stone of the Irish kings, the Lia Fail, or Stone of Destiny, fabled to have been the pillow of the patriarch Jacob when he dreamed of the heavenly ladder, was said to have been presented by Murkertagh to the king of Dalriada, by whom it was conveyed to Dunstaffnage castle in Scotland. (*See* SCONE.) A lineal descendant of Murkertagh was Niall Frassach (*i.e.,* of the showers), who became king of Ireland in 763. His grandson, Niall (791–845), drove back the Vikings who began to infest the coast of Donegal. Niall's son, Aedh (Hugh) Finnlaith, was father of Niall Glundubh (*i.e.,* Niall of the black knee), one of the most famous of the early Irish kings, from whom the family surname of the O'Neills was derived. His brother Domhnall (Donnell) was king of Ailech, a district in Donegal and Derry; the ruined masonry of the royal palace is still to be seen on a hill overlooking loughs Foyle and Swilly. On the death of Domhnall in 911 Niall Glundubh became king of Ailech, and, after defeating the kings of Dalriada and Ulidia he became king of Ireland in 915. To him is attributed the revival of the ancient meeting of Irish clans known as the Fair of Telltown. He fought many battles against the Norsemen, in one of which he was killed in 919 at Kilmashoge, where his place of burial is still to be seen.

His son Murkertagh, who gained a victory over the Norse in 926, is celebrated for his triumphant march round Ireland, the *Moirthimchell Eiream,* when he captured many kings and chieftains. From the dress of his followers in this expedition he was called "Murkertagh of the Leather Cloaks." The exploit was celebrated by Cormacan, the king's bard, and a number of Murkertagh's other exploits are related in the *Book of Leinster*. He was killed in battle against the Norse in 943, and was succeeded as king of Ailech by his son, Donnell Ua Niall (*i.e.,* O'Neill, grandson of Neill, or Niall, the name O'Neill becoming about this time an hereditary family surname), whose grandson, Flaherty, made a pilgrimage to Rome in 1030.

Aedh (Hugh) O'Neill, chief of the Cinel Eoghain, or lord of Tir-Eoghain (Tir-Owen, Tyrone) at the end of the 12th century, came into conflict with the Anglo-Norman monarchy, whose pretensions he disputed in Ulster. His son (or nephew), Hugh O'Neill, lord of Tyrone, was styled "Head of the liberality and valour of the Irish." Hugh's son, Brian, was inaugurated prince, or lord, of Tyrone in 1291; and his son Henry became lord of the *Clann Aodha Buidhe* (Clanaboy or Clandeboye) early in the 14th century. Henry's son Murkertagh the Strongminded, and his great-grandson Hugh, greatly consolidated the power of the O'Neills. Niall Og O'Neill, one of the four kings of Ireland, accepted knighthood from Richard II.; and his son Eoghan formally acknowledged the supremacy of the English crown, though he afterwards ravaged the Pale, and was inaugurated "the O'Neill" (*i.e.,* chief of the clan) on the death of his kinsman Domhnall Boy O'Neill. He was deposed (1455) by his son Henry, who in 1463 was acknowledged as chief of the Irish kings by Henry VII. Contemporary with him was Neill Mor O'Neill, lord of Clanaboy. From Neill Mor O'Neill's son Brian was descended the branch of the O'Neills who, settling in Portugal in the 18th century, became Portuguese nobles. This branch represents the male line of the ancient Irish kings of the house of O'Neill.

CONN O'NEILL (*c.* 1480–1559), 1st earl of Tyrone, surnamed Bacach (the Lame), grandson of Henry O'Neill mentioned above, was the first of the O'Neills to come to the front as a leader of the Irish against the English in the 16th century. Conn became chief of the Tyrone branch of the O'Neills (Cinel Eoghain) about 1520. Tyrone having been invaded in 1541 by Sir Anthony St. Leger, the lord deputy, Conn delivered up his son as a hostage, attended a parliament held at Trim, and, crossing to England, made his submission at Greenwich to Henry VIII., who created him earl of Tyrone for life. He was also made a privy councillor in Ireland, and received a grant of lands within the Pale. O'Neill's submission to the English king, and his acceptance of an English title were resented by his clansmen and dependents. The earl maintained a feud with his son Shane (John), arising out of his transaction with Henry VIII. The nomination of O'Neill's reputed son Matthew as his heir with the title of baron of Dungannon by the English king conflicted with the Irish custom of tanistry (*q.v.*), which regulated the chieftainship of the Irish clans; moreover, Matthew, if indeed he was O'Neill's son at all, was illegitimate, and Shane, Conn's eldest legitimate son, would not permit any invasion of his rights. The fierce family feud ended in the murder of Matthew by agents of Shane in 1558; Conn dying about a year later. Conn was twice married, Shane being the son of his first wife, a daughter of Hugh Boy O'Neill of Clanaboy. An illegitimate daughter of Conn married the celebrated Sorley Boy MacDonnell (*q.v.*).

SHANE O'NEILL (*c.* 1530–1567), rejected overtures from the earl of Sussex, the lord deputy, and refused to help the English against the Scottish settlers on the coast of Antrim, allying himself instead with the MacDonnells, the most powerful of these immigrants. Nevertheless Queen Elizabeth was disposed to come to terms with Shane, who after his father's death was *de facto* chief of the O'Neill clan. She recognized his claims to the chieftainship, thus throwing over Brian O'Neill, son of the murdered Matthew, baron of Dungannon, on terms. O'Neill, however, refused to put himself in the power of Sussex without a guarantee for his safety; and his claims were so exacting that Elizabeth determined to restore Brian. An attempt to incite the O'Donnells against him was frustrated by Shane's capture of Calvagh O'Donnell, whom he

[1] A list of these kings will be found in P. W. Joyce's *A Social History of Ancient Ireland* (London, 1903), vol. i., pp. 70, 71.

kept a prisoner for nearly three years. Elizabeth, who was not prepared to undertake the subjugation of the Irish chieftain, urgently desired peace with him, especially when the devastation of his territory by Sussex brought him no nearer to submission. Sussex was not supported by the queen, who sent the earl of Kildare to arrange terms with O'Neill. The latter agreed to present himself before Elizabeth. Accompanied by Ormonde and Kildare he reached London on Jan. 4, 1562. Elizabeth temporized; but finding that O'Neill was in danger of becoming a tool in the hands of Spanish intriguers, she permitted him to return to Ireland, recognizing him as "the O'Neill," and chieftain of Tyrone; though a reservation was made of the rights of Hugh O'Neill, who had succeeded his brother Brian as baron of Dungannon, Brian having been murdered in April 1562 by his kinsman Turlough Luineach O'Neill.

There were at this time three powerful contemporary members of the O'Neill family in Ireland—Shane, Turlough and Hugh, 2nd earl of Tyrone. Turlough had been elected tanist (*see* TANISTRY) when his cousin Shane was inaugurated the O'Neill, and he schemed to supplant him during Shane's absence in London. The feud did not long survive Shane's return to Ireland, where he re-established his authority, and renewed his turbulent tribal warfare. Elizabeth at last authorized Sussex to take the field against Shane, but two expeditions failed. Shane now laid the whole blame for his lawless conduct on the lord deputy's repeated alleged attempts on his life. Elizabeth consented to treat, and practically all O'Neill's demands were conceded. O'Neill now turned his hand against the MacDonnells, claiming that he was serving the queen of England in harrying the Scots. He fought an indecisive battle with Sorley Boy MacDonnell near Coleraine in 1564, and in 1565 routed the MacDonnells and took Sorley Boy prisoner near Ballycastle. This victory strengthened Shane O'Neill's position, and preparations were made for his subjugation. O'Neill ravaged the Pale, failed in an attempt on Dundalk, made a truce with the MacDonnells, and sought help from the earl of Desmond. The English, on the other hand, invaded Donegal and restored O'Donnell. O'Neill was routed by the O'Donnells at Letterkenny; and seeking safety in flight, he threw himself on the mercy of his enemies, the MacDonnells. Attended by a small body of gallowglasses, and taking his prisoner Sorley Boy with him, he presented himself among the MacDonnells near Cushendun, on the Antrim coast. Here, on June 2, 1567, he was slain by the MacDonnells. In his private character Shane O'Neill was a brutal, uneducated savage.

TURLOUGH LUINEACH O'NEILL (*c.* 1530–1595), earl of Clanconnell, was inaugurated chief of Tyrone on Shane's death. He sought to strengthen his position by alliance with the O'Donnells, MacDonnells and MacQuillans. An expedition under the earl of Essex was sent against him, which effected little, and in 1575 O'Neill received by treaty extensive grants of lands and permission to employ 300 Scottish mercenaries. In 1578 he was created baron of Clogher and earl of Clanconnell for life; but for the next few years he continued to intrigue against the English authorities. The latter, as a counterpoise to Turlough, supported his cousin Hugh, brother of Brian, whom Turlough had murdered. Eventually Turlough resigned the headship of the clan in favour of Hugh, who was inaugurated O'Neill in 1593. Turlough died in 1595.

HUGH O'NEILL (*c.* 1540–1616), 2nd earl (known as the great earl) of Tyrone, was the second son of Matthew, reputed illegitimate son of Conn, 1st earl of Tyrone. He succeeded his brother, Brian, when the latter was murdered by Turlough in 1562, as baron of Dungannon. He was brought up in London, but returned to Ireland in 1567 after the death of Shane, under the protection of Sir Henry Sidney. He served with the English against Desmond in Munster in 1580, and assisted Sir John Perrot against the Scots of Ulster in 1584. In the following year he attended parliament as earl of Tyrone, though Conn's title had been for life only, and had not been assumed by Brian. Hugh's constant disputes with Turlough were fomented by the English, but after Hugh's inauguration as the O'Neill on Turlough's resignation in 1593, he was supreme in the north. Having roused the ire of Sir Henry Bagnal (or Bagenal) by eloping with his sister in 1591, he afterwards assisted him in defeating Hugh Maguire at Belleek in 1593; and then again went into opposition and sought aid from Spain and Scotland. Sir John Norris was ordered to Ireland to subdue him in 1595, but Tyrone took the Blackwater fort and Sligo castle before Norris was prepared; he was thereupon proclaimed a traitor of Dundalk. In spite of the traditional enmity between the O'Neills and the O'Donnells, Tyrone allied himself with Hugh Roe O'Donnell, nephew of Shane's former enemy Calvagh O'Donnell, and the two chieftains opened communications with Philip II. of Spain, their letters to whom were intercepted by the viceroy, Sir William Russell. They presented themselves as champions of the Catholic religion, claiming religious and political liberty for the Irish. In April 1596 Tyrone received promises of help from Spain. He temporized successfully for more than two years, making professions of loyalty which deceived Sir John Norris and the earl of Ormonde. In 1598 a formal pardon was granted to Tyrone by Elizabeth. Within two months he was again in the field, and on Aug. 14, he destroyed an English force under Bagnal at the Yellow ford on the Blackwater. If the earl had known how to profit by this victory, he might now have successfully withstood the English power in Ireland; for in every part of Ireland—and especially in the south, where James Fitzthomas Fitzgerald, with O'Neill's support, was asserting his claim to the earldom of Desmond at the head of the Geraldine clansmen—discontent broke into flame. But Tyrone procrastinated. Eight months after the battle of the Yellow ford, the earl of Essex landed in Ireland. He met Tyrone at a ford on the Lagan on Sept. 7, 1599, when a truce was arranged; but Elizabeth objected to the conditions allowed to the O'Neill and to Essex's treatment of him as an equal. Tyrone then issued a manifesto to the Catholics of Ireland summoning them to join his standard. After an inconclusive campaign in Munster in January 1600, he returned to Donegal, where he received supplies from Spain and a token of encouragement from Pope Clement VIII. In May of the same year armies under Sir Henry Docwra and Mountjoy compelled O'Neill to retire to Armagh, a large reward having been offered for his capture alive or dead.

The appearance of a Spanish force at Kinsale drew Mountjoy to Munster in 1601; Tyrone followed him, and at Bandon joined forces with O'Donnell and with the Spaniards under Don John D'Aquila. The attack failed. O'Donnell went to Spain, where he died and Tyrone with a shattered force went to the north, where he renewed his temporizing policy. Early in 1603 Elizabeth instructed Mountjoy to open negotiations; and in April, Tyrone, in ignorance of Elizabeth's death, made his submission. In Dublin he heard of the accession of King James, at whose court he presented himself in June accompanied by Rory O'Donnell, who had become chief of the O'Donnells after the departure of his brother Hugh Roe. James confirmed Tyrone in his title and estates, but new disputes arose on his rights over certain of his feudatories, of whom Donnal O'Cahan was the most important. This dispute dragged on till 1607, when Tyrone arranged to go to London to submit the matter to the king. Warned, however, that his arrest was imminent, and possibly persuaded by Rory O'Donnell (created earl of Tyrconnel in 1603), Tyrone resolved to fly from the country.

"The flight of the earls," one of the most celebrated episodes in Irish history, occurred on Sept. 14, 1607, when Tyrone and Tyrconnel embarked at midnight at Rathmullen on Lough Swilly, with their wives, families and retainers, numbering 99 and sailed for Spain. Driven by contrary winds to take shelter in the Seine, the refugees passed the winter in the Netherlands, and in 1608 went to Rome, where they were entertained by Pope Paul V., and where Tyrconnel died the same year. In 1613 Tyrone was outlawed and attainted by the Irish parliament, and he died in Rome on July 20, 1616. He was four times married, and had a large number both of legitimate and illegitimate children.

SIR PHELIM O'NEILL (*c.* 1603–1653), a kinsman and younger contemporary of the earl of Tyrone, took a prominent part in the rebellion of 1641. In that year he was elected member of the

Irish parliament for Dungannon, and joined the earl of Antrim and other lords in supporting Charles I. against the parliament. On Oct. 22, 1641, he surprised and captured Charlemont castle; and having been chosen commander-in-chief of the Irish in the north, he forged and issued a pretended commission from Charles I. sanctioning his proceedings. Phelim and his followers ravaged Ulster on the pretext of reducing the Scots, but failed to take Drogheda, being compelled by Ormonde to raise the siege in April 1642. During the summer his fortunes ebbed, and he was superseded by his kinsman Owen Roe O'Neill.

OWEN ROE O'NEILL (*c.* 1590–1649), one of the most celebrated of the O'Neills, the subject of the well-known ballad "The Lament for Owen Roe," was the son of Art O'Neill, a younger brother of Hugh, 2nd earl of Tyrone. Having served with distinction in the Spanish army he was immediately recognized on his return to Ireland as the leading representative of the O'Neills. Phelim resigned the northern command in his favour, and escorted him from Lough Swilly to Charlemont. But jealousy between the kinsmen was complicated by differences between Owen Roe and the Catholic council which met at Kilkenny in 1642. Owen Roe's real aim was the complete independence of Ireland, while the Anglo-Norman Catholics represented by the council desired to secure religious liberty and an Irish constitution under the English crown. In 1646 a cessation of hostilities was arranged between Ormonde and the Catholics; and O'Neill, furnished with supplies by the papal nuncio, Rinuccini, turned against the Scottish parliamentary army under General Monro. On June 5, 1646, O'Neill routed Monro at Benburb, on the Blackwater; but, being summoned to the south by Rinuccini, he had to leave Monro unmolested at Carrickfergus. For the next two years confusion reigned, O'Neill supporting the party led by Rinuccini, though continuing to profess loyalty to Ormonde as the king of England's representative. Isolated by the departure of the papal nuncio from Ireland in 1649, he made overtures to Ormonde, and to Monk, who had superseded Monro in command of the parliamentarians in the north. O'Neill's chief need was supplies, and failing to obtain them from Monk he turned once more to Ormonde and the Catholic confederates, with whom he prepared to co-operate more earnestly when Cromwell's arrival in Ireland in August 1649 brought the Catholic party face to face with serious danger. Before anything was accomplished by this combination, however, Owen Roe died on Nov. 6, 1649.

The alliance between Owen Roe and Ormonde had been opposed by Phelim O'Neill, who after his kinsman's death expected to be restored to his former command. In this he was disappointed; but he continued to fight against the parliamentarians till 1652, when a reward was offered for his apprehension. Betrayed by a kinsman while hiding in Tyrone, he was tried for high treason, and executed on March 10, 1653. Phelim married a daughter of the marquis of Huntly, by whom he had a son Gordon O'Neill, who was member of parliament for Tyrone in 1689; fought for the king at the siege of Derry and at the battles of Aughrim and the Boyne; and afterwards commanded an Irish regiment in the French service, and died in 1704.

DANIEL O'NEILL (*c.* 1612–1664), a member of the Clanaboy branch of the family, spent much of his early life at the court of Charles I., and became a Protestant. He commanded a troop of horse in Scotland in 1639; was involved in army plots in 1641, for which he was committed to the Tower, but escaped; and on the outbreak of the Civil War returned to England and served with Prince Rupert, being present at Marston moor, the second battle of Newbury and Naseby. He then went to Ireland to negotiate between Ormonde and his uncle, Owen Roe O'Neill. He was made a major-general in 1649, and but for his Protestantism would have succeeded Owen Roe as chief of the O'Neills. He joined Charles II. at the Hague, and took part in the expedition to Scotland and the Scottish invasion of England in 1652.

HUGH O'NEILL (d. *c.* 1660), son of Owen Roe's brother Art Oge, and therefore known as Hugh Mac Art, had served with distinction in Spain before he accompanied his uncle, Owen Roe, to Ireland in 1642. After the death of Owen he defended Clonmel in 1650 against Cromwell, on whom he inflicted the latter's most severe defeat in Ireland. In 1647 he so stubbornly resisted Ireton's attack on Limerick that he was excepted from the benefit of the capitulation, and, after being condemned to death and reprieved, was sent as a prisoner to the Tower. He was released in 1652, and died, some time after 1660, probably in Spain.

The Clanaboy (or Clandeboye) branch of the O'Neills descended from the ancient kings through Neill Mor O'Neill, lord of Clanaboy in the time of Henry VIII., ancestor (as mentioned above) of the Portuguese O'Neills. Neill Mor's great-great-grandson, Henry O'Neill, was created baronet of Killeleagh in 1666. His son, Sir Neill O'Neill fought for James II. in Ireland, and died of wounds received at the battle of the Boyne. Through an elder line from Neill Mor was descended Brian Mac Phelim O'Neill, who was treacherously seized in 1573 by the earl of Essex, whom he was entertaining, and executed together with his wife and brother, some 200 of his clan being at the same time massacred by the orders of Essex. (*See* ESSEX, WALTER DEVEREUX, 1st earl of.) Brian Mac Phelim's son, Shane Mac Brian O'Neill, was the last lord of Clanaboy, and from him the family castle of Edenduffcarrick, on the shore of Lough Neagh in Co. Antrim, was named Shane's Castle. He joined the rebellion of his kinsman Hugh, earl of Tyrone, but submitted in 1586.

In the 18th century the commanding importance of the O'Neills in Irish history had come to an end. But John O'Neill (1740–1798), took an active part in debate in the Irish parliament, being a strong supporter of Catholic emancipation. He was one of the delegates in 1789 from the Irish parliament to George, prince of Wales, requesting him to assume the regency. In 1793 he was raised to the peerage of Ireland as Baron O'Neill of Shane's Castle, and in 1795 was created a viscount. In defending the town of Antrim against the rebels in 1798 O'Neill received wounds from which he died on June 18, being succeeded as Viscount O'Neill by his son Charles Henry St. John (1779–1841), who in 1800 was created Earl O'Neill. Dying unmarried, when the earldom therefore became extinct, Charles was succeeded as Viscount O'Neill by his brother John Bruce Richard (1780–1855), a general in the British army; on whose death without issue in 1855 the male line in the United Kingdom became extinct. The estates then devolved on William Chichester, great-grandson of Arthur Chichester and his wife Mary, only child and heiress of Henry (d. 1721), eldest son of John O'Neill of Shane's Castle.

WILLIAM CHICHESTER (1813–1883), 1st Baron O'Neill, a clergyman, on succeeding to the estates as heir-general, assumed by royal licence the surname and arms of O'Neill; and in 1868 was created Baron O'Neill of Shane's Castle. On his death in 1883 he was succeeded by his son Edward, 2nd Baron O'Neill, who was member of parliament for Co. Antrim 1863–80, and who married in 1873, Louisa, daughter of the 11th earl of Dundonald.

For the history of the ancient Irish kings of the Hy Neill see *The Book of Leinster,* edited with introduction by R. Atkinson (Royal Irish Academy, Dublin, 1880); *The Annals of Ulster,* edited by W. M. Hennessy and B. MacCarthy (4 vols., Dublin, 1887–1901); *The Annals of Loch Cé,* edited by W. M. Hennessy (Rolls Series, London, 1871). For the later period *see* P. W. Joyce, *A Short History of Ireland* (London, 1893), and *A Social History of Ancient Ireland* (2 vols., London, 1903); *The Annals of Ireland by the Four Masters,* edited by J. O'Donovan (7 vols., Dublin, 1851); Sir J. T. Gilbert, *History of the Viceroys of Ireland* (Dublin, 1865), and, especially for Owen Roe O'Neill, *Contemporary History of Affairs in Ireland, 1641–1652* (Irish Archaeol. Soc., 3 vols., Dublin, 1879); also *History of the Irish Confederation and the War in Ireland* (Dublin, 1882); John O'Hart, *Irish Pedigrees* (Dublin, 1881); *The Montgomery MSS.* "The Flight of the Earls, 1607" (p. 767), edited by George Hill (Belfast, 1878); Thomas Carte, *History of the Life of James, Duke of Ormonde* (3 vols., London, 1735); C. P. Meehan, *Fate and Fortunes of Hugh O'Neill, Earl of Tyrone, and Rory O'Donel, Earl of Tyrconnel* (Dublin, 1886); Richard Bagwell, *Ireland under the Tudors, with an Account of the Earlier History* (3 vols., London, 1885–90); J. F. Taylor, *Owen Roe O'Neill* (London, 1896); John Mitchell, *Life and Times of Hugh, Earl of Tyrone, with an Account of his Predecessors, Con, Shane, Turlough* (Dublin, 1846); L. O'Clery, *Life of Hugh Roe O'Donnell* (Dublin, 1893). For the O'Neills of the 18th century, and especially the 1st Viscount O'Neill, see *The Charlemont Papers,* and F. Hardy, *Memoirs of J. Caulfield, Earl of Charlemont* (2 vols., London, 1812). *The O'Neills of Ulster: Their History and Genealogy,* by Thomas Mathews (3 vols., Dublin, 1907), an ill-arranged and

uncritical work has little historical value, but contains a mass of traditional and legendary lore, and a number of translations of ancient poems, and genealogical tables of doubtful authority.

**O'NEILL, EUGENE GLADSTONE** (1888– ), American dramatist, was born in New York city, Oct. 16, 1888, the son of the well-known actor James O'Neill. His early education was received at Roman Catholic schools and at the Betts academy. He went to Princeton university for one year. He worked as sailor before the mast, actor, reporter, and in other capacities. He began assimilating his crowded experiences and impressions at a sanatorium to which he was ordered because of tuberculosis; in 1914–15 attended Harvard university; and in 1916 spent the summer at Provincetown, thus making contact with the group who produced nearly all his short plays. He rapidly became the most conspicuous of American dramatists, and thrice was awarded the Pulitzer prize: in 1920 for his play, *Beyond the Horizon,* in 1922 for *Anna Christie;* and in 1928 for *Strange Interlude.* Among his works are *Emperor Jones* (1921); *The Hairy Ape* (1922); *The Fountain* (1923); *All God's Chillun's Got Wings* (1924); *Desire Under The Elms* (1924); *Marco Millions* (1924); *The Great God Brown* (1925); *Dynamo* (1928); *Mourning Becomes Electra* (1931); *Ah, Wilderness!* (1932). In 1936 he became the second American to win the Nobel prize for literature.

*See* Barrett H. Clark, *Eugene O'Neill* (1926); A. D. Mickle, *Studies on Six Plays of Eugene O'Neill* (1929).

**ONEONTA,** the only city of Otsego county, New York, U.S.A., on the Appalachian highway and the Susquehanna river, 76 mi. S.W. of Albany. It is served by the Delaware and Hudson and the Central railways. Pop. (1920), 11,582 (92% native white); 1930, 12,536; 1940, 11,731. Oneonta is beautifully situated among the western foothills of the Catskills, at an altitude of 1,150 ft., in a fertile farming and dairying region. It is the seat of a state normal school (1889), a state armory and Hartwick college (United Lutheran; 1928). The manufacturing industries include extensive railroad shops, flour mills, dress and glove factories and had an output in 1927 valued at $5,786,299. Oneonta was founded about 1780 and until 1830 was known as Milfordville. It was incorporated as a village in 1848 and as a city in 1908. The name is derived from the Indian name for the creek flowing through the city.

**ONION,** *Allium cepa* (family Liliaceae), a hardy bulbous biennial, which has been cultivated from time immemorial. It is one of the earliest of cultivated plants; it is represented on Egyptian monuments, and one variety cultivated in Egypt was accorded divine honours. It is commonly cultivated throughout the temperate zones. A. de Candolle regards it as a native of western Asia. The edible part of the onion is the thickened bases of the leaves that arise from an extremely shortened or "telescoped" stem, the small hard structure at the base of the bulb, called the stem plate. The upper portion of the leaves is cylindrical and hollow. The seed stalk formed in the second season may be 2 to 5 ft. tall, topped by a globose umbel of small whitish flowers. In some types of onion this umbel is replaced by a cluster of bulblets, or bulblets and flowers. The seeds are small, black and shaped roughly like halves of a sphere. Most varieties of onion are sensitive to the length of day and night. Varieties adapted to summer culture in northern latitudes when the days are long will not form normal bulbs and ripen when grown during the short winter days of lower latitudes although soil and temperature may be favourable. Conversely, certain varieties that make large bulbs during the short winter days of low latitudes, ripen and stop growth when very small if grown during long days in higher latitudes. There are three main classes of onions: (1) those forming well-developed bulbs the first season and seeds the second season; (2) forms in which bulbs form at the top of the stalk; (3) the non-bulbing "multiplier" onion that is propagated by division of the cluster of vegetatively produced plants. The mild Spanish type of onion must be used soon after harvest while the hot, firm, northern varieties can be stored all winter.

Most varieties, particularly those grown extensively in Great Britain, and the northern parts of Europe and the United States, require a cool or mild mean temperature. The Spanish and Egyptian types will tolerate hot days of spring or early summer but are not adapted to midsummer heat of the lower latitudes. Seed must thus be sown as far ahead of summer heat as possible, and still escape sharp freezing weather: late February to mid-March in England, or late March and early April in the northern United States. In the southwestern United States and in England seed of adapted varieties is sown in the fall. A large portion of the crop in the United States is grown from seedlings transplanted from plant beds to the field 3 in. apart, and from small dry bulbs or "sets" grown from seed the previous year. Small bulbs or sets are grown by planting seed very thickly (50 to 100 lb. per acre) in a wide band, on soil of moderate fertility, thus crowding and stunting the plants. Onions require rich soil, especially well prepared. Onions grown from seed sown in the field require careful thinning to 2 to 4 in. apart in the rows, depending on variety and conditions of culture. Rows are usually 1 to 1½ ft. apart. The average annual production of onions in the United States, for market, was (1930–41) about 14,500,000 sacks of 100 lb. each, from about 121,000 ac. of land. (V. R. B.)

**ONNES, HEIKE KAMERLINGH** (1853–1926), Dutch physicist, was born in Groningen on Sept. 21, 1853. He studied mathematics and physics in his native town. In 1871 he went to Heidelberg, where he studied under Bunsen and Kirchhoff (*qq.v.*). Later he returned to Groningen, where in 1879 he took his doctor's degree. He was professor of experimental physics at Leyden, 1882–1923. Here he founded and developed the famous Cryogenic laboratory. Stimulated by van der Waals, Onnes became interested in the equations of state and the general thermodynamic properties of liquids and gases. (*See* THERMODYNAMICS.) Onnes set himself the task of making measurements over a large range of pressure and temperature. His name is associated particularly with the measurement and attainment of low temperatures; in this direction Onnes showed himself a master of experimental physics. In 1908 he succeeded in liquefying helium, but was unable to solidify it; this was subsequently done by his successor Keesom. Onnes obtained the isothermals for a number of gases and mixtures of gases at low temperatures; he also studied the optical, magnetic and magneto-optical properties of bodies. He carried out investigations on the influence of low temperatures on nickel and manganese iron alloys. He also demonstrated that the resistance of electric conductors disappeared suddenly at a temperature near the absolute zero, and termed this phenomenon "super-conductivity." His systematic researches on super-conductivity (started in 1914) are of extreme importance on account of their bearing on the theory of electrical conduction in solids (*see* ELECTRICITY, CONDUCTION OF: *Solids*). In 1913 the Nobel prize for physics was conferred on him. His published work includes *Algemeine Theorie der Vloeistoffen* (*General Theory of the Fluids,* 1881). He died at Leyden on Feb. 21, 1926.

*See* J. P. Kuenen, *De Toekenning van den Nobelprys aan H. Kamerlingh Onnes* (*Chemisch Weekblad, 1913*).

**ONOMACRITUS** (*c.* 530–480 B.C.), seer, priest and poet of Attica. He had great influence on the development of the Orphic religion and mysteries, and was said to have composed a poem on initiatory rites. The works of Musaeus, the legendary founder of Orphism in Attica, are said to have been reduced to order (if not actually written) by him (Clem. Alex. *Stromata,* i. p. 143 [397]; Pausanias i. 22, 7). He was in high favour at the court of the Peisistratidae till he was banished by Hipparchus for making additions of his own in an oracle of Musaeus. When the Peisistratidae were themselves expelled and were living in Persia, he furnished them with oracles encouraging Xerxes to invade Greece and restore the tyrants in Athens (Herod. vii. 6).

*See* F. W. Ritschl, "Onomakritos von Athen," in his *Opuscula,* i. (1866), and p. 35 of the same volume: Smith, *Dict. of Gk. and Roman Biography* s.v. (bibl.).

**ONONDAGA,** a tribe of North American Indians of Iroquoian stock, forming one of the Six Nations. The tribal headquarters was about the lake and creek of the same name in New York state. Their territory extended northward to Lake Ontario and southward to the Susquehanna river. They were the official guardians of the council-fire of the Iroquois. Their chief town,

near the site of the present Onondaga, consisted of some 140 houses in the middle of the 17th century, when the tribe was estimated as numbering between 1,500 and 1,700. During the 18th century the tribe divided, part loyally supporting the Iroquois league, while part, having come under the influence of French missionaries, migrated to the Catholic Iroquois settlements in Canada. Of those who supported the league, the majority, after the War of Independence, settled on a reservation on Grand river, Ontario, where their descendants still are. In 1926 there were 568 upon the Onondaga reservation in New York state.

For Onondaga cosmology see *21st Ann. Report Bureau Amer. Ethnol.* (1899–1900). *See* also NORTH AMERICA: *Ethnology*.

**ONTARIO,** a province of Canada, bounded broadly by Quebec to the east, by the states of New York, Ohio, Michigan and Minnesota to the south, by Manitoba to the west, and part of Hudson bay with James bay to the north. In most cases the actual boundary consists of rivers and lakes, the Ottawa to the northeast, the St. Lawrence and its chain of lakes and rivers to the south as far as Pigeon river, which separates Ontario from Minnesota. From this point it follows small rivers and lakes to the Lake of the Woods, between Ontario, Minnesota and Manitoba. From Lake Timiskaming northwards the eastern boundary is the meridian of 79° 30′.

**Physical Geography.**—Ontario extends 1,000 mi. from east to west and 1,050 mi. from north to south, between latitudes 57° and 42°, including the most southerly point in Canada. Its area is 412,582 sq.mi. (49,300 water), and it is the most populous of the provinces, but the bulk of its inhabitants live in one-tenth of its area, between the Great Lakes, the Ottawa and the St. Lawrence, a country of relatively fertile soils.

The southwestern part is divided into two tracts by the Niagara escarpment, a line of cliffs capped by hard limestones, running from Queenston Heights near Niagara falls west to the head of Lake Ontario near Hamilton, and then northwest to the Bruce peninsula on Georgian bay. The tract northeast of the escarpment has an area of 9,000 sq.mi. and an altitude of 250 to 1,000 ft., and the southwestern tract includes 15,000 sq.mi. with an elevation of 600 to 1,700 ft. Within this last petroleum, natural gas, salt and gypsum are obtained, but elsewhere in southern Ontario there are no economic minerals except building materials. The higher areas consist of rolling hills of boulder clay or moraines; the lower levels are plains sloping towards the Great Lakes and containing the silt deposited in ancient lakes at the end of the glacial period. The old shore cliffs and gravel bars of these glacial lakes frequently provide sites for roads, towns and cities. The Niagara escarpment is the cause of waterfalls on all the rivers which plunge over it, Niagara falls being of course the most important.

While all the larger cities and most of the manufacturing and farming districts are in southern Ontario, there is developing a "new Ontario," stretching for hundreds of miles to the north and northwest of the region just described and covering a much larger area, chiefly made up, except for an extensive clay belt, of ancient rocks forming the Pre-Cambrian shield. The rocky character of this area long repelled settlement until its abundant minerals, water powers and northern forests invited exploitation. Now powerful industries dependent upon these natural resources have drawn population.

**Lakes and Rivers.**—Numerous lakes and rivers are scattered throughout Ontario, the most important chain being that of the St. Lawrence and the Great Lakes with their tributaries, which drain the more populous southern districts. Lake Nipigon, a beautiful body of water 852 ft. above the sea, 70 mi. long and 50 mi. wide, may be regarded as the headwaters of the St. Lawrence, since Nipigon river is the largest tributary of Lake Superior. All the rivers entering Lake Superior have high falls, which provide power for the industries of the region. At the southeastern end of Lake Superior the St. Mary's river carries its waters to Lake Huron, with a fall from 602 to 581 ft., most of which takes place at Sault Sainte Marie, where locks permit vessels of 10,000 tons to pass from one lake to the other and where water power is generated. The northeast shores of Lake Huron and its large expansion, Georgian bay, are fringed with thousands of islands, mostly small, but Manitoulin Island, 80 mi. long and 30 mi. broad, is a notable exception. This island and the Bruce peninsula shut away the greater part of Georgian bay from the main lake.

Lakes Superior and Huron both reach depths hundreds of feet below sea level, but Lake St. Clair, towards which Lake Huron drains southward through the St. Clair river, is shallow and marshy. Detroit river connects Lake St. Clair with Lake Erie at an elevation of 570 ft., and this comparatively shallow lake, running for 240 mi. east and west, empties northwards by Niagara river into Lake Ontario, which is only 246 ft. above the sea. Niagara falls, with rapids above and below, hurry the waters of the upper lakes over the Niagara escarpment, and richly provide hydro-electric power for the industries of southern Ontario. The Welland canal, between Port Colborne on Lake Erie and Port Weller on Lake Ontario, has a minimum depth between locks of 27½ ft., and of 30 ft. in the locks. From Lake Ontario the St. Lawrence passes through the meshes of the Thousand Islands, and follows several rapids separated by stretches of quiet water to Montreal at the head of ocean navigation. Some steamers can run the rapids going down, but must ascend through the canals. All other rivers in southern Ontario are tributaries of the lakes or of the St. Lawrence; the Ottawa, navigable in parts, being the largest, and the Trent next in importance. Numerous lakes in northern Ontario constitute a picturesque region for summer resorts, especially Lake Timagami, the Muskoka lakes and Lake of the Woods, the last mentioned forming part of the Hudson bay system of waters flowing through Manitoba. In Ontario the Albany, Moose, Missinaibi and Abitibi flow into Hudson bay, but none of these rivers is navigable except for canoes.

**Climate.**—The climate of Ontario varies greatly, as might be expected from its wide range of latitude and the relations of the Great Lakes to the southern peninsula of the province. The northern parts, as far south as the north shore of Lake Superior, have long and cold but bright winters, with temperatures reaching sometimes −50° F.; while the summers are delightful, with much sunshine and some hot days but pleasantly cool nights. Between Georgian bay and Ottawa the winters are less cold, but usually have a plentiful snowfall; while the summers are warm. The southwest peninsula of Ontario has a climate greatly modified by the lakes which almost enclose it. As the lakes never freeze the prevalent cold northwest winds of North America are warmed in their passage over them, and often much of the winter precipitation is in rain, resulting in weather more uncertain than that in the north. The summers are often sultry, although the presence of the lakes prevents the intense heat experienced in the states to the south and west. Owing to its mild winters, the southwest peninsula is a famous fruit country, and also grows such field crops as Indian corn (maize) and tobacco. Small fruits and tomatoes are widely cultivated for the city markets and the canning industry.

**Population.**—The population of the province in 1941 was 3,787,655 and the growth since 1911 is reflected in the decimal census of the dominion:

| | 1911 | 1921 | 1931 | 1941 |
|---|---|---|---|---|
| Population of province | 2,527,292 | 2,933,662 | 3,431,683 | 3,787,655 |
| Percentage of the total dominion population | 35.07 | 33.38 | 33.07 | 32.89 |

The percentage increase of the population in 70 years (1871–1941) was 131.77. In 1941 the density of population (number of persons per square mile of land area) was 10.34, compared with the average for the nine provinces of 5.69. An increasing percentage of the people live in cities, towns or incorporated villages, as is illustrated in two such census years as 1911 and 1931:

| | 1911 | 1931 |
|---|---|---|
| Percentage of population rural | 47.43 | 38.92 |
| Percentage of population urban | 52.57 | 61.08 |

The smallest urban unit, the village, when asking for incorporation must by provincial law have a population of at least 750 in an area not exceeding 500 ac. The villages are numerous, and in

1941 Ontario had 60 cities and towns with over 5,000 inhabitants. At the same date the largest city and capital of the province, Toronto, had a population of 667,457, and Greater Toronto, which included the satellite communities in close relationship to the city, had 909,928. Four other important cities, each having over 75,000 people, are Hamilton, Ottawa, London and Windsor. Racially Ontario ranks third among the nine provinces in the proportion of the British in its population. In 1931, 74% of the people were of British origin, 8% French and 15% European other than British and French. The French settlements are mainly near the St. Lawrence and in the newer areas of northeastern Ontario. The strongest sectarian group numerically is the United Church, which as in other provinces resulted from union of the Methodists, Congregationalists and Presbyterians. Its strength and influence have given a puritan tone to social life and legislation. Next in strength of membership is the Anglican Church followed closely by the Roman Catholic.

**Government.**—The structure of government in Ontario differs little from that in other Canadian provinces. Nominally executive power is vested in a lieutenant-governor appointed for five years by the federal administration, but actually dwells in an executive council, the members of which sit in and are responsible to an elected legislature in unison with the traditional British principles of cabinet government. The legislature consists of one house, 90 members, elected on a wide franchise including women; its maximum life is five years unless extended by special act. The revenue of the provincial government has been derived from a variety of direct taxes, licences, dominion subsidies, royalties from use of resources, and returns on the sale and control of liquor. An extensive system of municipal administration has existed since the middle of the 19th century, and in 1940 embraced 38 counties, 27 cities, 148 towns, 156 villages and 571 townships, all of these possessing in some form elected councils and officials with some taxing power on property. The municipal regime of Ontario has influenced notably the municipal development in other provinces, especially the provinces of the west.

**Education.**—Ontario has been distinguished for its ready support of education. In the early years, the legislature made considerable grants of land for this purpose, and today (1943) no other service of government absorbs so large a proportion of the provincial expenditure. A minister in the executive council is responsible to the legislature for policy, and his permanent deputy may exercise a more important influence. School inspectors, appointed by the provincial department, endeavour to secure throughout the province uniform standards, while in every school section elected trustees levy taxes, appoint the teachers and in general provide for the needs of the local school. Attendance is compulsory between the ages of 8 and 16 although in rural areas permission is readily obtained for children to work on farms from the age of 14, and under special conditions the law may be relaxed also in the cities. The public schools are free and undenominational, but not secular, as prayer and Bible reading may hold a place in the daily program. Since 1863 the Roman Catholics have exercised the right to separate schools, set up in any district upon request of not less than five heads of families. Taxes levied upon the supporters of these institutions are devoted wholly to their maintenance. Protestants and Negroes may also claim, but rarely do, the right to separate schools.

Secondary education, with increased emphasis on social studies, is provided in high schools and collegiate institutes, which may require fees or give free education at the option of the local trustees. There are also many incorporated private schools, exempt from municipal taxation. They are grouped principally in Toronto and its neighbourhood, the most distinguished being Upper Canada college, founded in 1829. Higher education is provided by the provincial university in Toronto and four other universities: Queen's in Kingston, Western in London, McMaster (Baptist) in Hamilton, and the University of Ottawa (Roman Catholic) in the federal capital. The provincial institution, known as the University of Toronto, had in 1942 a student body of more than 7,000 in all faculties. It is a federation of colleges, with a distinguished place among the universities of North America. All the universities are co-educational, and women generally form about two-fifths of the whole student body. In addition to the universities, model and normal schools exist to train teachers, while scientific agriculture is promoted by the Ontario Agricultural college at Guelph, founded and endowed by the government.

**Agriculture.**—Ontario is the richest agricultural province in the dominion. The value of its farm capital (including land, buildings, implements and stock) exceeds a quarter of the total value of farm capital in Canada; the same remark may be made of the gross values of its agricultural production, and the average value per acre of its occupied farm land ranks next to that of British Columbia. Notable is the wide variety of production. Field crops take the lead in gross value, followed by dairying, production of farm animals, poultry products, fruits and vegetables (much production for canning), sugar beets and tobacco. Wheat-growing has long ceased to hold the premier place that it still retains in the prairie provinces, and farmers, in not depending upon the foreign wheat market, are saved from the rapid changes of income suffered by their compatriots farther west. The average Ontario farmer has won relative security through diversification, made possible by the presence of urban markets and a suitable climate and fertility. But there is some regional specialization in products. Fruit-growing extends throughout the Niagara peninsula and along the lakes of Erie and Ontario. Apples, peaches, pears, plums, cherries and grapes are the principal commercial fruits. Dairying is usually close to the urban centres. Tobacco is grown in the southwestern part of the province, the most southern area in Canada. A mixed and pioneer farming is found in the clay belt of the north, the products being sold in the mining centres. The ordinary farm in the province ranges between 50 and 150 ac., and most farms are worked by their owners.

**Manufactures.**—Ontario leads the other provinces individually in the gross and net value of manufactures; indeed for a generation the gross value of its manufactures has equalled that of the remainder of Canada, and the net value exceeds greatly that of agriculture within the province. This premier place of manufacturing in the economy is due finally to the geographic assets of Ontario: the fertile soils maintaining many farmers with a high standard of life, the presence of rich forest and mineral resources, the relative proximity to the coal and iron ore of the United States, the cheap transport afforded by the St. Lawrence and the Great Lakes, and the abundance of water power which has made up for the absence of domestic coal and has stimulated the rise of electro-metallurgical industry. In manufactures, as in agriculture, notable is the variety of production, which includes both capital and consumable goods, nonferrous metal smelting and refining, automobiles, agricultural implements, meat-packing products, electrical apparatus, machinery, pulp and paper, flour and livestock feed, rubber goods, leather, butter, cheese, primary iron and steel, furniture, hosiery, knit goods, gloves, canned fruit and vegetables, petroleum products, cocoa and chocolate. In some of the above instances, notably agricultural implements, rubber and leather goods, Ontario is responsible for over 75% of the whole Canadian production. Significant in the manufacturing development has been the extension of American branch plants, which concentrate in Ontario more than in any other province. The strong automotive industry, confined almost entirely to this province, has been mainly an overflow across the frontier of the near-by American industry, and technology and skill are abundantly imported as well as capital.

**Water Power.**—Among Canadian provinces Ontario ranks second to Quebec in the horse-power developed and in potential power resources. In 1940 the figure of turbine installation was 2,597,595 h.p. and the potential 24-hr. power at ordinary minimum flow was estimated at 5,330,000 h.p. Most of the power is developed in central electric stations, but much is produced by pulp and paper mills and other industries. Ontario was the pioneer province in the public ownership of hydro power. In 1906 it constituted the Hydro-Electric Power commission, which at first merely bought power generated at Niagara by private companies and transmitted it at cost to the municipalities, the initial capital being provided by the government. Later the commission

purchased the private companies at Niagara and elsewhere, and thus achieved for public ownership the most vital force in the industry of the province. Public opinion and all the political parties have consistently supported this policy of public ownership, although some details of the policy have given rise to sharp controversy. In 1940 the commission served 886 municipalities and 748,232 customers with a total of 1,954,069 h.p. Modern significant developments have been the purchase and import of power from private Quebec companies (some power is transmitted 225 mi. from the Gatineau river to Toronto) to meet the expanded needs of manufactures in southern Ontario; the utilization of many power sites in the north, notably on the Abitibi, to aid mining and the pulp industry; the extension of rural electrification through subsidies from the government; and the diversion of water from parts of the Kenogami and Ogoki rivers, which are tributaries of the Albany flowing to James bay, into the Lake Superior system, thus ultimately increasing the hydro-power of the Niagara.

**Mining.**—Since 1907 Ontario has been the chief mineral-producing province of Canada, and now (1943) annually contributes about 50% of the total mineral production of the dominion. The minerals are varied, including gold, silver, cobalt, radium, copper, nickel, lead, zinc and practically all the commercial nonmetallic minerals except coal. The richest mining areas are in the extensive Pre-Cambrian region of northern Ontario, although petroleum, natural gas and salt have been developed in the southwestern peninsula of the province. For many years, thanks to the nickel-copper deposits at Sudbury, Ontario has been the principal producer of the world's supply of nickel, turning out in 1938 some 83% of that supply. The International Nickel company at Sudbury has been notable for finding varied industrial uses for its metal. But in the economic life of Ontario for many years the crucial mineral factor has been gold, of which this province produces between 50% and 60% of the total Canadian output. Here as elsewhere the special stimulus to mining came with the revaluation of gold in the depression of the '30s, when old properties were enlarged and new mines were discovered and speedily developed. In 1925 Ontario produced in gold 1,461,039 fine oz.; in 1941, 3,194,308. This expansion created for Canada essential foreign credits both before and after the outbreak of war in 1939. Most of the Ontario gold comes from auriferous quartz mines in the districts of Porcupine and Kirkland Lake. In contrast with the gold of Quebec and Manitoba, only a negligible quantity is derived from mines producing ores of copper, nickel and zinc. Ontario has also much iron ore, generally of low grade, but the development of a promising mine of high grade ore at Steep Rock lake west of Port Arthur was stimulated by war in 1939.

**Forest Industry.**—Over 60% of the land area of Ontario is classified as forested, or some 241,000 sq.mi., of which the bulk is still under the crown. The area of merchantable timber is of course much smaller than this figure, being about 66,000 sq.mi. Among the provinces, Ontario ranks second to Quebec in total stand of timber, estimated in 1942 at 71,000,000,000 cu.ft. out of a total for Canada of accessible timber of 212,000,000,000 cu.ft. Undue importance, however, need not be attached to the precise figures, since in detail they are subject to error and are constantly revised. It is sufficient to emphasize that Ontario has highly valuable forests which still profoundly influence its economic development, as they helped to shape its history, feeding with raw material many secondary manufactures. Varied are its commercial woods. White pine, durable and easily worked, has the largest market, while red pine, spruce, jack pine, birch, hemlock, balsam and maple are also significant. The pulp and paper industry, providing much employment and facilitating Canadian foreign exchange, is central in the forest economy of northern Ontario, where it exists as the dominant secondary industry not merely because of abundant spruce and balsam but also because of hydro power in the numerous rivers of the Pre-Cambrian shield. Secondary to pulp and paper but important is the sawn lumber industry, which found a wider market in manufactures when war in 1939 checked the displacement of lumber materials by metals. Owing to the shortage of light metals wood, for example, was reintroduced to the manufacture of aeroplanes. Progress has been made in forest conservation, notably in fire control with the effective aid of lookout towers, aviation and more rigorous regulations, but the opportunity for a considerable advance in the scientific management of the forest as a natural resource related to other resources remains. In the past the Ontario forest was recklessly exploited, and in the southern part of the province today many counties have less than 10% wood coverage, not always sufficient even to protect watersheds. A beginning has been made in developing county forests, and also many millions of commercial trees are distributed annually from government nurseries for private reforestation. Significant are the eight proclaimed provincial forests, of which the largest is Timagami (6,830 sq.mi.), wherein settlement is prohibited, and no timber may be sold except by order in council. It is the aim to bring these forests on a sustaining yield basis. Two provincial forest parks are Algonquin (2,740 sq.mi.), in the highlands of Ontario, and Quetico (1,500 sq.mi.), in the Rainy river country, which are maintained chiefly to insure a primeval forest, to protect wild life, and to offer a recreation resort for the public.

**Communications.**—The waterways of Ontario, previously described, provide natural avenues of communication which have greatly aided the development of the province. But in addition to the waterways, the southern and closely peopled part of Ontario is gridironed with steam railways and roads, some American lines also running through the southwestern portion of the province. The province has one-fourth of the total single-track mileage of the dominion, some 10,657. A portion of the mileage in the past was constructed under the spur of municipal and provincial subsidies, and gradually many small lines were consolidated into great railway systems. Important in opening up the mining areas of northern Ontario has been the provincially-owned line, known as the Temiskaming and Northern Ontario railway (with a mileage of 514), constructed and operated by the Ontario Government Railway commission. In 1939 the province had surfaced roads totalling 55,379 mi., which then constituted one-half of the total for the whole of Canada and partly explained why Ontario drew more American tourists than any other province. Ninety per cent of this road mileage was surfaced with gravel and stone. Registered motor vehicles numbered over 600,000 in 1938. (A. Br.)

## HISTORY

Champlain was the first European to record anything about the present Ontario. In 1613 he went up the Ottawa in a vain search for the northern ocean; and in 1615 he pushed westward and reached the eastern shores of Lake Huron, the first to tell of the Great Lakes with their vast stretches of fresh water.

Missions to the natives were a chief interest of the French pioneers in Canada and within Ontario is found their earliest important effort. Huronia, on the borders of Lake Simcoe and the Georgian bay, the scene of a promising Jesuit mission, was devastated by the Iroquois in 1649 with the martyrdom of Fathers Brébeuf, Lalemant and others, making one of the most tragic stories in Jesuit annals. Meanwhile, the fur trade expanded and, before the British conquest, the French had trading posts at strategic points; Fort Frontenac, where now is Kingston—a defiance of the Iroquois—on the south side of Lake Ontario; Toronto, on its north shore, near the west end; Niagara; Detroit; Michilimackinac at the entrance to Lake Michigan; Sault Ste. Marie and on the greatest and farthest lake, Superior, a fort where now stands the city of Fort William.

They did, however, little settlement and, apart from such posts, Ontario was virgin wilderness when in 1763 it became British. In 1774, by the Quebec act, it became a part of the province of Quebec ruled from Quebec. The American Revolution began in the next year and for the first time, came serious settlement by exiled loyalists from the United States, bitterly hostile to that country. The Quebec act entrenched the civil law of France; but the loyalists wished English law and a representative assembly, and in 1792 two Canadas were created; Lower Canada, east of the Ottawa river; Upper Canada, west; each with its own legislature. At once Upper Canada adopted English law. The first governor, John Graves Simcoe, considered the seat of government at Niagara was too near the American frontier; and it was quickly changed to York, the present Toronto.

The mind of Simcoe, a soldier, appointed later commander in chief in India, was, with justice, alert on problems of defense. When war with the United States broke out in 1812, the Americans captured and burned York, for which later the British retaliated by burning the Capitol at Washington. Only after peace in 1814 and the fall of Napoleon in 1815 was there adequate opening for development. English, Scots and Irish arrived in considerable numbers, until, by 1837, there were 350,000 people in Upper Canada. Political differences became acute; one extreme wing, composed chiefly of the loyalist elements, was reactionary; the other, led in the end by a Scot, William Lyon Mackenzie, was radical. In Lower Canada there was a similar issue with Papineau as the radical leader. Holding the middle ground, on clear-cut principles of constitutional right, was Robert Baldwin. He claimed that in Upper Canada as in England the head of the state must govern through advisers who had the confidence of the people. After abortive rebellion in both provinces in 1837–38 a striking political evolution took place. Upper and Lower Canada were united in 1842 under a parliament in which they had equal representation. Sectionalism as between French and English endured and the solution was found in 1867 in a federal system. (*See* CANADA: *History.*)

Apart from its few burning issues about self-government, Ontario has a quiet history. With a population chiefly British in political traditions, it has played an important part in solving problems of self-government of moment for the whole British empire. When in 1792 Upper Canada was created, the Protestant religion was endowed with public lands. First the Church of England alone benefited. But its members were a minority of the population; other religious bodies protested angrily; and, in the end, the principle of the state endowment of religion was abandoned in Upper Canada. Baldwin's clear-cut teaching made also inevitable cabinet government on the model developed in England.

The federal constitution of 1867 gave Ontario a legislature, and cabinet government on this developed model. There was the new feature in Ontario of the abolition of the second chamber. The legislature might, indeed, at its discretion create one but this has not been done. The most populous of the Canadian provinces has still but one chamber; and so far has this been from involving capricious change that one prime minister remained in office for a quarter of a century. The system has worked so well as now to be accepted in all the Canadian provinces except Quebec. While Sir Oliver Mowat was prime minister of Ontario from 1871 to 1896 disputes arose as to the limits of federal and provincial authority. Mowat was a strenuous supporter of the rights of the provinces; and appeals to the privy council and experience have united to establish the principle that, within their defined rights, the provinces are supreme, and not under the supervision of the federal authority. By a curious paradox they have, in some respects, fuller powers, for they can alter their own constitutions.

The long Liberal ministry of Mowat was followed by a decline of the party's prestige and in 1905 the Conservatives, led by Sir James Whitney, came into power. In 1916, during World War I, Whitney's successor, Sir William Hearst, passed a drastic Prohibition law relating to the sale of intoxicating liquors. They could be bought only at government stores and on a medical certificate of illness; and all public drinking places were closed. An election in 1919 gave the new Farmers' party a larger number of members than had either the Conservatives or the Liberals and they took office under C. A. Drury. They showed a lack of experience, and in 1923, while the Liberal party made a poor showing, the Conservatives, under G. Howard Ferguson, came into power with a large majority. There was discontent with the rigour of the Prohibition law and in 1926 Ferguson carried his second election by securing a large majority for the system now in effect in Ontario of state control of the liquor traffic. Drinking places remain closed; but, under individual licences and strict supervision, purchase is permitted and the government gets a considerable revenue from its monopoly of the trade. Apart from this there has been recently no acute division on provincial policy. The strongly conservative legislature of 1929 gave way at the 1934 elections to one dominated by the Liberals.

The Conservatives were sustained in power in the general election of 1929, but Mr. Ferguson, who accepted in 1930 the office of Canadian high commissioner in London, was succeeded by G. S. Henry in the provincial prime ministership. The party was defeated in 1934 and the Liberals assumed office under Mitchell Hepburn, who was succeeded in 1942, in a cabinet reconstruction, by his colleague Gordon Conant, but remained in office as provincial treasurer. The leadership of the Conservatives in opposition passed to Col. George Drew. During Mr. Hepburn's regime Ontario politics centred largely on power policy, on the cancellation by the Ontario government of the contracts with extraprovincial power companies (by virtue of jurisdiction over property and civil rights (B.N.A. act [§92]). With this went a general alienation of the policy of Mr. Hepburn's Liberal government from that of the Liberal government at Ottawa.

BIBLIOGRAPHY.—J. E. Middleton and F. Landon, *The Province of Ontario, A History* (4 vols. Toronto, 1927–28) with much unimportant local material, covers the salient history adequately. There are many county histories. For general political development *see* the authorities cited under CANADA. C. R. W. Biggar, *Sir Oliver Mowat* (2 vols. Toronto, 1905) is in effect, a history of Ontario for the 30 critical years after federation. (G. M. W.; X.)

**ONTARIO,** a city of San Bernardino county, California, U.S.A., 38 mi. E. of Los Angeles, at an altitude of 1,000 feet. It is served by the Pacific Electric, the Santa Fe, the Southern Pacific and the Union Pacific railways. The population was 14,197 in 1940. It lies on a sloping plateau at the foot of Mt. San Antonio ("Old Baldy," 10,080 ft. high). Through the heart of the city and on up to the foothills runs famous Euclid avenue, a straight avenue 8 mi. in length and 200 ft. wide, with pepper trees on either side of a central lawn strip. Citrus fruit, peaches, apricots, grapes, walnuts, dairy, poultry products and rabbits are products of the region. The city has packing plants and nurseries; its manufactures include pectin, orange juice and citric acid, clay pigeons, handcraft commodities, electric irons and other household appliances. The Cal-Aero academy is there, a primary centre of the U.S. army air corps. Ontario was founded in 1882, by George and William B. Chaffey; incorporated, 1891. It is governed by a modified council-manager form.

**ONTARIO, LAKE,** the smallest and most easterly of the Great Lakes of North America, is bounded on the north by the province of Ontario and on the south by the state of New York. It is roughly elliptical, its major axis, 180 mi. long, lies nearly east and west, and its greatest breadth is 53 mi. The area of its water surface is 7,540 sq.mi. and the total area of its basin 34,630 sq.mi. Its greatest depth is 738 ft., its average depth much in excess of that of Lake Erie, and it is, as a general rule, free from outlying shoals or dangers.

**Physiography.**—On the north side of the lake the land rises gradually from the shore, and spreads out into broad plains, which are thickly settled by farmers. A marked feature of the topography of the south shore is what is known as the Lake ridge, or, as it approaches the Niagara river, the Mountain ridge. This ridge extends, with breaks, from Sodus to the Niagara river, and is distant from the lake 3 to 8 mi. The low ground between it and the shore is a celebrated fruit-growing district, covered with vineyards, peach, apple and pear orchards and fruit farms. The Niagara river is the main feeder of the lake; the other largest rivers emptying into the lake are the Genesee, Oswego and Black from the south side, and the Trent, which discharges into the upper end of the bay of Quinte, a picturesque inlet 70 mi. long, on the north shore, between the peninsula of Prince Edward, near the eastern extremity of the lake, and the mainland. The east end of the lake, where it is 30 mi. wide, is crossed by a chain of five islands, and the lake has its outlet near Kingston, where it discharges into the head of the St. Lawrence river between a group of islands. Elsewhere the lake is practically free from islands. There is a general surface current down the lake towards the eastward of about 8 mi. a day, strongest along the south shore, but no noticeable return current. As a result of its relatively great depth there are seldom any great fluctuations of level in this lake due to wind disturbance, but the lake follows the general rule of the Great Lakes of seasonal and annual variation. Its mean surface elevation above mean sea level, for a period of 68 years, is 246.09 ft., which is some 326.33 ft. below the level of Lake Erie. The lake never freezes over except near land, but the harbours are closed by ice from about mid-December to mid-April.

**Ports.**—The principal Canadian ports are Kingston, at the head of the St. Lawrence river; Toronto, where the harbour is formed by an island with improved entrance channels constructed both east and west of it; and Hamilton, at the head of the lake, situated on a land-locked lagoon, connected with the main lake by Burlington channel, an artificial cut. The principal U.S. port is Oswego, where a breakwater has been built, making an outer harbour.

**Commerce.**—The commerce of Lake Ontario is limited in comparison with that of the lakes above Niagara Falls, and is in general confined to vessels which can pass the Welland canal and the St. Lawrence canals; the harbours on the lake are planned to accommodate vessels limited to the size determined by the dimensions of the smallest locks, which are: length 270 ft., width 45 ft. and depth 14 ft. on sills. The commerce on the lake is generally confined to coal shipped from Rochester, Sodus bay, Little Sodus bay and Oswego to Canadian ports on the lake and U.S. and Canadian ports on the St. Lawrence river; to coal from Oswego to upper lake ports; to grain and other products shipped from upper lake ports through the Welland canal to the St. Lawrence; to lumber from Canadian ports; and to pleasure traffic.

**Canals.**—The completion, about 1930, of the New Welland canal by the Canadian Government (*see* NIAGARA RIVER) will permit the large lake vessels now operating on the upper Great Lakes to enter Lake Ontario. Negotiations under way in 1928 between the United States and the Canadian Governments will undoubtedly result in the improvement of the St. Lawrence river for power and navigation, thereby providing a navigable channel to the sea, suitable for ocean-going vessels. For a century, the Erie and Oswego canals, built and operated by the State of New York, have been important water outlets from Lake Erie and Lake Ontario to the Hudson river and to New York city. The present canal is 12 ft. deep and is designed for use by boats drawing 10½ feet. The canal distance from Oswego to New York city is 338 miles. The Murray canal extends from Presqu'ile bay, on the north of the lake, to the head of the bay of Quinte, and enables vessels to avoid 70 m. of open navigation. It is 11 ft. deep below the lowest lake level and has no locks.

Trent canal is the term applied to a series of rivers and lakes connected by short canals, designed to form a continuous system of light-draught navigation between Lake Ontario and Georgian bay, Lake Huron. Six-foot navigation is now available for 224 m. from Lake Ontario to Swift Rapids on the Severn river and, upon completion of the Severn division at the Georgian bay end, will be possible for the entire route. Even now facilities are provided whereby small motor boats proceed through from Lake Ontario to Lake Huron. At Kingston the Rideau canal, extending 128 m. to Ottawa, enters the St. Lawrence river at the foot of the lake. This canal has 47 locks, with minimum dimensions of 134 ft. by 33 ft., and a depth of 5 feet.

BIBLIOGRAPHY.—Bulletin No. 37, *Survey of Northern and Northwestern Lakes* (Detroit, April 1928); *Annual Report* of Chief of Engineers, U.S. army, U.S. Government Printing Office (1927); *The St. Lawrence Waterway*, report of Joint Board of Engineers appointed by the Governments of the United States and Canada, U.S. Government Printing Office (1927). (E. JA.)

**ONTENIENTE,** a town of eastern Spain, in the province of Valencia; on the right bank of the Clariano or Onteniente, a subtributary of the Júcar, and on the Játiva-Villena railway. Pop. (1940) 11,712 (mun., 13,564). Onteniente has a parish church remarkable for its lofty square tower, and a palace of the dukes of Almodovar. Linen and woollen cloth, paper, brandy, furniture and earthenware are manufactured.

**ONTOLOGY,** the name given to that branch of philosophy which deals specially with the nature of being, *i.e.*, reality in the abstract. The idea, denoted in modern philosophy by the term "ontology" in contrast to the broader "metaphysics" and the correlative "epistemology," goes back to such phrases as ὄντωςὄντα, which Plato uses to describe the absolute reality of ideas; Plato, however, uses the term "dialectic" for this particular branch of metaphysics. Aristotle, likewise, holding that the separate sciences have each their own subject matter, postulates a prior science of existence in general which he describes as "first philosophy." So far, therefore, the science of being is distinguished not from that of knowing but from that of the special forms of being: as to the possibility of objective reality there is no question. A new distinction arises in the philosophy of Wolff who first made "ontology" a technical term. Theoretical philosophy (metaphysics) is by him divided into that which deals with being in general whether objective or subjective, as contrasted with the particular entities, the soul, the world and God. The former is ontology. This intermediate stage in the evolution of the science of being gave place to the modern view that the first duty of the philosopher is to consider knowledge itself (*see* EPISTEMOLOGY), and that only in the light of conclusion as to this primary problem is it possible to consider the nature of being. The evolution of metaphysics has thus relegated ontology to a secondary place. On the other hand it remains true that the science of knowing is inseparable from, and in a sense identical with that of being. Epistemological conclusions cannot be expressed ultimately without the aid of ontological terms.

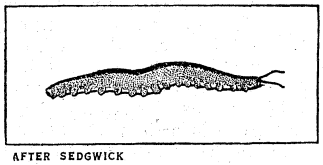
*See* METAPHYSICS; PHILOSOPHY; and KNOWLEDGE, THEORY OF.

**ONYCHOPHORA,** a small but unusually interesting group of animals of the phylum Arthropoda (*q.v.*), differing in so many important respects from all other Arthropoda that a special class has been created for them. The class Prototracheata or Onychophora, containing only about 110 species, is equivalent in rank to the classes Crustacea, Insecta, Diplopoda, Chilopoda and Arachnida, although these groups contain thousands of genera and species.

A small group of genera which necessitates the creation of a separate class is usually the recipient of particular interest, for it will present highly important indications of the evolutionary relations between other groups of the animal kingdom. It is often to be regarded as the survivor of a group more extensive in range and more numerous in species and individuals in past times.

The Onychophora is such a case. It presents features which are typically arthropod. At the same time it possesses nephridia which recall the segmented worms (Annelida, *q.v.*), the group to which the Arthropoda are structurally most closely related. It may be relict of the evolutionary transition between these groups, as a fossil genus, *Asheaia,* has been discovered in deposits of Cambrian age.

The Onychophora contains only seven genera but these are so much alike that it is still common to use the term *Peripatus* as the generic name for all. The different species resemble each other externally so closely that, but for the differences in the number of legs, a picture in black and white like fig. 1 would stand for any of them. Notwithstanding this resemblance it appears necessary to restrict the use of the old generic name *Peripatus* to a few species.



AFTER SEDGWICK

FIG. 1.—PERIPATOPSIS CAPENSIS, DRAWN FROM LIFE, LIFE SIZE

The geographical distribution of the group is very wide but discontinuous and very local. Species occur in the West Indies, western Mexico, Central America, northern South America and Chile, South Africa, Malaya, India, Melanesia and Australasia.

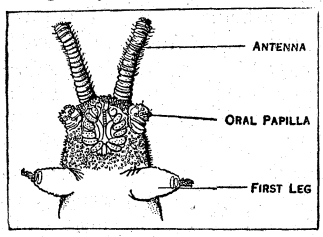
Specimens are only met with here and there, even where favourable conditions exist over a wider area. This discontinuity of occurrence coupled with the obviously poor powers of distribution of these creatures is strong evidence to indicate a group on the way to extinction. The distribution of the genera, which form two families, Peripatidae and Peripatopsidae, is as follows: *Peripatus* —America; *Eoperipatus*—Indo-Malaya; *Peripatoides* and *Oöperipatus*—Australia; *Opisthopatus*—Chile and South Africa; *Paraperipatus*—Malaya; *Peripatopsis*—Central Africa.

Since the present account is a short general summary we shall continue to use the term "Peripatus" to include all species of the group. It will be understood, however, that this is for convenience only.

The animal is always found in moist situations (although the district itself may not be moist during the whole year). It is generally found under rotting branches lying on the ground, under stones, under bark and in the crevices of tree stumps. It is extremely sensitive to a dry atmosphere (specimens frequently will not withstand 24 hours in a dry cardboard box, whereas they will be happy for many days in a small glass tube containing moist soil although the tube may be tightly corked). It never comes out into daylight and in captivity is much more active at night. It is probably carnivorous, feeding on small insects and other small animals in slime which it secretes.

Peripatus is a segmented animal, and at a first glance looks

somewhat like a caterpillar; but the long antennae, the peculiar body-surface and the legs soon dispel that view. The actual segmentation is shown externally only by the occurrence of paired legs, one pair to each segment. The surface of the body is marked by ring-like ridges, 12 or 24 to each segment. Some of these are almost continuous round the circumference of the animal (they are all broken by a fine groove down the middle of the dorsal surface), others are less complete and arise between the former. The skin and body wall is highly characteristic, the superficial cuticle being very thin (as in the worms, in contrast to the usual arthropod condition) and raised everywhere on the ridges into delicate microscopic papillae. These close papillae give the skin a velvety appearance and their presence makes it difficult to wet the creature. The colours of these animals are dark gray, olive green, or brown to brick red above, and light, often almost white, on the under surface. Some species are uniformly coloured; others present distinct colour patterns, usually of lozenge-shaped spots. Those of the western hemisphere are usually slightly patterned and the old world species show more contrasting colours.




FROM SEDGWICK IN "TEXTBOOK OF ZOOLOGY" (G. ALLEN & UNWIN)

FIG. 2.—VENTRAL VIEW OF HEAD OF P. CAPENSIS

Both head- and tail-ends taper and there is no distinct head. The anterior end bears two characteristic antennae, very mobile and extensible. In fact the whole animal is remarkably extensible and there is a great difference in length between a living specimen in motion (especially if this is rapid) and one in spirit.

Slightly posterior and ventral to the antennae are two small blunt oral papillae, and between these the buccal cavity is situated (fig. 2). An anal aperture is found at the extreme posterior end of the animal and further forward on the ventral surface between the last pair of legs is the reproductive aperture in both sexes. The males may sometimes be distinguished from the females by slight differences in the appearance of the genital opening. In many cases, however, the only difference, not always distinct, is the presence of little apertures of crural glands on the legs of the male (fig. 3).

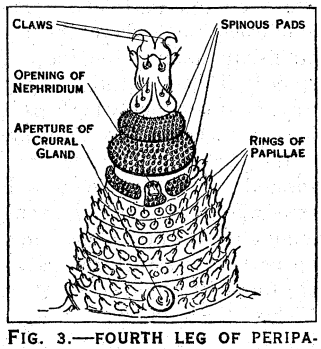



FIG. 3.—FOURTH LEG OF PERIPATOIDES (MALE)

The other apertures on the surface of the body are those of the tracheae (respiratory organs—*see* below) and the excretory organs. None of the former can be seen with the naked eye and only four of the latter, on the 4th and 5th pairs of legs (fig. 3).

The limbs of Peripatus are characteristic. Each consists of a cone-like stumpy leg bearing distally a narrower foot which carries two sickle-shaped claws. The skin of the legs bears rings of tiny papillae like those of the body and near the apex there are spinous pads. The structure of the appendages is thus quite unlike the jointed arthropod leg.

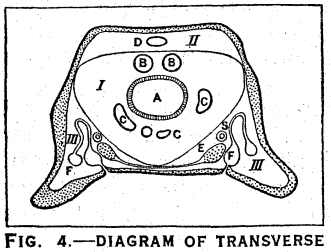
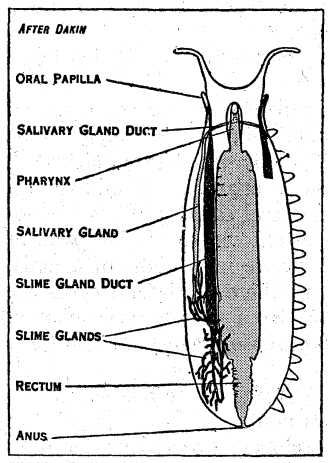



FIG. 4.—DIAGRAM OF TRANSVERSE SECTION THROUGH MIDDLE OF BODY OF PERIPATUS

**Internal Structure.**—A transverse section through an adult shows clearly how the body cavity, which is a haemocoele, is subdivided by delicate sheets of tissue (fig. 4) into (I.) a large central space extending the whole length and containing the gut (A), slime glands (B) and reproductive organs (C); (II.) a shallow dorsal space above the central cavity, containing the heart (D); (III.) two lateral spaces each with a nerve cord (E), nephridia (F), and salivary glands (S). The excretory organs are also found in these compartments, especially in the extensions which exist in the legs.

The *Alimentary Canal.* The buccal cavity contains a pair of horny jaws (fig. 5) which may just be seen from the exterior. Each consists of two cutting plates lying in contact. These jaws are the only mouth appendages present. The mouth at the posterior end of the buccal cavity leads into a short muscular pharynx and from this a short oesophagus opens into the stomach (fig. 5). This forms the greater part of the alimentary canal. It is a straight and wide tube leading almost to the posterior end where a short, narrow rectum opens at the terminal anus.




BY COURTESY OF THE ZOOLOGICAL SOCIETY

FIG. 5.—PERIPATOIDES OCCIDENTALIS, SHOWING PARTS

The only glands connected with the alimentary canal are two salivary glands (fig. 5) which open by a common duct into the buccal cavity. Each gland is a long tubular structure lying in a lateral cavity close to the nerve cord.

The *Slime Glands* (fig. 5) are another peculiar feature. There are two of these, each opening on an oral papilla. Each consists of a long dilated tube which acts as a reservoir and lies over the stomach in the central cavity of the body. This reservoir extends back a considerable distance and then gives off numerous diverticula in which the slime is secreted. These diverticula lie around the posterior part of the stomach, often entangled in the coils of the reproductive organs. When a living specimen is touched the slime is shot out from the oral papillae to a distance of several inches. Contact with the air causes it to congeal into white, sticky threads. It is supposed that the substance is used for offence or defence.

The *tracheae* are among the most noteworthy features of the Onychophora because they are characteristic of certain other Arthropoda. They arise in bunches from the bottom of little epidermal pockets, tracheal pits. It is impossible, however, to see these pits externally. From each pit a large or small bunch of parallel tracheae start off, without branching; then they separate and finally branch, when they reach the organs they supply. Since the small single tubes require a high magnification to see them, one can only see readily the little rosettes of tubes where they are bunched at the tracheal pits and then only by examining the internal surface of the body-wall in fresh specimens.

The tracheal pits are numerous and arranged in definite positions. In the West Australian species there are two main rows, one on each side, between the mid-dorsal line and the level of the legs. There are also four longitudinal series on the ventral surface. E. Gaffron stated that there were about 75 openings to a segment in *P. edwardsi.* The present author has counted 32 without difficulty in *Peripatoides occidentalis.* The tracheal tubes have a spiral thickening in the walls similar to that in other Arthropoda.

The *excretory organs* are probably the most surprising of all the structures found in this animal and at once call to mind the annelid worms, being not at all like the excretory organs of the arthropod groups. They are paired structures, one pair to each pair of legs. With the exception of those of the 4th and 5th pairs, each excretory tube opens on the ventral surface at about the point where its corresponding leg joins the body. The 4th and 5th pairs open on papillae near the distal end of the corresponding legs (fig. 3). It is a striking fact that this distinction should be found constantly in the different genera.

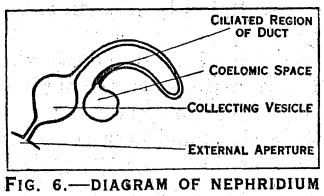



FIG. 6.—DIAGRAM OF NEPHRIDIUM OF PERIPATOIDES OCCIDENTALIS

The excretory organs have been termed *nephridia* and there is some evidence from embryology in support of this. Anatomical study, however, is insufficient to indicate the exact homologies of

these organs and the embryological evidence requires confirmation. Each "nephridium" (fig. 6) consists of a tube with an enlargement, the collecting vesicle, near its aperture and another, corresponding to a coelomic cavity, at its internal blind end. In the West Australian *Peripatoides* W. J. Dakin discovered that cilia were present in that part of the tube leading out from the coelomic vesicle. This is the second part of the body where cilia have been found in these animals and since cilia are characteristically absent in the Arthropoda, it is a point of importance. Their other site is the reproductive organs of the female.

The *blood system* appears to consist only of a feebly developed dorsal tubular heart.

The *nervous system* consists of a pair of large supraoesophageal ganglia completely united in the middle line and occupying most of the head space, and a pair of cords which run backward. These latter, instead of being close together in the mid-ventral line, are situated at the sides in the lateral cavities of the haemocoele. Numerous commissures, 8–10 between successive pairs of legs, connect the lateral cords. There are indications of ganglia, corresponding to the legs in number, where the lateral cords are slightly thickened. Nerves pass out from the supraoesophageal ganglia to the tentacles, eyes and skin sense organs and also leave the lateral nerve cords.

The only sense organs are the eyes and numerous skin sense organs all of which look alike in structure.

The eyes are moderately well-developed, situated on the head near the base of the antennae. They are simple eyes, not compound like those so characteristic of the Arthropoda. They differ also fundamentally from the arthropod type of simple eye, the ocellus. It is sufficient here to point out that on the whole the visual organ presents features of a simple type met with in both annelid worms and arthropods, but it has followed its own line of evolution.

The skin sense organs consist of little packets of cells associated with a projecting spine. They look like and are usually regarded as tactile organs. Peripatus is, however, extremely sensitive to chemical stimuli as well as to vibrations and the presence of a very little chloroform vapour or acetic acid in the air produces a quick reaction.

**Reproduction.**—The sexes are separate. The reproductive organs consist of a pair of tubular testes in the male and a pair of ovaries in the female. In both sexes the reproductive organs are continuous with the tubes which lead their products to the exterior, opening at the single aperture already described. In the female, part of each duct is differentiated to form a uterus in which the young develop. Slight differences in the arrangement occur in the different species. Almost all produce living young.

One feature of special note is the varying amount of yolk in the eggs and its result. The Australian species have large yolk-laden eggs, and all species come near to laying eggs. At least one species of eastern Australia is actually oviparous and eggs are laid in sculptured shells. In all others the eggs are retained within the female and after a period of several months the young are born.

The South African and Australian species give birth to the young in April–June. Fertilization in one of the latter species takes place in the preceding August or September and the period of gestation would thus be 8–9 months. It has been given as 13 months for the Cape species.

The eggs are fertilized internally and it has been stated that the male of the Cape species deposits its spermatozoa on the surface of the female. Since the uterus is said never to contain spermatozoa, the mode of entrance into the body would be a complete mystery. There can be no doubt that in the Australian species copulation of the two sexes takes place and the spermatozoa pass up the vagina of the female.

The embryology of the Cape species has been worked out and reference should be made to A. Sedgwick (*see* below) for details. Further work is required in this direction and would be of undoubted interest and importance.

BIBLIOGRAPHY.—A. Sedgwick, "A Monograph of the Development of *Peripatus capensis*" (originally published in various papers in the *Quart. Journ. Mic. Sci.*, 1885–1888); "A Monograph of the Species and Distribution of the Genus *Peripatus*, Guilding," *Quart. Journ. Mic. Sci.* xxviii, 431–494 (1888); A. H. Clark, "Distribution of Onychophora," *Smithsonian Misc. Coll.*, lxv, no. 1, pp. 1–25 (1915); Bouvier, "Monographie des Onychophores" *Ann. des. Sci. Nat.* (Paris, 1905–1907); W. J. Dakin, "The Anatomy, etc., of West Australian Peripatoides," *Proc. Zool. Soc.* (London, 1920); "The Eye of Peripatus," *Q.J.M.S.* (1921); "Infracerebral Organs of Peripatus," *Q.J.M.S.* (1922). (W. J. D.; X.)

**ONYX,** a striped agate in which white layers alternate with black. When brown or red bands occur instead of black the stone is termed sardonyx (*see* SARD AND SARDONYX). The Romans applied this name originally to a species of marble, now called onyx marble, because of a resemblance between its well-defined white and yellow veins and the shades in the fingernail (ὄνυξ). When this marble became less important the name was transferred to the striped agate. Onyx has always been largely employed in cameo work because the design and background could be cut so as to occur in differently coloured layers. The best cameos are those produced by the ancients, though a revival of the art was occasioned by the discovery in the middle of the 19th century of the South American sources of onyx. Many inferior agates are now made suitable for the cutting of cameos by artificially dyeing the layers (*see* AGATE) and glass imitations are also extensively produced. Beads, brooches, ring stones and other small ornaments are frequently made of onyx and larger pieces are fashioned into cups and vases. Onyx marble is much softer and less precious than true onyx and includes the following ornamental stones; Mexican onyx or Tecali marble, which is often of a delicate green shade, Algerian onyx and Gibraltar stone.

The chief localities for onyx are South America and India.

*See* C. W. King, *Precious Stones, Gems and Precious Metals* (London, 1865); A. Eppler, *Die Schmuck und Edelsteine* (Stuttgart, 1912). For onyx marbles *see* G. P. Merrill, *Rep. U.S. Nat. Mus. for* 1893 (1895). (W. A. W.)

**OOLITE,** a geological term used in two senses; the commonest use refers to a particular type of structure common in limestones and ironstones, where the rock is composed of small rounded grains, resembling the roe of a fish (Gr. ὄον, an egg, λίθος, a stone). This structure is apparently produced in more than one way, most commonly perhaps by accretion of $CaCO_3$ from solution in water around tiny sand grains or shell fragments in moving water, where the grains are kept in constant motion. Grains formed in this way show radial or concentric crystalline structure when cut open. In some instances the grains are merely minute rounded pebbles of an older limestone, and such may show no particular structure. Many fine examples of oolitic deposits are formed by calcareous algae in hot springs, as at Carlsbad and Vichy. Such grains consist of aragonite, not calcite. Oolitic ironstones are apparently formed in a way similar to that first described, but the exact manner of precipitation of the iron is still somewhat doubtful. Bacteria may play a part.

The second use of the term is stratigraphical, to indicate the British rocks forming the middle and upper divisions of the Jurassic system (*q.v.*) where oolitic rocks are common. This usage is now out of date. (R. H. RA.)

**OOLOGY:** *see* EGG.

**OOTACAMUND,** town, British India, headquarters of the Nilgiris district in Madras, approached by a rack railway from Mettupalaiyam station on the Madras railway. Pop. (1941) 29,850.

Ootacamund is the principal sanatorium of southern India and summer residence of the governor of Madras and is noted for hunting, fishing and shooting. It is placed on a plateau 7,220 ft. above the sea, with a fine artificial lake, and mountains rising above 8,000 ft. The mean annual temperature is 58° F., with a minimum of 38° in January and a maximum of 76° in May; mean annual rainfall, 49 in. The houses are scattered on the hillsides amid luxuriant gardens. In the neighbourhood are plantations of coffee, tea and cinchona. The Lawrence Memorial school for the children of European soldiers was founded in 1858.

**OPAH** (*Lampris luna*), a pelagic fish of the order Allotriognathi. The body is compressed and deep, with minute scales. A dorsal fin, high anteriorly, runs along nearly the whole length of the back; the caudal is strong and deeply cleft, for rapid swim-

ming. The pelvic fins contain numerous (15–17) rays. In its gorgeous colours the opah surpasses even the dolphin. The fins are bright scarlet, and the sides bluish-green above, violet in the middle, red beneath, variegated with oval spots of brilliant silver. Its home is the Atlantic, especially near Madeira and the Azores. It occurs also in the Pacific, and is rare in the Mediterranean. It grows to a length of 4 to 5 ft. and a weight exceeding 100 lb.

**OPAL,** a mineral, in chemical composition an amorphous hydrated silica, some forms of which are highly prized as gems. Many varieties of opal (Lat. *opallus,* Gr. *ὀπάλλιον*), are recognised but of these few have any value as gem stones. The most beautiful is precious opal which displays a wonderful scintillating coloured brilliance, known as opalescence. In early times it excited the keenest admiration, witnessed by Pliny's enthusiastic description, "For in them you shall see the living fire of the ruby, the glorious purple of the amethyst, the green sea of the emerald, all glittering together in an incredible mixture of light." Orange or yellow stones which exhibit opalescence are called fire opals. Black opals are stones in which the background is extremely dark. Really black stones are extremely valuable and rather rare. Common opal is a term applied to the varieties which do not exhibit opalescence. Most of the names applied are self-explanatory, *e.g.,* milk opal, resin opal, liver opal, agate opal, etc. Prase and jasper opals are green and red respectively. A curious, very porous variety, which can absorb surprising quantities of water is called hydrophane. It will adhere to the tongue. It is almost opaque when dry, but becomes practically transparent when saturated with water. Another porous variety is cachelong, which has a lustre like mother of pearl.

Opal is the silicious material of the tests of radiolaria and the frustules of diatoms. These may accumulate as deposits of tripoli or kieselguhr, used for polishing. Opal is often found as pseudomorphs after gypsum, glauberite, calcite and other minerals. Pseudomorphic aggregates are sometimes known as pineapple opal. Opal has been discovered in a fibrous form much like asbestos, from which it may be distinguished by its harsh touch.

**Occurrence.**—Opal is widely distributed as nodules and stalactitic masses in the cavities of volcanic rocks, deposits from hot springs, etc. It is deposited as a gel or sol. Precious opal is found only in a few places. Cserwenitsa in Hungary was for long the only source; probably all the ancient stones were found there. Since the discovery of the rich fields in Australia, the Hungarian mines have lost most of their importance. The discovery of opals at White Cliff, New South Wales, was followed in a few years by the field on the boundary between New South Wales and Queensland. Many "black opals" are found there, but truly black stones are found at Lightning Ridge. The black opal has been thus described:—"It combines the iridescence of the dewdrop with the colour of the rainbow, set in the blackness of night. It is a smothered mass of hidden fire." Precious opals have been found in Hōsako, Japan, which are nearly colourless and transparent with a bluish tint, and show a change rather than a play of colours, from emerald green to apple red. Esperanza, Queretana and Timapan in Mexico are noted particularly for fire opals (girasol). A fine mass of precious opal was found recently in Nevada.

**Coloration.**—Pure opal, which is colourless, is rarely found. It is usually stained dull colours by ferric oxide, alumina, lime or magnesia. That the coloration is not ordinary absorption is shown by the fact that the transmitted light is complementary to the reflected. If for example a blue stone is held up to the light, it appears yellow. The opalescence is not due to any pigmentation, but to the fact that as the original gel dried and cooled it became riddled with cracks, which were subsequently filled up by another gel containing a different amount of water. The resulting heterogeneity of the opal gives it a varying refractive index, which affects the light in the same way as a soap bubble. The thinner and more uniform the cracks the greater the splendour of the colours, the shade depending on the direction in which it is viewed. In the variety known as harlequin opal the rainbow colours are flashed from little angular surfaces forming a mosaic.

Opals are usually cut *en cabochon.* If they are too thin for this, they are used for inlay work, and if scattered in small pieces throughout the matrix, they are sold as such, under the name "root of opal." Fire opal shows to best advantage if facetted. Opal is not placed among the most precious of stones because of its softness, but Pliny placed it after the emerald. He relates that Mark Antony exiled a rich senator, Nonius, for the sake of an opal the size of a hazel nut. Many superstitions have centred round opal, and even in modern times it has been regarded as unlucky.

**Properties.**—Opal contains from 3–13% of water, precious opal between 6 and 10%. It is soluble in caustic alkalis, and when mixed with soda easily fusible. It is soft, 5·5–6 on Mohs' scale and is therefore easily scratched. It is brittle and has a conchoidal fracture. Opals are porous, and it is dangerous to immerse them in liquids. Normally opal is isotropic, but owing to internal strains it is sometimes doubly refracting. The refractive index ranges from 1·444–1·464. They are said to be more brilliant on warm days, but a high temperature, by withdrawing water, destroys their value. Recently milk opal has been coloured by oils and pigments to imitate the rare blue and dark red stones. The colour is fixed with Canada balsam.

*See* A. Eppler, *Die Schmuck- und Edelsteine* (Stuttgart, 1912); G. F. Herbert Smith, *Gemstones* (London, 1926). (W. A. W.)

**OPAVA** (German, *Troppau*), the capital of Silesia, lies on the Opava, a tributary of the Oder, in the middle of a wide fertile plain. The old town, founded in the 13th century, is girdled by parkland beyond which stretch extensive suburbs of the new town, in which are centred the industries (brewing, sugar refining, cloth and industrial machinery). Pop. (1930) 36,030, mostly German. In 1938 the town was ceded to Germany by the pact of Munich.

**OPELIKA,** a trading and industrial centre of eastern Alabama, U.S.A., county seat of Lee county; on federal highways 29 and 241, served by the Central railway of Georgia and the Western railway of Alabama. Pop. 6,156 in 1930, and 8,487 in 1940. Founded in 1773; incorporated 1858.

**OPELOUSAS,** a city of southern Louisiana, U.S.A., capital of St. Landry parish; 130 mi. W.N.W. of New Orleans, on the Missouri Pacific, the Southern Pacific and the Texas and Pacific railways and truck and bus lines. Pop. (1940) 8,980. It has a crate factory, machine shop, cotton-seed mill and oil refinery; moss, broom and mop, mattress and paprika factories, two saw-mills, two ice factories, bottling works, five cotton gins, one compress.

**OPEN BILL.** A curious stork (*q.v.*) of the genus *Anastomus* so called from the formation of the lower mandible, which is hollowed out so as to meet the maxilla at the base and tip. There is an African and an Indian species.

**OPEN-FIELD SYSTEM.** The "open," or "common" field was a characteristic feature of manorial agriculture (*see* LAND TENURE). It had its origin, however, in primitive conditions long antecedent to the development of feudalism. Three or four centuries before the Roman occupation the Celtic inhabitants of Britain had evolved a system of co-operative tribal husbandry on the open-field system. The cultivated, or arable, land occupied by the kindred, or tribe, was divided into narrow strips separated by balks of turf. The strips were about a furlong in length and of varying widths. It may be surmised that the length of the strips became more or less standardized at an early date, as the disadvantage of irregular lengths for adjoining strips became obvious. The furlong—clearly "furrow-long"—is generally agreed to have represented the distance which oxen would conveniently plough at a stretch, and the ploughman could keep a fairly straight line. In due course persistent trial and error would result in the general acceptance of the most suitable length which when once adopted would become the standard enforced by tradition. The width of the ordinary strip was, in like manner, gradually fixed at four times the length of an ox-goad, which was 5½ yards. Land measurements were no doubt not very exact in those days but the result was eventually to establish the standard size of the strip at approximately 220×22 yd., or in other words an acre.

In the Celtic open-field each free tribesman was allotted five strips. The allocation of the strips was made in accordance with strict tribal regulations, and the cultivation of the land was carried out co-operatively. The plough was common property but the oxen appear to have been individually owned.

This system fitted very readily into the manorial organization introduced by the Normans. The status of the cultivators was changed, but the open-field with its separate acre or half-acre strips and its co-operative methods of husbandry continued. The administration of the manor became in form autocratic and the land was held in servile tenure, but in practice the rules governing the allocation of the strips and the cultivation of the land

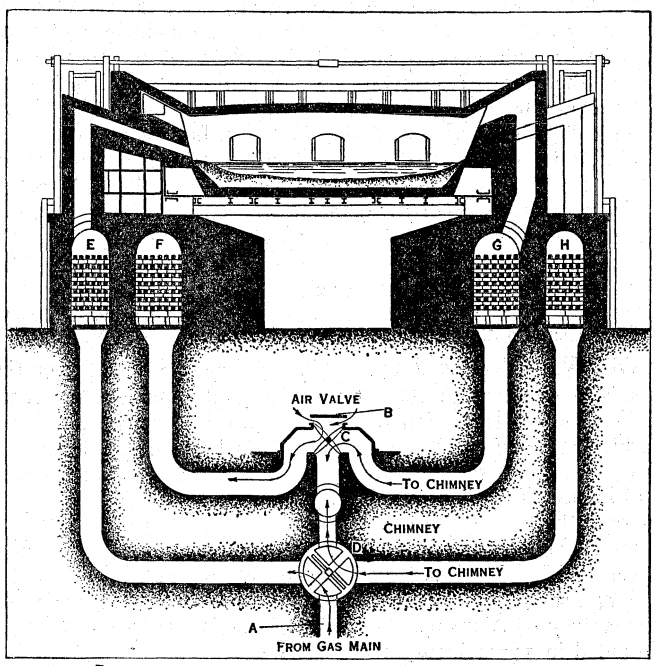



DIAGRAM ILLUSTRATING THE OPEN-HEARTH PROCESS

were settled by the tenants. Gradually the rigidity of the manorial organization broke down, the relations of lord and tenants were changed and only the forms of feudalism lingered. But the open-field system survived in thousands of parishes until the wholesale enclosures of the end of the 18th and early part of the 19th centuries abolished it generally, although it lingered in isolated cases until the beginning of the 20th century. Indeed at least two open-fields—at Laxton in Nottinghamshire and Braunton in Devon—continued to exist after that time. (R. H. R.; X.)

**OPEN-HEARTH STEEL PROCESS.** In recent years two distinct modifications of steel making process have been included under this common title: (1) the Siemens process, in which pig-iron and ore are the materials used, and (2) the Siemens-Martin process, which uses a mixture of pig-iron and scrap steel. A combination of the two is also in general use.

Steel-making by this process was not a success until the brothers Siemens perfected their system of regenerative gas heating. The principle involved is simple and consists in utilizing the waste heat of the products of combustion to raise the temperature of the gas and air employed in heating the furnace, and so increasing very considerably the temperature obtained. The furnace is of the reverberatory type but instead of having a fire-box at one end and a chimney flue at the other both ends are built with ports for gas and air; the latter are generally arranged above the former in order to promote mixing of the gas and air and at the same time to afford some protection for the roof against the intense heat of the furnace. The ports are connected by flues with chambers filled with brickwork—called regenerators—which in turn are connected with the gas and air supply through a system of valves; these last named allow the direction of the gas and air through the furnace to be reversed from time to time. The roof of the furnace must be built with very refractory bricks, generally silica, and the hearth made of sand or dolomite according to the process for which the furnace is to be used.

A diagrammatic sketch of the furnace is given above. Gas from a producer and atmospheric air are admitted to the furnace through the valves A and B, from which they pass to the reversing valves C and D and from them through the regenerators E and F into the hearth where combustion takes place; from here through the hearth of the furnace the waste gases pass into the regenerators G and H and then through flues to the chimney via the reversing valves. The gas and air are reversed in direction every 20 to 30 min., by which means it is possible to maintain the high temperature required in the furnace.

Two methods of working the process are in general use—acid and basic. In the former the hearth is made of silica sand mixed with a small quantity of oxide of iron, in the latter it is of dolomite mixed with a small amount of tar; in both cases the hearth is fritted together under the intense heat of the furnace before any melting is done.

In the acid process no elimination of sulphur and phosphorus is possible during the working of the charge, and it is necessary to start with pig-iron and scrap which are low in these elements. The amount of silicon admissible depends upon the amount of scrap in the charge; when the amount is high, pig-iron containing a higher percentage of silicon can be used than when the quantity of scrap is small, but the total amount of silicon present should be about 1·5%. Assuming the furnace already hot from previous working, the pig-iron and scrap are charged into it in the order given; during the melting down the greater part of the silicon and manganese is oxidised and unites with the oxide of iron derived from the scrap to form a slag consisting mainly of silicates of iron and manganese. From time to time additions of iron ore are made to the slag in order to render it oxidising and so capable of removing by oxidation the impurities in the charge. Of these, silicon and manganese are the first to go, and carbon in the form of gaseous carbon monoxide follows, the gas liberated causing the bath to boil vigorously. Towards the close of the operation great care must be taken to avoid the addition of more ore than is necessary to make the carbon sufficiently low, otherwise steel of poor quality will be produced. Ferro-manganese and ferro-silicon are now added to deoxidise the metal and the charge tapped into a ladle and then cast into ingots.

In the basic process the procedure is somewhat different. In this case the elimination of the phosphorus and sulphur is possible on account of the nature of the slag, which consists of phosphate and silicate of calcium containing a large quantity of lime in suspension; additions of iron ore are made as in the acid process, and small quantities of lime must also be added from time to time to maintain the basicity of the slag; excess, however, must be prevented, otherwise the slag will become pasty and incapable of carrying on its work. Precautions must also be taken to secure the removal of the phosphorus and carbon in the order mentioned; otherwise the bath will go off the boil, and great difficulty will be experienced in getting rid of the phosphorus. The nature of the slag also necessitates the postponement of the deoxidation of the bath until the charge is in the ladle; should the ferro-manganese necessary be added in the furnace, there is great risk of the phosphorus being reduced from the slag and passing back into the metal. Pig-iron for use in the basic process may contain from 1 to 2% of phosphorus and should be low in both sulphur and silicon but fairly high in manganese. (*See* also IRON AND STEEL.)

BIBLIOGRAPHY.—H. H. Campbell, *The Manufacture and Properties of Iron and Steel* (1903; 4th ed., 1907); F. W. Harbord and J. W. Hall, *The Metallurgy of Steel* (1904; 7th ed., 1923); D. Carnegie, *Liquid Steel* (1913; 2nd ed., 1918). *See* also *Journal of the Iron and Steel Institute* (London 1871, etc.), and *Journal of the Mining and Metallurgical Engineers* (New York). (T. BA.)

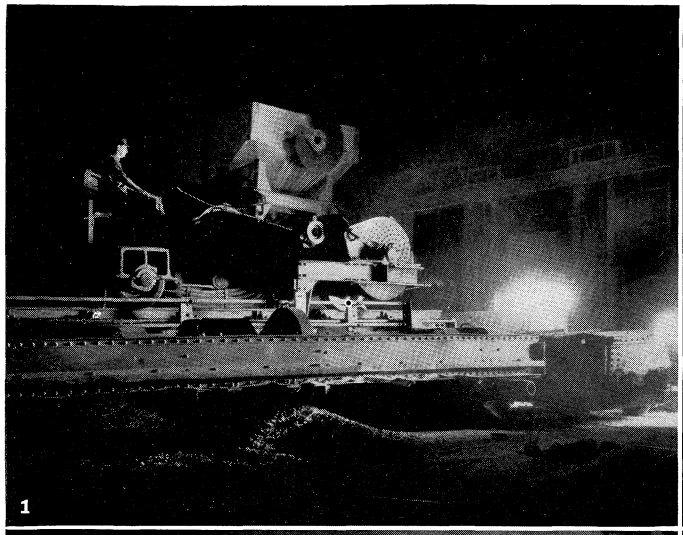
**OPEN SHOP:** *see* CLOSED SHOP.

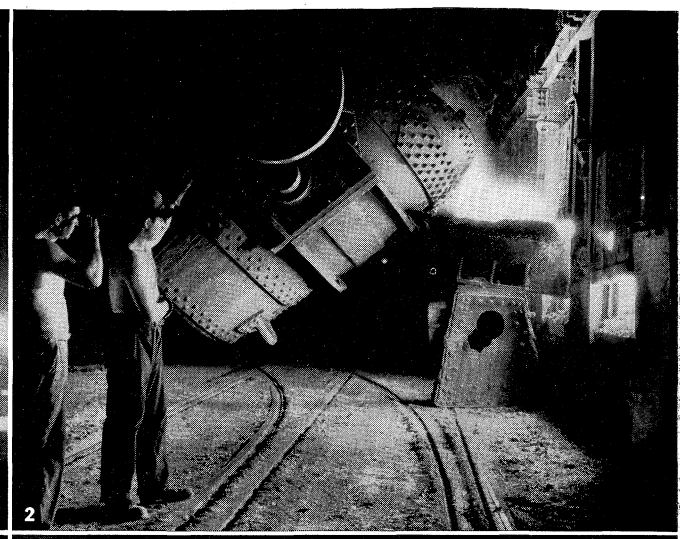
**OPERA,** a drama set to music, as distinguished from plays in which music is merely incidental.

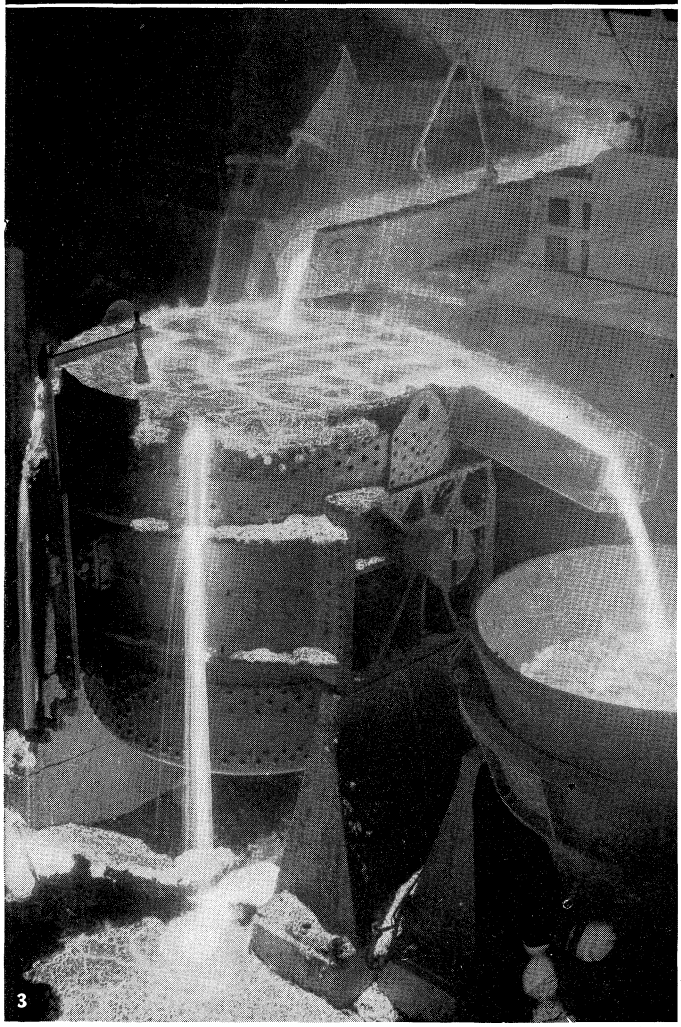
**Italian Beginnings.**—The historian, Doni, tells us that in the last years of the 16th century a group of amateurs held meetings at the house of the Bardi in Florence with the object of trying experiments in musical declamation by solo voices supported by instruments. Hitherto the only high musical art was unaccompanied choral music; its expression was perfect within such limits that dramatic music within those limits was as inconceivable as dramatic architecture. But the literary *dilettanti* who met at the house of the Bardi were not mature musical artists; and no technical scruples interfered with their glorious project of restor-

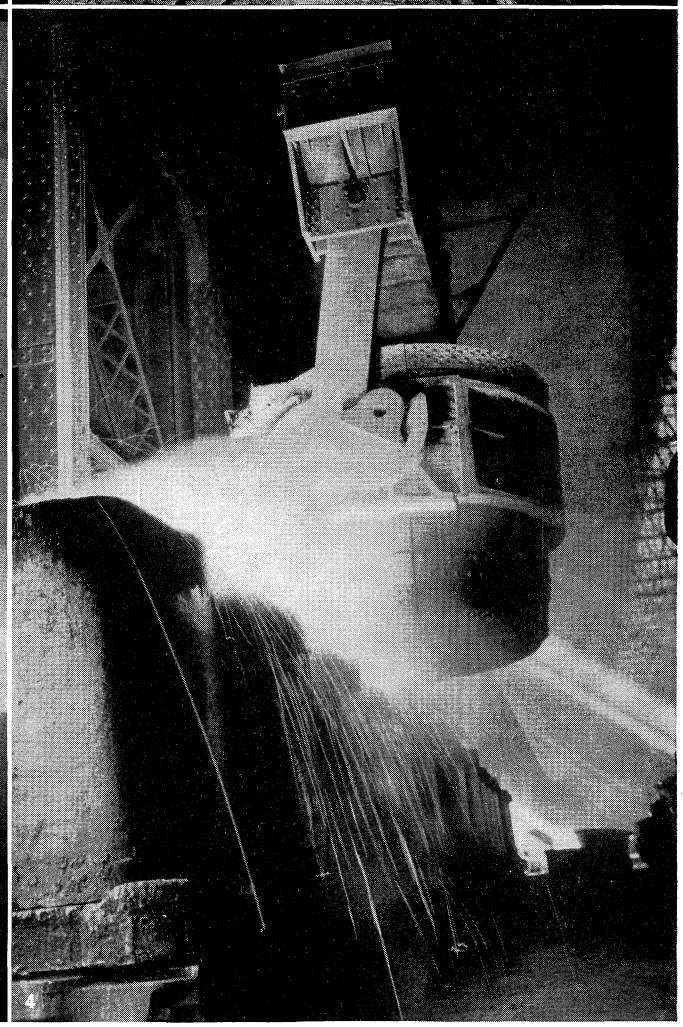
# OPEN-HEARTH STEEL PROCESS











BY COURTESY OF THE U.S. STEEL CORPORATION; PHOTOGRAPHS, (1, 2, 3) ROBERT YARNALL RICHIE, (4) AIKINS

## MELTING AND CASTING OF STEEL

1. Charging an open hearth with scrap iron
2. Charging an open-hearth furnace with molten pig iron
3. Tapping molten steel from an open-hearth furnace
4. Pouring molten steel from ladle into ingots

ing the musical glories of the Greek tragedy. Vincenzo Galilei, the father of Galileo, warbled the story of Ugolino to the accompaniment of the lute, much to the amusement of expert musicians; but he gained the respectful sympathy of literary listeners.

The first public production in this "monodic" style was Jacopo Peri's *Euridice* (1600), which was followed by a less successful effort of Caccini's on the same subject. Feeble as were these efforts, they impressed contemporary imagination as infinitely more suggestive of life and passion than the forlorn attempts then in vogue, to provide good music for a music-drama by means of a polyphonic chorus behind the scene, with actors in dumb-show on the stage. As Parry happily points out in this connection, the laying of a foundation stone suggests a future so inspiriting as to exclude all sense of the triviality of the present achievement. A great master of pure polyphony, Orazio Vecchi, had already, in 1594, the year of Palestrina's death, laughed the madrigal-opera to extinction in his *Amfiparnasso*. The woodcuts which adorn its first edition show how the actors sang or mimed in front, while the other singers completed the harmony behind the stage.

With the decadence of the madrigal, Monteverdi (*q.v.*) brought a real musical power to bear on the new style. At the beginning of the 17th century no impressionable young musician could fail to be profoundly stirred by Monteverdi's *Orfeo* (1602), *Arianna* (1608) and *Il Combattimento di Tancredi e Clorinda* (1624), works in which instruments were used with the same archaic boldness, the same rhetorical force and the same lack of artistic organization as vocal style and harmonic resources. So explosive was the spark of Monteverdi's genius that the next step necessary for the progress of opera was a development of forms, not only non-dramatic but anti-dramatic.

The types of monody conceivable by the pioneers of opera were codified in the system of free musical declamation known as *recitative*. This is said to have been used by Emilio del Cavalieri as early as 1588. Formal melody, such as that of popular songs, was as much beneath the dignity of monody as it had been beneath that of the highest forms of polyphony; but in the absence of any harmonic system but that of the church modes, which was ruined by the new unprepared discords, formal melody proved a godsend as the novelty of recitative faded. Tunes were soon legalized at moments of dramatic repose; it was in the tunes that the strong harmonic system of Neapolitan tonality took shape; and by the early days of Alessandro Scarlatti, before the end of the 17th century, the art of tune-making had blossomed into the musically safe and effective form of the *aria* (*q.v.*).

The poet Metastasio realized that there was nothing unnatural in a scheme of drama which allowed each stage of the action to culminate in a tableau marked by a burst of lyric poetry and lyric music. Some 30 such tableaux would give occasion for 30 arias (including a few duets, rarely a trio and only once in Handel's 42 operas a quartet) while the connecting action and dialogue was set in recitative. Metastasio devoted his whole life to opera-libretti on this plan, which he executed with consummate skill. He was far from satisfied with the way in which most composers set his texts. The scheme was fatally easy for small musicians and did not stimulate the higher faculties of great ones; while great and small were equally at the mercy of singers.

Before this stagnation of baroque opera there was a provincial outburst of life in the wonderful patchwork of Purcell's art (1658–95). In the early *Dido and Aeneas* he and the humble Nahum Tate (of Tate and Brady) produced, perhaps, the most perfect opera before Gluck. Dryden was less accommodating. He had been so disgusted by the stupid vanity of the fashionable Monsieur Grabu that when he wrote *King Arthur* he insisted on arranging that the musical characters should be quite independent of the main action, and with the infliction of this condition upon Purcell, English opera was relegated to a permanent musical squalor which even endured to ruin Weber's last work, *Oberon*, in 1826.

**Gluck.**—Another sign of life was present in the farcical operas and intermezzi or comic entre-actes of certain Neapolitan composers (*see* LEO, PERGOLESI, LOGROSCINO), one of which (Pergolesi's *La Serva Padrona*) occasioned the war of Buffonistes and Antibuffonistes in Paris (*see* MUSIC, sec. 6).

The forms of music known before 1750 were architectural or decorative, but essentially non-dramatic. Baroque opera required something more than reform, and the opportunity for progress came with the rise of the sonata style. The music of Gluck's time was too firmly organized to be upset by new discoveries; in fact the chief need for opera was retrenchment in rhetorical forms. Gluck, as Handel had remarked of his early works, was no contrapuntist, and to the end of his life this hampered him in "jining his flats." But he had a genius for phrasing (*see* RHYTHM), which went far to promote dramatic movement, and another aspect of this was a sense of symphonic form as vigorous as could find scope in opera at all; while his melodic power was of the kind which Matthew Arnold calls "touchstones of poetry."

The lasting effect of his work on French music left the course of Italian *opera seria* unchecked. Mozart's *Idomeneo* is the grave of some of his greatest music, including many genuinely dramatic strokes, and his perfunctory *Clemenza di Tito* is the last *opera seria* that contains any music worth extracting. The unmistakable influence of Gluck could not save *Idomeneo;* and Mozart's triumphs belong to the comedy of manners, until he entered the transcendental world of *Die Zauberflöte*. His first impulse was inveterately musical, and his power of dramatic movement and characterization grew steadily without always preventing him from yielding to singers and indulging himself in dramatically vicious musical luxuries. But after his first exuberant German opera, *Die Entführung aus dem Serail,* it is not so easy as it seems to catch Mozart napping. He is a dangerously subtle parodist, and in *Così fan tutte* the heroic coloratura arias of the virtuous Fiordiligi and Dorabella are the arias of ladies who do protest too much; and in *Die Zauberflöte* the vocal fire works of the Queen of Night are the rhetoric of a formidable person who, we are told, "hopes to cajole the people with illusions."

**Mozart.**—The article MOZART contains further remarks on his operas. They are organized so thoroughly on the basis of their libretti that it is a serious mistake, not made by scholars like Jahn, to underrate the wits of his literary collaborator, Da Ponte. Goethe did not even underrate the rapscallion Schikaneder, but took the symbolical aspects of *Die Zauberflöte* so seriously as to sketch a sequel to it. Since boyhood Mozart never wrote an opera without thoroughly controlling its dramatic movement. Where he relaxes the relaxation is complete. The movement in *Die Entführung* is intermittent and the static elements excessively favoured, but the movement exists and is powerful. In *Figaro,* the fourth act, with its tangle of assignations in the garden, has five arias in succession which would make a mere concert on the stage if they were all performed; but there is an ironic dramatic tension behind the last of them (*Deh vieni, non tardar*); and when the librettist provides action Wagner is not as quick as Mozart in his timing of the details and the whole. One of Wagner's English propagandists, Hueffer, cited the duet in which Cherubino and Susanna are trying to find a way out of the locked room before the Count returns, and accused Mozart of keeping the Count waiting at the door until this effective piece of music had run its formal course. But every stage manager finds that Mozart has barely given Cherubino time for a natural hesitation before jumping out of the window, in spite of Susanna's terrified protest.

**The Qualities of Opera.**—And here we may profitably consider what are the qualities necessary for success in opera. It is notorious that the absolute value of the music comes last, if it is a factor of success at all. Unquestionably it is a factor in immortality; and the music of *Idomeneo* is immortal, though that opera is revived only in Mozart festivals. But operas cannot wait for immortality, and can manage on quite flimsy music to achieve as much immortality as musical history has given time for. It might be thought that success depends on dramatic power; and this is nearer the truth. But dramatic power comes only third in the conditions, and coherence is not necessary at all.

Two qualities take precedence of dramatic power as conditions for success in opera; one is the theatrical sense, and the other the histrionic sense. They are inseparable but not identical. The theatrical sense can thrill the listener before the curtain rises,

as in the modulation to F major at the end of the overture to *Don Giovanni;* the histrionic sense can save the stage-manager the trouble of telling the actors what to do with their hands. The beginning of Rossini's *Barbiere* is an excellent example, especially when compared with that of Paisiello's setting, which dominated the stage until Rossini's ousted it. Paisiello's opening is good music for any moderately cheerful situation, Rossini's opening consists of a scale rising for nine notes and descending again, with long halts and water-beetle glides. Actors may be defied to walk on during this music with any steps but those of conspirators! And the scoring (which is so perfunctory that literally half of the bulk of the opera is expressed by abbreviations) gives in perfection the theatrical atmosphere of a night scene. The same ridiculous scale in another ridiculous rhythm hisses up and down in thirds *sul ponticello* (close to the violin bridge) while Basilio describes the destructive effects of a well managed calumny. Poor Paisiello's famous duet between two stammerers was no asset wherewith to outbid Rossini's ubiquitous histrionic sense in the contest for popularity.

But when brilliant writers tell us that Rossini is superior to Mozart in the sense of pace, it is high time to study the elements of Mozart's art. Three senses of pace enter into music. There is that of the athlete, relying on his own limbs, the limbs of his horse or the wheels which he directly controls. There is that of the passenger reclining in his car; and there is the cosmic motion of the stars among which our own humble earth moves hundreds of times faster than a cannon ball, yet takes several minutes to traverse its own diameter. Of these three senses of movement that of the passenger in his car is equivalent to repose, and to nothing else; while cosmic movement, discernible in Bach, Beethoven and Wagner must be related to human measurements before it means anything at all. The one directly exhilarating sense of movement is that of the athlete; and we are asked to believe that Rossini exemplifies this when Figaro rattles his "Largo al factotum" at some nine syllables a second, immovable for six minutes except for semaphore gestures once in 12 bars, to the right when the music halts on the dominant, to the left when it halts on the tonic: No, let us be accurate; there is another tradition which identifies the tonic with the right and the dominant with the left. Mozart's *Figaro* contains one piece of patter-singing even faster than "Largo al factotum," but he pronounces judgment on this kind of movement by giving it to the decrepit Dr. Bartolo ("se tutto il codice dovesse leggere," etc.).

The decline of *opera seria* and *opera buffa* led to an approximation between tragic and comic styles till the distinction became too subtle to be distinguished by any but experts. Dance rhythms became the only Italian forms of accompaniment, and vocal scale exercises remained the last resource of the dying Desdemona. Yet Rossini retained so much histrionic force that an English spectator of his *Otello* is recorded to have started out of his seat at the catastrophe, exclaiming "Good Heavens! the tenor is murdering the soprano!" And in times of political unrest more than one opera became as dangerous as censorship could make it. An historical case is brilliantly described in George Meredith's *Vittoria.* But what has this to do with the progress of music? The history of Italian opera from after its culmination in Mozart to its subsidence on the big drum and cymbals of the Rossinians is the history of "star" singers.

Verdi's art, both in its burly youth and in its shrewd old age, changed all that. He reformed nothing except by slow experience; but he gradually found a meaning for everything. Even the vile Italian brass is used in his last works in just the same style as in his earliest, with the enormous difference that he appreciates its brutality and uses it only where brutality is wanted. Verdi's development belongs to a later stage of operatic history.

**France.**—After Mozart the next forward step in operatic art was again made in France. The French histrionic atmosphere had a stimulating effect upon every foreign composer who visited Paris. Rossini himself, in *Guillaume Tell,* was electrified into a higher dramatic and orchestral life than the rollicking rattle of his serious and comic Italian operas. The grave defects of its libretto were overcome by unprecedented efforts at the cost of an entire act. Anywhere but in Paris Rossini's music would have pulled a worse drama through or else failed outright; but in Paris the composer found it worth while to learn how to rescue his best music from failure.

The French contribution to musical history between Gluck and Rossini is of austere nobility worthy of a better crown than Meyerbeer's music. If Cherubini and Méhul had had Gluck's melodic power, the classics of French opera would have been the greatest achievements in semi-tragic music-drama before Wagner. As it is, their austerity is negative, failing to achieve beauty rather than rejecting what is irrelevant. The histrionic sense is good, but the sense of movement rejects patter-singing without achieving anything more real. Cherubini's *Medée, Les Deux Journées* and *Faniska,* however, did achieve grand musical forms and had a great influence on Beethoven.

Beethoven's *Fidelio* gives occasion to consider the function of the librettist, who obviously has the composer at his mercy unless the composer is prompt to get the upper hand. Mozart (*q.v.*) learnt betimes to bully his librettist. Beethoven did not; and the expansion of Bouilly's pretty *opéra comique, Fidelio ou l'amour conjugal* into the powerful *Leonore* (afterwards renamed *Fidelio*), was executed according to Beethoven's general intentions but with many blunders as to the *mise-en-scène.* French *opéra-comique* is not comic opera, but opera with spoken dialogue. It thus includes Cherubini's tragic *Medée* and Méhul's biblical *Joseph.* It has a tendency (which culminates in Bizet's *Carmen*) to arrange that much of the music should happen more or less as it might occur in an ordinary play. For instance, necessary antecedents may be told in "that dear old song which I am never tired of hearing," whereupon the family history follows in a ballad. Other occasions for music are the plighting of troth in a little private ceremony, the entry of a company of soldiers, and, less realistically, ordinary entries and tableau-situations in general, until we recapture the Metastasio scheme. Opera, viewed from this point, lacks opportunity for great musical forms which can deal with more than one action; but the influence of Mozart's wonderful concerted finales was not to be resisted, and Cherubini's librettists arranged that the second act in *Les deux Journées, Lodoiska,* and one or two other operas, should end with continuous music for something like 20 minutes, with various changes of action. The last act French taste did not allow to expand, and in all French operas the end is perfunctory; whereas Mozart and Beethoven love to expatiate on the final happiness.

It is not known where the concerted finale originated, since its reputed invention by Logroscino (*q.v.*) is not borne out by his extant works; but it is already fully developed in the second act of Mozart's *La finta Giardiniera* (written at the age of 18). In his first *Singspiel, Die Entführung,* Mozart ends the second act with a highly developed quartet, while the whole opera ends with a vaudeville, *i.e.,* a series of verses delivered by each character in turn, with a burden in chorus; followed by a short movement for full chorus. But in his other *Singspiel, Die Zauberflöte,* the finales to both acts, like those in *Figaro, Don Giovanni* and *Così fan tutte,* cover so much action within their half-hour's extent that it would evidently cost Mozart little effort to extend the finale backwards over the whole act and so to achieve, without transcending his own musical language, the perfect continuity of Verdi's *Falstaff.* This would have suited neither his singers nor his public; but we do not know how he might have crushed opposition if he had lived longer and had seen the possibilities of French opera, with its thrilling tales of heroic adventure.

**Fidelio.**—As fate befell, Beethoven took the problem in hand too late. The original libretto of Fidelio was by the author of *Les Deux Journées,* and was on the usual French lines with (as Brahms once put it) vaudeville turns for each person in succession. Two acts were occupied with the love of the jailor's daughter, Marceline, for Fidelio, the mysterious new assistant who is really the disguised wife of the hero, who has been secretly imprisoned by the villain, and whom she has been seeking for two years. She reluctantly uses Marceline's delusion in order to further her design of penetrating to the lowest dungeons of this jail, where a mysterious prisoner is being starved to death. In the

original libretto a trio begins on the occasion of the father's giving his blessing on their engagement. And on the operatic vaudeville scale this is well enough timed. But Fidelio-Leonora's heroic project and the martyrdom of her Florestan in Pizarro's dungeon are themes too sublime for this light style of opera, which was all very well for the adventures of the hero of *Les Deux Journées,* carted out of Paris in his humble friend's water cart. It was the sublime themes that attracted Beethoven; and in *Leonore* (as his opera was first named) his librettist, Sonnleithner, tried to expand them without the necessary recasting of the whole action. So the trio of plighted troth was begun earlier, so as to take in half of the previous conversation, which dealt with the project of getting permission for Fidelio to assist in the work of the dungeons, and with Fidelio's imperfectly suppressed excitement thereat. We thus have the music bursting into the conversation in an inexplicable way; and two revisions barely saved the first two acts even when an experienced dramatist named Treitscke compressed them into the first act of *Fidelio.*

The rest, from the rise of the curtain on Florestan in the dungeon, was not beyond mending; and spectators who are insensible to its power should confine their criticisms to the costumes of the box-holders. *Fidelio* is one of the most important works in the history of opera; and *The Messiah* has not a firmer hold of the British public than *Fidelio* has of every class of unspoilt music-lover in Germany. The story is one of the finest ever put on the stage, and everybody in Germany knows it; which is fortunate, since nobody could ever make it out from the action, until it begins to explain itself in the dungeon scene. But in the first act the mystery is a mere puzzle, and even if Fidelio's disguise is as transparent as most operatic male parts for female voices, the spectator has no evidence beyond the playbill that she is other than the strangely embarrassed lover of the adoring jailor's daughter.

The difficulties of *Fidelio* are thus very instructive. Turn back from it to the almost nonsensical *Zauberflöte* and observe how perfectly the comings and goings of Mozart's music explain themselves. Music begins naturally on the rise of the curtain, and stops naturally with the exits of all the characters except the youth who is lying unconscious. He revives, wonders where he is, hears a distant piping; and the approach of the bird catcher, Papageno, explains the piping and is accompanied by the orchestral introduction to his song. Later on, three veiled ladies give the hero a miniature portrait of the princess he is to rescue. He gazes at the portrait and falls in love; the orchestra heaves two sighs and Tamino's love-song begins. The scene darkens, the Queen of Night appears, enthroned among stars, pours out her woes and promises her daughter to the hero. She vanishes. Daylight returns. Tamino, wondering whether it was all a dream, is encountered by poor Papageno who, punished for his lies with a padlock on his mouth, can only sing *hm, hm, hmm;* another perfect occasion for music, worked up in a quintet in which the three veiled ladies remove his padlock and instruct him and Tamino how to set forth on their quest. And so from point to point the happy nonsense proceeds, always right and effective in matters the mishandling of which may ruin the finest story.

**Co-ordination.**—These are the matters in which Sullivan, with his Gilbert, is as right as Wagner. It makes little difference whether the opera be with spoken dialogue, with dialogue in the secco-recitative of *opera buffa,* with the accompanied recitative of Gluck and of Weber's *Euryanthe,* or in absolute Wagnerian continuity. The composer will always have to demand from his librettist an effective timing of the chief musical opportunities, and from himself a royal punctuality in the relation of his music to the drama. Wagner's advice to young opera writers was to begin with *Singspiele.* The *a priori* critic complains that spoken dialogue and music are on irreconcilably different planes; and so they are when the transitions are mishandled. But Mahler, one of the greatest opera conductors of all time, did not think the planes incompatible. He insisted on being his own stage manager (which laudable example has been followed by Sir Thomas Beecham), and he rehearsed every word and every pose in the dialogue of *Fidelio.*

Secco-recitative, *i.e.,* recitative accompanied on the pianoforte (or harpsichord) is no bad medium when it is properly done, viz., at the pace of spoken dialogue and, on the part of the conductor (who takes the pianoforte), with a light touch and some discreetly humorous "gagging." Modern composers, of course, might as well attempt prehistoric Chinese as try to revive this convention. With accompanied recitative and other more highly organized music the composer begins to lose the clear outlines of the problem of timing his chief musical events; and the wisdom of Wagner's advice appears. For only in the *Singspiel,* with *Freischütz* and *Zauberflöte* as examples, and with *Fidelio* as both an inspiration and a warning, do we see the bones of opera laid bare.

These principles are more important than any details of chronological operatic history. The reader who has grasped them can afford to ignore most of the patriotic and political aspects that have made this or that opera famous. *Der Freischütz* was the first German opera that had a truly German subject; and Wagner, speaking at a reburial of Weber's remains, said that there never was a more German composer. Very true, but that did not prevent Weber from following *Freischütz* by *Euryanthe,* his greatest effort, on a subject of chivalry ruined by an incompetent librettist; nor from contributing his swan song, *Oberon,* to the English stage and the English operatic tradition which, ever since the time of Dryden and Purcell, inculcated an utter incoherence in the musical scheme. Weber's distress at being made to compose separate numbers as Planché sent them to him, with no information as to their order or context, was surpassed only by his disgust at finding that Planché was quite right in thinking that such information did not matter.

*Euryanthe,* with its elaborate accompanied recitative and its 13 distinct *Leitmotive* (to anticipate the Wagnerian term) is an opera on lines hardly less advanced than those of Wagner's *Lohengrin.* Weber retains the outward appearance of the division into separate numbers, as arias, duets, finales and so on; but the division is becoming artificial, and some vestiges of its real purport are useless. For example, the condemnation of *Euryanthe* at the end of the second act is expanded by Weber into a longish movement merely because he does not realize that a short outburst would suffice to round off the whole act far more grandly than a self-contained finale.

**Wagner.**—With Wagner's *Der Fliegende Holländer* extremes meet. It purports to be divided into nine "numbers," but the musical traces of such divisions are only a nuisance, and the formal expansion of the Dutchman's duet with Senta is as out of place as a Punch and Judy show, besides being very poor music. On the other hand, the division into three acts is a grudging concession to the brutal necessities of the first performances, for Wagner conceived and executed *Der Fliegende Holländer* as a one-act opera, with continuous music during its changes of scene. It has been divided into three as if by a butcher's chopper, cutting off the curtain music at the first available tonic chord, and restarting it at the cut or a little earlier. The opera ought always to be performed in one act. Spohr's comment on it was that it had too few full closes and rounded off forms. This shows how far it still seemed recognizable to him as a classical opera.

Wagner's mature work solves the problem of a music on the same time-scale as the drama. Every other feature of Wagner's art results naturally from this. Musical dialogue becomes completely realistic, to such an extent that Wagner could not at first (in *Die Walküre*) make up his mind to let his lovers sing together. He overcame this scruple in *Tristan,* and so recovered the classical art of making a composite emotional tableau. This he developed to unprecedented heights in *Die Meistersinger von Nürnberg.* The continuity of such highly organized music demanded a rational organization of recognizable themes. What more inevitable principle could organize them but that of association with personal and dramatic ideas? Thus Wagner's system of *Leitmotiv* grew up as naturally as the thematic organization of sonatas. The illustrations at the end of the article MELODY give a typical example of his handling of a theme in various contexts. Other aspects of his music are illustrated in HARMONY and INSTRUMENTATION.

Not only was Wagner his own librettist, but he succeeded in

making clear and cogent upon the stage stories and ideas that no dramatist, musical or non-musical, had thought possible before. It is always a mistake to suppose that the libretto, however contemptible as literature, can be neglected in the enjoyment of an opera, however great as music. But Wagner's dramas, with all their affectations and amateurishnesses of style, are pieces of epoch making stage-craft and overwhelming tragic powers, except *Meistersinger,* which achieves the yet higher mark of a comedy full of kindly wisdom and bathed in sunshine, with no shadows deeper than moonshine; for even its poor little villain, Beckmesser, is only a critic.

It was not Wagner's fault that so many of his epigonoi neglected his advice and, instead of writing *Singspiele,* refused to tackle anything smaller than continuations of the sorrows of Wotan. Lighter forms of opera prospered, nevertheless. Bizet first wrote *Carmen* as an *opéra comique.* It is doubtful whether it has been improved by the compression of its spoken dialogue into accompanied recitative, though this is well done and the recitatives have their points. It carries to an extreme the device of rationalizing the musical occasions; for if it were performed as a play an enormous amount of the music would still remain as songs or dances. *Meistersinger* is almost as full of songs and choruses on the same realistic basis.

The last works of Verdi have a complete Wagnerian continuity, but they reveal that unless the music is inveterately polyphonic the *Leitmotiv* system is Wagner's private affair, which need concern nobody else.

**Modern Opera.**—Space fails for anything like a complete review of modern opera; but it may be noted that the prevalence of Wagnerian continuity eventually enabled composers to take extant dramas and set them without any extensive remodelling at all. If the operas *Pelléas et Mélisande, Salome* and *Elektra* are compared with the original plays by Maeterlinck, Wilde and Hofmannsthal, it will be found that the poets have suffered less from Debussy and Strauss than dramatic authors usually suffer from actor-managers. Debussy has omitted Maeterlinck's difficult and not musical first scene of the servants who, having heard of the prince's approaching return with a strange bride, must be speaking after the following scene, in which Golaud first meets Mélisande in the forest. By omitting the first scene Debussy secures an opening in the right atmosphere but loses the basis of the entry of the servants in the last scene of all. Here history repeats itself, for Weber offended the librettist of *Freischütz* by refusing to compose an opening scene with the hermit who appears as *deus ex machina* at the end. In both cases the composers are right, though the sacrifice is serious.

Debussy and Strauss have so treated these three plays that they are better acted when given as operas than when given without music. No actress except an opera singer ever has her declamation and movements so superbly timed, and timed permanently to the tenth of a second, as in these wonderful pieces of musical stage-craft. The methods of the two composers are poles asunder, and Debussy's language is, as has been said elsewhere, the exact opposite of Maeterlinck's. Yet from his opposite direction Debussy reaches the Maeterlinckian world. He has no *Leitmotiv,* hardly even a recurring figure. Strauss uses the whole Wagnerian system, together with his own *al fresco* technique (the term is also his own, *see* INSTRUMENTATION, last section).

In later works Strauss and Hofmannsthal have shown that they accept no limits to the number of different kinds of opera that one composer may write. An annotated catalogue would be required to keep pace with the various types of modern opera from the parodistic to the tragic and the symbolical.

A few final definitions may serve to fill up lacunae in an account which has deliberately sacrificed historical order to the laying down of a few broad aesthetic criteria. Besides the matters already defined the following particulars should be noted:

1. *Singspiel* originated in farces, such as Dittersdorf's *Doktor und Apotheker.* But in France the *opéra comique,* which corresponds to *Singspiel,* had no comic origin at all, but arose from the refusal of the *Académie de Musique* to allow rival companies to infringe its monopoly of *Grand Opéra,* or opera in which every word is sung and even the recitatives have orchestral accompaniments.

2. French *Grand Opéra* has had a continuous history from the foundation of the *Académie de Musique* in 1669 to the present day. It absorbed the works of Meyerbeer, which so infuriated Wagner by producing "effects" without assuming any responsibility for causes. And this is all that can be said of Meyerbeer here.

3. *Opéra bouffe* has no historic connection with *opera buffa* but is the offshoot of vaudeville music in the early classical sense described above. Its chief representative on the Continent is Offenbach, and it is the ancestor of the Savoy operas of Gilbert and Sullivan.

4. *Melodrama* is the use of an orchestral accompaniment to spoken dialogue (*see* BENDA). It is promising in theory, but generally disappointing in effect, because the speaking voice becomes dragged by the music into an out-of-tune sing-song. Benda never lets the voice speak during any notes except a long-sustained chord. Mozart, after one example in an unfinished opera, *Zaide,* dropped this form, though he admired Benda's essays so much that he put them under his pillow during his travels. Other classical examples are significantly short and cautious. There is one in *Fidelio* which quotes from earlier movements in a thoroughly Wagnerian way. But the device is more prominent in incidental music to plays, as in Beethoven's music for Goethe's *Egmont.* Mendelssohn's music for *A Midsummer Night's Dream* contains the most brilliant and resourceful examples yet achieved; but they are beyond the musical capacity of the English non-operatic theatre, which, however, has practised the worst style of the method, till it has become a disease spreading an operatic continuity of bad music over large tracts of our drama.

In every period of musical fermentation the art of opera, while it has failed to sift good composers from bad, has instantly sifted the men of real ideas from the aesthetes and faddists; Monteverdi from the prince of Venosa, Gluck from Gossec, Wagner from Bruckner on the one hand and Liszt on the other. As the ferment subsides laziness levels opera sooner than anything else; but every revolutionary principle that enters into music to destroy and expand must, first or finally, seek its ratification on the stage.

*See* also ARIA, BALLET, OVERTURE, INSTRUMENTATION and the articles on individual opera composers. (D. F. T.)

**OPHICLEIDE,** a brass wind instrument, now almost obsolete, having a cup-shaped mouthpiece and keys, in fact a bass keyed-bugle. The name (from Gr. ὄφις serpent, and κλεῖδες keys), applied to it by Halary, the patentee of the instrument, is hardly a happy one, for there is nothing of the serpent about the ophicleide. The ophicleide is almost perfect theoretically, for it combines the natural harmonic scale of the brass wind instruments having cup-shaped mouthpieces, such as the trumpet, with a system of keys, twelve in number, one for each chromatic semitone of the scale and it is capable of absolutely accurate intonation. Unfortunately its timbre is not satisfactory, the lower register being rough, the medium coarse and the upper wild and unmusical, and it has been superseded by the bass tuba.

The invention of the ophicleide is frequently but falsely attributed to Alexandre Frichot, a professor of music at Lisieux, department of Calvados, France. Actually the first idea of adding keys to instruments with cupped mouthpieces, unprovided with lateral holes, with the aim of filling up some of the gaps between the notes of the harmonic scale, goes back, according to Gerber, to Kölbel, a hornplayer in the Russian imperial band, about 1760. Anton Weidinger, trumpeter in the Austrian imperial band, improved upon this first attempt, and applied it in 1800 to the trumpet. But the honour belongs to Joseph Halliday, bandmaster of the Cavan militia, of being the first to conceive, in 1810, the disposition of a certain number of keys along the tube, setting out from its lower extremity, with the idea of producing by their successive or simultaneous opening a chromatic scale throughout the extent of the instrument. Later, in 1817, Jean Hilaire Asté, known as Halary, a professor of music and musical instrument maker of Paris, extended the same principle with complete success to other instruments of the same family.

**OPHIR,** an unidentified region famous in Old Testament times for its fine gold. Solomon's Tyrian sailors brought its gold for that monarch. The geographical list of Genesis X. associates it with Sheba and Havilah, the latter also being a recognized gold bearing region (Gen. ii. 11). Solomon's ships set forth from Ezion-Geber at the head of the Gulf of Akaba. Presumably then it lay somewhat to the south of Suez, but where?

(1) *East Africa.*—The extensive and imposing ruins discovered at Zimbabwe in Mashonaland, about 200m. inland from Sofala, have been acclaimed as marking the site of long lost Ophir. But careful investigation has resulted in depriving the ruins of any claim to great antiquity. An identification with Zanzibar has been suggested.

(2) *The Far East.*—The fact that three years were occupied in the voyage to Ophir (1 Ki. x. 22) as well as the nature of the cargoes (gold, silver, ivory, apes and peacocks) suggests a distant voyage, although attempts have been made to minimize these arguments. The Indus delta; Johore; Supara in Goa; Farther India; Malabar; Malacca; Sumatra have all been adduced.

(3) *Abyssinia.*—The territory on the Abyssinian coast from ancient Adulis to Bab-el-Mandeb whose inhabitants call themselves Aphar.

(4) *Arabia.*—The most common and, indeed, the most plausible view is that Ophir was somewhere in Arabia. It has been sought in West Arabia at Asyr between the Hejāz and Yemen; but the view that it is some district on the southern coast appears the most atractive.

The lack of sufficient data for identification has given and no doubt will continue to give scope for imagination. There have not been wanting wild and fanciful surmisings. Spain, Armenia, Phrygia and even Peru have had their advocates. (E. Ro.)

**OPHITES.** Strictly speaking, this is the name given to an obscure sect of Gnostics, of which our knowledge is derived mainly from Origen (*Contra Celsum,* vi. 25) supplemented by Irenaeus (*Adv. Haer.,* i. 30) and Epiphanius (*Haer.,* xxxviii); but the more important use of the term is as the comprehensive name for a group of Gnostic sects which resemble one another, first, because no name of any personal founder or leading teacher is associated with any of them; and further, because they attach religious importance to the serpent. The type of mythology may be illustrated from the account of Irenaeus. It begins with a triad, the highest deity, described as "primal Man"; intellect or reason, his Son, the "second Man"; and the Spirit, introduced as a female principle. Through her the Christ is begotten as "third Man." Christ ascended, with the Spirit, but in their ascent a ray of light fell on the waters. This was Sophia (prudence or wisdom) and from this contact came Ialdabaoth the "demiurge." He in turn produced six powers, and (from the dregs of matter) the serpent. Ialdabaoth then announced himself as the supreme Being; and when man (created by the six powers) gave thanks not to Ialdabaoth but to the primal Man, the former created a woman (Eve) to destroy him. Then Sophia sent the serpent (as benefactor) to persuade Adam and Eve to eat of the tree of knowledge and so break the commandment of Ialdabaoth, who banished them from paradise to earth. After a long war between mankind, aided by Sophia, and Ialdabaoth (this is the inner meaning of the Old Testament story), the Spirit sent the Christ to earth to enter the pure vessel, the virgin-born Jesus. Jesus Christ worked miracles and declared himself the Son of the primal Man. Ialdabaoth instigated the Jews to kill him, but only Jesus died on the cross, for Christ had departed from him. Christ then raised the spiritual body of Jesus, which remained on earth for 18 months, initiating a small circle of elect disciples.

This form of Ophitism is Christianized to a larger extent than others of the kindred sects, in most of which the Christian element is slighter and less essential. They are also far less impregnated with Greek philosophy than the "classic systems of Gnosticism"; and the early sources warrant the inference that the mythology itself is only a covering for observances (ritual, initiation, secret pass-words, incantations) characteristic of mystery-religions.

Notwithstanding the conclusion based by De Faye on his instructive investigations, the prevalent view holds the field, namely, that Ophitism represents a primitive phase of Gnosticism, which was gradually developed and transformed into various great speculative systems by a series of historic teachers.

*See* E. F. Scott, art. "Ophitism" in Hastings, *Encyclopaedia of Religion and Ethics;* Lichtenhahn, art. "Ophiten" in Herzog-Hauck, *Real-encyklopädie;* E. de Faye, *Gnostiques et Gnosticisme* (1913); Reitzenstein, *Peimandres* (1904). *See* also art. GNOSTICISM. (S. H. M.)

**OPHIUCHUS,** in astronomy, a constellation of the northern hemisphere, anciently named Aesculapius, and mentioned by Eudoxus (4th century B.C.) and Aratus (3rd century B.C.) According to the Greek fables, it variously represents: Carnabon (or Charnabon), king of the Getae, killing one of the dragons of Triptolemus, or Heracles killing the serpent at the river Sangarius (or Sagaris), or the physician Asclepius (Aesculapius), to denote his skill in curing snake bites. Like Sagittarius (which it adjoins) it includes a region of the sky rich in globular clusters and diffuse nebulae. A very bright nova or new star was observed in Ophiuchus in 1604.

**OPHIUROIDEA:** *see* BRITTLE STARS.

**OPHRYS,** a genus of plants of the orchid family (*Orchidaceae*), comprising about 30 species native to Europe, western Asia and North Africa, including the bee-orchis (*O. apifera*), the spider-orchis (*O. aranifera*) and the fly-orchis (*O. muscifera*), the second of which is one of the few orchids that are self-fertilized.

(*See* ORCHIDS; also C. Darwin, *The Fertilisation of Orchids.*)

**OPHTHALMOLOGY** (*see* EYE, ANATOMY OF; EYE, DISEASES OF). The science of ophthalmology deals with the processes by means of which the images of external objects are brought to our consciousness. It is therefore concerned with:

(*a*) the eye itself; (*b*) the nerve paths and tracts which convey visual impulses originating in the eye, through the different parts of the brain to the brain cortex, where these impulses are converted into conscious impressions; (*c*) the eyelids which cover and protect the eyes; (*d*) the tear glands and ducts; (*e*) the muscles that bring about the movements of the eyes and keep them trained in the desired direction; (*f*) the nerves and their complicated cerebral connections which supply these muscles; (*g*) the bony walls of the orbit; (*h*) the blood-vessels and lymph paths which maintain the nutrition of all these structures.

It treats of disease in these parts and derives importance from the fact that many diseases of the central nervous system and many general diseases manifest themselves by some derangement of function or structure which can be detected by the ophthalmic surgeon.

The eye is unique in the body in that its retina, which is available to minute examination by means of the ophthalmoscope, is the only portion of the brain available to inspection during life. Similarly, the arteries and veins which supply the retina can also be minutely examined during life, the diseases of them observed and followed in all their changes. The value of these observations is enhanced by the fact that the eye itself acts as a low-power microscope, providing a magnification of about 15 diameters for the examination of these structures. The eyes are the subject of a number of hereditary diseases, and form one of the most convenient media for the study of transmission of such diseases.

**Affections of the Eye.**—The function of the eyeball is to provide that a clear image of external objects shall be formed upon the retina, but in certain cases it departs from the normal and the acuity of sight is lowered. It may be too long, so that the retina lies behind the point at which the images of external objects are formed; this is myopia or short-sightedness, and may be compensated by the wearing of concave lenses in the form of spectacles. In other cases, the eyeball is too short and the retina lies in front of the point at which the image of external objects is formed. This is hypermetropia or long-sightedness; it can be compensated by the focusing muscle of the eye, making the lens more convex; or, preferably, by the wearing of appropriate convex lenses in the form of spectacles. In astigmatism the refractive power of the eye varies in different axes, so that, for instance, in an extreme case the vertical axis may be myopic whilst the horizontal axis is hypermetropic.

Normally the visual axes of the two eyes are parallel and images of external objects are formed upon corresponding points of each retina. This arrangement is largely responsible for stereoscopic vision, which enables us to judge the position of objects in space with accuracy. Should it be upset *e.g.* by paralysis of some of the muscles, stereoscopic vision is lost and double vision usually arises.

**Eyeball and Camera Compared.**—The eyeball may be likened to a photographic camera. Roughly speaking it is globular in shape and is an inch long in all dimensions. The front part, or cornea is curved, is perfectly transparent and functions as a lens. Behind it is a chamber filled by the aqueous humour—little more than water. Further back is the iris—the coloured part of the eye. The hole in its centre forms the pupil, and by contraction or dilation of the tissues of the iris the pupil can be varied in size through a wide range; it may be compared to the stop in the camera. In bright lights the pupil is small, and it becomes large in dull illumination. The iris rests behind upon the lens.

The lens is bi-convex, its back surface having the greater curvature. It is perfectly transparent, and the focusing of the eye for near or distant objects is brought about by alteration in its curvatures by contraction of the ciliary muscle. Here is an essential difference between the eye and the photographic camera, whose focus is adjusted by shifting the position of the lens. As age proceeds, opacities frequently develop in the lens; almost everyone at the age of 60 or over may be said to have the beginnings of cataract, though the sight is quite unaffected thereby. When, however, these opacities involve the centre of the lens, and render sight very imperfect, the term of cataract becomes applicable; in such a case the cataract can be removed by operation and the sight restored.

**Vitreous Chamber and Retina.**—Behind the lens is the vitreous chamber, which is occupied by a perfectly transparent, colourless substance, much like white of egg. Clothing the back of the eye, and extending forward some distance in front of its equator, is the retina. It rests upon a highly vascular membrane which is responsible for the nutrition of the greater part of it, namely the choroid; in man, however, the retina has its own blood vessels clearly visible with the ophthalmoscope. The retina may be likened to the sensitive plate of the camera for upon it images are formed which initiate impulses which, when conveyed to the cortex of the brain, give rise to the sensations of sight. Its sensitive layer is placed posteriorly, and is composed of delicate structures known as the rods and cones.

At the central spot or yellow spot of the retina, the point of distinct vision, cones alone are present. The rods are believed to be concerned with lights of lower intensities, and in accordance with this they alone are present in night-flying birds (*see* VISION or SIGHT).

**Optic Nerves and the Cerebral Cortex.**—The nerve fibres from the retina converge upon the optic disk, and leave the eye as the optic nerve, which traverses the orbit to enter the skull. Inside the skull the two optic nerves meet and each is divided into two parts, one part continuing to the mid-brain on the same side, the other part crossing over to the opposite side. This crossing forms the chiasma; in many animals, the birds for instance, the whole of each optic nerve crosses over in this way. Beyond the chiasma the nerve fibres are again collected into a compact bundle known as the optic tract, which terminates in the mid-brain. From here nervous impulses are relayed in two chief directions; some connect up with the nerves which control the movements of the eyes and others, forming the so-called optic radiations, make a long sweep backwards to reach the cerebral cortex, where, as already stated, the impulses are transformed to sensations of sight.

The exact area of the cerebral cortex, in which these fibres end, is known with great accuracy and forms the visual cortex. It is placed at the extreme hind end of the brain, and the adjoining mesial surface of each hemisphere, in the region of the calcarine fissure (*see* BRAIN). Should a minute portion of this cortex be cut out as the result of injury or blocking of its blood supply, the precise area of the defect which will be found in the vision can be stated with certainty. This accurate localisation was much advanced as a result of observations made during the War.

**General Diseases and the Eye.**—Amongst the general diseases of the body in which important manifestations occur in connection with the eye a few may be mentioned.

In brain tumours or abscesses, swelling of the optic disk is seldom absent, and forms perhaps the most important sign in the diagnosis of the condition. In addition the ocular nerves may have their functions interrupted, so that the movements of the eyes are interfered with, they no longer move in unison and double vision occurs. If nothing can be done for the brain tumour the optic nerve atrophies and blindness ensues. In advanced renal disease changes in the retina develop and convey a particularly grave prognosis, for patients seldom live so long as two years after their discovery. In diabetes a similar change may also arise, which may greatly spoil the sight, and although of less serious import than in renal cases, it must be considered a bad omen. Venereal disease frequently attacks the eye, whether in the early or late stages, and is perhaps the most prolific source of blindness. Tuberculous disease occasionally occurs. In diseases of the blood in general, eye signs are very common, and there are many other diseases where the diagnosis may be greatly assisted by the discovery of changes in some part of the ocular apparatus. The introduction of the "slit lamp" has made many investigations possible which previously were quite outside our scope.

(R. F. M.)

BIBLIOGRAPHY.—M. L. Hepburn, *The Ophthalmology of General Practice* (1922); C. H. May and C. Worth, *Manual of the Diseases of the Eye, for Students and Practitioners,* 4th ed. (1922); J. Meller, *Ophthalmic Surgery.* Edited by W. M. Sweet, 3rd ed. (1923) and Sir J. H. Parsons, *Diseases of the Eye,* 5th ed. (1926); J. M. Ball, *Modern Ophthalmology* 6th ed., Philadelphia, 1927 (bibl.); R. F. Moore, *Medical Ophthalmology,* 2nd ed., London, 1925 (bibl.); G. E. de Schweinitz, *Diseases of the Eye,* 10th ed., Philadelphia, 1924; E. Fuchs, *Textbook of Ophthalmology,* trans. from 12th German ed. by A. Duane, 8th ed., Philadelphia, 1924; W. S. Duke-Elder, *Recent Advances in Ophthalmology,* London, 1927 (bibl.).

**OPIE, AMELIA** (1769–1853), English author, daughter of James Alderson, a physician in Norwich, where she was born on Nov. 12, 1769. Miss Alderson had inherited radical principles and was an ardent admirer of Horne Tooke. She was intimate with the Kembles and with Mrs. Siddons, with Godwin and Mary Wollstonecraft. In 1798 she married John Opie, the painter. In 1801 she produced a novel entitled *Father and Daughter,* which showed genuine fancy and pathos. She published a volume of graceful verse in 1802; *Adeline Mowbray* followed in 1804, *Simple Tales* in 1806, *Temper* in 1812, *Tales of Real Life* in 1813, *Valentine's Eve* in 1816, *Tales of the Heart* in 1818, and *Madeline* in 1822. In 1825 she joined the Society of Friends. She died at Norwich on Dec. 2, 1853.

A *Life,* by Miss C. L. Brightwell, was published in 1854.

**OPIE, JOHN** (1761–1807), English historical and portrait painter, was born at St. Agnes near Truro in May 1761. While quite young he won some local reputation by portrait-painting; and in 1780 he started for London, under the patronage of Dr. Wolcot (Peter Pindar), and was introduced to the town as "The Cornish Wonder," a self-taught genius. He became a fashionable portrait painter, but after a period of prosperity fell into neglect. He then set himself to make good the defects of his early education by studying Latin, French and the English classics as well as the technique of his art.

His first important historical subject to be exhibited was the "Assassination of James I.," followed by his "Murder of Rizzio" which secured his immediate election, in 1786, as associate of the Academy, of which he became a full member in 1787. He was employed on five subjects for Boydell's "Shakespeare Gallery"; and until his death on April 9, 1807, his practice alternated between portraiture and historical work. His painting shows breadth of handling and a certain rude vigour, individuality and freshness, but lacks grace and poetic feeling.

Opie's portraits of Mary Wollstonecraft, of himself, and the "Portrait of a Boy" are in the national collections. He also wrote a *Life of Reynolds* in Wolcot's edition of Pilkington and a *Letter on the Cultivation of the Fine Arts in England,* in which he advocated the formation of a national gallery. His Academy *Lectures* were published in 1809 with a memoir by his widow (*see* above). *See* also Claude Phillips,

"John Opie" (*Gazette des Beaux-Arts,* 1892, i. 299).

**OPISTHOCOMUS HOATZIN:** *see* HOATZIN.

**OPISTHODOMOS:** *see* EPINAOS.

**OPITZ VON BOBERFELD, MARTIN** (1597–1639), German poet, was born at Bunzlau, Silesia, on Dec. 23, 1597, and studied at Frankfurt-on-Oder, Heidelberg and Leyden. He led a wandering life in the service of various territorial nobles. In 1624 he was appointed councillor to duke George Rudolf of Liegnitz and Brieg in Silesia, and in 1625, as reward for a requiem poem composed on the death of archduke Charles of Austria, was crowned laureate by the emperor Ferdinand II who a few years later ennobled him under the title "von Boberfeld." He was elected a member of the *Fruchtbringende Gessellschaft* in 1629, and in 1630 went to Paris, where he made the acquaintance of Hugo Grotius. He settled in 1635 at Danzig, where Ladislaus IV of Poland made him his historiographer and secretary. Here he died of the plague on Aug. 20, 1639.

Opitz was the head of the so-called First Silesian school of poets, and was during his life regarded as the greatest German poet. He was the "father of German poetry," at least in respect of its form; his *Buch von der deutschen Poeterey,* written in 1624, put an end to the hybridism that had until then prevailed, and established rules for the "purity" of language, style, verse and rhyme. Opitz's own poems are in accordance with the rigorous rules which he laid down. They are mostly a formal and sober elaboration of carefully considered themes, and contain little beauty and less feeling. To this didactic and descriptive category belong his best poems.

Collected editions of Opitz's works appeared in 1625, 1629, 1637, 1641, 1690 and 1746. His *Ausgewählte Dichtungen* have been edited by J. Tittmann (1869) and by H. Oesterley (Kürschner's *Deutsche Nationalliteratur,* vol. xxvii. 1889). There are modern reprints of the *Buch von der deutschen Poeterey* by W. Braune (2nd ed., 1882), and, together with *Aristarchus,* by G. Witkowski (1888), and also of the *Teutsche Poemata,* of 1624, by G. Witkowski (1902). *See* H. Palm, *Beiträge zur Geschichte der deutschen Literatur des 16ten und 17ten Jahrhunderts* (1877); K. Borinski, *Die Poetik der Renaissance* (1886); R. Beckherrn, *Opitz, Ronsard und Heinsius* (1888). Bibliography by H. Oesterley in the *Zentralblatt für Bibliothekswesen* for 1885.

**OPIUM.** The drug known in commerce as opium is derived from the immature fruits of *Papaver somniferum* (fig. 1), family *Papaveraceae,* by slightly incising the fruits and collecting and drying the exuded milky juice.

There are several forms of the plant in cultivation for yielding opium. The truly wild plant (*var. setigerum*) is found on the northern coast of the Mediterranean. It has acutely toothed leaves, the lobes sharp-pointed, each ending in a bristle. The leaves, flower stalks and sepals are covered with scattered bristly hairs, and the stigmata are seven or eight in number.

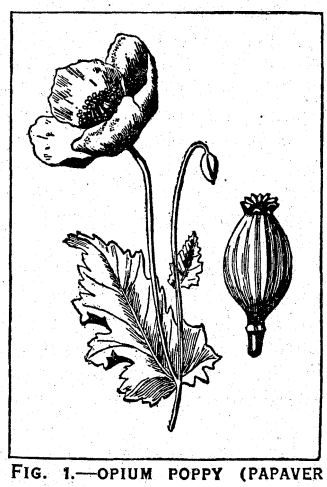


FIG. 1.—OPIUM POPPY (PAPAVER SOMNIFERUM)

The variety of the plant chiefly cultivated in Asia Minor and Egypt is distinguished by having a sub-globular fruit and 10 to 12 stigmata. It is glabrous and is known as *var. glabrum.*

The one cultivated in Persia is *var. album,* which has a fruit more or less egg-shaped; the pores below the stigmata do not open when the fruits are ripe. It varies in the colour and shape of the petals. Those (the majority) with white petals have usually white seeds, those with reddish or purple petals have usually slate-coloured seeds.

**Cultivation.**—The successful cultivation of the plant is only possible where there is not an excessive rainfall and where the climate is tropical or sub-tropical. The yield of opium is smaller in temperate than in tropical regions and the industry can only be profitably carried on where labour and land are sufficiently cheap and abundant.

The mode of cultivation adopted varies. In Turkey, from which the chief supplies of medicinal opium are obtained, the cultivation is carried on by peasant proprietors. A naturally light and rich soil is chosen, improved by manure and irrigation where necessary, and the land should be sloping and well drained, moisture in excess being injurious. The ground is ploughed twice, the second time crosswise. The seed is mixed with four times its weight of sand to prevent it being sown too thickly, ¾ to 1 lb.

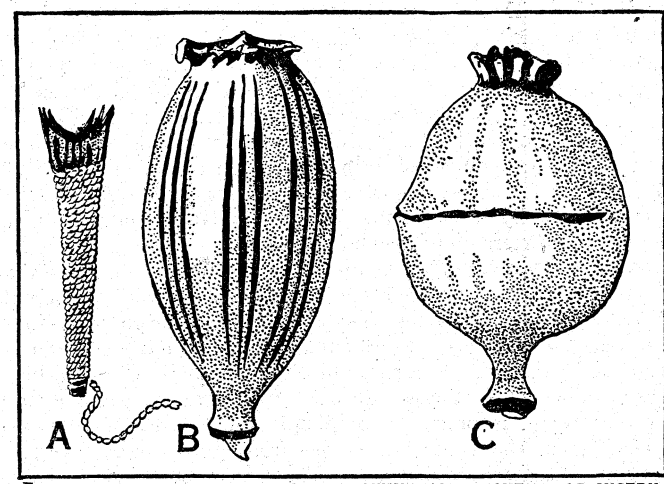



FIG. 2.—OPIUM POPPY CAPSULES, SHOWING (A) NUSHTUR, OR INSTRUMENT USED IN INDIA FOR MAKING THE INCISIONS, DRAWN FROM SPECIMENS IN THE MUSEUM OF THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN, (B) CAPSULE AS INCISED IN INDIA, (C) MODE OF INCISION PRACTISED IN TURKEY

being used to every *toloom* (1,600 sq.yd.). The crop is very uncertain owing to droughts, ground-frosts and locusts. To avoid failure, and to allow time for collecting the produce, every toloom has three sowings from October to March, the crops thus coming to perfection in succession. In localities where there is hoar frost in spring, the seed is sown in September, or at latest in the beginning of October. The yield of opium and seed is then greater than if sown later. After sowing, the land is harrowed and young plants are hoed and weeded, chiefly by women and children, from early spring until the time of flowering. In the plains the flowers expand at the end of May, and on the uplands in July. At this period gentle showers are of great value, as they cause an increase in the subsequent yield of opium. The petals fall in a few hours, and the capsules grow so rapidly that in a short time—generally from nine to 15 days—the opium is fit for collection. This period is known by the capsules yielding to pressure from the fingers, by assuming a lighter green tint, and by exhibiting a kind of bloom called "cougak," easily rubbed off with the fingers; they are then about 1½ in. in diameter. The incisions are made by holding the capsule in the left hand and drawing a knife two-thirds round it, or spirally beyond the starting point (fig. 2), great care being taken not to let the incisions penetrate to the interior, lest the juice should flow inside and be lost; in this case also it is said that the seeds will not ripen, and that no oil can be obtained from them. The operation is usually performed after the heat of the day, commencing early in the afternoon and continuing to nightfall, the exuded juice being collected next morning. This is done by scraping the capsule with a knife, transferring the concreted juice to a poppy-leaf held in the left hand, the edges of the leaf being turned up to avoid spilling the juice; the knife-blade is moistened with saliva by drawing through the mouth after every alternate scraping to prevent the juice from adhering to it. When as much opium has been collected as the size of the leaf will allow, another leaf or more is wrapped over the top of the lump, which is then placed in the shade to dry for several days. The pieces vary in size from about 2 oz. to 2 lb., being made larger in some districts than in others. The capsules are generally incised only once, but the fields are visited a second or even a third time to collect the opium from the poppy-heads subsequently developed by the branching of the stem. The yield of opium varies, even on the

same piece of land, from one-third to 7½ *chequis* (or 1·62 lb.) per *toloom,* the average being 1½ *chequis* of opium and 4 bushels (50 lb.) of seed. The seed, which yields 35 to 42% of oil, is worth about two-thirds the value of the opium. The whole of the operation must, of course, be completed in the few days, usually from five to ten, during which the capsules are capable of yielding the drug.

**Macedonian Opium.**—Four varieties of poppy are cultivated—two with white flowers and large oval capsules without holes under their "combs" (stigmata), and bearing respectively yellowish and white seed, and the other two having red or purple flowers and seeds of a slate colour with a reddish layer under the surface, one bearing small capsules perforated just below the top and the other larger capsules not perforated. The white varieties are recommended as bearing more abundant opium of superior quality. The yellow seed is said to yield the best oil; that obtained by hot pressure is used for lamps and for paint and the cold-pressed oil for culinary purposes.

**Indian Opium.**—The poppy grown in India is usually the white-flowered variety, but in the Himalayas a red-flowered poppy with dark seeds is cultivated. The land intended for poppy culture is usually near villages, in order that it may be more easily manured and irrigated. On a rich soil a crop of maize or vegetables is grown during the rainy season, and after its removal in September the ground is prepared for poppies. Under less favourable circumstances the land is prepared from July till October by ploughing, weeding and manuring. The seed is sown between Nov. 1 and 15, and germinates in 10 or 15 days. The fields are divided for purposes of irrigation into beds about 10 ft. square, which usually are irrigated between November and February; but if the season be cold, with hardly any rain, the operation is repeated five or six times. When the seedlings are 2 or 3 in. high, they are thinned out and weeded. The plants during growth are liable to injury by severe frost, excessive rain, insects, fungi and the growth of a root-parasite (*Orobanche indica*). The poppy flowers about the middle of February, and the petals, when about to fall, are collected for the purpose of making "leaves" for the spherical coverings of the balls of provision opium, or cannon ball opium as it is popularly called.

**Persian Opium.**—The variety grown in Persia appears to be *var. album,* having roundish ovate capsules. Several forms of this variety are grown. The best quality of Persian opium is said to be derived from the white-flowered form, which is the earliest to flower and most widely grown; a second quality from a bizarre flower with deeply cut petals and a central band of bluish-purple flanked with rich magenta; a third quality from a white flower with broad margins and an apex of salmon pink and magenta; a fourth from a dark scarlet flower with a central band of bluish purple to within a fifth of the apex of the petals; a fifth from a dark bluish purple flower; a sixth from a lilac flower suffused with faint purple colour, which is considered to yield a very poor quality indeed. The more fully exposed the plants are to the sun the finer the crop.

**European Opium.**—Experiments made in England, France, Italy, Switzerland, Greece, Spain, Germany, and even in Sweden prove that opium as rich in morphia as that of Eastern countries can be produced in Europe. In 1830, Young, a surgeon at Edinburgh, succeeded in obtaining 56 lb. of opium from an acre of poppies, and sold it at 36s. a pound. In France, the cultivation has been carried on since 1844 at Clermont-Ferrand by Aubergier. The juice, of which a workman is able to collect about 9·64 troy oz. in a day, is evaporated by artificial heat immediately after collection. The juice yields about one-fourth of its weight of opium, and the percentage of morphia varies according to the variety of poppy used, the purple one giving the best results. By mixing assayed samples he is able to produce an opium containing uniformly 10% of morphia. It is made up in cakes of 50 grammes but is not produced in sufficient quantity to become an article of wholesale commerce. Some specimens of French opium have been found by Guibourt to yield 22·8% of morphia, being the highest percentage observed as yet in any opium. Experiments made in Germany by Karsten, Jobst, and Vulpius have shown that it is possible to obtain in that country opium of excellent quality, containing 8 to 13% of morphia. It was found that the method yielding the best results was to make incisions in the poppy-heads soon after sunrise, to collect the juice with the finger immediately after incision, and evaporate it as speedily as possible, the colour of the opium being lighter and the percentage of morphia greater than when the juice was allowed to dry on the plant. Cutting through the poppy-heads caused the shrivelling up of the young fruit, but the heads which had been carefully incised yielded more seed than those which had not been cut at all. Newly manured soil was found to act prejudicially on the poppy. The giant variety of poppy yielded most morphia.

BIBLIOGRAPHY.—*Pharmaceutical Journal* (1) xi., xiv., and (2) x.; E. Impey, *Report on Malwa Opium* (Bombay, 1848); *Report on Trade of Hankow* (1869); *New Remedies* (1876); *Pharmacographia* (1879); *Journ. Soc. Arts* (1882); *The Friend of China* (1883), etc.; *Report* of Straits Settlements, Federated Malay States, Opium Commission, app. xxiii. and xxiv. (1908); A. H. Allen, *Commercial Organic Analysis,* vol. iii. (1924); F. Browne, *Report on Opium* (Hongkong, 1908); W. Watt, *Dictionary of the Economic Products of India* (1892); H. Moissan, *Comptes Rendus* (1892); E. Lalande, *Archives de médicine navale* (1890); International Opium Commission, *Report of Delegations,* vol. ii. (1909); P. W. Squire, *Companion to British Pharmacopoeia* (1908). (E. M. Ho.)

**Medicine.**—Of the opium alkaloids only morphine and codeine are used to any extent in medicine. Thebaine is not so used, but is an important and sometimes very dangerous constituent of the various opium preparations, which are still largely employed, despite the complexity and inconstant composition of the drug. Of the other alkaloids narceine is hypnotic, whilst thebaine, papaverine and narcotine have an action which resembles that of strychnine. So complex a drug as opium is necessarily incompatible with a large number of substances. Tannic acid, for instance, precipitates codeine as a tannate, salts of many of the heavy metals form precipitates of meconates and sulphates, whilst the various alkalis, alkaline carbonates and ammonia precipitate the important alkaloids.

The pharmacology of opium differs from that of morphine (*q.v.*) in a few particulars. The chief difference is due to the presence in opium of thebaine, which readily affects the more irritable spinal cord of very young children. In infants especially opium acts markedly upon the spinal cord, and, just as strychnine is dangerous when given to young children, so opium, because of the strychnine-like alkaloid it contains, should never be administered, under any circumstances or in any dose, to children under one year of age.

When given by the mouth, opium has a somewhat different action from that of morphine. It often relieves hunger, by arresting the secretion of gastric juice and the movements of the stomach and bowel, and it frequently upsets digestion from the same cause. Often it relieves vomiting, though in a few persons it may cause vomiting, but in far less degree than apomorphine, which is a powerful emetic. Opium has a more marked diaphoretic action than morphine, and is much less certain as a hypnotic and analgesic.

**Toxicology.** (*See* also DRUG ADDICTION and POISON).—Under this heading must be considered acute poisoning by opium, and the chronic poisoning seen in those who eat or smoke the drug. Chronic opium poisoning by the taking of laudanum—as in the familiar case of De Quincey—need not be considered here, as the hypodermic injection of morphine has almost entirely supplanted it.

The acute poisoning presents symptoms not easily distinguished from those produced by alcohol, by cerebral haemorrhage and by several other morbid conditions. The differential diagnosis is of the highest importance, but very frequently time alone will furnish a sufficient criterion. The patient who has swallowed a toxic or lethal dose of laudanum, for instance, usually passes at once into the narcotic state, without any prior excitement. Intense drowsiness yields to sleep and coma which ends in death from failure of the respiration. This last is the cardinal fact in determining treatment. The comatose patient has a cold and clammy skin, livid lips and ear-tips—a grave sign—and "pin-point pupils." The heart's action is feeble, the pulse being small, irregular and

often abnormally slow. The action on the circulation is largely secondary, however, to the all-important action of opium on the respiratory centre in the medulla oblongata. The centre is directly poisoned by the circulation through it of opium-containing blood, and the patient's breathing becomes progressively slower, shallower and more irregular until finally it ceases altogether.

**Treatment.**—In treating acute opium poisoning the first proceeding is to empty the stomach. The best emetic is apomorphine, which may be injected subcutaneously in a dose of about one-tenth of a grain. But the gastric wall is often paralysed in opium poisoning, so that no emetic can act. It is therefore better to wash out the stomach, at half-hour intervals, with a solution containing about ten grains of salt to each ounce of water. If apomorphine is obtainable, both of these measures may be employed. Potassium permanganate decomposes morphine by oxidation, the action being facilitated by the addition of a small quantity of mineral acid to the solution. The physiological as well as the chemical antidotes must be employed. The chief of these are coffee or caffeine and atropine. A pint of hot strong coffee may be introduced into the rectum, and caffeine in large doses—ten or twenty grains of the citrate—may be given by the mouth. A twentieth, even a tenth of a grain of atropine sulphate should be injected subcutaneously, the drug being a direct stimulant of the respiratory centre. Every means must be taken to keep the patient awake. He must be walked about, have smelling salts constantly applied to the nose, or be stimulated by the faradic battery. But the final resort in cases of opium poisoning is artificial respiration, which should be persevered with as long as the heart continues to beat.

**OPIUM-EATING AND OPIUM-SMOKING.** *Opium-eating.*—Opium, like many other poisons, produces after a time a less effect if frequently administered as a medicine, or as a stimulant. According to the experimental work of Faust, the toleration towards the use of large quantities of opium is due to the gradually increasing power of the tissues to destroy the drug. Opium-eating is chiefly practised in Asia Minor, Persia and India. Opinions differ widely as to the injurious effect of the habit; the weight of evidence appears, however, to indicate that it is much more deleterious than opium-smoking.

Vincent Richards has collected some statistics regarding Balasor in Orissa which throw some light on the influence of this practice on the health. He examined about 600 opium-eaters who took, on an average, 5 to 7 grains daily. The diseases for which it was chiefly taken were malarial fever, dysentery, diarrhoea, spitting of blood, rheumatism and elephantiasis. Richards concluded that its moderate use may be and is indulged in for years without producing any decided or appreciable ill effect, except weakening the reproductive powers. Dr. W. Dymock of Bombay, speaking of Western India, concurs in Richards' opinion regarding the moderate use of the drug. Dr. Moore's experience of Rajputana strongly supports the same view. Among the Rajputs infused opium has long been a drink both of reconciliation and of ordinary greeting.

*Opium-smoking.*—This is chiefly practised by the inhabitants of China and the islands of the Indian Archipelago, and in countries where Chinese are largely employed. Opium-smoking began in China in the 17th century. Foreign opium was first imported by the Portuguese (early 18th century). In 1906 it was estimated that about 27% of the adult males in China smoked opium.

For smoking, the Chinese use an extract of opium known as prepared opium or *chandoo,* containing about 8% of morphine, and a cheaper preparation known as dross opium extract, containing about 7% of morphine. This latter is used chiefly by the poorer classes.

Prepared opium is made by a lengthy process of digestion of opium in water, boiling, evaporating, beating, followed by a peculiar toasting process which is very important and is very carefully done. The opium at this stage resembles dark coloured ginger-nut crackers. There is more boiling of this in water, straining, evaporating, filtering and further evaporating until the prepared opium results as a black treacly substance, having the fragrant opium-like odour which is characteristic.

Opium-smoking is performed by the smoker lying on his side. Then he takes a thin metal dipper and puts the sharp end into the opium. Twisting it round and round, he brings a drop over the flame of a lamp until it is sufficiently roasted. There is further manipulation of the opium, and eventually a little piece of opium, about the size of a grain of hemp-seed, is left adhering to the bowl of the pipe immediately over the orifice. The smoker then holds the bowl over the lamp. The heat causes the opium to frizzle, and the smoker takes three or four long inhalations which are exhaled through both the mouth and the nose. Moissan has shown that the smoke of chandoo contained only a very small quantity of morphine. F. Dent and also H. Fraser and B. J. Eaton found that the smoke from 100 grams of chandoo yielded 0·100 gram of morphine in two independent experiments. Frank Browne examined the smoke of dross opium extract which is very largely smoked in the East. Dross opium extract is prepared by boiling together opium dross or residues from the smoking of chandoo and residues from the smoking of dross opium extract, with a small quantity of demorphinated opium, and filtering and evaporating to a proper consistence. His results are shown in the table with an analysis of tobacco smoke by Pontag. The results are expressed in percentages.

| | Carbon monoxide | Morphine | Nicotine | Ammonia | Pyridine | Hydrocyanic acid |
|---|---|---|---|---|---|---|
| | c.c. | Gram | Gram | Gram | Gram | Gram |
| Dross opium extract. . | 0 | 0·016 | .. | 0·395 | 0·147 | 0·0103 |
| Tobacco . . | 4 to 5 | .. | 1·16 | 0·36 | 0·15 | 0·004 to 0·010 |

The following shows the nature of the dross opium extract used—expressed in percentages on the extract:—

| | | | |
|---|---|---|---|
| Water ..... | 8·61 | Morphine ..... | 7·35 |
| Ash ..... | 28·45 | Insoluble in water .... | 3·84 |

A smoker of this extract would use from five to six grams daily. He is considered to smoke in excess when he burns about double this quantity.

This dross opium extract is admitted by smokers to be stronger in effect than chandoo. This strength must be attributed to the pyridine bases, ammonia, hydrocyanic acid, and other substances rather than to the morphine, which is present in much less amount than in the smoke of chandoo.

So far as can be gathered from the conflicting statements published on the subject, opium-smoking may be regarded much in the same light as the use of alcoholic stimulants. To the great majority of smokers who use it moderately it appears to act as a stimulant, and to enable them to undergo great fatigue and to go for a considerable time with little or no food. According to the reports on the subject, when the smoker has plenty of active work it appears to be no more injurious than smoking tobacco. In a large dock company in the Far East where 5,000 labourers were employed, the managers were unable to pick out any opium-smokers who, by any difference in physique, capacity for work or in behaviour, were different from the non-smokers.

When carried to excess, opium-smoking becomes an inveterate habit; but this happens chiefly in individuals of weak will power who would just as easily become the victims of intoxicating drinks, and who are practically moral imbeciles, often addicted also to other forms of depravity. The effect in bad cases is to cause loss of appetite, a leaden pallor of the skin and a degree of leanness so excessive as to make its victims appear like living skeletons. All inclination for exertion gradually becomes lost, business is neglected, and certain ruin to the smoker follows. By its Charter or Covenant, the regulation of the traffic of opium was expressly delegated to the League of Nations, whose efforts in endeavouring to secure the strictly legitimate use of the drug, may be seen in the pamphlet mentioned in the references below.

See *Pharmaceutical Journ.* (1) xi. p. 269, xiv. p. 395; (2) x. p. 434; Impey, *Report on Malwa Opium* (Bombay, 1848); *Report on Trade of Hankow* (1869); *New Remedies* (1876), p. 229; *Pharmacographia*

(1879) p. 42; *Journal of the Royal Society of Arts* (1882); *The Friend of China* (1883), etc. *Report* of the Straits Settlements, Federated Malay States, Opium Commission (1908), App. xxiii. and xxiv.; Allen, *Commercial Organic Analysis,* vol. iii. pt. iv. p. 355; Frank Browne, *Report on Opium* (Hong Kong, 1908); and *Pharmaceutical Journ.* 1920 I. p. 274—"Some Constituents of Opium Smoke"; G. Watt, *Dictionary of the Economic Products of India* (1892); H. Moissan, *Comptes rendus,* of the 5th of December 1892, iv. p. 33; Lalande, *Archives de médicine navale,* t. i. (1890); International Opium Commission (1909), vol. ii. "Report of the Delegations"; Squire, *Companion to the British Pharmacopeia* (1916) (19th edition); *Pharmaceutical Journ.* 1910 I. pp. 452, 524; *Pharmaceutical Journ.* 1920 I. p. 274; League of Nations pamphlet—Social and Humanitarian Work—*Traffic in Opium and other Dangerous Drugs;* J. D. Mann and W. A. Brend, *Forensic Medicine and Toxicology; British Pharmaceutical Codex* 1923 ed. p. 680. (F. Bro.)

**OPIUM TRAFFIC.** The use of the poppy and the coca leaf goes back to time immemorial. However, its organized use for the purposes of commerce and revenue seems to have developed in the last 200 years, in spite of protests against its use for other than medical and scientific purposes.

In 1783 Warren Hastings pronounced opium to be "a pernicious article of luxury which ought not to be permitted but for the purpose of foreign commerce only!" A few years later the directors of the East India company wrote: "If it were possible to prevent the use of the drug altogether except strictly for the purpose of medicine we would gladly do it in compassion to mankind," and Lord Ashley in 1843 proposed a resolution in the British parliament to the effect that the continuance of the opium monopoly and opium trade "was utterly inconsistent with the honour and duty of a Christian kingdom." Yet to-day there are still countries whose colonies obtain large revenues from such monopolies.

The importation of opium into China by foreign traders led to the war of 1840 between Great Britain and China. The Chinese, in spite of the fact that they were not the victors and despite any pressure brought to bear upon them, still refused to legalize the opium trade. China was now open to the world and a huge smuggling trade in opium sprang up which has given rise to endless difficulties ever since, both to the Chinese and to the British Governments.

The second war broke out between China and Great Britain, with France as her ally, 15 years later, and, after its close, not only was the cultivation of opium in China itself permitted, but the import of opium from India was also legalized. Yet the Chinese Government still continued to regard the use of opium as an important moral and economic question, and, in the year 1906, she decided to put an end to the use of the drug within ten years. For this reason, in the following year, she entered into what is known as the "Ten Years' Agreement with India," by which China should cease the cultivation of the poppy and forbid the consumption of opium on the understanding that the export of Indian opium to China should be reduced *pari passu* and cease altogether in ten years. At first this undertaking was carried out faithfully by both parties concerned, and according to a statement made by Sir John Jordan at one of the meetings of the opium advisory committee, China in 1917 had almost freed herself from the curse of the poppy. Political troubles, however, broke out, effective government in China was suspended, and to-day the production of opium in China is not only a great national but an international problem.

**International Action.**—It was first realized in 1906 that if the Chinese Government were able to suppress the opium evil, she must be assisted by other nations. In 1909 President Roosevelt proposed that an international investigation should be made. As a result, an international opium commission met that year at Shanghai, at which 13 Powers were represented. The recommendations made at this meeting formed the basis of the first Opium Convention, which was drawn up at The Hague in 1912. The articles of this convention may be summarized as follows:—

1. The distribution of raw opium to be controlled and the use of prepared opium to be gradually suppressed.

2. The export of raw opium to countries prohibiting its entry to be stopped and its export to countries restricting its import to be controlled.

3. The export and import of prepared opium to be prohibited except to those countries not yet ready to suppress its use.

4. The use of alkaloids of opium and its derivatives to be confined to medical and legitimate purposes; a Government licence to be obtained by all persons engaged in the manufacture, sale, distribution, import and export of the drugs.

5. The last chapter of the convention consisted of clauses dealing with assistance to China and with certain obligations undertaken by China herself.

6. Before the convention came into effect the adherence of the 34 non-signatory Powers in Europe and America was required.

International opium conferences were held at The Hague in July 1913 and June 1914, at which a number of Powers ratified the convention. During the World War all action in this connection was suspended until the Paris Peace Conference in 1919. In the peace treaties of 1919–20 the signatory Powers agreed that the ratification of these treaties should constitute a ratification of the convention of 1912 and the protocol adopted by the third Opium Conference of 1914 (according to which the convention should come into effect upon its ratification regardless of the non-signatory Powers).

**The Advisory Committee and the League of Nations.**—Under the Covenant (Article 23 c), the duty of supervising the execution of agreements with regard to the traffic in opium and other dangerous drugs devolved upon the League of Nations. In order to carry out this obligation, the first Assembly of the League constituted an advisory committee on opium and other dangerous drugs.

The committee, which sits once a year except in special circumstances, has obtained certain important and definite results, such as additional ratifications to The Hague Convention (56 States have now ratified, 50 of these States being members of the League) and the adoption by a very large number of countries of an important certificate system. Under this system no Government may allow the export from its territories of any dangerous drugs covered by The Hague Convention, except on the production by the exporter of a licence from the importing country, certifying that the drugs in question are required for legitimate purposes.

**The Import Certificate.**—The Council, on the recommendation of the advisory committee, invited the Governments and members of the League to prepare an estimate of total annual requirements for the inhabitants of their territories for medical, scientific and other uses, with a view to proposing at some future date to the States concerned a new distribution of production which would limit the total output of raw material to the amount required for legitimate medical and scientific purposes. Subsequently two conferences met during the latter part of 1924 and the early months of 1925.

The 1924 conference did not find it possible to recommend the immediate complete suppression of the use of prepared opium, but drew up an agreement which embodied the substitution of government monopoly for other systems in force. No general agreement could be reached regarding any provisions for registering or rationing addicts, nor was it found possible to embody in the agreement provisions for uniform prices or uniform penalties for the infraction of law, or to limit imports. It was held by the majority of members of the conference that no rationing could be enforced or total suppression imposed so long as a large illicit supply of opium remained uncontrolled. To this the representative of China objected, protesting against the refusal of the majority to take immediate steps to suppress opium-smoking until producing countries should find it possible to control smuggling. The conference, in a protocol to the agreement, decided to take any necessary measures not already taken for the entire suppression within a period of 15 years of the consumption of prepared opium in the territories under their authority, this period to begin so soon as the effective execution of the measures required to prevent illicit exportation of raw opium from their territories had been undertaken by the poppy-growing countries. Provision under the agreement is made for a League commission to decide when these measures have been effectively executed. The agreements reached took the form of an agreement, a protocol and a final act. Instruments of ratification have been deposited by all States

represented at the conference, other than China and Japan. The agreement is therefore now in force.

**The Convention of 1925.**—The result of the deliberations and discussions of the conference of 1925 was a convention providing for the more effective restriction of the production and manufacture of narcotics, and establishing stricter control and supervision of the international trade. It is not, however, in force as of the ten signatures required to bring the convention into effect seven must be deposited by members of the council, whereas on Jan. 1, 1928 only four members had ratified their signatures.

Among the suggestions made in the convention was the creation of a central board, whose task it would be to follow the course of international trade and the general acceptation of the export and import certificate system. The conference also drew up a protocol by which the signatory States, recognizing their obligations to establish such control over the production, distribution and exportation of raw opium as would put a stop to illicit traffic, agreed to take within five years of the date of the coming into force of the protocol such measures as might be required to prevent the smuggling of opium seriously interfering with the effective suppression of the use of prepared opium in those territories where such use is temporarily authorized. A final act, containing further recommendations, was drawn up. Among these special mention may be made of a request to the council to consider the possibility of sending a commission to various opium-producing countries to study the difficulties connected with the limitation of the production of opium, and to advise as to what measures should be taken to make it possible to limit the production of opium in those countries to the quantities required for medical and scientific purposes.

The result of this final act is shown in the League of Nations commission of enquiry sent to Persia to report on the possible substitution of crops for the existing opium crops. This commission, which consisted of one American, one Italian, and one French expert, presented its report to the Council of the League of Nations at its meeting in March 1927.

As a result of this report the representative of Persia made the following proposals on behalf of his Government. The programme which he undertook to submit to the Majliss, with recommendation for its enactment into law, is as follows:—

1. The approval of the recommendation of reduction in area under poppy cultivation of 10% per annum after three years on the plan proposed by the commission of enquiry. The annual reduction to continue for three years, after which time the Persian Government will reconsider its position, taking into account the effect the reduction has had on the welfare of the cultivator, the trade balance, the budget and the general economic condition of the country, and what action has been taken by other producing and manufacturing countries to curtail the production of the raw material and the manufacture and distribution of habit-forming drugs.
2. Acceptance of the opium export certificate system with an annual reduction beginning not later than the third year after the present, of 10% of the quantity annually permitted to leave the country without production of import certificates (subject to reservations indicated elsewhere).
3. The exemption of land taxes for a period of five years in the case of areas diverted from the cultivation of the poppy to that of substitute crops.
4. Preference in the granting of agricultural loans to be given by the State bank of Persia, when established, to cultivators who divert part or all of their land under opium cultivation to that of substitute crops.

Since the conference of 1925 discussed the possibility of limitation of the growth of the poppy and its export, India has also undertaken to reduce her export of opium 10% a year until all export ceases. Thus a material advancement has been made in two out of the four great countries of production.

With regard to the stricter control of manufactured drugs, two interesting schemes are, at the present time, receiving detailed examination by the opium advisory committee. One, submitted by the American assessor on the committee, proposes the nationalization of all factories manufacturing narcotic drugs; the other is a proposal made by the German member of the committee for the internationalization of manufacture by the formation of an international trust which should acquire a controlling interest in all the factories involved and with which the League of Nations itself should be closely associated.

A small expert body of the main committee was appointed to study the methods of drug control as enforced in the chief manufacturing countries, including the consideration of an interesting memorandum put forward by M. Cavazzoni, the Italian member of the committee on how such control might best be effected.

BIBLIOGRAPHY.—League of Nations, *Annual Reports of Advisory Committee on Traffic in Opium* (Geneva); *Opium Conference Reports and other Papers* (Geneva, 1925, etc.); W. W. Willoughby, *Opium as an International Problem* (Baltimore, 1925); John Palmer Gavit, *Opium* (1925); Raymond Leslie Buell, *The International Opium Conferences,* "World Peace Foundation" Pamphlets (Boston, 1925); Sir F. Whyte, *China and Foreign Powers* (1926). (R. E. C.)

**OPON,** a municipality (with administrative centre and 23 *barrios* or districts), on the small island of Mactan (area about 45 sq.mi.), province of Cebu, Philippine Islands. The island of Mactan, where Magellan was slain by the natives in March 1521, is separated from Cebu by a channel only about one mile wide. Pop. (1939) 33,426; 41 were whites. Opon is a shipping and commercial suburb of the municipality of Cebu, the harbour of which is sheltered by Mactan island. Its extensive groves of coco-nut trees afford supplies of copra, while maize (corn) and maguey are cultivated, and fisheries are important. The vernacular is Cebuano, a dialect of Bisayan. Of the inhabitants aged 6 to 19 inclusive, 21·9% in 1939 attended school, while 35·1% of the population 10 years old and over was literate.

**OPOPANAX.** A gum-resin obtained from the root of *Opopanax chironium,* formerly used as an anti-spasmodic medicine. The perfume known as opopanax is distilled from a *Commiphora.*

**OPORTO,** the second city of Portugal, about 3 mi. from the mouth of the Douro, in 41° 8′ N. and 8° 37′ W. Pop. (1930) 232,280; (est. 1935) 248,935. The part of the city south of the Douro is known as Villa Nova de Gaia. Oporto is the see of a bishop. It is the true capital of northern Portugal, and the commercial and political rival of Lisbon, much as Barcelona is the rival of Madrid. Three main railway lines meet here—from Lisbon, from Valença do Minho on the northern frontier, and from Barca d'Alva on the north-western frontier. Oporto is built chiefly on the north or right bank of the Douro; its principal suburbs are Bomfim on the east, Monte Pedral and Paranhos on the north, Villar Bicalho, Lordello and São João da Foz on the west, Ramalde, Villarinha, Matosinhos, Leça da Palmeira and the port of Leixões on the north-west. The mouth of the river is obstructed by a sandy spit of land which has been enlarged by the deposits of silt constantly washed down by the swift current; on the north side of this bar is a narrow channel varying in depth from 16 ft. to 19 ft. A fort in São João da Foz protects the entrance, and there is a lighthouse on a rock outside the bar. As large vessels cannot enter the river, a harbour has been made at Leixões (*q.v.*).

The approach to Oporto up the winding and fjord-like estuary is one of singular beauty. On the north the streets rise in terraces up the steep bank, built in many cases of granite overlaid with plaster, so that white is the prevailing colour of the city; on the south are the hamlets of Gaia and Furada, and the red-tiled wine lodges of Villa Nova de Gaia, in which vast quantities of port are manufactured and stored. The architecture of the houses and public buildings is often rather Oriental than European in appearance. Palms, oranges and aloes grow side by side with the flowers and fruits of northern Europe, for the climate is mild and very equable, the mean temperatures for January and July—the coldest and the hottest months—being respectively about 50° and 70°. The design of some of the native river craft is peculiar—among them may be mentioned the *caicos,* high-prowed canoe-like fishing boats, the *rascas* with their three lateen sails, and the *barcos rabello,* flat-bottomed barges with huge rudders, used for the conveyance of wine down stream. Two remarkable iron bridges, the Maria Pia and the Dom Luiz I., span the river. The first was built by Messrs. Eiffel and Company of Paris in 1876–77; it rests on a granite substructure and carries the Lisbon railway line across the Douro ravine at a height of 200 ft. The second was constructed in 1881–85 by a Belgian firm; its arch, one of the largest in Europe, has a span of 560 ft. The Douro is liable in winter to sudden and violent floods; in 1909–10 the water rose 40 ft. at Oporto, where it is confined in a deep and narrow bed.

The older quarters in the east are extremely picturesque, with their steep and narrow lanes overshadowed by lofty balconied houses. Overcrowding and dirt are common, for the density of population is nearly 13,000 per sq.m., or greater than in any other city of Portugal. The completion of the tramway system was long delayed. Ox-carts are used for the conveyance of heavy goods, and until late in the 19th century sedan-chairs were still occasionally used. As a rule the natives of Oporto are strong and of fine physique; they also show fewer signs of negro descent than the people of Lisbon. Their numbers tend to increase very rapidly; in 1864 the population of Oporto was 86,751, but in 1878 it rose to 105,838 and nearly doubled in the next half century. Many of the men emigrate to South America, where their industry usually enables them to prosper, and to return with considerable savings.

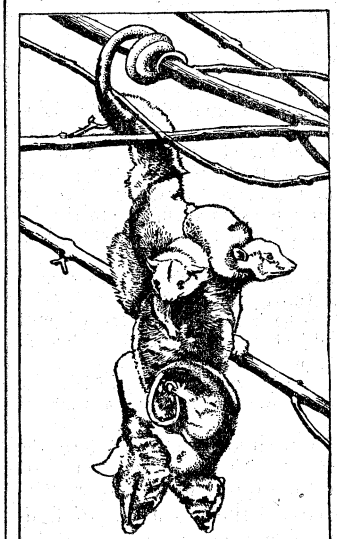
The cathedral, which stands at the highest point of eastern Oporto, on the site of the Visigothic citadel, was originally a Romanesque building of the 12th century; its cloisters are Gothic of the 14th century, but the greater part of the fabric was modernized in the 17th and 18th centuries. The interior of the cloisters is adorned with blue and white tiles, painted to represent scenes from the Song of Solomon. The Romanesque and early Gothic church of São Martinho de Cedo Feita is the most interesting ecclesiastical building in Oporto, especially noteworthy being the curiously carved capitals of its pillars. Though the present structure is not older, except in details, than the 12th century, the church is said to have been "hastily built" (*cedo feita, cito facta*) by Theodomir, king of the Visigoths, in 559, to receive the relics of St. Martin of Tours, which were then on their way hither from France. The Torre dos Clerigos is a granite tower 246 ft. high, built in the middle of the 18th century at the expense of the local clergy (*clerigos*); it stands on a hill and forms a conspicuous landmark for sailors. Nossa Senhora da Lapa is a fine 18th-century church, Corinthian in style; São Francisco is a Gothic basilica dating from 1410; Nossa Senhora da Serra do Pilar is a secularized Augustinian convent used as artillery barracks, and marks the spot at which Wellington forced the passage of the Douro in 1809. The exchange (*lonja*) is another secularized convent, decorated with coloured marbles. Parts of the interior are floored and panelled with polished native-coloured woods from Brazil, which are inlaid in elaborate patterns; there is a very handsome staircase, and the fittings of one large room are an excellent modern copy of Moorish ornamentation.

Other noteworthy public buildings are the museum, library, opera-house, bull-ring, hospital and quarantine station. The crystal palace is a large glass and iron structure built for the industrial exhibition of 1865. The English factory, built in 1790, has been converted into a club for the British residents—a large and important community whose members are chiefly connected with the wine and shipping trades. The English club gave its name to the Rua Nova dos Inglezes, one of the busiest streets, which contains many banks, warehouses and steamship offices. The Rua da Alfándega, skirting the right bank of the Douro and passing the custom house (*alfándega*), is of similar character; here may be seen characteristic types of the fishermen and peasants of northern Portugal. The Rua das Flores contains, on its eastern side, the shops of the cloth-dealers; on the west are the jewellers' shops, with a remarkable display of gold and silver filigree-work and enamelled gold. These ornaments are often very artistic, and are largely worn on holidays by women of the poorer classes.

Oporto is chiefly famous for the export of the wine which bears its name. An act passed on Jan. 29, 1906 defined "port" as a wine grown in the Douro district, exported from Oporto, and containing more than 16·5% of alcoholic strength. The vines from which it is made grow in the Paiz do Vinho, a hilly region about 60 m. up the river, and having an area of 27 m. in length by 5 or 6 in breadth. The trade was established in 1678, but the shipments for some years did not exceed 600 pipes (of 115 gallons each). In 1703 the British government concluded the Methuen treaty with Portugal, under which Portuguese wines were admitted on easier terms than French or German, and henceforward "port" began to be drunk (*see* PORTUGAL: *History*). In 1747 the export reached 17,000 pipes. In 1754 the great wine monopoly company of Oporto originated, under which the shipments rose to 33,000 pipes. At the beginning of the 19th century the policy of the government more and more favoured port wine, besides which the vintages from 1802 to 1815 were splendid both in Portugal and in Madeira —that of 1815 has, in fact, never been excelled. For the next few years the grape crop was not at all good, but the 1820 vintage was the most remarkable of any. It was singularly sweet and black, besides being equal in quality to that of 1815. In 1852 the *Oidium* which spread over Europe destroyed many of the Portuguese vineyards. In 1865 *Phylloxera* did much damage, and in 1867 the second monopoly company was abolished. From this time the exports again increased. (*See* WINE.)

A third of the population is engaged in the manufacture of cottons, woollens, leather, silk, gloves, hats, pottery, corks, tobacco, spirits, beer, aerated waters, preserved foods, soap or jewellery. The fisheries—chiefly of hake, bream and sardines—are extensive. Many tourists land at Oporto and visit Braga (*q.v.*), Bussaco (*q.v.*) and other places of interest, on their way to Lisbon.

The history of Oporto dates from an early period. Before the Roman invasion, under the name of Portus Cale, it was a town on the south bank of the Douro with a good trade; the Alani subsequently founded a city on the north bank, calling it *Castrum Novum*. About A.D. 540 the Visigoths under Leovigild obtained possession, but yielded place in 716 to the Moors. The Christians, however, recaptured Oporto in 997, and it became the capital of the counts of *Portucalia* for part of the period during which the Moors ruled in the southern provinces of Portugal. (*See* PORTUGAL: *History*.) The Moors once more became its masters for a short period, till in 1092 it was brought finally under Christian domination. The citizens rebelled in 1628 against an unpopular tax, in 1661 for a similar reason, in 1757 against the wine monopoly, and in 1808 against the French. The town is renowned in British military annals from the duke of Wellington's passage of the Douro, by which he surprised and put to flight the French army under Marshal Soult, capturing the city on the 12th of May 1809. Oporto sustained a severe siege in 1832–33, being bravely defended against the Miguelites by Dom Pedro with 7,000 soldiers; 16,000 of its inhabitants perished. In the constitutional crises of 1820, 1826, 1836, 1842, 1846–47, 1891 and 1908–10 the action of Oporto, as the capital of northern Portugal, was always of the utmost importance. In 1919 the monarchy was proclaimed at Oporto and lasted for three weeks. In Feb. 1927 it was the scene of an army rising and was bombarded during three days by government troops.



OPOSSUM (DIDELPHIS VIRGINIANUS), HANGING FROM A TREE WITH YOUNG

BIBLIOGRAPHY.—Mendez Corrêa, *As Origens da Cidade do Porto* (1932); G. Perreira, *Les Vignobles du Portugal* (1932).

**OPOSSUM,** the name of several American marsupials, also applied in Australia to the phalangers (*q.v.*). True opossums are found almost throughout America (*see* MARSUPIALIA). They form the family Didelphidae, distinguished by the opposable first hind toe and by the dentition. They are small, nocturnal animals, with long noses, ears and tails, the latter being usually naked and prehensile. The opposable first hind toe is clawless and the tip is expanded into a flat pad. The other digits all bear claws. Mainly arboreal, they feed on birds, insects and fruit. The best known species of the type-genus is *Didelphis virginianus*, which is very common in the United States. It is nearly the size of a cat, gray in colour, the fur being woolly. When caught, it feigns death (hence the expression "playing 'possum"). The ova of opossums have a thin horny shell, and many more are produced

than can survive. The female produces 6 to 16 young, after a period of gestation of 14 to 17 days. At birth the immature and helpless young, only about ½ in. long, are placed by the mother in her pouch, where they cling to the nipples by their mouths. When big enough to leave the pouch, the young are often carried on the mother's back, holding on to her fur or clinging to her tail by their own prehensile tails.

The water-opossum (*Chironectes minimus*) has webbed feet (*see* WATER-OPOSSUM). Numerous other species inhabit various parts of America, being especially numerous in the tropical parts.

**OPPELN,** a town in the Prussian province of Silesia, Germany, on the Oder, 51 mi. S.E. of Breslau, on the railway to Kattowitz and at the junction of lines to Ratibor, Neisse and Tarnowitz. Pop. (1939) 52,806. Oppeln was a flourishing place at the beginning of the 11th century, and became a town in 1228. It was the capital of the duchy of Oppeln and the residence of the duke from 1163 to 1532, when the ruling family became extinct. Then it passed to Austria, and with the rest of Silesia was ceded to Prussia in 1742. In the partition of Upper Silesia between Germany and Poland in 1921 (*see* SILESIA) Oppeln was retained by Germany. It is the seat of the provincial administration of Upper Silesia, and contains the oldest Christian church in the district, that of St. Adalbert, founded at the close of the 10th century. It has a 15th-century palace on an island in the Oder. The industries of Oppeln include the manufacture of Portland cement, beer, soap, cigars, chemicals, clogs and lime; trade is carried on by rail and river in cattle, grain and the vast mineral output of the district, of which Oppeln is the chief centre. The upper classes speak German, the lower Polish.

**OPPENHEIMER, J. ROBERT** (1904– ), U.S. physicist and scientist, was born April 22 in New York city. He was graduated from Harvard university in 1925, studied at Cambridge university until 1926 and then at Göttingen university, where he received his Ph.D. degree in 1927. He became a professor of physics at the University of California and at the California Institute of Technology in 1929. Dr. Oppenheimer devoted considerable time to research on the nature of matter, electricity and radiation, and was an authority on the structure of the atom. During World War II, the U.S. government placed him in charge of a special laboratory dealing with the technical problems involved in putting together the components of the atomic bomb. Dr. Oppenheimer planned the construction of the laboratory in an isolated area at Los Alamos, 20 miles from Santa Fe, N.M., and organized and directed its activities after its completion. He arrived at Los Alamos in March 1943 and under his direction, a galaxy of scientific stars worked in what was described as "probably the best-equipped physics laboratory in the world." Of Dr. Oppenheimer's role in the creation of the atomic bomb, secretary of war Henry L. Stimson, in his statement of Aug. 6, 1945, declared: "The development of the bomb itself has been largely due to his (Dr. Oppenheimer's) genius and the inspiration and leadership he has given to his associates." The atomic bomb, dropped on two cities in Japan in Aug. 1945, was instrumental in bringing about that nation's surrender. Dr. Oppenheimer also was a member of a four-man advisory group of leading U.S. scientists that worked with a government interim committee on establishment of postwar organizations to direct and control the use of atomic energy.

His resignation as chief of the atomic bomb project at Los Alamos was announced on Oct. 17, 1945.

**OPPIAN** (Gr. Ὀππιανος), the name of the authors of two (or three) didactic poems in Greek hexameters, formerly identified, but now generally regarded as two different persons. (1) Oppian of Corycus (or Anabarzus) in Cilicia, who flourished in the reign of Marcus Aurelius (emperor A.D. 161–180). According to an anonymous biographer, his father was banished to Malta by Verus. Oppian, who had accompanied his father into exile, returned after the death of Verus (169) and went on a visit to Rome. Here he presented his poems to Aurelius and regained the imperial favour for his family. Oppian subsequently returned to his native country, but died of the plague at the age of 30. His poem on fishing (*Halieutica*), of about 3,500 lines, dedicated to Aurelius and his son Commodus, is still extant. (2) Oppian of Apamea (or Pella) in Syria. His extant poem on hunting (*Cynegetica*) is dedicated to the emperor Caracalla, so that it must have been written after 211. It consists of about 2,150 lines, and is divided into four books, the last of which seems incomplete. It is inferior to the *Halieutica.*

A third poem on bird-catching (*Ixeutica,* from ἰξός, bird-lime), also formerly attributed to an Oppian, is lost; a paraphrase in Greek prose by a certain Eutecnius is extant.

The chief modern editions are J. G. Schneider (1776); F. S. Lehrs (1846); U. C. Bussemaker (Scholia, 1849); (*Cynegetica*) P. Boudreaux (1908). The anonymous biography referred to above will be found in A. Westermann's *Biographi Graeci* (1845). On the subject generally *see* A. Martin, *Etudes sur la vie et les oeuvres d'Oppien de Cilicie* (1863); A. Ausfeld, *De Oppiano et scriptis sub ejus nomine traditis* (1876). There are translations of the *Halieutica,* in English by Diaper and Jones (1722), and in French by E. J. Bourquin (1877).

**OPPIUS, GAIUS,** an intimate friend of Julius Caesar. He managed the dictator's private affairs during his absence from Rome. According to Suetonius (*Caesar,* 56), many authorities considered Oppius to have written the histories of the Spanish, African and Alexandrian wars which are printed among the works of Caesar. It is now generally held that he may possibly be the author of the last (although the claims of Hirtius are considered stronger), but certainly not of the two first. He also wrote a life of Caesar and the elder Scipio.

For a discussion of the whole question, *see* M. Schanz, *Geschichte der römischen Literatur* (2nd ed., 1898); Teuffel-Schwabe, *Hist. of Roman Literature* (Eng. trans., 1900); *see* also Cicero, *Letters,* ed. Tyrrell and Purser, iv. introd. p. 69.

**OPPOSITION,** in logic, means the various relations which can exist between judgments or propositions having the same subject and predicate but differing in quality or quantity. *See* LOGIC.

**OPTICS.** The study of Optics is usually divided into three parts: *Physical Optics, Physiological Optics* and *Geometrical Optics. Physical Optics* is primarily concerned with the nature and properties of light itself and is treated under LIGHT. *Physiological Optics* deals with the mechanism of vision, and is treated under VISION.

*Geometrical Optics,* which is the subject of this article, is the name applied to that part of Optics which deals with the properties of optical instruments such as telescopes, microscopes, photographic lenses, spectroscopes and the elementary lenses, mirrors and prisms from which they are constructed. As geometrical methods have been widely employed in inquiries concerning optical instruments, the name is not without historical justification. Nevertheless we shall have occasion to take exception to the validity of these methods in this field. They are in fact only admissible to an extent which deprives the historical theory of much of its utility. A brief account of this theory can, however, hardly be omitted here both on account of its historical importance and because even at the present day the majority of the literature on the subject is still couched in geometrical terms.

The basic conception of geometrical optics in this theory is the ray of light. The fact that light travels in straight paths was well known to the Greek mathematicians and the transition from optics to pure geometry was thus simple. More precisely in geometrical optics we assume that the ray of light continues in the same straight line while it travels in the same homogeneous medium. When it encounters a surface separating this medium from another, for example the surface between air and water, the ray proceeds in another direction from the point in which it meets this surface, and again continues to follow a straight path until another surface is reached. The new path may be in either the original or the new medium. In the former event the ray is said to be reflected, and in the latter refracted, at the surface of separation. We regard the whole continuous path of the light as a single ray, but distinguish the original and final portions as the incident ray and the emergent ray respectively. We may also apply the terms reflected ray or refracted ray as the case may be

to the latter.

The new directions are determined by simple geometrical laws. The law of reflection states (1) the incident ray, the reflected ray, and the normal to the surface at the point of reflection lie in one plane; (2) the incident and reflected rays lie on opposite sides of the normal; (3) the angles made by the incident and reflected rays with the normal are equal. The law of refraction states (1) the incident ray, the refracted ray, and the normal to the surface at the point of refraction lie in the same plane; (2) the incident ray and the refracted ray lie on opposite sides of the normal; (3) the sine of the angle made by the incident ray with the normal bears a constant ratio to the sine of the angle made by the refracted ray with the normal. This ratio depends only on the composition of the two media separated by the surface, and is known as the relative index of refraction.

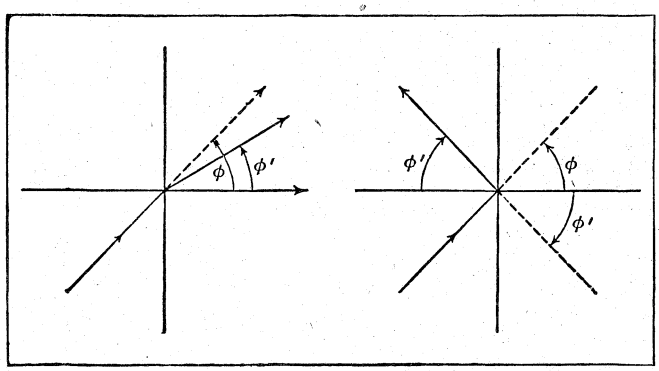



FIG. 1.—ANGULAR-SIGN CONVENTIONS, SHOWING (LEFT) REFRACTION: ANGLES OF INCIDENCE AND REFRACTION BOTH POSITIVE; AND (RIGHT) ANGLE OF INCIDENCE POSITIVE, ANGLE OF REFLECTION NEGATIVE

From a comparison of these two laws it will be seen that the law of reflection may be considered as a special case of the law of refraction, the relative refractive index being equal to either $+1$ or $-1$. Let us adopt the convention that angles are to be measured by the value of the anti-clockwise rotation needed to reach the ray position from the onward drawn normal. Thus in fig. 1a, the angles of incidence and refraction $\phi$ and $\phi'$ are positive, and if $\mu$ is the relative refractive index $\sin\phi = \mu\sin\phi'$. When reflection occurs the angle of reflection is opposed in sign to the angle of incidence (*see* fig. 1, right), and $\mu$ should therefore receive the value $-1$. It will be noted also that the reflected ray travels in the opposite direction to that contemplated in the law of refraction. As we shall see later all lengths entering into optical equations are either multiplied or divided by a refractive index and the double reversal of sign frees us from all difficulties regarding the signs of the quantities we employ. We are therefore enabled to dispense with any detailed consideration of reflecting instruments and can proceed to deal with refraction as an inclusive process.

For a reason which will become apparent later it is necessary for the reflecting and refracting surfaces used in optical instruments to approach very closely to ideal geometrical forms. The manufacturing processes by which the necessary degree of perfection can be reached impose severe limitations on the types of surface which may be employed, and in practice any surface but a portion of a sphere —with the plane as a special case—is rarely employed. We will therefore consider the refraction of light at a spherical surface.

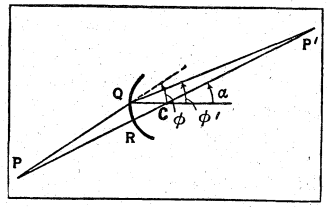



FIG. 2.—REFRACTION AT A SPHERICAL SURFACE

In fig. 2 let a ray passing through the point $P$ be refracted at $Q$, a point on a spherical surface whose centre is at $C$. The refracted ray lies in the plane $PQC$ containing the incident ray $PQ$ and the normal $QC$, and it will therefore in general meet $PC$ at some point $P'$. Let $PC$ meet the surface in $R$ and make an angle $\alpha$ with $QC$, and let $\phi$ and $\phi'$ be the angles of incidence and refraction. Then from the triangles $PQC$, $P'QC$

$$\frac{\sin\alpha}{\sin\phi} = \frac{PQ}{PC}, \quad \frac{\sin\alpha}{\sin\phi'} = \frac{QP'}{CP'},$$

and therefore by the law of refraction

$$\mu\frac{PQ}{PC} = \frac{QP'}{CP'}.$$

If now $Q$ is near $R$, $PQ$ and $QP'$ differ from $PR$ and $RP'$ by small quantities of the second order, and the equation becomes

$$\mu\frac{PC-r}{PC} = \frac{r+CP'}{CP'}$$

or

$$\frac{\mu-1}{r} = \frac{\mu}{PC} + \frac{1}{CP'}$$

where $r$ is the radius of the surface. It follows from this expression that all rays which, before refraction in the neighbourhood of $R$, pass through $P$, will afterwards pass through $P'$. Physically this means that light energy diverging from a particle of matter placed at $P$ will converge to $P'$ or alternatively will diverge in the new medium as though it were liberated at $P'$. The reunion of the rays at $P'$ is thus of the greatest significance, and $P'$ is called the image of the object $P$. If $P'$ is so situated that the rays can actually pass through it the image is called real, but if it is so placed that they may merely be regarded as having originated there the image is called virtual. It should be observed that there is no need for the rays to have actually passed through the point $P$, that is to say we may deal with virtual objects as well as virtual images.

Consider now a succession of spherical surfaces which are all met by rays under the conditions just described. Corresponding to an object point $P$, real or virtual, the first surface forms an image at a definite point $P_1$. The point $P_1$ may be regarded as a source of rays falling upon the second surface, which forms an image $P_2$ of $P_1$. Each surface in turn forms a point image of that due to the preceding surfaces, and we conclude that the whole series of surfaces will form at a definite point $P'$ in the final medium, an image, either real or virtual, of an arbitrary point $P$ in the object space. The relation connecting $P$ and $P'$ may be shown to be unique and reversible, so that it is a matter of convention which of the spaces external to the system is regarded as the object space and which as the image space. It will be observed that we have not assumed axial symmetry in the system, so that this conclusion holds whether the centres of curvature of the various refracting surfaces are collinear or not.

**Symmetrical Optical Instruments.**—The refracting surfaces in a great majority of optical instruments are surfaces of revolution with a common axis of symmetry. In consequence of this rotational symmetry the theory of these instruments is particularly simple. Rays which lie initially in a plane containing the axis remain in that plane, and the general one-one correspondence between the points of the two spaces degenerates to a one-one correspondence between points of a plane.

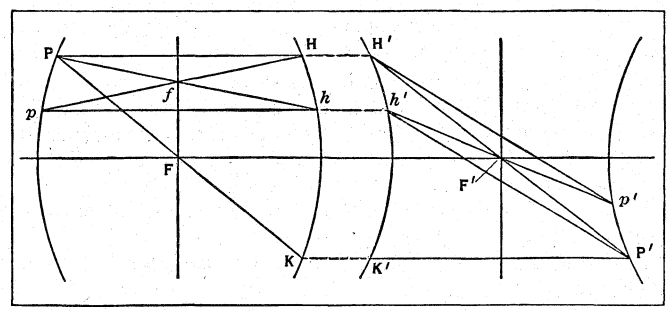



FIG. 3.—IMAGE SURFACES IN AN IDEAL INSTRUMENT
Determination of surfaces in which object and image are equal to one another, and also equal but inverted

The theory of the symmetrical instrument has been treated very comprehensively by Maxwell and later by Abbe on the assumption that this two dimensional point to point correspondence

holds. From symmetry it is clear that the image of each point on the axis is itself a point on the axis. Thus the axis is a self-conjugate ray for the system, that is to say the axis, regarded as a whole is its own image. Corresponding to the point at infinity on the axis in the object space there corresponds a point $F'$ (*see* fig. 3), usually at a finite distance, in the image space. This is named the second principal focus of the system. Then all rays which in the object space are parallel to the axis will be refracted so as to pass through $F'$ in the image space, and conversely all rays in the image space which pass through $F'$ correspond to rays which are parallel to axis in the object space. Similarly there is a point $F$ on the axis in the object space such that all rays passing through $F$ emerge in the image space as rays parallel to the axis. This point is called the first principal focus of the system. Since the incident portion of any ray refracted parallel to the axis lies in the same axial plane as the emergent portion, the two will meet if produced in some point $H$. The point thus determined on the incident ray is at the same distance from the axis as the whole of the emergent portion of the ray, and the height of the image of an object extending from $H$ to the axis is equal to the height of the object itself, a fact usually expressed by saying that the transverse magnification is 1. The locus of points $H$ determined in this manner is therefore called the first unit surface. It is to be considered as situated entirely in the object space.

In a similar way by considering the intersections of the incident and emergent portions of rays which pass through $F'$ in the image space we determine the second unit surface situated in the image space. Clearly these two surfaces have rotational symmetry about the axis and are conjugate to one another, that is, the one surface is the image of the other, and any ray striking the first unit surface in the point $H$ will follow a path in the image space passing through $H'$ in the second unit surface where $HH'$ is parallel to the axis. Now let $PHH'F'P'$ and $PFKK'P'$ be two rays meeting in $P$ and $P'$, the former being parallel to the axis in the object space and the latter in the image space. Let these two parallel portions be at equal distances from the axis and on opposite sides of it. The image extending from $P'$ to the axis is of equal height to an object lying between $P$ and the axis, and is inverted. $P$ and $P'$ therefore trace out conjugate surfaces corresponding to the transverse magnification $-1$. $F$ and $F'$ are the mid-points of $PK$ and $H'P'$ and the new surfaces are therefore precisely equal to the corresponding unit surfaces but face opposite ways. Now let $phh'F'p'$ be another ray parallel to the axis in the object space meeting the unit surfaces in $h$ and $h'$ and the negative unit surfaces in $p$ and $p'$. From symmetry $Ph$ and $pH$ intersect in a point $f$ situated in the plane through $F$ normal to the axis of the system, and from the congruent triangles $h'F'P'$, $H'F'p'$, $h'P'$ and $H'p'$ are parallel. In other words the normal plane through $F$ is conjugate to the surface at infinity in the image space, and similarly the normal plane through $F'$ is conjugate to the infinitely distant surface in the object space. By taking a pair of rays whose distances from the axis are in any assigned ratio we can construct the conjugate surfaces for this magnification.

It is a simple matter to show that the object space surfaces are all similar and similarly situated about $F$, and the image space surfaces also similar and similarly situated about $F'$. Since we have taken the ratio of the distances of corresponding points from the axis as the measure of the magnification, any corresponding secondary elements of length (that is elements normal to the plane through the axis of symmetry) in the image and object surfaces are in this ratio. Now consider two parallel incident rays inclined to the axis, not intersecting it but situated symmetrically with respect to it, the separation between them being small. They determine on every constant magnification object surface a secondary element of unvarying length. In the image space these rays intersect in a point $f'$ in the focal plane through $F'$. The lengths of the secondary elements intercepted on the constant magnification surfaces in the image space are therefore proportional to the distances of the points of intersection from $f'$. In other words these surfaces must be similarly situated with respect to any point $f'$ in the focal plane.

It follows that all the constant magnification surfaces are planes normal to the axis, and that the magnification in every such plane is uniform in all directions. All the properties of the system may therefore be related to the points in which these planes meet the axis of symmetry. With the aid of rays passing through $F$ and $F'$ (fig. 4) we readily prove, if $U$ and $U'$ are the

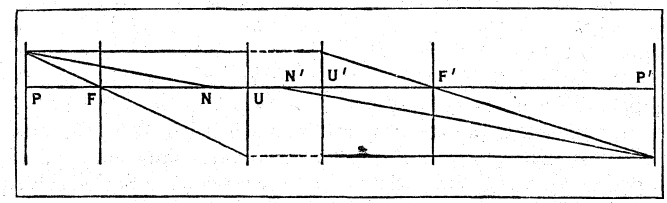



FIG. 4.—COLLINEAR IMAGERY SHOWING THAT ANY RAY THROUGH THE NODAL POINT N EMERGES IN A PARALLEL DIRECTION THROUGH N'

unit points, that is the points in which the unit planes meet the axis, and $P$ and $P'$ are any pair of conjugate axial points

$$\text{transverse magnification} = \frac{FU}{FP} = \frac{P'F'}{U'F'}$$

so that conjugate points are determined by $FP \cdot P'F' = FU \cdot U'F'$. If we draw through $f$ a straight line $fN$, parallel to the direction of the emergent rays arising from $f$, to meet the axis in $N$, we have $FN = U'F'$. The conjugate point $N'$ by the above relation is given by $N'F' = FU$. These points, from the circumstance that the incident and emergent rays through them are parallel to one another, are called the nodal points of the system. $FU$ and $U'F'$ are named the first and second focal lengths of the system. When these two focal lengths are equal the unit points coincide with the nodal points and are frequently called the principal points.

It is easy to show with a system consisting of a single surface that if an object point is moved along the axis, the image moves in the same direction. It follows that this holds also for any compound instrument, and hence $FU$ and $U'F'$ are always measured in the same direction. There are thus only two types of system—positive systems, illustrated in fig. 4, in which the principal foci $F$ and $F'$ are reached by proceeding from $U$ and $U'$ towards the real distant part of the corresponding space (the focal lengths thus being positive), and negative systems in which all these signs are reversed. The unit planes are usually situated close to or between the extreme refracting surfaces of the lens, and in a negative instrument all the real portions of the object space and of the image space are thus on a single side of the respective focal planes. It follows that such a negative system cannot yield a real image of a real object, and since the focal planes separate upright from inverted images, there is no inversion if either object or image is real. With a positive lens we can obtain a real inverted image of a real object, but if there is no inversion either the object or the image or both are virtual.

As we have based this discussion on the general correspondence of object and image points, the conclusions hold whenever the initial assumptions are satisfied irrespective of the way in which the system is constructed. Had we first considered the properties of a single spherical surface and extended the result to a combination of several such surfaces, our conclusions would not necessarily have applied to a system in which aspherical surfaces are employed.

Formulae are frequently used in which measurements are made from the unit points instead of from the principal foci. If we denote the transverse magnification by $m$, we have

$$\frac{PU}{FU} = 1 - \frac{1}{m}, \quad \frac{U'P'}{U'F'} = 1 - m, \quad \frac{U'P'}{PU} = -m\frac{U'F'}{FU}$$

and $\dfrac{FU}{PU} + \dfrac{U'F'}{U'P'} = 1$. When the two focal lengths have the common value $f$ the last two equations become

$$m = -\frac{U'P'}{PU}, \text{ and } \frac{1}{PU} + \frac{1}{U'P'} = \frac{1}{f}.$$

Systems which yield on a uniform scale a plane image of a plane object (and incidentally a plane image of every plane object) are admirably fitted for many practical purposes, for example the photographic reproduction of maps. The scheme we have just described, which is known as collinear imagery, has therefore been widely used as a standard with which the performance of real instruments may be compared. It is of value as an artificial reference frame, rather than as a scheme to which real instruments tend to conform.

**The Wave Theory and Lenses.**—We will now consider the properties of lenses according to the wave theory of light. The postulates of this theory, which have been justified by the most varied experiments, are that monochromatic light may be regarded as an undulatory disturbance of unvarying period which spreads out in all directions from the source at a uniform speed which depends only on the medium in which it is travelling. In common with other forms of wave motion the disturbance at a given instant at any point may be obtained by replacing the actual wave system by a system of secondary sources of proper intensities and phases distributed over a surface. The statistical distribution of light energy is assumed to be that of the energy distribution of the wave system on the assumption that a long train of waves is involved. On this basis the phenomena observed in the neighbourhood of an optical image—that is the point where the energy of the wave motion has its greatest value through the contributions of the secondary sources arriving in the same phase—have been very satisfactorily accounted for. It is shown in treatises on Physical Optics (*see* LIGHT) that these assumptions involve the propagation of light in straight paths normal to the wavefront (so that the rays of the geometrical theory are to be regarded as normals to the wavefront), and changes in the directions of these paths in agreement with the laws of reflection and refraction provided the relative refractive index is made equal to the ratio of the times taken by light to travel equal distances in the new and old media. It would therefore appear that we should find agreement between the deductions to which we are led by the geometrical and the wave theories. This conclusion however is incorrect. An essential condition in deducing the law of rectilinear propagation is that the wavefront should be of considerable lateral extent. When light approaches a real focus this condition is violated, with the result that the direction of propagation in fact is not constrained to the straight paths assumed in the geometrical theory. It is therefore not surprising to find that while the geometrical theory indicates correctly the positions in which images are formed and the conditions which should be satisfied if an instrument is to yield images of the highest quality, it is misleading in the character of the image it leads us to expect, and the effects to be observed in the neighbourhood of the image. The two theories also differ in the course they would lead us to adopt when any of the conditions corresponding to perfect imagery are not satisfied.

Since the relative refractive index depends only on the relative speed with which light travels in the two media we may, by assigning the value unity arbitrarily as the refractive index of a suitable substance under specified physical conditions, obtain an absolute refractive index for any other substance. As an absolute standard medium empty space is taken, but for practical purposes the refractive index of air at standard temperature and pressure is adopted. We shall hereafter, when we speak of refractive index, imply the absolute refractive index of a substance on one or other of these conventions. We will now show that the two focal lengths of any symmetrical optical system are in the ratio of the refractive indices of the two external media.

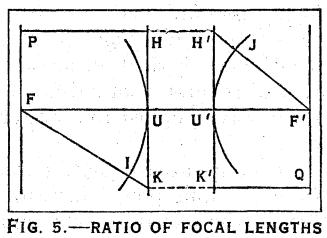


FIG. 5.—RATIO OF FOCAL LENGTHS

Let a plane wave normal to the lens axis in the object space of refractive index $\mu$ travel from the position $PF$, fig. 5, until, after being converted by the instrument into the spherical wave $U'J$, in the image space of refractive index $\mu'$, it reaches the principal focus at $F'$. Let another plane wave in the image space travel in the reverse direction from $F'Q$ to $F$. As different parts of the same wavefront take equal times to reach the focus, the time taken by the light to travel by the path $PHH'JF'$ is equal to that taken along the axial path $FUU'F'$, and similarly the paths $QK'KIF$ and $F'U'UF$ take equal times. The time taken to traverse the same axial path $FUU'F'$ is independent of the direction, and the times for all these paths are thus equal. Now the times taken along $PH$ and $FU$ are equal, and the times along the equal distances $U'F'$ and $JF'$ in the same medium are equal. It follows that the time taken to travel from $U$ to $U'$ exceeds that between $H$ and $H'$ by the time needed to traverse the distance $H'J$. Similarly the time for the journey $UU'$ exceeds that between $K$ and $K'$ by the time taken to cover the distance $IK$. Now if $H$ and $K$ are at equal distances $y$ from the axis the time taken to travel between $H$ and $H'$, from the symmetry of the instrument, is equal to that taken between $K$ and $K'$. It follows that $\mu \cdot IK = \mu' \cdot H'J$, or

$$\mu[\{(FU)^2+y^2\}^{\frac{1}{2}}-FU]=\mu'[\{(U'F')^2+y^2\}^{\frac{1}{2}}-U'F'];$$

that is, if the terms in $y^4$ and higher powers of $y$ are negligible,

$$\tfrac{1}{2}\mu\,\frac{y^2}{FU}=\tfrac{1}{2}\mu'\,\frac{y^2}{U'F'},$$

and since this holds for finite values of $y$ we must have

$$FU : U'F' = \mu : \mu'.$$

In particular if the two external media are composed of the same kind of matter the two focal lengths are equal to one another.

Let us now consider the possibility, according to the physical criterion of equality of time along the geometrical rays, of collinear imagery. Let $PQRS$ be four object points and $P'Q'R'S'$ their images. Denote by $\{AB'\}$ the distance light would travel in the medium of refractive index unity in the time taken to travel from $A$ through the instrument to $B'$. Then since with geometrically perfect imagery the time between two conjugate points is equal by all paths,

$$\begin{aligned}
\{PP'\} &= \mu PQ + \{QP'\} = \mu PS + \{SP'\}\\
\{QQ'\} &= \{QR'\} + \mu' R'Q' = \{QP'\} + \mu' P'Q'\\
\{RR'\} &= \mu RS + \{SR'\} = \mu RQ + \{QR'\}\\
\{SS'\} &= \{SP'\} + \mu' P'S' = \{SR'\} + \mu' R'S'
\end{aligned}$$

or $$\mu(PQ+RS-PS-RQ)=\mu'(P'Q'+R'S'-P'S'-R'Q').$$

Now without altering the configuration of the figure $PQRS$ we may, if the focal lengths of the system are finite, make the scale of the figure $P'Q'R'S'$ as large or as small as we like by moving $PQRS$ as near or as far from the lens as we like. In particular we may make each dimension of the figure $P'Q'R'S'$ smaller than any assigned finite small length. This relation cannot therefore hold, and collinear imagery is not possible for a system of finite focal length. In other words it is impossible to construct an optical system having a finite focal length which will refract all rays from any given object point so as to pass through a single image point. Using terms significant in the wave theory, the time taken to travel through the instrument between a point in the object space and a point in the image space cannot be independent of the path followed for an arbitrary choice of the object point. When the focal length is not finite the image is a copy of the object on uniform transverse and longitudinal scales, and collinear imagery is achieved when the two refractive indices are numerically equal and the object and image are congruent figures. The most familiar example is afforded by reflection at a plane mirror, where we suppose the two external refractive indices differ only in sign. (*See* MIRROR.)

**The Size of a Point Image: Resolving Power.**—The extent of the divergence between the two theories may be illustrated by considering properties of importance to the user of the instrument. First we will consider the size of the image of a point source. Of the spherical wave which spreads out from the source only a portion can enter the instrument, and corresponding to the perfect reunion of the rays in an image point we have an emergent

wave of spherical form. In fig. 6, $BAC$ represents a wave-front filling the aperture $BC$: the wave is in the form of a portion of a concave sphere of which $F$ is the centre. According to geometrical optics the image is the point $F$, and is formed by rays filling the cone $BFC$ of which $AF$ is the axis and $\alpha$ is the semi-angle. By the principles of physical optics the disturbances produced by the train of waves are the same as would be produced by a suitable series of disturbances situated in the wave-front $BAC$. Now any disturbance at $A$ gives rise to a spherical wave with $A$ as centre. If we confine ourselves to a region around $F$ of dimensions small compared with $AF$ we may consider the wave from $A$ to be a plane wave $PP'$ at $F$. Similarly from $B$ and $C$ we get plane waves $QQ'$ and $RR'$ making angles $\pm\alpha$ with $PP'$. Now all parts of the wave front $BAC$ are equidistant from $F$, and the component disturbances at $F$ are therefore all in the same phase—that is to say, all the displacements are in the same direction and reach their maximum values at the same instant.

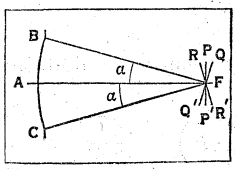


FIG. 6.—DEPENDENCE OF RESOLVING POWER ON APERTURE

The energy of the wave motion is therefore a maximum at $F$, for there the co-operation is as great as possible. The wave from $B$ will, however, have already passed beyond $P$, and that from $C$ will not yet have reached $P$ by the time the wave from $A$ has arrived at the position $PFP'$. To find the disturbance at $P$ we therefore have to take the displacement at $B$ when the wave-front $BAC$ is short of the position shown by the distance $PQ$, and similarly the displacement at $C$ when this wave-front has advanced beyond the position shown by the distance $PR$. That is to say the component displacements at $P$ vary in phase, the total range being found by measuring the difference of path, *i.e.*, the length $2PF\sin\alpha$, along the train of waves in the direction of their motion. Now if $P$ is near enough to $F$ the differences of phase are small, and the displacements differ very little from those at $F$; in other words at points very close to $F$ the light energy is practically the same as at $F$, so that the image is of finite dimensions, and not a point. As $P$ moves farther away from $F$ the range of phase increases, and at a certain stage we begin to receive contributions from points near $B$ which tend to neutralize those contributed from points near $C$, so that the light energy as we pass through these positions of $P$ diminishes rapidly. Finally we reach a position of $P$ at which the range of phase is great enough for the various contributions to neutralize one another, or at least to so nearly neutralize one another that our impression on looking at this point is that we have reached or passed the edge of the image.

Since the changes of intensity are due wholly to differences of phase, the image edge will be reached when the difference of path is some constant $\theta$ times the wave length $\lambda$ of the light, *i.e.*,

$$2PF\sin\alpha=\theta\lambda$$

or
$$\text{image diameter}=2PF=\frac{\theta\lambda}{\sin\alpha}=d.$$

If $\lambda_0$ is the wave length of the light in the standard medium $\lambda_0=\lambda\mu$, and the last fraction becomes $\theta\lambda_0/\mu\sin\alpha$. As the aperture which limits the light passing through the instrument is reduced, $\sin\alpha$ decreases, and the size of the image increases. If two near object points are to be distinguished on examining them through the instrument their images must be separate, and the resolving power of the instrument, as its capacity for rendering distinct images of near objects is called, is measured by the reciprocal of the image diameter, that is by $\mu\sin\alpha/\theta\lambda_0$. With light of a given wave length the denominator is invariable, and as $d\mu\sin\alpha$, as we shall see later, is unaltered by refraction, the resolving power of an instrument is measured by $\mu'\sin\alpha'$, where the accented quantities relate to the object space. On account of its importance in microscopy this quantity is known as the numerical aperture of the instrument. The utility of an optical instrument evidently depends upon the variation in path having a small value compared with the wave length of the light used. Since the wave length is very small, a very close approach to the theoretical form, as has already been mentioned, is necessary in the refracting surfaces.

**Depth of Focus.**—We will now consider according to the two theories how far we may expect to be able to depart along the axis of the instrument from the ideal focus $F$ and still retain a satisfactory image. According to geometrical optics light rays fill the cone $BFC$, fig. 7, and the image in the plane $XY$ will be a circle of diameter $IJ$. The image is considered satisfactory if $IJ$ does not exceed a certain diameter, say $d$, so that the permissible range for $G$ is given by the condition

$$FG=\tfrac{1}{2}d\cot\alpha$$

or very approximately

$$FG=d\cdot\frac{I}{a},$$

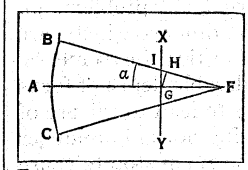


FIG. 7.—DEPTH OF FOCUS

where $I$ is the distance of the image from the principal point and $a$ is the effective diameter of the lens aperture, supposed situated in the unit plane. The important feature of this formula is that the depth of focus is inversely proportional to the first power of the diameter of the aperture.

Let us now consider the same problem from the point of view of the wave-theory. Instead of relying on the geometrician's hypothesis we are able to rest on the well attested fact that an image begins to appear less sharp when the extreme difference between the phases of the component waves at the centre of the image reaches a definite value, that is to say when the path difference at $G$ amounts to $\phi\lambda$ where $\phi$ is a definite number. This criterion differs from that considered on the geometrical theory less radically than might at first sight appear, for the existence of an appreciable phase difference at the image centre means that in this neighbourhood the light energy is less: but the total light energy of the waves is absorbed wherever the plane may be placed, and energy removed from the central regions must therefore appear in some other place. But to say that an appreciable amount of energy is found farther from the centre is only another way of stating that the image is sensibly enlarged.

Resuming, however, the determination of the range for $G$, the distance of this point from $B$ differs by an unimportant amount from $BH$, where $GH$ is perpendicular to $BF$. Since the extreme paths obviously arise from $A$ at one limit and marginal points such as $B$ at the other, and since all path lengths to $F$ are equal, the extreme path difference is the difference between $FG$ and $FH$, or $FG(1-\cos\alpha)$ or

$$FG=\frac{\phi\lambda}{1-\cos\alpha}$$

Now $a=2I\sin\alpha$, and therefore approximately

$$FG=8\phi\lambda\left(\frac{I}{a}\right)^2.$$

This formula indicates a law of a quite different type from that derived geometrically, the range varying inversely as the square of the aperture diameter, instead of as the first power.

**The Depth of Field.**—By reasoning of a character essentially similar to that of the foregoing section we can find expressions for the nearest and greatest distances $x$ and $x'$ at which objects may be situated from the lens for their images to appear sharp on a screen focussed for a distance $X$. According to the geometrical theory the conditions are

$$\frac{1}{x}-\frac{1}{X}=\frac{1}{X}-\frac{1}{x'}=\frac{d}{Ia},$$

and the conditions derived from a limiting difference of path are

$$\frac{1}{x}-\frac{1}{X}=\frac{1}{X}-\frac{1}{x'}=\frac{8\phi\lambda}{a^2},$$

where the symbols bear the same meanings as in the previous section. Thus assuming the objects are at a considerable distance from the lens, so that $I$ is approximately equal to the focal length of the lens, according to geometrical optics the focal

length of the lens and the aperture are equally important, the range being inversely proportional to both. On the other hand according to the wave theory the focal length has nothing whatever to do with the question, and the range is inversely proportional to the square of the aperture. Both theories, it will be observed, indicate the selection of the same plane for the theoretical focus to secure the utmost sharpness for all objects between two given extreme planes.

It should be unnecessary to point out that the problems on which it has been shown that the two theories differ so widely, are of much practical importance in the use of optical instruments. As an example in photography, when considerable depth of focus is required, the geometrical formula is likely to lead to the use of an unnecessarily small stop, thereby involving not only a longer exposure, but also, through the tendency of a small stop to cause loss of sharpness, a poorer negative.

**The Eikonal.**—The examples we have just considered show that a complete investigation of the properties of lenses involves the determination of the time taken by light to reach any given point in the neighbourhood of the geometrically determined image, by both stationary and non-stationary routes (that is along "rays" and along other paths), as a preliminary to the calculation of the energy of the wave motion there. The computation of the time by non-stationary routes may be omitted if the surface where the secondary sources are placed is selected in the image space and the times from the source to this surface are determined for stationary routes only. In practice the energy distribution will not be determined in routine calculations, as typical calculations or observations will show the effects caused by departing from strict equality of path by different amounts, for each of the types of variation encountered in well-corrected systems.

All calculations will therefore relate to the geometrical paths, but variation in the lengths of these paths rather than their distances from a mean point in the neighbourhood of an image is to be regarded as the significant factor on which the quality of the image depends. The two sets of magnitudes are not independent, and we proceed to find the connection between them.

Take origins of rectangular co-ordinates in both object and image spaces. Suppose in the first space that a point source of light is situated at $(x, y, z)$ in the object space. Light is radiated from this point in all directions, and some traverses the optical system and finds its way into the image space. Generally the wave-front in the image space will be a curved surface, and the normals or rays at different points of this surface differ in direction. A particular emergent ray may therefore be specified by its direction cosines. Let these be $(L', M', N')$, and suppose also that $(\xi', \eta', \zeta')$ is a point on this ray. The disturbance has taken a definite time to reach $(\xi', \eta', \zeta')$ from $(x, y, z)$: let the corresponding optical path length, that is, the distance light travels in a standard medium in this time, be denoted by $\mathcal{U}$. Let $\mathcal{U}+\delta\mathcal{U}$ be the path length for a neighbouring ray starting from $(x, y, z)$ and finishing at $(\xi'+\delta\xi', \eta'+\delta\eta', \zeta'+\delta\zeta')$, the final direction being $(L'+\delta L', M'+\delta M', N'+\delta N')$. If $\mu'$ is the refractive index of the final medium, the second path exceeds the first by

$$\mu'\{(L'+\delta L')\delta\xi'+(M'+\delta M')\delta\eta'+(N'+\delta N')\delta\zeta'\}$$

since the wave-front, which marks the locus of points optically equidistant from $(x, y, z)$, is normal to the ray. Now suppose that the tangent planes to the wave-fronts at $(\xi', \eta', \zeta')$ and $(\xi'+\delta\xi', \eta'+\delta\eta', \zeta'+\delta\zeta')$ pass through the image space origin. Then

$$L'\xi'+M'\eta'+N'\zeta'=0,$$

$$(L'+\delta L')(\xi'+\delta\xi')+(M'+\delta M')(\eta'+\delta\eta')+(N'+\delta N')(\zeta'+\delta\zeta')=0,$$

and these conditions enable the expression we have found for the path difference to be written

$$-\mu'\{\xi'\delta L'+\eta'\delta M'+\zeta'\delta N'\}=\delta\mathcal{U} \qquad (1).$$

Now $L'$, $M'$, $N'$ are connected by the relation

$$L'^2+M'^2+N'^2=1,$$

and therefore only two of them, say $M'$ and $N'$, may be regarded as independent variables. On eliminating $L'$ (1) becomes

$$-\mu'\left(\eta'-\frac{M'}{L'}\xi'\right)\delta M'-\mu'\left(\zeta'-\frac{N'}{L'}\xi'\right)\delta N'=\delta\mathcal{U}.$$

Since $\mathcal{U}$ is now regarded as a function of $M'$ and $N'$, for any small variations of $M'$ and $N'$ we shall have

$$\delta\mathcal{U}=\frac{\partial\mathcal{U}}{\partial M'}\delta M'+\frac{\partial\mathcal{U}}{\partial N'}\delta N',$$

and, since $M'$ and $N'$ may be varied independently, we find, by comparing these equations,

$$\mu'\left(\eta'-\frac{M'}{L'}\xi'\right)=-\frac{\partial\mathcal{U}}{\partial M'},\quad \mu'\left(\zeta'-\frac{N'}{L'}\xi'\right)=-\frac{\partial\mathcal{U}}{\partial N'}.$$

Now $\eta'-\frac{M'}{L'}\xi'$ and $\zeta'-\frac{N'}{L'}\xi'$ are invariants for any given ray, and represent the $y'$ and $z'$ co-ordinates of the intersection of the ray with the plane $x'=0$. If we understand that $y'$ and $z'$ are the co-ordinates of a point in this plane we may write these equations

$$\mu'y'=-\frac{\partial\mathcal{U}}{\partial M'},\quad \mu'z'=-\frac{\partial\mathcal{U}}{\partial N'} \qquad (2)$$

If then we know $\mathcal{U}$ as a function of $M'$ and $N'$, that is to say if we know how the length of the optical path from the source to a plane through the image space origin varies as the direction of this plane alters, we can find where the common normal to this plane and the wave meets an arbitrary fixed plane through the origin.

If, instead of starting with a source of light at a known point of the object space, we had assumed it to be situated in the image space, some of the light diverging from this point would reach the lens and after refraction would emerge into the object space. We could take $\mathcal{U}'$ as a measure of the time taken by the light to reach a plane in the direction $(L, M, N)$ passing through the object space origin, and obtain the equations

$$\mu y=\frac{\partial\mathcal{U}'}{\partial M},\quad \mu z=\frac{\partial\mathcal{U}'}{\partial N} \qquad (3)$$

for the point $(y, z)$ in which the common normal to the wave-front and the plane $L\xi+M\eta+N\zeta=0$ meets the plane $x=0$. The change of sign which will be observed on comparing equations (2) and (3) is due to the assumption that the positive directions of the axes are unaltered, so that a positive displacement of $(\xi, \eta, \zeta)$ corresponds to a decrease in the time $\mathcal{U}'$.

The function $\mathcal{U}$ suffers from the grave disadvantage that it is unsymmetrical, the variables in the object space being point co-ordinates, and in the image space direction cosines. A function which is symmetrical is at once obtained by considering the particular case in which the source of light is at infinity. It is inconvenient to include in the function the infinite term representing the length of the path between the source and a reference position near the lens, so the path is measured from the wave-front which passes through the object space origin. Since all points on the same wave-front are at the same optical distance from the source, $\mathcal{E}$, the new finite path length, which is a function of $(M, N, M', N')$, differs from $\mathcal{U}$ only by a constant, and, as in the case of $\mathcal{U}$, the equations

$$\mu'y'=-\frac{\partial\mathcal{E}}{\partial M'},\quad \mu'z'=-\frac{\partial\mathcal{E}}{\partial N'} \qquad (4)$$

are satisfied. In a similar way from $\mathcal{U}'$, by placing the source at infinity in the image space in the direction $L'$, $M'$, $N'$, and rejecting the constant infinite part of the path, we obtain a finite function $\mathcal{E}'$ having $(M, N, M', N')$ as its variables and satisfying the equations

$$\mu y=\frac{\partial\mathcal{E}'}{\partial M},\quad \mu z=\frac{\partial\mathcal{E}'}{\partial N} \qquad (5)$$

Now $\mathcal{E}$ and $\mathcal{E}'$ measure the time taken by the light to travel between the same two planes in opposite directions along the stationary path. This stationary path between two planes is unique and independent of the curvature of the wave-front at either

plane. Moreover the speed of light is independent of direction. It follows that $\mathcal{E}$ and $\mathcal{E}'$ are equal, and, since they are expressed in terms of the same variables, they must be identical. This symmetrical function of the direction cosines, which is one of the Characteristic Functions introduced into Optics by Hamilton, will be referred to as the Eikonal, a name proposed by Bruns.

In the application of this function the planes $x=0$ and $x'=0$ will be chosen to coincide with the object and image planes, or at least to be parallel to them. Equations (4) and (5) then show how this function, which itself expresses the length of a path carried through the refracting surfaces, and is thus particularly suitable for investigations according to the wave theory, enables the points in which rays travelling in specified directions meet the object and image surfaces to be found.

**Focal Lengths and Principal Foci.**—The rays, being the normals to the wave front, are the loci of points for which the path is stationary for slightly displaced routes, and conjugate foci are points of a particular path between which the path length is stationary for larger deviations. In an axially symmetrical system we can see immediately that a pair of such points for a skew ray (that is to say, a ray which does not lie entirely in an axial plane) are the intersections of any axial plane with the incident and emergent rays. By considering a ray in an axial plane as the limiting position of a skew ray, we can extend the definition to all rays. We shall call such conjugate points secondary foci. We proceed to find the positions of the principal secondary foci and the magnitudes of the corresponding focal lengths.

Take the axes of $x$ and $x'$ in coincidence with the axis of symmetry, so that $\mathcal{E}$ may be regarded as a function of three variables only, viz., $\frac{1}{2}\mu^2(M^2+N^2)$, $\mu\mu'(MM'+NN')$ and $\frac{1}{2}\mu'^2(M'^2+N'^2)$. Denoting these by $a$, $b$, $c$ respectively, and differentiation by the addition of a suffix, equations (4) give

$$y'+\mu M\mathcal{E}_b+\mu' M'\mathcal{E}_c=z'+\mu N\mathcal{E}_b+\mu' N'\mathcal{E}_c=0 \qquad (5)$$

that is to say, the ray goes through the point $(\rho' L', Y', Z')$ distant $\rho'$ along the ray from the reference plane $x'=0$, where $\rho'=\mu'\mathcal{E}_c$ provided

$$Y'=-\mu M\mathcal{E}_b,\ Z'=-\mu N\mathcal{E}_b \qquad (6)$$

These equations show that at this point the ray goes through a point in the axial plane containing the infinitely distant origin of light $(L, M, N)$. In other words the secondary principal focus lies on the ray at the distance $\mu'\mathcal{E}_c$ beyond its intersection with the reference plane $x'=0$. Similarly the secondary principal focus in the object space lies on the ray at a distance $-\mu\mathcal{E}_a$ from its intersection with the reference plane $x=0$, the measurement being made in the positive direction. By partial analogy with the properties associated with the nodal points of collinear imagery, if $f$ is the object space secondary focal length, the $y'$ and $z'$ coordinates of the secondary image of the infinitely distant object $(L, M, N)$ are $Mf$ and $Nf$ respectively. Equations (6) thus give $f=-\mu\mathcal{E}_b$, and similarly the image space secondary focal length is given by $f'=-\mu'\mathcal{E}_b$.

The secondary conjugate points corresponding to the magnification $S$ must satisfy

$$\frac{Y'}{Y}=\frac{Z'}{Z}=s,$$

and if these points are distant $\rho'$ and $\rho$ from the corresponding principal foci, by equations (5) we have

$$\frac{\rho' M'-\mu M\mathcal{E}_b}{\rho M+\mu' M'\mathcal{E}_b}=\frac{\rho' N'-\mu N\mathcal{E}_b}{\rho N+\mu' N'\mathcal{E}_b}=s$$

or

$$\rho=-\frac{\mu\mathcal{E}_b}{s},\ \rho'=\mu'\mathcal{E}_b\cdot s$$

since for a skew ray $M/M'$ and $N/N'$ are not equal. The connection between the principal foci, the focal lengths, a pair of conjugate foci and the magnification for any ray thus correspond exactly to those found for the instrument as a whole in collinear imagery. The fact that this law is followed for lengths measured along the ray itself, and not their projections on the axis, clearly involves the failure of collinear imagery. The constant magnification surfaces in fact tend to be spherical rather than plane.

We will next determine the primary principal foci, which are the points of intersection of successive parallel incident rays lying in the same plane through the axis of the system. Without loss of generality we may suppose $z=z'=N=N'=0$, and the $y'$ co-ordinate of the point in which the ray meets the plane $x'=X'$ is $\frac{M'}{L'}X'-\mu' M'\mathcal{E}_c-\mu M\mathcal{E}_b$. If this point is conjugate to the infinitely distant point $(L, M)$, this value of $y'$ will be unaltered by substituting $\left(L'-\frac{M'}{L'}\delta M', M'+\delta M'\right)$ for $(L', M')$. Since $\delta M'$ is finite, we see that we must travel along the ray from its intersection with the reference plane the distance

$$\frac{X'}{L'}=\mu' L'^2\{\mathcal{E}_c+2a\mathcal{E}_{bb}+2b\mathcal{E}_{bc}+2c\mathcal{E}_{cc}\}$$

to reach the primary principal focus. The corresponding distance for the object space is

$$-\mu L^2\{\mathcal{E}_a+2a\mathcal{E}_{aa}+2b\mathcal{E}_{ab}+2c\mathcal{E}_{bb}\}.$$

To determine the focal lengths we note from (5) that the ray $(M+\delta M, M')$ meets the reference plane in the point $y'+\delta y'$ where

$$\delta y'=-\mu\delta M\{\mathcal{E}_b+2a\mathcal{E}_{ab}+b(\mathcal{E}_{bb}+\mathcal{E}_{ac})+2c\mathcal{E}_{bc}\}.$$

Now the separation between these parallel emergent rays is $L'\delta y'$, and the angle between the two incident rays is $\delta M/L$. We define the focal length as the distance at which this separation is subtended by this angle, or

$$F=-\mu LL'\{\mathcal{E}_b+2a\mathcal{E}_{ab}+b(\mathcal{E}_{bb}+\mathcal{E}_{ac})+2c\mathcal{E}_{bc}\},$$

and similarly

$$F'=-\mu' LL'\{\mathcal{E}_b+2a\mathcal{E}_{ab}+b(\mathcal{E}_{bb}+\mathcal{E}_{ac})+2c\mathcal{E}_{bc}\},$$

where $F$ and $F'$ are the first and second primary focal lengths respectively. Substituting these values in generalised variations of (5) we find for points distant $\rho$ and $\rho'$ from the principal primary foci

$$L\delta Y-M\delta X=\rho\frac{\delta M}{L}-F'\frac{\delta M'}{L'},$$

$$L'\delta Y'-M'\delta X'=\rho'\frac{\delta M'}{L'}+F\frac{\delta M}{L},$$

showing that conjugate points for the transverse magnification $p$ are given by $\rho=F/p$, $\rho'=-F'p$, in harmony with the laws found in other cases. Just as we extended the conception of secondary foci from skew rays to rays in an axial plane, we may extend the primary concept to rays in general by basing generalised definitions upon the expressions we have derived.

**The Sine Law and the Cosine Law.**—The conditions that must be satisfied for an instrument to yield a plane image of a plane object at the constant magnification $G$ may now be investigated. Put

$$a=S^2A-SGB+G^2C,$$
$$b=2SA-(S+G)B+2GC,$$
$$c=A-B+C,$$

so that

$$(S-G)^2A=a-Gb+G^2c,$$
$$(S-G)^2B=2a-(S+G)b+2SGc,$$
$$(S-G)^2C=a-Sb+S^2c.$$

Adopting for the moment the ray conception of imagery,

$$y=\frac{\partial\mathcal{E}}{\mu\partial M}=\mu M\mathcal{E}_a+\mu' M'\mathcal{E}_b=$$
$$\frac{1}{(S-G)^2}\{(\mu M-G\mu' M')(\mathcal{E}_A+\mathcal{E}_B)+(\mu M-S\mu' M')(\mathcal{E}_B+\mathcal{E}_C)\}$$

$$y'=\frac{\partial\mathcal{E}}{\mu'\partial M'}=\frac{1}{(S-G)^2}\{(\mu M-G\mu' M')(G\mathcal{E}_A+S\mathcal{E}_B)$$
$$+(\mu M-S\mu' M)(G\mathcal{E}_B+S\mathcal{E}_C)\}$$

so that

$$y'-Gy=\frac{1}{S-G}\{(\mu M-G\mu' M')\mathcal{E}_B+(\mu M-S\mu' M')\mathcal{E}_C\}$$

and similarly

$$z'-Gz=\frac{1}{S-G}\{(\mu N-G\mu' N')\mathcal{E}_B+(\mu N-S\mu' N')\mathcal{E}_C\}$$

Thus, if the reference points lie in the planes conjugate to one another for magnification $G$, the presence of terms in $B$ and $C$ with finite coefficients involves displacements of the image points from their desired positions. The condition required is therefore that $\mathcal{E}$ should be a function of $A$ only, that is the direction cosines only occur in the combination

$$(\mu M-G\mu' M')^2+(\mu N-G\mu' N')^2\cdot$$

$\mu M-G\mu' M'$ and $\mu N-G\mu' N'$ must then be constant for all rays through a given object point. These are the generalised sine conditions. When the object point lies on the axis each of these quantities must vanish. In consequence of the axial symmetry only one condition, known as Abbe's sine condition, is in fact involved. If we write $G=\frac{l'}{l}$ where $l$ and $l'$ are conjugate lengths normal to the axis, and $\psi$ and $\psi'$ are the angles made by the ray with the axis, Abbe's condition takes the form $\mu l\sin\psi=\mu' l'\sin\psi'$, a result of which use has already been made in discussing the resolving power of optical instruments.

If $(0, y, z)$ is the point of intersection with the first reference plane of a ray $A$ in the direction $(L, M, N)$, and $(0, y+\delta y, z+\delta z)$ is the point in which a parallel ray $B$ meets the same plane, the change of co-ordinates may be regarded as the result of a displacement through the distance $\sigma$ in the direction $l, m, n$ if $L\delta y=\sigma(Lm-Ml)$, $L\delta z=\sigma(Ln-Nl)$, which involve

$$L(\delta y\delta M+\delta z\delta N)=\sigma L(l\delta L+m\delta M+n\delta N)-\sigma l(L\delta L+M\delta M+N\delta N)$$

whatever $\delta L$, $\delta M$, $\delta N$ may be. If $(L+\delta L, M+\delta M, N+\delta N)$ is a neighbouring direction to $(L, M, N)$ the equation becomes

$$\delta y\delta M+\delta z\delta N=\sigma(l\delta L+m\delta M+n\delta N).$$

Similarly if $(0, y', z')$, lies on ray $A$, and a parallel emergent ray $C$ passes through $(0, y'+\delta y', z'+\delta z')$, and the displacement corresponds to a movement through the distance $\sigma'$ in the direction $(l', m', n')$, we shall have

$$\delta y'\delta M'+\delta z'\delta N'=\sigma'(l'\delta L'+m'\delta M'+n'\delta N')$$

where $(L'+\delta L', M'+\delta M', N'+\delta N')$ is any direction near that of these two parallel rays. Now if the ray $B$ emerges in the direction $(L'+\delta L', M'+\delta M', N'+\delta N')$ we have

$$\mu\delta y=\mu(y+\delta y-y)=\frac{\partial}{\partial M}(\mathcal{E}_{(B)}-\mathcal{E}_{(A)})=\mathcal{E}_{MM'}\delta M'+\mathcal{E}_{MN'}\delta N'+\cdots.$$

Similarly $\mu\delta z=\mathcal{E}_{NM'}\delta M'+\mathcal{E}_{NN'}\delta N'+\cdots.$

Also if $(L+\delta L, M+\delta M, N+\delta N)$ is the direction of incidence of the ray $C$,

$$\mu'\delta y'=-\mathcal{E}_{MM'}\delta M-\mathcal{E}_{NM'}\delta N\cdots$$
$$\mu'\delta z'=-\mathcal{E}_{MN'}\delta M-\mathcal{E}_{NN'}\delta N\cdots$$

so that neglecting small quantities of the third order

$$\mu(\delta y\delta M+\delta z\delta N)+\mu'(\delta y'\delta M'+\delta z'\delta N')=0$$

or $$\mu\sigma(l\delta L+m\delta M+n\delta N)+\mu'\sigma'(l'\delta L'+m'\delta M'+n'\delta N')=0,$$

that is $$\mu\sigma(\cos\theta_C-\cos\theta_B)+\mu'\sigma'(\cos\theta_B'-\cos\theta'_C)=0$$
$$\mu\sigma\cos\theta_B-\mu'\sigma'\cos\theta_B'=\mu\sigma\cos\theta_C-\mu'\sigma'\cos\theta_C',$$

where $\theta$ and $\theta'$ are the angles made by the ray indicated with the directions $(l, m, n)$ and $(l', m', n')$ respectively. If then a small parallel displacement of a collection of incident rays, determined for example by their caustic surface, is to correspond to a parallel displacement of the emergent group, so that the caustic surface of the latter is to be translated without change of shape, the set of rays must all satisfy an equation of the form

$$\mu\cos\theta=p\mu'\cos\theta'+q$$

where $p$ and $q$ are constants, and the displacement in the image space will be $p$ times as great as that in the object space. This cosine law is of wider application than the laws previously given, since no special assumptions, such as that the rays concerned all pass through a given point, have been made. The converse of this law, which has recently been extended in various directions, may also be proved. We can only consider here some specially simple applications.

*The law of refraction* is obtained by considering rays which pass through a point on the surface, the object and image displacements being necessarily equal. By considering a movement in the plane containing both rays we find, on writing $\phi$ and $\phi'$ for the complements of $\theta$ and $\theta'$, $\mu\sin\varphi=\mu'\sin\varphi'+q$, and $q$ vanishes as $\varphi$ and $\varphi'$ vanish together. The analytical form may also be derived at once, for we must have

$$\mu(L\delta x+M\delta y+N\delta z)=\mu'(L'\delta x+M'\delta y+N'\delta z)+q,$$

where $\delta x$, $\delta y$, $\delta z$ are the components of the common displacement, so long as $l\delta x+m\delta y+n\delta z=0$ where $l$, $m$, $n$ are the direction cosines of the normal to the surface. That is to say $q=0$ and

$$\frac{\mu' L'-\mu L}{l}=\frac{\mu' M'-\mu M}{m}=\frac{\mu' N'-\mu N}{n}$$

is the formula required.

*The Abbe Sine Law.*—In a system symmetrical about an axis let there be no aberration in the image of a given point on the axis. The condition for the absence of aberrations in the image of a small object normal to the axis through this point is obtained by considering displacements normal to the axis. If $\psi$ and $\psi'$ are the angles made by an incident and the corresponding emergent ray with the axis, the condition is

$$\mu\sin\psi=p\mu'\sin\psi'+\text{constant}$$

where $p$ is the transverse linear magnification. Since the axis itself is both an incident and emergent ray of the group forming the axial image, the constant is zero.

*The Sine Law for Axial Displacements* (Herschel's Condition).—In the previous system let displacements along the axis be considered. Then the condition that there should be no aberration in the image of a short element of length along the axis is

$$\mu\cos\psi=P\mu'\cos\psi'+\text{constant}.$$

Since $\psi=\psi'=0$ is a member of the group of rays, the constant is equal to $\mu-P\mu'$, and the condition may be written in the form

$$\mu^{\frac{1}{2}}\sin\tfrac{1}{2}\psi=P^{\frac{1}{2}}\mu'^{\frac{1}{2}}\sin\tfrac{1}{2}\psi'$$

which is inconsistent with the Abbe sine law unless $\psi=\pm\psi'$. Both conditions are satisfied by paraxial rays, and therefore $P=p^2\mu'/\mu$. This condition illustrates the proportionality of the longitudinal magnification to the square of the transverse magnification.

*The Extended Sine Law.*—If there is perfect imagery for the transverse plane for which the magnification is $m$, the displacement of the object and image point caustics must satisfy the cosine law for displacements in the directions of the $y$ and $z$ axes. Thus in the symmetrical system in which the axes of $x$ and $x'$ coincide with the axis of symmetry, and the axes of $y$ and $y'$ and of $z$ and $z'$ are respectively parallel to one another, the conditions for perfect imagery over the whole plane when there is no aberration on the axis are

$$\mu M-\mu' M'm=q$$
$$\mu N-\mu' N'm=q'$$

where $q$ and $q'$ are functions of $y$, $z$, the co-ordinates of the object point from which the rays arise. Symmetry shows that $q=yQ$, $q'=zQ$ where $Q$ is a function of $y^2+z^2$.

**The Construction of the Eikonal.**—Before the expressions which have been derived can be applied the eikonal must be constructed. We proceed to show how this may be done.

Suppose that the surface whose homogeneous equation is

$f(a, x, y, z)=0$ separates media whose refractive indices are $\mu$ and $\mu'$ respectively. Let the reference planes for the two media both pass through the origin of co-ordinates and have direction cosines $(L, M, N)$ and $(L', M', N')$ respectively. Since for the stationary path the light travels perpendicularly to these planes, the distances of $(x, y, z)$ from these planes for the light are $Lx+My+Nz$ and $L'x+M'y+N'z$ respectively. It readily follows that in the time taken by the light to travel from the plane $(L, M, N)$ to the plane $(L', M', N')$ via the point $(x, y, z)$ the distance travelled in the standard medium is

$$\mathcal{E}=\mu(Lx+My+Nz)-\mu'(L'x+M'y+N'z).$$

If $(x, y, z)$ determines the neighbourhood of the surface for which the time is stationary between the planes, we must have

$$(\mu L-\mu'L')\delta x+(\mu M-\mu'M')\delta y+(\mu N-\mu'N')\delta z=0$$

for all infinitesimal values of $\delta x$, $\delta y$, $\delta z$ which satisfy

$$f_x\delta x+f_y\delta y+f_z\delta z=0.$$

That is to say we shall have

$$\frac{\mu L-\mu'L'}{f_x}=\frac{\mu M-\mu'M'}{f_y}=\frac{\mu N-\mu'N'}{f_z}$$

and each of these will be equal to

$$\frac{\mu(Lx+My+Nz)-\mu'(L'x+M'y+N'z)}{xf_x+yf_y+zf_z}.$$

Now, since $f$ is homogeneous in $a, x, y, z$,

$$af_a+xf_x+yf_y+zf_z=0,$$

and therefore

$$\frac{\mathcal{E}}{af_a}=\frac{\mu'L'-\mu L}{f_x}=\frac{\mu'M'-\mu M}{f_y}=\frac{\mu'N'-\mu N}{f_z}$$

Now $f_a, f_x, f_y, f_z$ are four homogeneous functions of $a, x, y, z$, between which the three ratios of these variables may be eliminated, giving

$$\phi(f_a, f_x, f_y, f_z)=0$$

where $\phi$ is a homogeneous function. It at once follows that $\mathcal{E}$ satisfies the equation

$$\phi(\mathcal{E}/a, \mathfrak{L}, \mathfrak{M}, \mathfrak{N})=0$$

where $\mathfrak{L}, \mathfrak{M}, \mathfrak{N}$ denote $\mu'L'-\mu L$, $\mu'M'-\mu M$, $\mu'N'-\mu N$ respectively. This equation expresses $\mathcal{E}$, the stationary path length between the planes $(L, M, N)$ and $(L', M', N')$, in terms of their direction cosines, so that $\mathcal{E}$ is the eikonal.

Consider refraction at the paraboloid of revolution

$$y^2+z^2-4ax=0.$$

Here

$$\frac{f_a}{-4x}=\frac{f_x}{-4a}=\frac{f_y}{2y}=\frac{f_z}{2z},$$

so that

$$f_y^2+f_z^2-f_af_x=0$$

and

$$\mathcal{E}=a\frac{\mathfrak{M}^2+\mathfrak{N}^2}{\mathfrak{L}}.$$

Again at the spherical surface

$$x^2+y^2+z^2-r^2=0$$

we have

$$\frac{f_x}{x}=\frac{f_y}{y}=\frac{f_z}{z}=\frac{f_r}{-r},$$

and therefore

$$f_x^2+f_y^2+f_z^2=f_r^2$$

or

$$\mathcal{E}=\pm r(\mathfrak{L}^2+\mathfrak{M}^2+\mathfrak{N}^2)^{\frac{1}{2}}.$$

One root corresponds to the part of the surface which is convex, the other to the part which is concave, to the incident light.

By a similar process the equation of the refracting surface may be found when $\mathcal{E}$ is given as a homogeneous function of the first order in $\mathfrak{L}, \mathfrak{M}, \mathfrak{N}$. The equation of the eikonal for the sphere may be written

$$\mathcal{E}=r[\mu'^2+\mu^2-2b-2(\mu^2-2a)^{\frac{1}{2}}(\mu'^2-2C)^{\frac{1}{2}}]^{\frac{1}{2}}=r(\mu'\cos\phi'-\mu\cos\phi)$$

where $\phi$ and $\phi'$ are the angles of incidence and refraction. If then we write $\kappa=\frac{\mu'\cos\phi'-\mu\cos\phi}{r}$, we have $\mathcal{E}=r^2\kappa$, $\mathcal{E}\mathcal{E}_b=-r^2$ or the secondary focal lengths are $\mu/\kappa$ and $\mu'/\kappa$ respectively, where $\kappa$ is called the secondary power. The equations

$$\kappa\mathcal{E}_a=\frac{\mu'L'}{\mu L},\ \kappa\mathcal{E}_c=\frac{\mu L}{\mu'L'}$$

merely mean that the refracting surface is the unit surface. Again

$$\mathcal{E}_b+2a\mathcal{E}_{ab}+b\mathcal{E}_{bb}+b\mathcal{E}_{ac}+2c\mathcal{E}_{bc}=-\frac{\cos\phi\cos\phi'}{LL'\kappa}$$

so that the primary power is $\kappa\sec\phi\sec\phi'$; also

$$\mathcal{E}_c-L'^2\{\mathcal{E}_c+2a\mathcal{E}_{bb}+2b\mathcal{E}_{bc}+2c\mathcal{E}_{cc}\}=\frac{\sin^2\phi}{\kappa},$$

the quantity on the left when multiplied by $\mu'$ being the distance between the primary and secondary principal foci in the image space, that is to say the astigmatism. It is worth noting that at the two principal foci the astigmatism is inversely as the refractive index.

When the incidence is normal both powers become equal to $\frac{\mu'-\mu}{r}$, an expression of importance because in a symmetrical instrument incidence is normal for paraxial rays, that is rays which lie close to the axis of symmetry. As the unit in which powers are expressed, the dioptrie or dioptre, the inverse of a metre, is universally employed. Thus a lens of power 5 dioptries (written 5D.) has a focal length of 20 cm. in air.

*The Combination of Systems.*—Having found the eikonal for the separate surfaces of the instrument it is now necessary to find those for the combination. The process involved may be illustrated by combining two systems. Let $O_0$, $O_1$ and $O_2$ in media of refractive indices $\mu_0$, $\mu_1$ and $\mu_2$ be the reference points on the axis, $\mathcal{E}_1$ the eikonal for the first portion between planes through $O_0$ and $O_1$, $\mathcal{E}_2$ that for the second part between planes through $O_1$ and $O_2$, and $\mathcal{E}_{12}$ that for the whole. From the definitions of the eikonal it follows that $\mathcal{E}_{12}=\mathcal{E}_1+\mathcal{E}_2$. Moreover

$$-\frac{\partial\mathcal{E}_1}{\partial M_1}=\mu_1y_1=\frac{\partial\mathcal{E}_2}{\partial M_1},\text{ or }\frac{\partial}{\partial M_1}(\mathcal{E}_1+\mathcal{E}_2)=0$$

with a similar equation involving $N_1$. These two conditions enable $M_1$ and $N_1$ to be eliminated from $\mathcal{E}_1+\mathcal{E}_2$, leaving $\mathcal{E}_{12}$ expressed in terms of the external variables only.

**Paraxial Laws.**—From the formulae reached in a previous section we see that the refraction of paraxial rays is determined by the part of $\mathcal{E}$ which is linear in $a$, $b$ and $c$. Let us put

$$\mathcal{E}=\text{const.}+\alpha a+\beta b+\gamma c+\cdots;$$

then the conditions from which $M_1$ and $N_1$ are to be found are

$$\mu_0M_0\beta_1+\mu_1M_1\gamma_1+\mu_1M_1\alpha_2+\mu_2M_2\beta_2=0,$$
$$\mu_0N_0\beta_1+\mu_1N_1\gamma_1+\mu_1N_1\alpha_2+\mu_2N_2\beta_2=0.$$

Squaring and adding we find for the combination

$$\mathcal{E}=\text{constant}+\alpha_1a-\frac{\beta_1^2a+\beta_1\beta_2b+\beta_2^2c}{\gamma_1+\alpha_2}+\gamma_2c+\cdots.$$

This expression shows that if we put

$$\alpha=\frac{A}{B},\ \beta=-\frac{1}{B},\ \gamma=\frac{C}{B},\ AC-BD=1$$

the paraxial constants of the compound instrument are given by the matrix law

$$\begin{pmatrix}A_{12} & D_{12}\\ B_{12} & C_{12}\end{pmatrix}=\begin{pmatrix}A_1 & D_1\\ B_1 & C_1\end{pmatrix}\begin{pmatrix}A_2 & D_2\\ B_2 & C_2\end{pmatrix},$$

the extension of which to any number of systems is simple. It is an easy matter to show that the equations for the points in which a ray meets the reference planes are given by

$$\begin{pmatrix}A & 1\\ 1 & C\end{pmatrix}\begin{pmatrix}\mu M & \mu N\\ -\mu'M' & -\mu'N'\end{pmatrix}=B\begin{pmatrix}y & z\\ y' & z'\end{pmatrix},$$

the converse relation by

$$\begin{pmatrix} A & 1 \\ 1 & C \end{pmatrix}\begin{pmatrix} -y' & -z' \\ y & z \end{pmatrix}=D\begin{pmatrix} \mu'M' & \mu'N' \\ \mu M & \mu N \end{pmatrix},$$

and the relation between axial conjugate points by

$$(\mu\ x)\quad \begin{pmatrix} A & D \\ B & C \end{pmatrix}\begin{pmatrix} x' \\ -\mu' \end{pmatrix}=0.$$

If the system consists of a series of spherical refracting surfaces of powers $\kappa_1, \kappa_2, \kappa_3, \cdots$ and separations $\mu_1\tau_1, \mu_2\tau_2, \cdots$ between their vertices, the constants are calculated from the product

$$\begin{pmatrix} A & D \\ B & C \end{pmatrix}=\begin{pmatrix} 1 & 0 \\ \kappa_1 & 1 \end{pmatrix}\begin{pmatrix} 1 & -\tau_1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ \kappa_2 & 1 \end{pmatrix}\begin{pmatrix} 1 & -\tau_2 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ \kappa_3 & 1 \end{pmatrix}\cdots.$$

where the reference points are at the points of intersection of the axis with the extreme surfaces and, for any surface separating media of refractive indices $\mu$ and $\mu'$, $\kappa=R(\mu'-\mu)$, $R$ being the curvature of the surface at the vertex, considered positive if its convex side is presented to the incident light. In the special case in which all the refracting surfaces cross the axis at the same point this product reduces to the simple form

$$\begin{pmatrix} A & D \\ B & C \end{pmatrix}=\begin{pmatrix} 1 & 0 \\ \kappa_1+\kappa_2+\kappa_3+\cdots & 1 \end{pmatrix}.$$

Systems in which the overall axial depth is negligible are termed "thin." They are of much importance in the preliminary development of instruments owing to the simplicity of all formulae relating to thin systems and to the accident that it is nearly always the aim of the designer of optical systems to use no greater amount of glass, quartz or other transparent solid than is necessary.

**Chromatic Aberrations.**—We have hitherto regarded the refractive index as a property of the medium only. Optical instruments in general are used for the control of light of various wave-lengths, and as the nature of the light is changed the refractive index of the medium alters. It follows that $A, B, C, D$ are liable to vary as the colour of the light changes and the position and size of the image of a given object likewise vary. Most instruments would not be of much value unless these variations could be reduced to very small amounts. We will determine the conditions that must be satisfied for them to be eliminated. We shall assume that the two media external to the system are alike and are the standard medium to which the value unity for the refractive index is conventionally ascribed for all wave-lengths.

The matrix for refraction at a single surface is

$$\begin{pmatrix} 1 & 0 \\ R(\mu'-\mu) & 1 \end{pmatrix},$$

and this may be replaced by the product

$$\begin{pmatrix} 1 & 0 \\ R(1-\mu) & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ R(\mu'-1) & 1 \end{pmatrix}$$

corresponding to refraction from the medium of index $\mu$ into the standard medium followed immediately by refraction from the standard medium into that of index $\mu'$. We may therefore consider the system as a combination of a series of bodies, each bounded by two refracting surfaces, immersed in the standard medium. We call each of these elementary bodies a simple lens, and it is convenient to regard such lenses rather than the separate surfaces as the elements from which the instrument is built. The matrix for the instrument now takes the form

$$\begin{pmatrix} A & D \\ B & C \end{pmatrix}=\begin{pmatrix} A_1 & D_1 \\ B_1 & C_1 \end{pmatrix}\begin{pmatrix} 1 & -s_1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} A_2 & D_2 \\ B_2 & C_2 \end{pmatrix}\begin{pmatrix} 1 & -s_2 \\ 0 & 1 \end{pmatrix}\cdots.$$

where $s_1, s_2$ are separations in the standard medium between the vertices of successive lenses, and thus do not vary as the constitution of the light changes. If in consequence of a change in the wave-length of the light the matrix for a typical lens becomes

$$\begin{pmatrix} A+\delta A & D+\delta D \\ B+\delta B & C+\delta C \end{pmatrix},$$

the changes in the coefficients for the entire instrument to a first approximation will be given by

$$\begin{pmatrix} \delta A & \delta D \\ \delta B & \delta C \end{pmatrix}=\sum(P)\begin{pmatrix} \delta A_k & \delta D_k \\ \delta B_k & \delta C_k \end{pmatrix}(P')$$

where $(P)$ and $(P')$ denote the products of the matrices respectively preceding and following those of the lens $\kappa$ in the matrix product for the entire system, and the summation extends to all the lenses.

Now $$\begin{pmatrix} A & D \\ B & C \end{pmatrix}=\begin{pmatrix} 1 & 0 \\ \frac{C-1}{D} & 1 \end{pmatrix}\begin{pmatrix} 1 & D \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ \frac{A-1}{D} & 1 \end{pmatrix},$$

and thus $\frac{C-1}{D}=R(\mu-1)$, $\frac{A-1}{D}=R'(1-\mu)$, $D=-t/\mu$ where $R$, $R'$, $t$ are the curvatures of the two surfaces and the axial thickness of the single lens. It follows that for light of a different colour for which the refractive index is $\mu+(\mu-1)/\nu$, where $\nu$ is a quantity regularly given by glass makers, the increments in $A, C, D$ are given to the first order by

$$\delta\frac{A-1}{D}=\frac{A-1}{D\nu},\ \delta\frac{C-1}{D}=\frac{C-1}{D\nu},\ \delta D=-D\frac{\mu-1}{\mu\nu},$$

so that $\delta A=\frac{A-1}{\mu\nu}$, $\delta C=\frac{C-1}{\mu\nu}$, $\delta B=\frac{B}{\nu}+\frac{(A-1)\ (C-1)}{\mu\nu D}$,

that is to say the increment in the matrix is

$$\frac{1}{\nu}\begin{pmatrix} 0 & -D \\ B & 0 \end{pmatrix}+\frac{1}{\mu\nu}\begin{pmatrix} A-1 & D \\ \frac{(A-1)(C-1)}{D} & C-1 \end{pmatrix}.$$

When the thickness of the component is negligible only the first of these matrices is of consequence, and the only alteration is due to a proportional change in $B$. If all the components are thin lenses in contact, the properties of the system, so far as the paraxial terms are concerned, will be the same for light of the two wave-lengths if $\Sigma\frac{B}{\nu}=0$. In particular for a system of two thin lenses in contact we have

$$\frac{B_1}{\nu_1}=-\frac{B_2}{\nu_2}=\frac{B_{12}}{\nu_1-\nu_2}$$

as the sole condition for achromatism. In the more general case the expressions most frequently employed are that given for $\delta B$ and

$$\delta\left(\frac{A}{B}\right)=-\frac{1}{\nu}\left\{\frac{A}{B}-\frac{(A-1)^2}{\mu DB^2}\right\},\ \delta\left(\frac{C}{B}\right)=-\frac{1}{\nu}\left\{\frac{C}{B}-\frac{(C-1)^2}{\mu DB^2}\right\}.$$

Alternatively we may divide the complete expression into the three parts

$$\frac{1}{\nu}\begin{pmatrix} 0 & -D \\ B & 0 \end{pmatrix}+\frac{1}{\mu\nu}\begin{pmatrix} A & D \\ B & C \end{pmatrix}-\frac{1}{\mu\nu}\begin{pmatrix} 1 & 0 \\ \frac{A+C-2}{D} & 1 \end{pmatrix}$$

where the first indicates a proportional increment in the power of the element and a decrement in its effective thickness, the second a proportional change in all constants of the complete system, and the last the subtraction of the change in these constants which would arise if the separation between the surfaces of the component were annihilated without any change in the curvatures of its surfaces. In actual calculations it is probably more convenient to replace the $-D$ in the first part by 0 and the 0 in the last part by $-t$.

In a large number of instruments having a small field of view the only condition to which close attention is paid is the coincidence of the principal focal planes for different colours corresponding to $\delta\left(\frac{C}{B}\right)=0$. When the field is large the condition $\delta B=0$ has to be closely satisfied also. In the older eyepieces consisting of two separated simple thin lenses (those nearest the objective and the eye being respectively named the field lens and the eye lens), no other chromatic condition was imposed on this part of the instrument. This leads to the definite value

$$\left(\frac{\nu_1}{\kappa_1}+\frac{\nu_2}{\kappa_2}\right)\Big/(\nu_1+\nu_2)$$

for the axial separation of the two lenses, and when both lenses are made from the same kind of glass the old rule that the separation should equal the mean of the focal lengths of the two lenses follows. Modern eyepieces have to cover larger fields than are suited to the older forms, and either the field lens, or the eye lens, or both are compound. Attention to all three conditions is comparatively rare, and is only of importance when good correction is desired in widely separated image planes. If the system is symmetrical end for end, $A=C$, and the three conditions fall to two. Since

$$\begin{pmatrix} A & D \\ B & C \end{pmatrix}\begin{pmatrix} C & \frac{D}{p} \\ pB & A \end{pmatrix}=\begin{pmatrix} AC+pBD & \left(1+\frac{1}{p}\right)AD \\ (1+p)BC & AC+\frac{1}{p}BD \end{pmatrix},$$

a complete system made from two similar components, not necessarily of equal focal length, with corresponding parts next to one another, will be achromatised if $A/B$ and $D/C$ remain unaltered as the colour changes, that is to say the separate components, must be corrected for the position in which light parallel to the axis between the components comes to a focus, and for the image of the centre of symmetry.

The discussion of the conditions which should be satisfied when the rays considered do not lie close to the axis does not differ in any essential feature from that just given.

**Aberrations for Homogeneous Radiation.**—We have seen earlier that a plane image of a plane object will only be secured when $\mathcal{E}$ is expressible as a function of $(\mu M-G\mu'M')$ and $(\mu N-G\mu'N')$ only, where $G$ is the transverse magnification. In general other terms occur, and the characteristic effects due to them are called aberrations. The quadratic terms in $\mathcal{E}$ may be written in the form

$$-\tfrac{1}{2}[\sigma_0A^2-2\sigma_1AB+\sigma_2B^2+2\left(\sigma_2+\frac{\omega}{\kappa}\right)AC-2\sigma_3BC+\sigma_4C^2]$$

where $A$, $B$, $C$ denote the quantities previously defined and the $\sigma$'s are known as the aberrational coefficients; $\sigma_1$ is the coefficient for distortion, $\sigma_2$ for astigmatism, $\omega$ for curvature of the field, $\sigma_3$ for coma, and $\sigma_4$ for central aberration. Central aberration is so named because the other aberrations disappear on the axis of the system. It must not be supposed that central aberration is not present over the whole field. The significance of these terms will be more fully appreciated if we note that the co-ordinates $(Y, Z)$ of an image point when aberrations are absent are given by

$$Y\kappa=\mu M-G\mu'M',\ Z\kappa=\mu N-G\mu'N'.$$

If then $(\eta, \zeta)$ is the point in which the plane of the stop is met we may substitute

$$A=\frac{(Y^2+Z^2)\kappa^2}{2(S-G)^2},\ B=\frac{(Y\eta+Z\zeta)\kappa^2}{(S-G)^2},\ C=\frac{(\eta^2+\zeta^2)\kappa^2}{2(S-G)^2}$$

in either the expression for $\mathcal{E}$ or in

$$y'-Y=\frac{1}{(S-G)}(Y\mathcal{E}_B+\eta\mathcal{E}_C),\ z'-Z=\frac{1}{S-G}(Z\mathcal{E}_B+\zeta\mathcal{E}_C).$$

From the latter we see that a finite value of $\sigma_1$ implies only a fixed displacement of the image point from its ideal position, so that object and image are not geometrically similar; hence the description of this aberration as distortion. At the displaced image point there is no difference of phase. By writing

$$(Y^2+Z^2)\ (\eta^2+\zeta^2)=(Y\eta+Z\zeta)^2+(Y\zeta-Z\eta)^2$$

we see that the terms in $B^2$ and $AC$ may be analysed into two components, for one of which the point of intersection with the stop lies in the same axial plane as the object point, and for the other in a perpendicular axial plane. It is easy to show that either of these divergences may be removed for a given object point by moving the image plane along the axis. The terms in fact denote that the primary and secondary image surfaces are curved, the curvatures at the axis being $3\kappa^2\sigma_2+\kappa\omega$ and $\kappa^2\sigma_2+\kappa\omega$ respectively. The common part $\kappa\omega$, which depends only on the Airy-Petzval sum, is known technically as the curvature. A finite value of $\sigma_2$ implies that the primary and secondary image surfaces differ in curvature, so that $\sigma_2$ measures their separation, *i.e.*, the astigmatism. The coma, which has $\sigma_3$ for its coefficient, differs from the others in that $y'-Y$ and $z'-Z$ change in sign with $\eta$ and $\zeta$. The geometrical trace of the rays is therefore unsymmetrical and the phase variation is also unsymmetrical. No change of focus will remove this defect, but the want of symmetry may be removed, for small apertures, by choosing a proper position for the stop. Such a change however also affects the aberrations we have already mentioned. It may easily be shown that the rays from any object point which pass through one half of a circular zone of the stop concentric with the axis, meet the image plane in a complete circle, touching two straight lines, making an angle of 60° with one another, which meet in the image point for light which has passed through the centre of the stop. The primary focus for rays in the axial plane is three times as far as the secondary focus from the ideal image point. The central aberration measured by $\sigma_4$ is symmetrical, the rays through concentric circular zones of the stop meeting the image surface in concentric circular zones of radii proportional to the cube of the radii of the former. The aberration implies that each zone has a separate surface on which the image is formed, owing to want of agreement of phase. The primary foci for light from a point on the axis lie on a semi-cubical paraboloid with the axis of the system for its axis of revolution; the axis itself is the locus of the secondary foci. The former are three times as far as the latter from the paraxial image plane. The coefficient $\sigma_0$, with a correction added, is the quantity which corresponds to $\sigma_4$ when the reference plane is moved to another position. It is interpreted as the central aberration at the middle of the stop.

We can obtain the addition laws very simply for these aberrations by noting that, since all the paraxial terms when eikonals are added are completely accounted for by substituting for the intermediate direction cosines expressions linear in the external direction cosines, we have only to make the same substitutions for $A, B, C$ in these aberrational terms. The expressions obtained in this way are

$$(\sigma_p)_{1,n}=\Sigma(\sigma_p)_\kappa S_\kappa^{4-p}G_\kappa^p,\ \ (p=0, 1, 2, 3, 4),$$

where the component parts are $n$ in number, of which $\kappa$ is a typical member, and $S_\kappa$, $G_\kappa$ are the magnifications which the images of the stop and of the object formed by lens $\kappa$ undergo in the subsequent parts of the system. The quantity $\frac{\omega}{\kappa}$, where $\kappa$ is the power of the system, is transformed according to the same law as $\sigma_2$, and in this case we are led to an expression which is well known on account of its simplicity. This is the so-called Petzval sum

$$(\omega\kappa)_{1,n}=\Sigma(\omega\kappa)_\kappa$$

where $\omega_\kappa=\frac{1}{\mu_\kappa\mu'_\kappa}$. A more correct name would be the Airy sum, using the name of its first discoverer.

If $\mathcal{E}$ and $\mathcal{E}'$ are the eikonals for the same system when the reference points correspond to two different magnifications $G$ and $G'$, we have

$$\mathcal{E}-\frac{\mu^2L}{\kappa G}-\frac{\mu'^2L'G}{\kappa}=\mathcal{E}'-\frac{\mu^2L}{\kappa G'}-\frac{\mu'^2L'G'}{\kappa},$$

and if $A', B', C'$ are the effective variables in the latter expression corresponding to the $A, B, C$ of the former, we obtain a linear transformation from the one system to the other, and the aberrational coefficients for any positions of the object and stop can be expressed in terms of those for standard positions. By paying special attention to the factor $4AC-B^2$ which can be separated in a large number of terms, we are enabled to classify the aberrations generally by order and by series, the latter classification deriving its importance from the fact that though the conditions for the disappearance of any given aberration depend on the magnification, the disappearance of all the aberrations of a given order and series for a given pair of object and stop positions involves their disappearance for all positions. To this rule there is only one exception—that of the zero series, comprised of terms

which do not contain $4AC-B^2$ as a factor. In the quadratic terms just considered we may write the terms in $B^2$ and $AC$ in the form

$$-\frac{1}{6}\left(3\sigma_2+\frac{\omega}{\kappa}\right)(B^2+2AC)-\frac{\omega}{6\kappa}(4AC-B^2)$$

showing that the term involving $\omega$ belongs to series I.

It is no less advantageous when considering aberrations than when dealing with the paraxial constants to take the simple lens rather than the single surface as the effective unit. We proceed to find expressions for the aberrational coefficients of a simple thin lens, taking as the standard conditions the stop in the unit surface and the object in the surface for magnification $-1$. This choice offers many advantages due to symmetry. If object and image space are interchanged the coefficients with an even suffix are unaltered and those with an odd suffix merely changed in sign.

If the origins are taken at the vertex of a single surface system of power $\kappa_1$,

$$\mathcal{E}_1=\frac{\mu_1-\mu_0}{2\kappa_1}\left[\frac{\mathcal{M}_1^2+\mathcal{N}_1^2}{\mathcal{L}_1}-\frac{\epsilon_1(\mathcal{M}_1^2+\mathcal{N}_1^2)^2}{2\mathcal{L}_1^3}+\cdots\right].$$

Adding a similar expression, the condition, $\frac{\partial}{\partial M_1}(\mathcal{E}_1+\mathcal{E}_2)=0$ gives $\mu_1M_1\kappa=\mu_0M_0\kappa_2+\mu_2M_2\kappa_1$, where $\kappa=\kappa_1+\kappa_2$.

Hence $$\mu_1M_1=\frac{\mu_0M_0+\mu_2M_2}{2}-\frac{\kappa_1-\kappa_2}{\kappa}\left(\frac{\mu_0M_0-\mu_2M_2}{2}\right),$$

$$\frac{\mathcal{M}_1}{\kappa_1}=\frac{\mathcal{M}_2}{\kappa_2}=-\frac{\mu_0M_0-\mu_2M_2}{\kappa}.$$

To secure reference points at the negative unit surfaces we have to add $2(\mu_2^2L_2+\mu_0^2L_0)/\kappa$ to $\mathcal{E}$. Write 1, $\mu$, 1 for $\mu_0$, $\mu_1$, $\mu_2$ and put $\kappa_1-\kappa_2=2(\mu-1)\rho\kappa$ so that $\rho\kappa$ is the common addition made to the curvature of both surfaces to derive its shape from the symmetrical form. Then on expansion we find

$$\begin{aligned}\mathcal{E}_\kappa&=4-4A-2A^2-2B^2-4(1+\omega)AC-8\rho(1+\omega)BC\\&-2\left[\frac{1}{(1-\omega)^2}+4\rho^2(1+2\omega)+(\epsilon_1+\epsilon_2-1)\left\{\frac{1}{(\mu-1)^2}+12\rho^2\right\}\right.\\&\left.+(\epsilon_1-\epsilon_2)2\rho\left\{\frac{3}{\mu-1}+4\rho^2(\mu-1)\right\}\right]C^2+\cdots\end{aligned}$$

where $\omega=1/\mu$. If the surfaces are spherical $\epsilon_1=\epsilon_2=\frac{1}{2}$ and the last two terms disappear from the coefficient of $C^2$. If they are paraboloidal $\epsilon_1=\epsilon_2=0$ and the coefficient of $C^2$ becomes

$$-2\left[\frac{1+\omega}{1-\omega}-8\rho^2(1-\omega)\right].$$

Since the refracting surfaces are in contact the coefficient of $A^2$ must correspond to the absence of stop aberration. The absence of a term in $AB$ indicates that there is no distortion. The coefficients which determine the curvature and astigmatism are not under control. The coma may be removed by giving the lens a symmetrical form—that is by making $\rho=0$. The central aberration can then only be controlled by giving the surfaces a suitable shape—viz., by making $\epsilon_1=\epsilon_2=-\frac{1}{2}(\mu^2-1)$. This fixes the eccentricity of the osculating ellipsoids.

Let us write $4\beta$ for the coefficient $BC$ and $-2\gamma$ for that of $C^2$. Then with the stop magnification $S$ and the object magnification $G$, after moving the origins and introducing the appropriate changes in $A$, $B$, $C$, we find the following expression, most of the coefficients in which were first obtained by Airy.

$$\begin{aligned}\mathcal{E}_\kappa=&-\frac{(1-G)^2}{G}+\frac{(S-G)^2}{G}A-\frac{(S-G)(S^3-G)}{2G}A^2\cdots\\&-\tfrac{1}{8}[\gamma-4\mathcal{S}\beta+\mathcal{S}^2(3+2\omega)](1-S)^4A^2\\&+\tfrac{1}{4}[\gamma-(3\mathcal{S}+\mathcal{G})\beta+3\mathcal{S}^2+\mathcal{S}(\mathcal{S}+\mathcal{G})\omega](1-S)^3(1-G)AB\\&-\tfrac{1}{8}[\gamma-2(\mathcal{S}+\mathcal{G})\beta+\mathcal{S}(\mathcal{S}+2\mathcal{G})\\&+\tfrac{1}{3}(\mathcal{S}^2+4\mathcal{S}\mathcal{G}+\mathcal{G}^2)\omega](1-S)^2(1-G)^2(2AC+B^2)\\&-\frac{\omega}{12}(S-G)^2(4AC-B^2)\\&+\tfrac{1}{4}[\gamma-(\mathcal{S}+3\mathcal{G})\beta+\mathcal{G}(2\mathcal{S}+\mathcal{G})+\mathcal{G}(\mathcal{S}+\mathcal{G})\omega](1-S)(1-G)^3BC\\&-\tfrac{1}{8}[\gamma-4\mathcal{G}\beta+\mathcal{G}^2(3+2\omega)](1-G)^4C^2\end{aligned}$$

where $\mathcal{S}=\frac{1+S}{1-S}$, $\mathcal{G}=\frac{1+G}{1-G}$ and the terms in the first line correspond to the elimination of aberrations. We may now employ the addition formulae for these aberrational coefficients to obtain corresponding expressions for any number of thin lenses in contact. We then find that $\omega$ is the Airy-Petzval sum, and if $\rho\kappa$ is a common curvature addition made to all the surfaces from a standard form the preceding formulae apply without alteration except that $\beta$ and $\gamma$ take the forms

$$\beta=\beta_0+2\rho(1+\omega),\quad \gamma=\gamma_0+4\rho^2(1+2\omega).$$

These formulae are particularly advantageous in their application to lenses which are to be cemented together, so that the second surface of one lens has the same curvature as the first surface of the next succeeding lens. For example telescope objectives may be advantageously designed in this way, the conditions to be applied being $\sigma_3=\sigma_4=0$, that is $\beta=(2+\omega)\mathcal{G}$, $\gamma=(5+2\omega)\mathcal{G}^2$, where $\mathcal{G}=1$ for an infinitely distant object. The coma is eliminated by giving a suitable degree of "bending" to the lens as a whole, and the central aberration by the choice of suitable glasses, or by departing from the spherical form for the surfaces, or by distributing the lens powers suitably between three or more components. When there are only two component lenses the ratio of their powers is determined by the condition for the removal of the chromatic aberrations. For more complete information on these developments the reader is referred to numerous papers in the *Transactions of the Optical Society*.

When the lens is no longer thin expressions for the aberrations differing very slightly from those just given may be obtained by the same general procedure. As a rule it is unnecessary to repeat the calculations after such thicknesses as are necessary for the construction of an actual lens have been introduced, as it has been shown that over a wide range of constructions the aberrations of this order introduced by separating the surfaces are automatically compensated in the most advantageous way by the aberrations of the next higher order which become significant at the aperture the thickness is introduced to yield.

Formulae may be obtained for these higher order aberrations in a similar manner; the chief complication is due to the necessity for taking into account in the values of $M_1$ and $N_1$ terms depending on the lower order aberrations.

**Main Types of Optical Instruments.**—Optical instruments tend to assume one of a few forms. Telescopes are systems of very great or even infinite focal length; they may invariably be regarded as a combination of two systems of finite focal length placed with their inner principal focal surfaces nearly or exactly in coincidence. The one part, often of large absolute aperture and long focal length, usually conforms to the thin lens type and is corrected for coma and central aberration. In the other part, the eyepiece, attention is chiefly given to the curvature and astigmatism. Telescopes are essentially instruments for increasing the angle an object appears to subtend at an observer's eye, and in most of them the field of view is small. At the opposite extreme are microscopes, also divisible into objective and eyepiece, but the former is of short focal length and small absolute, but large numerical, aperture. In the higher powers (that is shorter focal lengths) the objectives tend to be very complex. As with telescopes the most important objective corrections are those for colour, central aberration and coma. The eyepiece is of simple construction. Only a small part of an object can be viewed at once. Camera lenses form a class in some respects intermediate between telescopes and microscopes. The field is large and the numerical aperture moderate. In general they are not separable into parts having distinct functions, and all aberrations must be considered. The use of lenses at appreciable axial separations is necessary for the attainment of satisfactory

corrections.

**Ray Tracing.**—The professional optical designer in evolving complex instruments finds it expedient to use formulae for the aberrational coefficients merely as a general qualitative or roughly quantitative guide to indicate the modifications he should make in a partially developed system to reduce as far as possible the remaining aberrations. The outstanding difficulty in the way of using algebraic expansions for the whole of his work is the uncertain value of the terms of the expansion he must neglect. As he aims at taking into consideration lengths as small as a quarter of a wave length or less, that is to say about one ten-thousandth of a millimetre, it will be appreciated that our knowledge of the higher order aberrations must be thorough before reliance can in general be placed on expansions. The method adopted by the designer is to trace step by step through the system a selected set of rays, and to infer from their positions in the image space the aberrations remaining in the system. For tracing these rays many methods have been devised, of which particulars may be obtained from practical treatises. They are usually entirely trigonometrical, and logarithmic tables are generally employed. The calculations for skew rays are necessarily much more troublesome than those for rays in an axial plane, and in practice skew rays are rarely computed. A method of computing rays in an axial plane, suitable for use with a calculating machine, is as follows.

The incident ray is defined by $\mathfrak{b}$, the length of the perpendicular to the ray from the vertex of the surface, and $\sin\psi$, where $\psi$ is the angle between the ray and the axis. The refractive index is denoted by $\mu$, the angle of incidence by $\phi$, the curvature of the surface by $R$, and the separation between the vertices of this and the next surface by $t$. The same letters, with accents where necessary, are used for the refracted ray, and with the suffix 1 for the following surface.

In the customary methods of calculation $\psi_1$ is found by the angular relation

$$\psi_1=\psi'=\psi-\phi+\phi'$$

which necessitates references to tables. In the present method the use of these tables is avoided by first finding an approximate value $\sin\theta$ for $\sin\psi'$ given by

$$\sin\theta=\sin\psi-\sin\phi+\sin\phi'.$$

In the absence of aberration this value is correct, and also $\mathfrak{b}'=\mathfrak{b}$. In general aberration is present and corrections of aberrational magnitude are required. The working equations are

$$\begin{aligned}
\sin\phi&=\sin\psi+R\mathfrak{b},\\
\sin\phi'&=\sin\phi\times\mu/\mu,\\
\sin\theta&=\sin\psi-\sin\phi+\sin\phi',\\
N&=\mathfrak{b}\,(\sin\phi-\sin\phi')\,(\sin\psi+\sin\phi'),\\
D&=\tfrac{1}{4}\{\sin^2\theta+(\cos\psi+\cos\phi+\cos\psi')^2-1\},\\
\mathfrak{b}'-\mathfrak{b}&=N/D,\\
\sin\psi'&=\sin\theta-R(\mathfrak{b}'-\mathfrak{b}),\\
\mathfrak{b}_1&=\mathfrak{b}'+t\sin\psi_1.
\end{aligned}$$

It is to be noted that $\frac{1}{2}N$ and $\frac{1}{2}N\mu\sin\phi$ are the linear first order coma and spherical aberration respectively for the single refraction, $D$ is the ratio of twice the first order aberration to the total aberration, and

$$\frac{(\mathfrak{b}'-\mathfrak{b})\mu\sin\phi}{\{(1+\cos\psi)\,(1+\cos\phi)\,(1+\cos\phi')\,(1+\cos\psi')\}^{\frac{1}{2}}},$$

which is represented at most refractions with ample accuracy by

$$\tfrac{1}{4}(\mathfrak{b}'-\mathfrak{b})\mu\sin\phi,$$

is the difference in path between the route along the ray and that along the axis from their first to their second crossing point. Brief tables are used for finding $D$.

Graphical methods of representing the state of correction of the system are widely used. For example the central aberrations may be shown by taking as ordinate the distance from the axis at which a ray crosses the unit surface and as abscissa the distance of its intersection with the axis from a suitable fixed point. The type of curve thus secured is widely used. The paraxial portion of the curve touches the ordinate axis. A more useful curve is obtained by taking the square of the height at which the unit surface is crossed as ordinate. The inclination of this curve to the ordinate axis for rays near the axis depends on the lowest order central aberration, and the curvature gives higher order aberrations. Moreover if we draw through any point $X$ on the abscissa axis a straight line parallel to the ordinate axis, the areas intercepted between this line and the curve measure the differences of path for light passing through the corresponding zones of the unit surface when the image point is at $X$. By choosing this ordinate so as to cut off alternately equal areas on opposite sides of the curve we can determine the point for which the differences of phase will be least. Corresponding to each geometrical figure a second curve may be drawn with the same ordinates, and the phase at a given image point as abscissa. When only first order aberration is present the geometrical figure is an inclined straight line, the phase curve is a parabola, and the best focus will be at the mid-point of the projection of the straight line on the abscissa axis. This result is at variance with the geometrical prediction that the best position of focus is three times as far from the position where the paraxial rays come to a focus as from the intersection of a marginal ray with the axis.

**Aplanatic Surfaces.**—Although some lenses designed in the last few years show marked improvements on any that were produced before the World War, no system has yet been evolved which yields over a wide surface an image entirely free from aberration. Points imaged without differences of phase for monorythmic (often called monochromatic) light have long been named aplanatic points. A more restricted interpretation of the term, now universally adopted, was introduced by Abbe, the change involving the absence of aberrations when the object point makes small excursions in a definite surface. Connected aggregates of object and image points each having this property form a pair of aplanatic surfaces. Until recently our knowledge of the conditions under which such perfect imagery is possible were very limited—they amounted to hardly more than the plane mirror reflection, in which the whole object space is imaged without aberration, the aplanatic spheres discovered by Thomas Young for refraction at a sphere, and the trivial case of any single surface at which refraction occurs. A more general result is obtained by noting that if $\mathcal{E}$ is given explicitly as a function of the direction cosines $(L, M, N)$ and $(L', M', N')$, the points

$$\left(\frac{\partial\mathcal{E}}{\mu\partial L},\ \frac{\partial\mathcal{E}}{\mu\partial M},\ \frac{\partial\mathcal{E}}{\mu\partial N}\right)\text{ and }\left(-\frac{\partial\mathcal{E}}{\mu'\partial L'},\ -\frac{\partial\mathcal{E}}{\mu'\partial M'},\ -\frac{\partial\mathcal{E}}{\mu'\partial N'}\right)$$

are on the incident and emergent rays respectively. Let us now suppose that $\mathcal{E}$ is a homogeneous function of the first order of three variables $\alpha$, $\beta$, $\gamma$, each of which is a linear function of the six direction cosines, so that

$$\alpha=\alpha_0+\alpha_1\mu L+\alpha_2\mu M+\alpha_3\mu N-\alpha_4\mu' L'-\alpha_5\mu' M'-\alpha_6\mu' N'$$

where $\alpha_0, \alpha_1, \cdots$ are constants, with corresponding expressions for $\beta$ and $\gamma$. Then

$$x=\alpha_1\mathcal{E}_\alpha+\beta_1\mathcal{E}_\beta+\gamma_1\mathcal{E}_\gamma,\quad x'=\alpha_4\mathcal{E}_\alpha+\beta_4\mathcal{E}_\beta+\gamma_4\mathcal{E}_\gamma$$

with similar equations for $y, y'$ and $z, z'$. It follows that $\mathcal{E}_\alpha, \mathcal{E}_\beta, \mathcal{E}_\gamma$ can be found in terms of $x, y, z$, and thus definite values of $x', y', z'$ obtained. That is to say we obtain a one-one correspondence between these points of the object and image spaces. They will be object and image points if the length of the optical path between them is constant. Now this path is

$$\mathcal{E}+\mu'(L'x'+M'y'+N'z')-\mu(Lx+My+Nz)$$

or substituting from the equations for $x, y, z, x', y', z'$ the path length is

$$\mathcal{E}-(\alpha-\alpha_0)\mathcal{E}_\alpha-(\beta-\beta_0)\mathcal{E}_\beta-(\gamma-\gamma_0)\mathcal{E}_\gamma;$$

that is, since $\mathcal{E}$ is homogeneous of the first order in $\alpha, \beta, \gamma$, the path is

$$\alpha_0\mathcal{E}_\alpha+\beta_0\mathcal{E}_\beta+\gamma_0\mathcal{E}_\gamma$$

which depends only on the object point $(x, y, z)$. There is thus no aberration in the image of this point. Moreover the aggregate of these object points forms a surface. For $\mathcal{E}$ satisfies a homogeneous relation of the form $\theta(\mathcal{E}, \alpha, \beta, \gamma)=0$, to which we can add three homogeneous equations

$$\frac{\theta_\alpha}{\mathcal{E}_\alpha}=\frac{\theta_\beta}{\mathcal{E}_\beta}=\frac{\theta_\gamma}{\mathcal{E}_\gamma}=-\epsilon_s.$$

On eliminating the ratios $\alpha$, $\beta$ and $\gamma$ bear to $\mathcal{E}$ between these four equations we obtain a relation of the form $\phi(\mathcal{E}_\alpha, \mathcal{E}_\beta, \mathcal{E}_\gamma)=0$, and if $\mathcal{E}_\alpha$, $\mathcal{E}_\beta$, $\mathcal{E}_\gamma$ are replaced by their values in terms of $x$, $y$, $z$ and of $x'$, $y'$, $z'$ we obtain the equations of the object and image surfaces. From the linear character of $\alpha$, $\beta$, $\gamma$ it follows that the image surface can at most be a regular deformation of the object surface.

The converse process of constructing the eikonal which will yield given aplanatic surfaces can be carried out. It is merely a slight generalization of the process by which the eikonal was constructed for a given refracting surface.

In general a given optical system can have only one pair of aplanatic surfaces, for $\mathcal{E}$ can only be expressed in one way as a homogeneous function of the direction cosines. Spherically symmetrical systems are exceptional. For example if

$$\mathcal{E}=(\alpha^2+\beta^2+\gamma^2)^{\frac{1}{2}}$$

where $\alpha=pL+qL'$, $\beta=pM+qM'$, $\gamma=pN+qN'$,

we may, in consequence of the identities

$$L^2+M^2+N^2=1=L'^2+M'^2+N'^2,$$

rewrite the equation in the form $\mathcal{E}=(\alpha'^2+\beta'^2+\gamma'^2)^{\frac{1}{2}}$ where

$$\alpha'=qL+pL',\ \beta'=qM+pM',\ \gamma'=qN+pN'.$$

Corresponding to the first form we have the conjugate surfaces

$$\mu^2(x^2+y^2+z^2)=p^2,\ \mu'^2(x'^2+y'^2+z'^2)=q^2,$$

and corresponding to the second the pair

$$\mu^2(x^2+y^2+z^2)=q^2,\ \mu'^2(x'^2+y'^2+z'^2)=p^2.$$

Thus with a sphere, since its surface is self-conjugate, we may put $p=\mu r$, $q=\mu' r$, and the alternative solution shows that the concentric spheres of radii $r\mu'/\mu$ and $r\mu/\mu'$ are respectively aplanatic conjugate object and image surfaces.

**Asymmetrical Systems.**—We have discussed at some length the properties of symmetrical lens systems because they form by far the most important section of geometrical optics. The expressions that have been given enable all the ordinary problems to be dealt with—for example the paraxial expressions are sufficiently accurate to determine how large any simple lens must be to pass the rays the instrument should transmit. It is also a simple matter to derive a number of well-known conclusions from the general laws that have been given—for example that the use of an optical instrument will not enable a brighter image of an object subtending an appreciable angle to be formed on the retina of an observer's eye. The reader is not likely to encounter any difficulty arising from the use of prisms inserted for the reflection of light at plane surfaces into the system, for they are equivalent to the insertion of a thick plate of glass with plane parallel faces. Methods of designing prisms to produce desired results cannot be considered in detail here. As a rule a trigonometrical procedure is adopted, but algebraic methods employing matrices appear to offer decided advantages.

There remain systems of much importance without axial symmetry. The theory of such systems, though not difficult, is much more involved than that of axially symmetrical systems. Taking systems in which all the surfaces are met normally by some straight line, and yield symmetrical sections when cut by any plane through this line, which may be called the axis, we find that in place of the second degree matrix for the axially symmetrical system we have to adopt a square matrix of the fourth degree, with sixteen constituent elements. Between these sixteen quantities six independent identities subsist, so that at most there are ten degrees of freedom for paraxial rays. For an account of these quantities, their connections with the positions of the rays and with various expressions giving the lengths of paths through the system, reference should be made to the *Transactions of the Optical Society*. When we proceed to higher order terms representing aberrations the complexity of the theory is enhanced. For example corresponding to the six coefficients for the lowest order monorythmic aberrations in axially symmetric systems we have in these unsymmetrical systems no less than thirty-five coefficients.

**Experimental Methods.**—The marked changes in the way optical instruments have come to be regarded in recent years is reflected in experimental applications of the theory. A good example is afforded by the use of modified types of Michelson interferometers for the testing of optical instruments. This application of interference is due to F. Twyman. An instrument of this type, equipped for varied work, has been constructed by Messrs. Adam Hilger, Ltd., for the National Physical Laboratory, at Teddington, England. Many other interference methods have recently been described. Space will not permit us to discuss many interesting points which arise in the use of these and other methods of investigating the properties of optical instruments experimentally. (*See* LENS.)

BIBLIOGRAPHY.—Nearly all authorities deal with the geometrical theory only, and some are chiefly of value on account of miscellaneous articles.

*See* for historical interest mainly: H. Coddington, *Treatise on the Reflexion and Refraction of Light;* W. R. Hamilton, "Theory of Systems of Rays" (4 papers from the *Proceedings of the Royal Irish Academy* which serve as a starting point for modern work); R. Smith, *Compleat System of Opticks.*

More modern works are: S. Czapski and O. Eppenstein, *Grundzüge der Theorie der optischen Instrumente;* H. Geiger and K. Scheel, *Handbuch der Physik; XVIII. H. Konen, Geometrische Optik;* R. T. Glazebrook, *Dictionary of Applied Physics; IV. Optics;* R. S. Heath, *Geometrical Optics;* R. A. Herman, *Geometrical Optics;* M. von Rohr (trans. R. Kanthack), *Formation of Images in Optical Instruments;* J. P. C. Southall, *Principles and Methods of Geometrical Optics;* Steinheil and Voit (trans. J. W. French), *Applied Optics;* G. C. Steward: *The Symmetrical Optical System* (Tract); H. D. Taylor, *A System of Applied Optics.*

For the physical principles involved reference may be made to the optical papers of the late Lord Rayleigh. The writings of A. Gullstrand are important for the optics of spectacle lenses.

Most recent work has been described in journals devoted to optics, of which the chief are the *Transactions of the Optical Society, Revue d'Optique, Journal of the Optical Society of America,* and *Rivista d'Ottica.*

Valuable contributions will also be found in *Zeitschrift für Instrumentenkunde, Die Naturwissenschaften, Phil. Trans., Proceedings of the Physical Society,* and many others. An extensive bibliography is given by Czapski and Eppenstein. (T. SM.)

**OPTIMISM,** in philosophy, is the theory that the world is the best possible, or that life is worth living (to allude to the popular form of the problem). For a discussion of this question *see* MELIORISM; PESSIMISM; PLATO; LEIBNITZ; HEGEL; also J. Sully, *Pessimism* (1877).

**OPTIMUM POPULATION.** The origin of this term is not clear. Since the World War it has come into common use to indicate a conception of the relation between population and the produce of industry to which Prof. Edwin Cannan first gave clear expression. The optimum theory of population which is outlined in what follows was not held by Malthus or by the older authors who discussed the population problem. It was their failure to formulate this theory which robs their treatment of the matter of much of its value. This conception which lies at the basis of the position now taken by all authorities may be briefly expressed as follows. At any given time the population which can exist on a given extent of land, consistently with the attainment of the maximum return to industry possible at the time, is definite. In other words, for any given area of land under any given set of circumstances there is an optimum population. If population is at the optimum number the greatest return per head possible under the circumstances will be attained. Departure from the optimum, whether in the direction of deficiency or of excess, will be accom-

panied by a return per head less than the possible return. Departure in the direction of deficiency is called under-population and departure in the direction of excess is called over-population. It is important to realize that no distinction is to be drawn between agriculture and manufacture in relation to this matter. In Prof. Cannan's words "if we start from what I have called the point of maximum return, we can say of manufacture as well as of agriculture that returns diminish as we move in either direction from that point." It is therefore essential from the point of view of economic prosperity that the population of any country should approach as closely as possible to the optimum. Over and under-population alike imply a smaller income per head than could be attained with smaller and larger numbers respectively. Unfortunately attempts to ascertain whether under- or over-population exist meet with the utmost difficulties. Unemployment is not necessarily an indication of over-population and the comparison of figures for the national income over a period of years is an uncertain guide. It is not possible to say whether or not England or the United States are over- or under-populated. It is, however, generally held that parts of India and China are probably over-populated. It is in other words probably true that the inhabitants of these countries would be better off if the population was less dense. (*See* POPULATION.)

BIBLIOGRAPHY.—L. Robbins, "The Optimum Theory of Population" in *London Essays in Honour of Edwin Cannan* (1927).

(A. M. C.-S.)

**OPTION,** the action of choosing, choice, or the opportunity of choosing. In ecclesiastical law "option" was the right claimed by an archbishop to select one benefice from the diocese of a newly-appointed bishop, the next presentation to which would fall to his, the archbishop's, patronage. This right was abolished in the early 19th century. For the stock exchange "option" see *infra* OPTIONS. "Local option" or "local veto" in politics is the power given to the electorate of a particular district to choose whether licences for the sale of intoxicating liquor shall be granted or not. (*See* LIQUOR LAWS.)

**OPTIONS.** Option dealing is practised more extensively on the Continent of Europe than in Great Britain or America, but in normal times a fair amount of business of this description is carried out daily on the London and American Stock Exchanges. Option dealing is a complicated matter, and is indulged in more by professional than amateur speculators. As the name implies, an option is a right over certain stocks, commodities or things. It may be the right to buy or the right to sell. In the former case it is termed a "call" option, *i.e.*, the holder of the option has the right to take up the shares or whatever it is; in the case of an option to sell, it is termed a "put" option, the holder having the right to sell the shares to the person with whom he has entered into the bargain constituting the option. It is possible to buy a "put and call" option, which gives the holder the right either to deliver and obtain payment for the stipulated quantity of stock at a date and price arranged when the bargain is entered into, or to call for delivery to him of the same amount of stock at the same price and at the same date.

The first column of the typical table of option rates reproduced represents the price to be paid for an option running for one month—or to be more precise, to the third account day after date of dealing; the second column is for an option running yet another month or the fifth account day after dealing. The rules of the Stock Exchange do not permit of dealing in options which run for more than three months or the seventh ensuing account day. The price stated is for either a call option or a put option, and the double option (put and call) can be purchased for double the price named. The first price in the list of 2¼ means that for every £2.5.0 paid at the time the bargain was entered into, the Stock Exchange jobber would give the purchaser of a call option the right to buy of him for settlement on the third subsequent account day £100 of Great Western Ordinary stock at a given price. This would be approximately the price of the day on which the option bargain was entered into, plus perhaps a fractional increase to allow for the fact that by the time the option was exercised the dividend date would be nearer. The holder of a call option, when he comes to exercise it, is entitled to all dividends, bonuses or subscription rights that may have accrued during the period of his option. In the case of a put option the holder would have to deliver any dividends or bonuses accrued; the price would be the same.

| Call or Put of | Settlements 9th Nov. | Settlements 7th Dec. | Call or Put of | Settlements 9th Nov. | Settlements 7th Dec. |
|---|---|---|---|---|---|
| HOME RAILS | | | MINES (Contd.) | | |
| Gt. Western | 2¼ | 2¾ | De Beers | 9/16 | ⅝ |
| L. M. S. | 1½ | 1⅝ | East Rand | 2/6 | 2/9 |
| Do. 4 pc Pf ('23) | 3 | 3¼ | Gen. Mining | 3/6 | 4/– |
| L.N.E. 1st Pref. | 3 | 3¼ | Gold Co. Select | 1/6 | 1/9 |
| Do. 2nd Pref. | 1½ | 1⅝ | Gold Fields | 2/6 | 3/– |
| Southern Def. | 1½ | 1⅝ | Johnnies | 2/6 | 3/– |
| MISCELLANEOUS | | | Kwahu | 2/9 | 3/3 |
| Austin | 2/– | 2/6 | Luipaards Vlei | 1/1½ | 1/4½ |
| Brit. Oxygen | 3/6 | 4/– | Marievale | 1/3 | 1/6 |
| Cements | 3/6 | 4/– | New Kleinfont'n. | 3/– | 3/3 |
| Coats | 2/– | 2/3 | Randfontein Est. | 2/4½ | 2/7½ |
| Courtaulds | 2/– | 2/3 | Rand Leases | 2/– | 2/3 |
| Distillers | 3/– | 3/6 | Rhodesian Ang. American | 1/9 | 2/3 |
| Dunlop Rubber | 2/– | 2/3 | Rhodesian Selection Trust | 1/3 | 1/4½ |
| Ford Motor | 1/4½ | 1/7½ | Rhokana | ⅝ | 11/16 |
| Imp. Chem. Ord. | 1/3 | 1/6 | Roan | 1/4½ | 1/7½ |
| Imp. Tobacco | 3/9 | 4/3 | Robinson Dp. B. | 2/6 | 3/– |
| Marks & Spen "A" | 3/6 | 4/– | Selection Trust | 1/3 | 1/6 |
| United Molasses | 1/6 | 1/9 | Simmers | 1/– | 1/3 |
| Vickers | 1/4½ | 1/7½ | Spaarwater | –/7½ | –/8¼ |
| Woolworths | 3/– | 3/6 | Venterspost | 2/3 | 2/9 |
| OILS | | | Vlakfontein | 1/9 | 2/– |
| Anglo-Ecuadorian | 2/– | 2/3 | Vogels | 2/– | 2/3 |
| Anglo-Iranian | 3/6 | 4/– | West Wits | 10/– | 11/6 |
| Apex Trinidad | 2/– | 2/3 | Westn. Holdings. | 1/7½ | 1/10½ |
| Attock | 3/6 | 4/– | Western Reefs | 2/– | 2/3 |
| Burmah | 3/6 | 4/– | AMERICANS ($ calculated at five to £) | | |
| Canadian Eagle | 1/– | 1/1½ | Amer. Celanese | 10/– | 12/– |
| Kern River | –/7½ | –/9 | Anaconda | 10/– | 12/– |
| Lobitos | 2/3 | 2/9 | Atchison | 3¾ | 4 |
| Mexican Eagle | 1/– | 1/1½ | Beth. Steel | 4¾ | 5¼ |
| Royal Dutch | 1¾ | 2 | Brazilian Tract. | 1⅛ | 1¼ |
| Shells | 3/1½ | 3/7½ | Canadian Pacific | ⅝ | ¾ |
| V.O.C. | 2/– | 2/3 | Chrysler | 5½ | 6 |
| RUBBER | | | Consd. Edison | 2½ | 2¾ |
| Anglo-Dutch | 2/– | 2/3 | Elec. Bond | 1⅛ | 1⅜ |
| Grand Central | 1/3 | 1/6 | Gen. Motors | 3¼ | 3¾ |
| Malayam | 1/6 | 2/– | Hydro | ⅝ | ¾ |
| Rubber Trust | 2/– | 2/3 | Inter. Nickel | 2¼ | 2¾ |
| United Serdang | –/6 | –/7½ | Internatn'l Tel. | 1 | 1⅛ |
| MINES | | | Montgomery W. | 3¼ | 3¾ |
| Am. Bank Areas | 1/– | 1/1½ | New York Cent. | 1¾ | 2 |
| Ang. Am. Corpn. | 3/– | 3/3 | Radio | ⅞ | 1 |
| Ang. Invest. Tst. | 2/– | 2/3 | Republic Steel | 1⅛ | 2⅛ |
| Ashanti | 3/– | 3/6 | Southern Com. | 2 | 2¼ |
| Bibiani | 1/9 | 2/3 | Southern Pacific | 1⅛ | 2⅛ |
| Blyvoors | 1/– | 1/1½ | U. S. Steel | 5 | 5½ |
| Burma Corpn. | 1/– | 1/1½ | | | |
| Chartered | 1/6 | 1/9 | | | |

**Intricacies of Options.**—Thus far it might appear as though the complications of option dealing had been exaggerated; but now we approach some of the intricacies of the business. To the uninitiated the purchase of a call option would appear to be a perfectly simple matter. The speculator buys an option entitling him to take up five account days later—say 10 or 11 weeks—£10,000 of Great Western Railway Ordinary stock at, say, 28%. He waits until towards the end of his option, and then if the price is 33 he sells in the market £10,000 of stock at that price, calls stock in respect of his option at 28 and delivers it in satisfaction of his sale, netting the difference as profit, less his brokerage charges. If during the period of his option the stock has fallen, he simply allows it to lapse, his loss being confined to the cost of the option.

That is how an option transaction appears to the layman. That is not, however, in the least the idea of the average purchaser of an option. What he desires is not to enter into a bet as to what

the price will be on a certain date, but to be able to avail himself of market fluctuations during the life of his option. Suppose, in the case named, that a week after the option has been purchased the price rises to 31, the holder of the option cannot demand delivery of the stock before the expiry of the option, and if he sells a week after he has bought his option, he will be called upon *at the next settlement* to deliver the stock he has sold. That is, however, just the sort of position that the experienced option speculator desires. He sells at 31 for the next account, feeling that he is in the position of a "protected bear." When the settlement arrives he does not deliver, but has the bargain carried over, and as the stock has risen there will probably be a number of investors for the rise ("bulls") who are desirous of not taking up the stock they have purchased, but wish to carry over their bargains, and have to pay interest for so doing. Our "protected bear," therefore, so far from having to pay for the privilege of not delivering the stock he has sold, may receive payment for not doing so. If within the next few days or weeks Great Western Ordinary falls a point or more, he can repurchase the stock he has sold (close his "bear") and is in the position where he started, with part of his option still to run. In a fluctuating market this process might be repeated several times during the course of the option, making it possible for the holder to realize several profits from the variations in price.

All sorts of combinations of this nature are possible with options, and there are a few men in London, usually foreigners, who have the reputation of being exceptionally clever in this class of dealing, and of making large profits out of it. The brokerage on options is exactly the same as if the actual stock were purchased.

Options as described above should not be confused with *Option Certificates* which are quoted in the ordinary sections of the Stock Exchange lists. A company will sometimes issue certificates conferring upon the holder the right to take up shares at a certain price within a certain period, and these option certificates are dealt in just as though they were shares. (A. E. Da.)

**OPTOMETRY,** the science which relates to the examination of the eyes, the analysis of their function, and the employment of preventive or corrective measures to ensure, through proper glasses, the maximum vision and comfort, but without the use of drugs or medicines. The name was adopted in 1904. The number of practitioners is estimated to be fully 15,000, chiefly in the United States and the British Empire.

**OPTOPHONE,** an instrument invented by E. E. Fournier d'Albe in 1914 which enables the blind to read ordinary letterpress such as printed books or newspapers. The invention thus places within reach of the blind the entire range of world literature, while previously their only means of reading—by raised letter systems—necessitated special books, both bulky and expensive.

The instrument depends for its action upon the chemical element, selenium, the electrical conductivity of which varies greatly in accordance with the amount of light to which it is exposed. Such a light-sensitive selenium bridge is placed between two separate conducting lines of graphite resting on a porcelain tablet and the whole connected in series with an electric battery to a telephone receiver. A beam of light is rendered intermittent by the interposition of a revolving siren disc and is then concentrated into a small bright point on the letter to be read. This is reflected back onto the selenium bridge. As the selenium bridge is exposed to the forms of letters in the line traversed, its changes in conductivity produce a succession of varying notes and chords in the telephone receiver, each letter having its characteristic sound. That is its simple form. Actually in the regular instrument a row of five or six luminous points just filling up the size of the tallest letters to be read is substituted for a single point, and each point is given a different frequency by suitably perforating the disc. A blind reader does not analyze the resulting sounds, but soon comes to recognize the general sound of each letter and in time knows his alphabet of sounds. Later in his practice the succession of sounds which make up certain words becomes familiar. Controlling apparatus to regulate the speed and position of the tracer is designed with a view to ease of manipulation by blind persons. After 1920 developments in amplification enabled the sounds to be made audible to any number in a room if desired, though individual receivers were retained for silent reading. (*See* Selenium Cells.)

**OPZOOMER, CORNELIUS WILLIAM** (1821–1892), Dutch philosopher, was born in Rotterdam on Sept. 20, 1821. He studied at the University of Leyden, receiving the degree of doctor of law in 1845. In 1846 he was appointed professor of philosophy at the University of Utrecht, which position he held the remainder of his life. His specialty was jurisprudence and many of his numerous writings were in that field, notably *Scheiding van Kerk en Staat* (1875), in which he sustained the primacy of the civil power, and a commentary on the civil code of Holland (11 vols., 1864–87). His greatest influence, however, was in the field of philosophy. He was an empiricist of the positivistic type. His thought can best be traced in such of his writings as *Der Weg de Wetenschap* (1851), *Wetenschap en Wijsbegeerte* (1857), *Het Wezen der Kennis* (1863), *De Waarheid en hare Kenbronnen* (1863), *De Godsdienst* (1864), *Goethe's Godsdienst* (1868), and *Ein Nieuwe Kritick der Wijsbegeerte* (1871). He advocated expulsion of the unscientific from religion, believing that the latter would be left unimpaired, and that it would lead to the reconciliation of religion and science and bring about a new Reformation. Though vigorously opposed at first his views rapidly gained adherents and he became the leader of the liberals and the founder of modern theology in his country. He was also a widely read man of letters, translated the *Antigone* of Sophocles and the *Julius Caesar* of Shakespeare into Dutch, and published (1872) a volume of critical studies on the great English dramatist. He died in Osterbeck on Aug. 23, 1892.

**ORACH** or **MOUNTAIN SPINACH** (called also sea purslane), known botanically as *Atriplex hortensis* (family, Chenopodiaceae), is a tall-growing hardy annual, whose leaves, though coarsely flavoured, are very often used as a substitute for spinach when young. The white and the green are the most desirable varieties. The plant should be grown quickly in rich soil. It may be sown in rows 2 ft. apart, and about the same distance in the row, about April, and for succession again in June. If needful, water must be given freely, so as to maintain a rapid growth. A variety, with reddish foliage, is a hardy annual 3 to 4 ft. high and sometimes grown for ornament.

**ORACLE,** a special place where a deity is supposed to give a response, by the mouth of an inspired priest, to the enquiries of his votaries, or the actual response. (Lat. *oraculum,* from *orare,* to speak; the corresponding Greek word is *μαντεῖον* or *χρηστήριον.*) (*See* Divination; Magic.) The whole question of oracles is bound up with that of magic. They are commonly found in the earlier stages of religious culture among different nations. But it is as an ancient Greek institution that they are most interesting historically.

A characteristic feature of Greek religion which distinguishes it from many other systems of advanced cult was the wide prevalence of a ritual of divination and the prominence of certain oracular centres which were supposed to give voice to the will of Providence. In the Greek world the methods of divination were of great variety, but nearly all can be traced among other communities, primitive and advanced, ancient and modern. The most obvious and useful classification of them is that of which Plato was the author, who distinguishes between (*a*) the "sane" form of divination and (*b*) the ecstatic, enthusiastic or "insane" form (Phaedrus p. 244). The first method appears to be cool and scientific, the diviner (*μάντις*) interpreting certain signs according to fixed principles of interpretation. The second is worked by the prophet, shaman or Pythoness, who is possessed and overpowered by the deity, and in temporary frenzy utters mystic speech under divine suggestion. To these we may add a third form (*c*) divination by communion with the spiritual world in dreams or through intercourse with the departed spirit: this resembles class (*a*) in that it does not necessarily involve ecstasy, and class (*b*) in that it assumes immediate *rapport* with some spiritual power.

We may subdivide the methods that fall under class (*a*) according as they deal with the phenomena of the animate or the inanimate world; although this distinction would not be relevant in the period of primitive animistic thought. The Homeric poems attest that auguries from the flight and actions of birds were

commonly observed in the earliest Hellenic period as they occasionally were in the later, but we have little evidence that this method was ever organized as it was at Rome into a regular system of state-divination, still less of state-craft. We can only quote the passage in the *Antigone* where Sophocles describes the method of Teiresias, who keeps an aviary where he studies and interprets the flight and the cries of the birds; it is probable that the poet was aware of some such practice actually in vogue. But normally the Greek augur drew omens from the cries or actions of some bird or beast casually met with (as Hom. *Il.* xiii. 521; Aesch. *Agam.* 109; Serv. Virg. *Aen.* iv. 377; Paus. ii. 19. 3); it is very rare to find such omens habitually consulted in any public system of divination sanctioned by the State. We hear of a shrine of Apollo at Sura in Lycia (Steph. Byz. *s.v.* Σοῦρα; Plutarch, *De sollert. anim.* p. 976 c; Ael. *Nat. anim.* xii. 1) where omens were taken from the movements of the sacred fish that were kept there in a tank; and again of a grove consecrated to this god in Epirus, where tame serpents were kept, and fed by a priestess, who could predict a good or bad harvest according as they ate heartily or came willingly to her or not (Ael. *Nat. anim.* xi. 2).

But the method of animal divination that was most in vogue was the inspection of the inward parts of the victim offered upon the altar, and the interpretation of certain marks found there according to a conventional code. A conspicuous example of an oracle organized on this principle was that of Zeus at Olympia, where soothsayers of the family of the Iamidae prophesied partly by the inspection of entrails, partly by the observation of certain signs in the skin when it was cut or burned (Schol. Pind. *Ol.* 6. 111). Another less familiar procedure that belongs to this subdivision is that which was known as divination *διὰ κληωδόνν*, which might sometimes have been the cries of birds, but in an oracle of Hermes at the Achaean city of Pharae were the casual utterances of men. Pausanias (VII. 22. 2) tells us how this was worked. The consultant came in the evening to the statue of Hermes in the market-place that stood by the side of a hearth-altar to which bronze lamps were attached; having kindled the lamps and put a piece of money on the altar, he whispered into the ear of the statue what he wished to know; he then departed, closing his ears with his hands, and whatever human speech he first heard after withdrawing his hands he took for a sign. The same custom seems to have prevailed at Thebes in a shrine of Apollo, and in the Olympian oracle of Zeus (Farnell, *Cults* iv. 221).

Of omens taken from what we call the inanimate world salient examples are those derived from trees and water. Both were in vogue at Dodona, where the ecstatic method of prophecy was never used; we hear of divination there from the bubbling stream, and still more often of the "talking oak"; under its branches may once have slept the Selloi, who interpreted the sounds of the boughs. (Hom. *Il.* xvi. 233, *Od.* xiv. 327; Hesiod, *ap.* Schol. Soph. *Trach.* 1169; Aesch. *Prom. Vinct,* 820). At Corope in Thessaly we hear vaguely of an Apolline divination by means of a branch of the tamarisk tree (Nicander, *Theriaka,* 612, Schol.), and there is a late record that at Daphne near Antioch oracles were obtained by dipping a laurel leaf or branch in a sacred stream (Robertson-Smith *Relig. Sem.* p. 128). We find water divination at Daphne, Taenarum and Patrae. Thunder magic, which was practised in Arcadia, is usually associated with thunder divination; but of this, which was so much in vogue in Etruria (*see* HARUSPICES) and at Rome, the evidence in Greece is singularly slight. Once a year watchers took their stand on the wall at Athens and waited till they saw the lightning flash from Harma, which was accepted as an auspicious omen for the setting out of the sacred procession to Apollo Pythius at Delphi; and the altar of Zeus Σημαλέος, the sender of omens, on Mount Parnes, may have been a religious observatory of meteorological phenomena (Paus. i. 32. 2). No doubt such a rare and portentous event as the fall of a meteor-stone would be regarded as ominous, and the State would be inclined to consult Delphi or Dodona as to its divine import.

We may conclude the examples of this main department of *μαντική* by mentioning a method that seems to have been much in vogue in the earlier times, that which was called *ἡ διὰ ψήφων μαντική*, or divination by the drawing or throwing of lots; these must have been objects, such as small pieces of wood or dice, with certain marks inscribed upon them, drawn casually or thrown down and interpreted according to a certain code. This was practised at Delphi and Dodona by the side of the more solemn procedure; we hear of it also in the oracle of Heracles at Bura in Achaea (Cic. *De div.* i. 76; Suid. *s. v.* *πυδώ*; Paus. vii. 25. 10). It is this method of "scraping" or "notching" (*χράειν*) signs on wood that explains probably the origin of the words *χρησμός*, *χοᾶσθαι*, *ἀναιρεῖν* for oracular consultation and deliverance. In Italy, oracles by lot (*sortes*) are the only native kind of whose existence we are certain; that of *Fortuna* at Praeneste was the best known.

All these methods are world-wide, and may depend on belief in the *mana* of the bird, spring, lot, etc., or in the controlling influence of a spirit or god. And, again, if we are to understand the most primitive thought, we probably ought to conceive of it as regarding the omen not as a mere sign, but in some confused sense as a cause of that which is to happen. By sympathetic magic the flight of the bird, or the appearance of the entrails, is mysteriously connected, as cause with effect, with the event which is desired or dreaded. When of the three beasts over which three kings swore an oath of alliance, one died prematurely and was supposed thereby to portend the death of one of the kings (Plut. *Vit. Pyrrh.* c. 6), or when in the Lacedaemonian sacrifice the head of the victim mysteriously vanished, and this portended the death of their naval commander (Diod. Sic. xiii. 97), these omens would be merely signs of the future for the comparatively advanced Hellene; but we may discern at the back of this belief one more primitive still, that these things were somehow casually or sympathetically connected with the kindred events that followed.

The other branch of the mantic art, the ecstatic or inspired, has had the greater career among the peoples of the higher religions; it is no doubt of great antiquity, and it is found still existing at a rather low grade of savagery. Therefore it is unsafe to infer from Homer's silence about it that it only became prevalent in Greece in the post-Homeric period. It did not altogether supersede the simpler method of divination by omens; but being far more impressive and awe-inspiring, it was adopted by some of the chief Apolline oracles, though never by Dodona.

The most salient example of it is afforded by Delphi. In the historic period, and perhaps from the earliest times, a woman known as the Pythia was the organ of inspiration, and it was generally believed that she delivered her oracles under the direct afflatus of the god. The divine possession worked like an epileptic seizure, and was exhausting and might be dangerous; nor is there any reason to suppose that it was simulated. This communion with the divinity needed careful preparation. Originally, as it seems, virginity was a condition of the tenure of the office; for the virgin has been often supposed to be the purer vehicle for divine communication; but later the rule was established that a married woman over 50 years of age should be chosen, with the proviso that she should be attired as a maiden. As a preliminary to the divine possession, she appears to have chewed leaves of the sacred laurel, and then to have drunk water from the prophetic stream called Kassotis which flowed underground. But the culminating point of the afflatus was reached when she seated herself upon the tripod; and here, according to the belief of at least the later ages of paganism, she was supposed to be inspired by a mystic vapour that arose from a fissure in the ground. Against the ordinary explanation of this as a real mephitic gas producing convulsions, there seem to be geological and chemical objections (*see* Oppe, "The chasm at Delphi," *Journ. Hell. Stud.,* 1904); nor have the recent French excavations revealed any chasm or gap in the floor of the temple. But the strong testimony of the later writers, especially Plutarch (*De defectu Orac.* c. 43), cannot wholly be set aside; and we can sufficiently reconcile it with the facts if we suppose a small crack in the floor through which a draught of air was felt to ascend. This, combining with the other mantic stimulants used, would be enough to throw a believing medium into the condition, familiar enough nowadays, of a "trance." It is probable that what she uttered were only unintelligible murmurs,

and that these were interpreted into relevance and set in metric or prose sentences by the "prophet" and the "holy ones" or Ὅσιοι as they were called, members of leading Delphic families, who sat round the tripod, who received the questions of the consultant beforehand, probably in writing, and usually had considered the answers that should be given.

Examples of the same enthusiastic method can be found in other oracles of Apollo. At Argos, the prophetess of the Apollo Pythius attained to the divine afflatus by drinking the blood of the lamb that was sacrificed in the night to him (Paus. ii. 24. 1); this is obviously a mantic communion, for the sacrificial victim is full of the spirit of the divinity. And we find the same process at the prophetic shrine of Ge at Aegae in Achaea, where the prophetess drank a draught of bull's blood for the same purpose (Farnell, *op. cit.* iii. 11). In the famous oracle shrines of Apollo across the sea, at Clarus and Branchidae near Miletus (the prophetic fountain at Branchidae is attested by Strabo, p. 814, and in a confused mystic passage of Iamblichus, *De Myst.*, 3, 11), the divination was of the same ecstatic type, but produced by a simple draught of holy water. The Clarian prophet fasted several days and nights in retirement and stimulated his ecstasy by drinking from a subterranean spring which is said by Pliny to have shortened the lives of those who used it (*Nat. Hist.* ii. 232). Then, "on certain fixed nights after many sacrifices had been offered, he delivered his oracles, shrouded from the eyes of the consultants" (Iamb. *loc. cit.*).

The divination by "incubation" was allied to this type, because though lacking the ecstatic character, the consultant received direct communion with the god or departed spirit. He attained it by laying himself down to sleep or to await a vision, usually by night, in some holy place, having prepared himself by a course of ritualistic purification. Such consultation was naturally confined to the underworld divinities or to the departed heroes. It appears to have prevailed at Delphi when Ge gave oracles there before the coming of Apollo, and among the heroes Amphiaraus, Calchas and Trophonius are recorded to have communicated with their worshippers in this fashion. And it was by incubation that the sick and diseased who repaired to the temple of Epidaurus received prescriptions from Asclepius.

Turning now to the history of oracles in Greece, we know that the leading one, Delphi, was a seat of prophecy from the earliest days of Greek tradition. Ge, Themis and perhaps Poseidon had given oracles here before Apollo. But it is clear that he had won it in the days before Homer, who attests the prestige and wealth of his Pythian shrine; and it seems clear that before the Dorian conquest of the Peloponnese a Dryopian migration had already carried the cult of Apollo Pythius to Asine in Argolis. Also the constitution of the Amphictyones, "the dwellers around the temple," reflects the early age when the tribe rather than the city was the political unit, and the Dorians were a small tribe of north Greece. The original function of these Amphictyones was to preserve the sanctity and property of the temple; but this common interest early developed a certain rule of intertribal morality. By the formula of the Amphictyonic oath preserved by Aeschines, which may be of great antiquity, the members bound themselves "not to destroy any city of the league, not to cut any one of them off from spring-water, either in war or peace, and to war against any who violated these rules." We discern here that Greek religion offered the ideal of a federal national union that Greek politics refused to realize.

The next stage in the history of the oracle is presented by the legend of the Dorian migration. For we have no right to reject the strong tradition of the Delphic encouragement of this movement, which well accounts for the devotion shown by Sparta to the Pythian god from the earliest days; and accounts also for the higher position that Delphi occupied at the time when Greek history is supposed to begin.

We have next to consider a valuable record that belongs to the end of the 8th century or beginning of the 7th, the Homeric hymn to Apollo, which describes the coming of the Dolphin-god Δελφίνιος to Pytho, and the organization of the oracle by Cretan ministers. Of this Cretan settlement at Delphi there is no other literary evidence, and the Ὅσιοι who administered the oracle in the historic period claimed to be of aboriginal descent. Yet recent excavation has proved a connection between Crete and Delphi in the Minoan period; and there is reason to believe that in the 8th century some ritual of purification, momentous for the religious career of the oracle, was brought from Crete to Delphi, and that the adoption of this latter name for the place which had formerly been called Πυθώ synchronized with the coming of Apollo Delphinius.

The influence of Delphi was great in various ways. We may first consider its political influence upon the other states. The practice of a community consulting an oracle on important occasions undoubtedly puts a powerful weapon into the hands of the priesthood, and might lead to something like a theocracy. And there are one or two ominous hints in the *Odyssey* that the ruler of the oracle might overthrow the ruler of the land. Yet owing to the healthy temperament of the early Greek, the civic character of the priesthood, the strength of the autonomous feeling, Greece might flock to Delphi without exposing itself to the perils of sacerdotal control. The Delphic priesthood, content with their rich revenues, were probably never tempted to enter upon schemes of far-reaching political ambition, nor were they in any way fitted to be the leaders of a national policy. Once only, when the Spartan State applied to Delphi to sanction their attack on Arcadia, did the oracle speak as if, like the older papacy, it claimed to dispose of territory (Herod. i. 66)—"Thou askest of me Arcadia; I will not give it thee." But here the oracle is on the side of righteousness, and it is the Spartan that is the aggressor. In the various oracles that have come down to us, many of which must have been genuine and preserved in the archives of the State that received them, we cannot discover any marked political policy consistently pursued by the "holy ones" of Delphi. As conservative aristocrats they would probably dislike tyranny; their action against the Peisistratidae was interested, but one oracle contains a spirited rebuke to Cleisthenes, while one or two others, perhaps not genuine, express the spirit of temperate constitutionalism. As exponents of an Amphictyonic system they would be sufficiently sensitive of the moral conscience of Greece to utter nothing in flagrant violation of the "ius gentium." In one department of politics, the legislative sphere, it has been supposed that the influence of Delphi was direct and inspiring. Plato and later writers imagined that the Pythia had dictated the Lycurgan system, and even modern scholars like Bergk have regarded the ἐήτεαι of Sparta as of Delphic origin. But a severer criticism dispels these suppositions. The Delphic priesthood had neither the capacity nor probably the desire to undertake so delicate a task as the drafting of a code. They might make now and again a general suggestion when consulted, and, availing themselves of their unique opportunities of collecting foreign intelligence, they might often recommend a skilful legislator or arbitrator to a state that consulted them at a time of intestine trouble. Finally, a legislator with a code would be well advised, especially at Sparta, in endeavouring to obtain the sanction and the blessing of the Delphic god, that he might appear before his own people as one possessed of a religious mandate. In this sense we can understand the stories about Lycurgus.

There is only one department of the secular history of Greece where Delphi played a predominant and most effective part, the colonial department. The great colonial expansion of Greece, which has left so deep an imprint on the culture of Europe, was in part inspired and directed by the oracle. For the proof of this we have not only the evidence of the χρησμοί preserved by Herodotus and others, such as those concerning the foundation of Cyrene, but also the worship of Apollo Ἀρχηγέτης, "the Founder," prevalent in Sicily and Magna Graecia, and the early custom of the sending of tithes or thanksgiving offerings by the flourishing western states to the oracle that had encouraged their settlements.

Apollo was already a god of ways, Ἀγυιεύς, who led the migration of tribes before he came to Delphi. And those legends are of some value that explain the prehistoric origin of cities such as Magnesia on the Maeander, the Dryopian Asine in the Peloponn-

nese, as due to the colonization of temple-slaves, acquired by the Pythian god as the tithe of conquests, and planted out by him in distant settlements. The success of the oracle in this activity led at last to the establishment of the rule that Herodotus declares to be almost universal in Greece, namely, that no leader of a colony would start without consulting Delphi. Doubtless in many cases the priesthood only gave encouragement to a preconceived project. But they were in a unique position for giving direct advice also, and they appear to have used their opportunities with great intelligence.

Their influence on the state cults can be briefly indicated, for it was not by any means far-reaching. They could have felt conscious of no mission to preach Apollo, for his cult was an ancient heritage of the Hellenic stocks. Only the narrower duty devolved upon them of impressing upon the consultants the religious obligation of sending tithes or other offerings. Nevertheless their opportunity of directing the religious ritual and organization of the public worships was great; for Plato's view (Rep. 427A) that all questions of detail in religion should be left to the decision of the god "who sits on the *omphalos*" was on the whole in accord with the usual practice of Greece. Such consultations would occur when the State was in some trouble, which would be likely to be imputed to some neglect of religion, and the question to the oracle would commonly be put in this way—"to what god or goddess or hero shall we sacrifice?" The oracle would then be inclined to suggest the name of some divine personage hitherto neglected, or of one whose rites had fallen in decay. Again, Apollo would know the wishes of the other divinities, who were not in the habit of directly communicating with their worshippers; therefore questions about the sacred land of the goddesses at Eleusis would be naturally referred to him. From both these points of view we can understand why Delphi appears to have encouraged the tendency towards hero-worship which was becoming rife in Greece from the 7th century onwards. But the only high cult for which we can discover a definite enthusiasm in the Delphic priesthood was that of Dionysus. And his position at Delphi, where he became the brother-deity of Apollo, sufficiently explains this.

As regards the development of religious morality in Greece, we must reckon seriously with the part played by the oracle. The larger number of deliverances that have come down to us bearing on this point are probably spurious, in the sense that the Pythia did not actually utter them, but they have a certain value as showing the ideas entertained by the cultivated Hellene concerning the oracular god. On the whole, we discern that the moral influence of Delphi was beneficent and on the side of righteousness. It did nothing, indeed, to abolish, it may even have encouraged at times, the barbarous practice of human sacrifice, which was becoming abhorrent to the Greek of the 6th and 5th centuries; but a conservative priesthood is always liable to lag behind the moral progress of an age in respect of certain rites, and in other respects it appears that the "Holy Ones" of Delphi kept well abreast of the Hellenic advance in ethical thought. An oracle attributed to the Pythoness by Theopompus (Porph. *De abstinentia,* 2, 16 and 17) expresses the idea contained in the story of "the widow's mite," that the deity prefers the humble offering of the righteous poor to the costly and pompous sacrifice of the rich. Another, of which the authenticity is vouched for by Herodotus (vi. 86), denounces the contemplated perjury and fraud of a certain Glaucus, and declares to the terrified sinner that to tempt God was no less a sin than to commit the actual crime. A later *χρησμός*, for which Plutarch (*De Pyth. Or.,* p. 404 B) is the authority, embodies the charitable conception of forgiveness for venial faults committed under excessive stress of temptation: "God pardons what man's nature is too weak to resist." And in one most important branch of morality, with which progressive ancient law was intimately concerned, namely, the concept of the sin of homicide, we have reason for believing that the Apolline oracle played a leading part. Perhaps so early as the 8th century, it came to lay stress on the impurity of bloodshed and to organize and impose a ritual of purification; and thus to assist the development and the clearer definition of the concept of murder as a sin and the growth of a theory of equity which recognizes extenuating or justifying circumstances (Farnell, *Cults.* iv. 300). Gradually, as Greek ethics escaped the bondage of ritual and evolved the idea of spiritual purity of conscience, this found eloquent expression in the utterances imputed to the Pythia (Ael. *Var. Hist.* iii. 44; Anth. Pal. xiv. 71 and 74). Many of these are no doubt literary fictions; but even these are of value as showing the popular view about the oracular god, whose temple and tripod were regarded as the shrine and organ of the best wisdom and morality of Greece. The downfall of Greek liberty before Macedon destroyed the political influence of the Delphic oracle; but for some centuries after it still retained a certain value for the individual as a counsellor and director of private conscience. But in the latter days of paganism it was eclipsed by the oracles of Claros and Branchidae.

BIBLIOGRAPHY.—A. Bouché-Leclerq, *Histoire de la divination dans l'antiquité,* in 4 vols., is still the chief work: *cf.* L. R. Farnell, *Cults of the Greek States,* vol. iv. pp. 179–233; Buresch, *Apollo Klarios;* Bernard Haussoullier, *Études sur l'histoire de Milet et du Didymeion;* Legrand, "Questions oraculaires" in *Revue des études grecques,* vol. xiv.; T. D. Dempsey, *The Delphic Oracle* (1918); Ch. Picard, *Ephèse et Claros* (1922); Pomtow on "Delphoi" in Pauly-Wissowa, *Realencyklopädie.*

ANCIENT AUTHORITIES.—Plutarch, *De Pythiae oraculis* and *De defectu oraculorum;* Cicero, *De divinatione;* Euseb. *Praep. Ev.* 4, 2, 14.

(X.; H. J. R.)

**ORADEA MARE,** a town of Transylvania; ceded to Hungary by Rumania in 1940. Pop. (1939) 82,687, mainly Magyar. It is situated in a plain on both banks of the river Crisul Repede, and is the seat of a Roman Catholic and of a Greek Uniate Bishopric (founded 1776). Among its principal buildings are the St. Ladislaus parish church, built in 1723, which contains the remains of the king St. Ladislaus (d. 1095), the Roman Catholic cathedral, built in 1752–1779, the Greek cathedral, the large rococo palace of the Roman Catholic bishop, built in 1778, and the archaeological and historical museum. There is a law academy, a seminary for priests, a modern school, a Roman Catholic and a Calvinistic gymnasium, a commercial academy, a training school for teachers and a secondary school for girls. Oradea Mare is an important railway junction; it possesses extensive manufactures of pottery and large distilleries, and carries on a brisk trade in agricultural produce, cattle, horses, fruit and wine.

Oradea Mare is a very old town; its bishopric was founded by St. Ladislaus in 1080. The town was destroyed by the Tatars in 1241. Peace was concluded here on Feb. 24, 1538 between Ferdinand I. of Austria and his rival John Zápolya, voivode of Transylvania. In 1556 it passed to Transylvania, but afterwards reverted to Austria. In 1598 the Turks besieged the fortress unsuccessfully, but took it in 1660 and held it till 1692. After World War I it was ceded to Rumania and in Aug. 1940 back to Hungary.

**ORAKZAI,** a Pathan tribe on the Kohat border of the North-West Frontier province of India. The Orakzais inhabit the mountains to the northwest of Kohat district, bounded on the N. and E. by the Afridis, on the S. by the Miranzai valley and on the W. by the Zaimukht country and the Safed Koh mountains. Their name means "lost tribes," and their origin is buried in obscurity; although they resemble the Afghans in language, features and many of their customs, they are rejected by them as brethren. One branch, the Ali Khel, has been traced to Swat, whence they were expelled by the other inhabitants, and it is not improbable that the whole tribe consists of refugee clans of the surrounding races. They are very wiry-looking mountaineers. (*See* TIRAH).

**ORAN,** a city and port of Algeria, capital of the department and military division of the same name, stands at the head of the Gulf of Oran, on the Mediterranean, in 35° 44′ N., 0° 41′ W. The city is 261 mi. by rail W.S.W. of Algiers, 220 mi. E. of Gibraltar and 130 mi. S. of Cartagena, Spain. It is built on the steep slopes of the Jebel Murjajo, which rises to a height of 1,900 ft. The city was originally cut in two by the ravine of Wad Rehhi, now for the most part covered by boulevards and buildings. West of the ravine lies the old port, and above this rises what was the Spanish town, with the ancient citadel looking down on it. Few traces of Spanish occupation remain. The modern quarter rises, like an amphitheatre, to the east of the ravine. A ring of populous

suburbs, Montplaisant, Gambetta, Saint-Eugène, Eckmühl, encircle it from northeast to southwest. The Place d'Armes, built on the plateau above the ravine, contains a fine column commemorative of the battle of Sidi Brahim (1845), between the French and Abd-el-Kader. The Château Neuf, built in 1563 by the Spaniards and formerly the seat of the beys of Oran, is surrounded by the beautiful Promenade de l'Etang, which overlooks the port. The *kasbah* (citadel) or Château Vieux, used for military purposes, lies southwest of the Château Neuf. Behind the *kasbah* are Fort St. Grégoire and Fort Santa Cruz, crowning, at a height of 1,312 ft., the summit of the Aidur. The Grand Mosque (in rue Philippe) was erected with money paid as ransom for Christian slaves at the end of the 18th century, to commemorate the expulsion of the Spaniards.

Oran is the seat of a large trade. There is regular communication with Marseille, Cette, Barcelona, Valencia, Cartagena, Malaga, Gibraltar and the various ports on the Barbary coast. The harbour is sheltered by a large jetty stretching from west to east, parallel to the shore and more than 3,936 ft. long. The different basins which it protects include the old harbour (1868), the Aucour basin (1876), the Morocco basin (1914) and the Poincaré basin (1928). The surface of the water is about 100 ac., the length of the quays 6,879 ft., the extent of the platforms 1,722,240 sq.ft.; there is a dock railway station on the south quay. Oran is the terminus of the standard (4′8½″) gauge railway lines from Algiers and from Ujda via Tlemçen and Sidi-bel-Abbes, and of the 1.055-metre gauge line from Colomb-Bechar-Kenadsa, which penetrates 470 mi. toward the south. The construction of the standard gauge railway from Ujda to Fez, of the lines into eastern Morocco, and of the Trans-Saharan railway may be expected to increase the importance of the port. The tonnage of goods in 1938 totalled 3,046,884 (imports 1,440,447, exports 1,606,437).

The total population of Oran (1936) was 194,746 (46,157 natives and 148,589 Europeans.)

*See* Augustin Bernard, "Oran, port du Maroc et du Sahara," *Bull. Soc. Géogr.* (Oran, 1928).

**History.**—Andalusian Arabs settled at Oran in the beginning of the 10th century. Important as a seaport, Oran was taken and retaken, pillaged and rebuilt, by the various conquerors of northern Africa. In the latter half of the 15th century under the sultans of Tlemçen it reached the height of its prosperity. Active commerce was maintained with the Venetians, the Pisans, the Genoese, the Marseilleais and the Catalans, who imported the produce of their looms, glasswares, tinwares and iron, and received in return ivory, ostrich feathers, gold-dust, tanned hides, grain and Negro slaves. Admirable woollen cloth and splendid arms were manufactured. The magnificence of its mosques and other public buildings, the number of its schools, and the extent of its warehouses shed lustre on the city; but luxury began to undermine its prosperity and its ruin was hastened by the conduct of the Moslem refugees from Spain, under whose influence the legitimate trade of the town gave place to piracy, Mers-el-Kebir becoming the stronghold of the pirates.

The Spaniards, animated by Cardinal Ximenes, determined to put a stop to the piracy. Mers-el-Kebir fell into their hands on Oct. 23, 1505, and Oran in May 1509. The latter victory, obtained with but trifling loss, was stained by the massacre of a third of the Mohammedan population. Cardinal Ximenes introduced the Inquisition, and also restored and extended the fortifications. The bey of Mascara seized Oran in 1708. The Spaniards recovered it in 1732, but found the maintenance of the place a burden rather than a benefit, the neighbouring tribes having ceased to deal with the Christians. The earthquakes of Oct. 8–Nov. 22, 1790, destroyed much of the town and a third of the garrison. Famine and sickness aggravated the situation when the bey of Mascara appeared before the town with 30,000 men. The Spanish commander held out till Aug. 1791. Bey Mohammed took possession of Oran in March 1792 and made it his residence instead of Mascara. The French army entered the city on Jan. 4, 1831, and took formal possession on Aug. 17.

In June 1940, at the time of the Franco-German armistice, a substantial portion of the French fleet took refuge at Oran and its naval base of Mers-el-Kebir. After fruitless negotiation by the British, with the purpose of preventing the vessels falling into axis hands, a British naval force made an attempt to destroy the ships (July 3, 1940). Several French vessels were sunk and others were severely damaged. Oran, one of the principal objectives in the Allied landings in North Africa, Nov. 8, 1942, was occupied Nov. 10, 1942, after the city had been encircled, against considerable resistance.

*See* M. D. Stott, *The Real Algeria* (1914). (P. W. I.)

**ORANGE, HOUSE OF.** The small principality of Orange, a district now included in the French department of Vaucluse, traces back its history as an independent sovereignty to the time of Charlemagne. William, surnamed *le Cornet,* who lived toward the end of the 8th century, is said to have been the first prince of Orange, but the succession is only certainly known after the time of Gerald Adhemar (*fl.* 1086). In 1174 the principality passed by marriage to Bertrand de Baux, and there were nine princes of this line. By the marriage of John of Châlons with Marie de Baux, the house of Châlons succeeded to the sovereignty in 1393. The princes of Orange-Châlons were (1) John I, 1393–1418, (2) Louis I, 1418–1463, (3) William VIII, 1463–1475, (4) John II, 1475–1502, (5) Philibert, 1502–1530. Philibert was a great warrior and statesman, who was held in great esteem by the emperor Charles V. For his services in his campaigns the emperor gave him considerable possessions in the Netherlands in 1522, and Francis I of France, who had occupied Orange, was compelled, when a prisoner in Madrid, to restore it to him. Philibert had no children, and he was succeeded by his nephew Réné of Nassau-Châlons, son of Philibert's sister Claudia and Henry, count of Nassau, the confidential friend and counsellor of Charles V. He too died without an heir in 1544 at the siege of St. Dizier, having devised all his titles and possessions to his first cousin William, the eldest son of William, count of Nassau-Dillenburg, who was the younger brother of Réné's father, and had inherited the German possessions of the family.

William of Orange-Nassau was but 11 years old when he succeeded to the principality. He was brought up at the court of Charles V and became famous in history as William the Silent (*q.v.*), the founder of the Dutch republic. On his assassination in 1584 he was succeeded by his eldest son, Philip William, who had been kidnapped by Philip II of Spain in his boyhood and brought up at Madrid. This prince never married, and on his death in 1618 his next brother, Maurice of Nassau (*q.v.*), stadtholder in the United Netherlands and one of the greatest generals of his time, became prince of Orange. Maurice died in 1625, also unmarried.

Frederick Henry, the son of Louise de Coligny, William's fourth wife, born just before his father's murder, now succeeded to the princedom of Orange and to all his brothers' dignities, posts and property in the Netherlands. Frederick Henry was both a great general and statesman. His only son, William II (*q.v.*), was married in 1641 to Mary, princess royal of England, he being 15 and the princess 9 years old at that date, and he succeeded to the title of prince of Orange on his father's death in 1647. At the very outset of a promising career he suddenly succumbed to an attack of smallpox on Nov. 6, 1650, his son William III (*q.v.*) being born a week after his father's death.

A revolution now took place in the system of government in the united provinces, and the offices of stadtholder and captain- and admiral-general, held by four successive princes of Orange, were abolished. However, the counter revolution of 1672 called William III to the head of affairs. At this time Louis XIV conquered the principality of Orange and the territory was incorporated in France, the title alone being recognized by the treaty of Ryswick. For William III's accession to the throne of England, *see* ENGLISH HISTORY. He left no children, and a dispute arose among various claimants to the title of prince of Orange. The king of Prussia claimed it as the descendant of the eldest daughter of Frederick Henry; John William Friso of Nassau-Dietz claimed it as the descendant of John, the brother of William the Silent, and also of the second daughter of Frederick Henry. The result was that at the Peace of Utrecht in 1713, the king of Prussia aban-

doned the principality to the king of France in exchange for compensation elsewhere, and John William Friso gained the barren title and became William IV., prince of Orange. His sons William V. and William VI. succeeded him. William VI. in 1815 became William I., king of the Netherlands (*q.v.*).

*See* Bastet, *Histoire de la ville et de la principauté d'Orange* (Orange, 1856). (G. E.)

**ORANGE,** a town of France, 18 mi. N. of Avignon on the P.L.M. railway. Pop. (1936) 9,040. Orange (*Arausio*), capital of the Cavari, was in 105 B.C. the scene of the defeat of a Roman army by the Cimbri and Teutones. It became after Caesar an important Roman colony. Its ramparts and fine buildings were partly destroyed by the Alamanni and Visigoths, and partly ruined by the erections of the middle ages. Orange was included in the kingdom of Austrasia, fell into the hands of the Saracens and was recovered by Charlemagne. It became the seat of an independent countship in the 11th century. The town had a university from the 14th century till the Revolution. Orange stands at some distance from the left bank of the Rhône, in the midst of meadows, orchards and mulberry plantations, watered by the Meyne, and overlooked by Mont Ventoux, 22 mi. to the east.

Orange has famous Roman remains. The triumphal arch ranks third in size and importance among those still extant in Europe; 72 ft. in height, 69 ft. in width, and 26 ft. in depth, it is composed of three arches supported by Corinthian columns. On three sides its sculptured decorations are well preserved. The arch seems to have been set up in honour of Tiberius, perhaps to commemorate his victory over the Gallic chieftain Sacrovir in A.D. 21. It was used as a donjon in the middle ages. The theatre, dating from the time of the emperor Hadrian and built against a hill on the summit of which a colossal figure of the Virgin stands, has a façade 121 ft. high, 340 ft. long and 13 ft. thick, which is pierced by three square gates surmounted by a range of blind arches and a double row of projecting corbels, with holes in which the poles of the awning were placed. Of the seats for the spectators, only the lower tiers remain. It was used as an out-work to the fortress built on the hill by Maurice of Nassau in 1622, and destroyed fifty years later by order of Louis XIV., who in 1660 captured the town. At the beginning of the 19th century it was filled with hovels and stables; the building has been cleared and restored, and now serves as a national theatre. Near the theatre traces have been found of a hippodrome; and there are statues, bas-reliefs and ruins of an amphitheatre. Notre Dame, the old cathedral, originally built by the prefect of Gaul, was ruined by the barbarians, rebuilt in the 11th and 12th centuries, and damaged by the Protestants.

There are manufactories of footwear, brooms, jewellery and beet-sugar. The town deals largely in fruit, and millet-stalks for brooms, as well as in wool, silk, honey and truffles.

**ORANGE,** a city of Orange county, California, U.S.A., 34 mi. S.E. of Los Angeles and 14 mi. from the Pacific ocean; served by the Pacific Electric, Santa Fe and Southern Pacific railways and Pacific Electric motor buses. Pop. 1930, 8,066; 1940, 7,901 (92% native white). It is surrounded by orange and lemon groves. The average annual crop of citrus has a value of $20,000,000.

The city's industries include four citrus and two walnut packing houses, insulated copper wire, twine, cordage, rope, machinery and gold-leaf manufacturers.

**ORANGE,** a town of Franklin county, Mass., U.S.A., on Millers river and the Boston and Maine railroad, 40 mi. N.W. of Worcester. Pop. (1930) 5,365; in 1940 it was 5,611. It has numerous and varied manufacturing industries.

The district of Orange was formed in 1783 from parts of Athol, Royalston and Warwick, and certain common lands, and in 1810 it was made a town.

**ORANGE,** a city of Essex county, New Jersey, U.S.A., 12 mi. W. of New York city, 4 mi. W. of Newark; served by the Erie and the Lackawanna railways, interurban trolleys and motorbus lines. Pop. (1920), 33,268 (21% foreign-born white and 15% Negro); (1940 federal census) 35,717. The city covers 2·2 sq.mi. at the base of the first Watchung mountain, in the heart of the great suburban residential community known as "the Oranges," completely surrounded by East, South and West Orange. There are some 60 manufacturing establishments in the city, with an output in 1939 valued at $11,633,438. The assessed valuation of property for 1941 was $43,077,642. Since 1914 the city has had a commission form of government. Settlement began here soon after the founding of Newark in 1666, and the region was generally called Newark Mountain. In 1718 the people of "the mountain" severed connections with the church at Newark and formed an independent congregation. The neighbourhood was referred to as Orange Dale in 1782 and two years later "Orange" was in use. The township of Orange was set off from Newark and incorporated in 1806. It was incorporated as a town in 1860; the other "Oranges" were set off from it in 1861, 1862 and 1863; and in 1872 it was chartered as a city.

**ORANGE,** a city on the eastern boundary of Texas, U.S.A., at the head of navigation on the Sabine river; the county seat of Orange county. It is on federal highway 90; has an airport of 200 ac. and a 30-ft. harbour, with a deep-water channel to the Gulf of Mexico; and is served by the Missouri Pacific and the Southern Pacific railways. The population was 9,212 in 1920 (27% Negroes) but fell to 7,472 in 1940 (federal census). The city is built around a deep hairpin bend in the river. It is surrounded by six gas and oil fields, huge forests of pine and cypress, and a cultivated district devoted chiefly to truck farming, poultry, and figs. The commerce of the port consists largely of exports of timber and lumber. A $5,000,000 U.S. navy yard was under construction in 1941. The rapidly developing manufacturing industries include saw and shingle mills, a rice mill, cotton gins, an oil refinery, shipyards, wrapping-paper and paper-bag factories, creosoting and fabricating steel plants and canneries. The city was founded as a trading post about 1800; and began on its present expansion with the completion of harbour improvements in 1914 and the discovery of oil in 1920.

**ORANGE,** the longest river of South Africa, almost traversing the continent from ocean to ocean. It rises in Basutoland, less than 200 m. from the Indian ocean, and flows west, with wide sweeps south and north, to the Atlantic. It drains, with its tributaries, an area estimated at over 400,000 sq.m., passing through more than twelve degrees of longitude or 750 m. in a straight line from source to mouth. The valley of the river exceeds 1,000 m., and the stream has a length of not less than 1,300 m. Its headstreams are in the highest part of the Drakensberg range, the principal source, the Sinqu, rising, at an elevation of more than 10,000 ft., on the Mont aux Sources in 28° 48′ E., 28° 50′ S.

Rising on the inner slopes of the hills these rivulets all join the Sinqu, which receives from the north several streams which rise in the Maluti Mountains. Of these the largest are the Semene and Sinqunyane (little Sinqu) and the best known the Maletsunyane, by reason of its magnificent waterfall—an unbroken leap of 630 ft. Increased by the perennial waters of these numerous torrents the Sinqu makes its way S.W. across the upland valleys between the Maluti and Drakensberg ranges. After a course of some 200 m., the Sinqu, already known as the Orange, receives the Makhaleng, or Kornet Spruit (90 m.), which rises in Machacha Mountain. The Orange here enters the great inner plateau of South Africa, which at Aliwal North, the first town of any size on the banks of the river, 80 m. below the Kornet Spruit confluence, has an elevation of 4,300 feet. Forty miles lower down the Orange is joined by the first of its large tributaries the Caledon (230 m.), which, rising on the western side of the Mont aux Sources, flows, first west and then south, through a broad and fertile valley. At the confluence the united stream has a width of 350 yards. Thirty miles lower down the Orange reaches, in 25° 40′ E., its southernmost point—30° 40′ S., approaching within 20 m. of the Zuurberg range. In this part of its course the river receives from the south the streams, often intermittent, which rise on the northern slopes of the Stormberg, Zuurberg and Sneeuwberg ranges. Of these the chief are the Kraai, which joins the Orange near Aliwal North, the Stormberg and the Zeekoe (Sea Cow), the last named having a length of 120 miles.

From its most southern point the Orange turns sharply N.W. for

200 mi., when having reached 29° 3′ S., 23° 36′ E. it is joined by its second great affluent, the Vaal (*q.v.*). Here it bends south again, and with many a zigzag continues its general westerly direction, crossing the arid plains of Bechuana, Bushman and Namaqualands. Flowing between steep banks, considerably below the general level of the country, here about 3,000 ft., it receives, between the Vaal confluence and the Atlantic, a distance of more than 400 mi. in a direct line, no perennial tributary but on the contrary loses a great deal of its water by evaporation. In this region, nevertheless, skeleton river systems cover the country north and south. These usually dry sandy beds, which on many maps appear rivers of imposing length, are deep and turbulent streams for a few hours or days following rare but violent thunderstorms.

In 28° 35′ S., 20° 20′ E., are the great waterfalls of the Orange, where in cataracts and cascades the river drops 400 ft. in 16 miles. The Aughrabies or Hundred falls, as they are called, are divided by ledges, reefs and islets, the last named often assuming fantastic shapes. Below the falls the river rushes through a rocky gorge, and openings in the cliffs to the water are rare. These openings are usually the sandy beds of dried-up or intermittent affluents, such as the Bak, Ham, Houm, Aub (or Great Fish) rivers of Great Namaqualand. Crossing the narrow coastal plain the river, with a southwesterly sweep, enters the ocean by a single mouth, studded with small islands, in 28° 37′ S., 16° 30′ E. A large sand bar obstructs the entrance to the river, which is not quite 1 mi. wide. The river when in flood, at which time it has a depth of 40 ft., scours a channel through the bar, but the Orange is at all times inaccessible to seagoing vessels. Above the bar it is navigable by small vessels for 30 or 40 miles.

Captain Henry Hop first crossed the Orange in September 1761, but shortly afterwards returned. In 1777 Captain (afterwards Colonel) R. J. Gordon, a Dutch officer of Scottish extraction, who commanded the garrison at Cape Town, reached the river in its middle course and named it the Orange in honor of the Prince of Orange. Next year Lieut. W. Paterson, an English traveller, reached the river in its lower course, and in 1779 Paterson and Gordon journeyed along the west coast of the colony and explored the mouth of the river. F. Le Vaillant also visited the Orange near its mouth in 1784. Mission stations north of the Orange were established a few days later, and in 1813 the Rev. John Campbell, after visiting Griqualand West for the London Missionary society, traced the Harts river, and from its junction with the Vaal followed the latter stream to its confluence with the Orange, journeying thence by the banks of the Orange as far as Pella, in Little Namaqualand, discovering the great falls. These falls were in 1885 visited and described by G. A. Farini, from whom they received the name of the Hundred falls. The source of the Orange was first reached by the French Protestant missionaries T. Arbousset and F. Daumas in 1836.

The story of Hop's expedition is told in the *Nouvelle description du Cap de Bonne Espérance* (Amsterdam, 1778). Lieut. Paterson gave his experiences in *A Narrative of Four Journeys into the Country of the Hottentots and Caffraria in the Years 1777–1778–1779* (London, 1789). *See* also Campbell's *Travels in South Africa* (London, 1815), Arbousset and Daumas' *Relation d'un voyage d'exploration au nord-est de la colonie du Cap de Bonne Espérance en 1836* (Paris, 1842), and Farini's *Through the Kalahari Desert* (London, 1886).

**ORANGE,** several species of *Citrus* (family Rutaceae, subfamily Aurantioideae), the genus to which the lemon, grapefruit and lime also belong. The orange tree has shining broad evergreen leaves, fragrant white blossoms, and nearly globose orange-coloured edible fruit. The species of orange most important commercially are the sweet or common orange (*C. sinensis*), the mandarin orange (*C. reticulata*), and the sour orange (*C. aurantium*). The species differ chiefly in shape, size, texture and flavour of fruit, and in tree characteristics (W. T. Swingle, 1943).

The tree of the sweet orange (*Citrus sinensis*), which is also called the common or China orange, sometimes attains a height of 35 ft. Leaves are medium-sized, ovate; petioles are less broadly winged than those of the sour orange. The pulp of the sweet orange is agreeably acidulous and sweet, the peel is comparatively smooth, and the oil glands are convex. The usual shape of the sweet-orange fruit is round; certain varieties are greatly elongated; others are much flattened; several, *e.g.*, the Washington Navel, have a conical protuberance, the navel, at the apex.

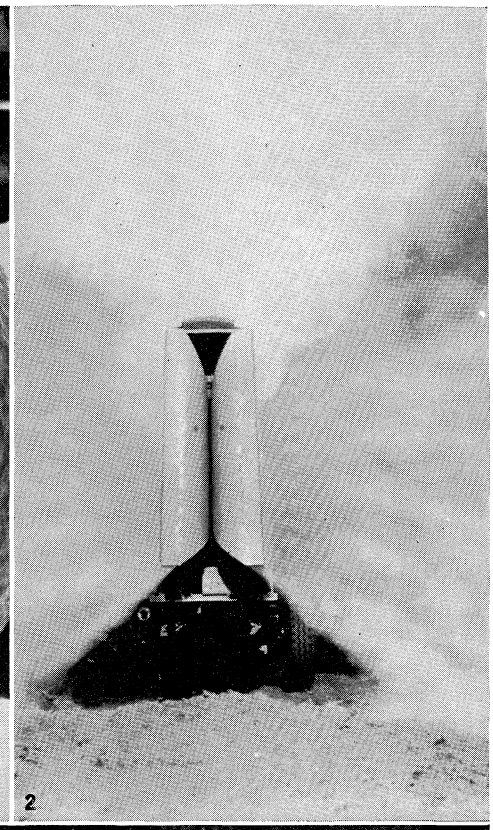
The mandarin orange (*Citrus reticulata*), some varieties of which are called tangerines, was formerly classified as *C. nobilis* (Swingle, 1943). Trees are smaller than those of sweet or sour orange; the twigs are slender and the leaves lanceolate. The fruits are depressed subglobose, with very thin loose peel easily separated from the segments and bright-orange colour when ripe. Some varieties, especially the tangerines, are decidedly reddish-tinted; the segments are readily separated from each other. The flavour is mild and pleasing. Some varieties, such as the Satsuma, are seedless.

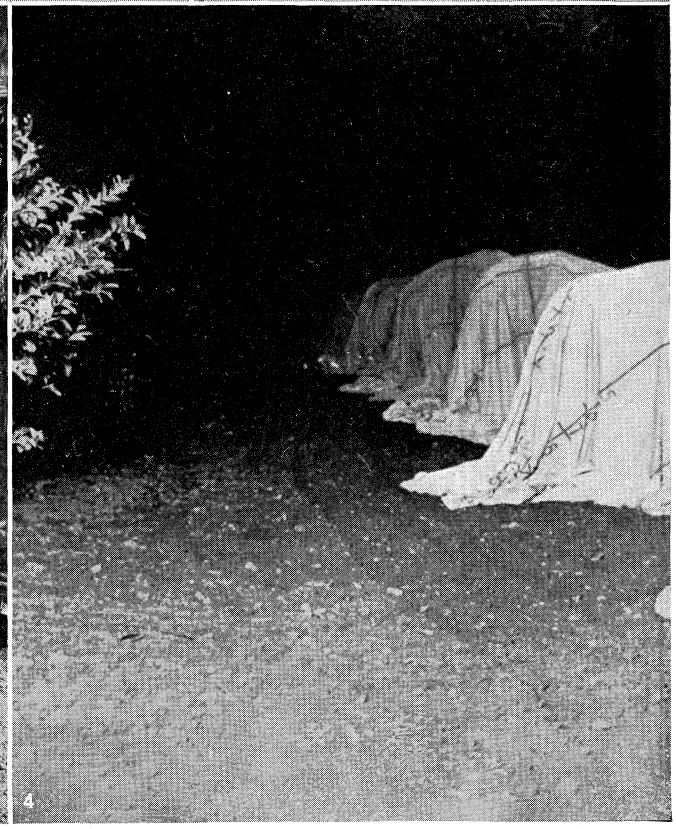
The sour orange, also called the Seville, bigarade, or bitter orange (*Citrus aurantium*), is a rather small tree, rarely exceeding 25 ft. in height. The green shoots bear sharp axillary thorns; leaves alternate, ovate, pointed at the tip, with margins entire or very slightly serrated; colour a glossy dark green; petioles more broadly winged than those of the sweet orange, articulated with the leaf. Fruits are subglobose, slightly depressed at both ends, sometimes nippled at apex; fruit surface is rough, dotted closely with concave oil glands; colour at maturity is brilliant orange with slight reddish tint; the pulp is only moderately juicy, relatively low in sugar, and thus decidedly acid-flavoured (3.5% to 4.5% acid); seeds are numerous.

These three species of orange reproduce themselves true to type, in most cases, by seed; and, where hybridizing is prevented, the seedlings of the sweet, mandarin and sour oranges retain the more distinctive features of their respective parent plants.

**History.**—There is some doubt as to the place of origin of the orange. Though the orange is now the most widely cultivated of *Citrus* species and is grown in most of the warmer parts of the world, its diffusion has taken place in comparatively recent historical periods. To ancient Mediterranean agriculture the orange was unknown, although the later Greeks and Romans were familiar with the citron (*Citrus medica*) as an exotic fruit. The careful research of G. Gallesio indicated that India was the country from which the orange spread to western Asia and eventually to Europe. Oranges are found apparently wild in the jungles along the lower mountain slopes of parts of northern India. This fact, however, is only a partial proof that they originated there. Oranges and other citrus species have escaped from cultivation in several parts of the world, such as Florida, South Africa and Argentina; having thrived in the wild state, they have sometimes been erroneously considered indigenous. The wild plants are generally thorny, and present the other characters of the sour orange, but occasionally wild oranges occur with sweet fruit; it is, however, doubtful whether either the sweet or the sour species is really indigenous to Hindustan, and Alphonse de Candolle is probably correct in regarding South China and the Indo-Chinese peninsula as the original home of the orange. Cultivated from a remote period in southeastern Asia, the orange was carried to southwestern Asia by the Arabs, probably before the 9th century, toward the close of which the sour orange (*C. aurantium*) seems to have been well known to that people; though, according to Mas'ūdī, it was not cultivated in Arabia until the beginning of the 10th century, when it was first planted in Oman, and afterwards carried to Mesopotamia and Syria. It spread ultimately, through the agency of the same race, to Africa and Spain, and perhaps to Sicily, following everywhere the tide of Mohammedan conquest and civilization. In the 12th century the sour orange was abundantly cultivated in all the eastern Mediterranean countries, and the returning Crusaders brought it from Palestine to Italy and southeastern France. In Florida the sour orange has grown, from an unknown period, in a wild state; but it seems certain that this orange was brought by the Spanish colonists to the West Indies and was transplanted to Florida soon after the first settlement, in 1565. The chief use of the sour orange in the western hemisphere is for rootstocks on which to graft sweet orange and other *Citrus* species (H. J. Webber, 1943).

There is no allusion to the sweet orange in European literature contemporary with the Crusades, and the introduction of this fruit into Europe took place at a considerably later period, though the exact time is unknown. The sweet orange was commonly cultivated in Italy early in the 16th century, and seems to have been known there previous to the expedition of Vasco da Gama (1497), as a Florentine narrator of that voyage appears to have been familiar with the fruit. The importation of this tree into Europe is usually attributed to the Portuguese, who first circumnavigated Africa and found the way to India and China, although Gallesio suspects that Genoese merchants of the 15th century, who must have found it growing abundantly then in the eastern





COURTESY OF (1) UNIVERSITY OF CALIFORNIA; (3) CALIFORNIA FRUIT GROWERS EXCHANGE

1. Navel orange with leaves and blossom
2. Modern equipment dusting a citrus orchard (rear view of motor-drawn duster)
3. Picking Washington navel oranges, the winter variety of California
4. Tents used to cover trees when fumigating a citrus orchard with hydrocyanic acid gas

(For further illustrations of citrus growing see article FRUIT FARMING, Plate II)

Mediterranean region, may have introduced it.

The mandarin orange (*Citrus reticulata*), a native of southern China, was not introduced into Europe until after mediaeval times, even though it was known and extensively planted in China and Japan as early as the 12th century. Throughout China and in Japan, oranges have been grown from very ancient times, and they were found diffused widely when the East-Indian archipelago was first visited by Europeans.

**Cultivation.**—Oranges are not strictly tropical plants, and they thrive best where the trees are chilled somewhat by occasional slight night frosts in winter. The trees are semidormant at that season, and temperatures as low as 30° to 28° F. will not harm trees or fruits unless frost occurs early, before the trees have finished their annual growth. On the coldest sites, some means of heating the orchards is resorted to in California, and, to a lesser degree, in Florida. In such cases the critical temperature is 26° F. In California, the usual practice is to burn petroleum oil in small 5- to 8-gallon-capacity heaters (40 to 50 per acre); in Florida, the locally produced pine or oak wood is the most widely used fuel.

The orange thrives in a wide range of soil conditions, from extremely sandy soils to rather heavy clay loams; it grows especially well in the intermediate types of soil. Orange orchards are generally planted in relatively deep soil where drainage is good. The orange trees are usually budded on stocks grown from the seed of selected vigorous trees of sour or sweet orange, or the so-called Rough lemon. The seeds are sown in well-prepared soil in a lath house; after about 12 months' growth there, the seedlings are removed to a nursery. After 12 to 16 months in the nursery, the trees, then about 1 cm. in diameter at a distance 6 in. above the ground, are usually large enough to bud. When the budded tops are one to two years old, the trees are large enough to plant in the orchard. The number of trees planted per acre in the United States ranges from 80 to 110, depending upon vigour and variety, and upon the method of culture to be followed.

The ground between the young, newly planted trees is often used for vegetable crops such as beans, tomatoes, or melons, the choice depending upon the market demand for such annual crops. The culture of intercrops helps to provide favourable conditions for the young orange trees for the first five or six years, until they reach the age of profitable production; after this, the entire land is usually devoted to the orchard. The growth of covercrops during the winter months in California, and during the summer months in Florida, prevents erosion damage and makes use of the seasonal rainfall for the production of organic matter to be incorporated into the soil. In addition to this organic material, it is essential to use relatively large amounts of fertilizers, such as various nitrogenous materials; in Florida, applications of phosphate and potash are essential. Some of the minor nutritional elements, especially zinc, copper, manganese and magnesium, are frequently lacking in citrus soils, and small applications are then necessary. In many areas where oranges are grown, it is necessary to supplement the rainfall with irrigation; this is generally the practice in California, Texas, Palestine, Spain, Morocco and in parts of South Africa. In the 18th century, the orange tree became a favourite object of conservatory growth in England; in the open air, in protected locations, it has often stood the cold of many seasons in the southern counties and has occasionally borne abundant fruit. The orange has usually been cultivated in England for the beauty of the plant and the fragrance of the blossoms, however, rather than for the supply of edible fruit.

In garden culture in southern Europe, the orange is sometimes trained as an espalier, and with careful attention yields fruit in great profusion when thus grown. Orange trees will continue to bear abundantly from 50 to 80 years, or even more; and some old orange trees, whose age must be reckoned by centuries, still produce crops; these very ancient trees are generally of the sour orange, and have probably been frozen back and then rejuvenated by sprouts from near the ground. Sweet-orange trees growing under orchard conditions occasionally acquire a considerable size; a 67-year-old sweet-orange tree near Pasadena, Calif., had a spread of 36½ ft.; its height was 33 ft.; its circumference, 1 ft. above ground, was 5 ft. 7 in.

**Harvesting and Packing.**—Oranges are picked when fully ripe, for, unlike some deciduous fruits, they do not ripen or improve in quality after being picked. In the United States it is unlawful to sell oranges until they have reached a certain state of maturity, determined by the ratio of total soluble solids to acids in the fruit juice. In California, the fruit must attain a maturity ratio of soluble solids to acids of 8:1 before it may be lawfully sold. As 80% to 85% of the soluble materials are sugars, and citric acid is the principle which gives oranges the typical mildly acid flavour, this ratio is often erroneously spoken of as the sugar-to-acid ratio. In some sections, oranges can be left on the trees for 5 to 6 months after they become mature enough to eat; during this period the sugars increase and the acids decrease, so that the ratio of soluble solids to acids at the end of the picking season is sometimes as high as 17:1. The vitamin content of oranges declines as the fruit becomes overmature.

Oranges are carefully handled during the picking and packing operations to prevent them from being punctured, scratched, bruised, or scarred by abrasions. This care is necessary to prevent losses from decay caused by various moulds, such as blue mould and other fungus organisms, which are widely distributed. The normal unbroken surface of the peel of the orange is very resistant to such diseases, but they readily gain entrance to the very susceptible inner portion of the peel and to the pulp of the fruit if the surface of the peel is injured even in the most minute way. To prevent such injury, and to prevent scarring of the fruit by the fingernails, oranges are picked by well-trained workmen wearing cloth gloves. The orange is removed from the twig by clipping the stem as close to the fruit as is practicable. By this care in handling, which is somewhat comparable to the handling of eggs, millions of dollars worth of fruit is saved which would otherwise be lost by decay.

As the oranges pass through the packing house, they are handled largely by machinery, from the time the field boxes are dumped until the fruit is finally ready for packing in the shipping boxes. The following is an example of the usual processes through which the fruit goes in the packing house. It is (1) doused in hot soapy water (115° F.), (2) cleaned as it passes under revolving brushes, (3) rinsed in clear water and brushed simultaneously, (4) rinsed in water and borax solution, (5) rinsed in clear water, (6) dried by passing on a belt conveyor through a tunnel through which air is forced at a high velocity, (7) culled by hand as it passes over a belt conveyor, (8) graded for size, and (9) wrapped in tissue paper and packed by hand. In California many packing houses use supplementary aids, such as nitrogen trichloride gas or other fungicides or disinfectants, to prevent decay. A very thin layer of wax is applied to most oranges to prevent undue drying in transit or in the market. In the United States, oranges are packed in wooden boxes for shipment, California boxes holding approximately 70 lb. of fruit, and Florida boxes holding approximately 90 lb. Each box is packed with the same-sized fruit throughout. A medium-sized orange is 6.9 cm. in diameter and packs 200 to a California box.

**Varieties.**—H. J. Webber (1943) describes 97 varieties of sweet and mandarin oranges which have been grown in the various subtropical parts of the world. Of the sweet oranges, the Washington Navel is the principal winter variety grown in California and Arizona, and the Valencia is the principal summer variety grown in these areas. The principal sweet varieties grown in Florida are: Hamlin, Pineapple, Parson Brown, Homosassa and Valencia. In Texas, the cultivation of the Valencia and Hamlin varieties increased greatly in the decade 1933–43. Blood oranges form another group of sweet oranges. They are characterized by the deep-red tint of the pulp, and comprise some of the best varieties; they are grown extensively in the Mediterranean region, but have not become popular in America.

The mandarin oranges, which include the tangerines, are grown more extensively in Florida than elsewhere in the United States; the variety most widely grown is the Dancy tangerine. The Temple, a loose-, thin-skinned fruit, especially desirable at one time in Florida, appears to be a hybrid between the mandarin and the sweet orange. Another loose-skinned type of orange, of the mandarin group, is the Satsuma, which was introduced into the United States in 1876, from Japan, where it is widely grown. The Satsumas ripen earlier in the fall and are more resistant to frost than other commercially grown citrus fruit. They have been rather extensively grown in certain areas bordering the Gulf of Mexico, where it is too cold for the production of sweet oranges; but freezes during the two decades 1922–42 greatly reduced the acreage. Mandarin oranges are highly prized as dessert fruits because of their attractive appearance and because their loose skin and easily separable segments make them easy to handle. The mandarins are lower in vitamin C content than are sweet oranges, lemons or grapefruit.

The sour orange is grown to some extent in all citrus-producing sections, but its production on a commercial scale has been mainly limited to southern Spain, where it was first planted years ago by the Moorish conquerors. The most important commercial use of the fruit is in the manufacture of marmalade. The sour orange in general is too acid and bitter for use as a fresh fruit; the juice, however, has a distinctive flavour which makes it a pleasing addition to certain beverages. The fruits are also used in making confections, liqueurs (curaçao), and other drinks. The fruit and leaves are used in making a number of medicinal preparations, and the flowers, leaves and fruits yield volatile oils (bigarade oils) of characteristic odour, much prized for perfumes. The oranges of the bergamot group (subspecies *Citrus bergamia*) are largely grown in southern Italy and Sicily for the essential oil which is expressed from the peel for making perfume. The bergamot group is thought to be of hybrid origin, with the sour orange as one of the parent species.

**Diseases and Insect Pests.**—Several diseases, of fungus or virus origin, are generally distributed over most of the subtropical areas where oranges are grown. One of the most troublesome of these diseases, brown-rot gummosis or foot rot, is caused by several species of fungi (*Phytophthora* spp.). This disease affects the lower trunk and the crown roots of the tree, and also produces a brown rot on the fruit, while it is still on the trees, in those years when weather is especially damp during the picking season. *Phytophthora* decays

also cause loss of picked fruit. Spray mixtures in which copper is the lethal element are commonly used to spray the lower part of the tree, as the splashing of the rain spreads the fungus spores most readily to the low-hanging fruits. When the disease is present on the crown roots and trunk, the tree has a devitalized appearance characterized by poor growth, pale small leaves, and more than the normal amount of dead twigs. The affected crown has dark-coloured areas from which gum exudes; beneath these areas the cambium is dead and discoloured. If not cut out and disinfected, the diseased areas continue to enlarge and finally girdle the tree. Preventive measures consist in avoiding both too deep planting and excessive water next to the trunk. The most serious virus disease of oranges is psorosis, formerly called "scaly bark" in California. Seriously affected trees become valueless. The disease is spread largely by propagating from diseased trees, and may be avoided by care in selecting healthy trees from which to take buds.

Loss of fruit in storage and transit is caused by rots produced by *Phytophthora* spp., green mould (*Penicillium digitatum*), blue mould (*P. italicum*), black rot (*Alternaria citri*) and others (H. S. Fawcett, 1936). Loss from these diseases is greatly reduced by the care exercised in handling the fruit during picking and packing. Loss from decay is also prevented by avoiding the picking of the fruit while it is damp with dew or rain, by picking before the fruit is overmature, and by keeping the fruit at temperatures between 38° and 40° F.

The insect pests most commonly troublesome to oranges in California are five species of scale: black scale (*Saissetia oleae*), yellow scale (*Aonidiella citrina*), purple scale (*Lepidosaphes beckii*), red scale (*Aonidiella aurantii*), and citricola scale (*Coccus pseudomagnoliarum*). Several species of mealybugs cause damage in particular cases and during some seasons, but, because of their insect parasites, they are not so generally harmful as the scale insects. In some districts in California, the citrus thrips (*Scirtothrips citri*) is a serious pest. The citrus red mite, or red spider (*Paratetranychus citri*), as well as aphids and other insects, causes damage in the coastal and intermediate areas if not controlled by insecticides. Other pests which are especially important are the Mexican fruitfly (*Anastrepha ludens*), in Texas, and the citrus rust mite (*Phyllocoptes oleivorus*), citrus whitefly (*Dialeurodes citri*), Florida red scale (*Chrysomphalus aonidum*) and also purple scale (*Lepidosaphes beckii*), in Florida. The control of insect pests in all citrus-producing areas is one of the most difficult and expensive factors in the commercial production of oranges.

One of the serious pests of oranges is the Mediterranean fruitfly (*Ceratitis capitata*), wherever it occurs in subtropical areas of the world. The fly lays its eggs in the peel of the fruit, and the larvae develop in the pulp. An infestation was found in Florida in the spring of 1929, but by late fall of 1930 it had been successfully exterminated, at an immense cost to the state and federal governments.

In California, the scale insects are usually controlled satisfactorily either by fumigation with hydrocyanic acid gas, or by spraying or dusting with toxic materials. In fumigating, each tree is completely covered with a heavy canvas tent; the gas is then discharged under this covering. To avoid injury to the fruit and foliage, fumigation is done at night and only within certain ranges of temperature and humidity. In the spray materials most commonly used, petroleum oil is the principal toxic agent. Highly refined, light-medium or medium oil emulsions applied at concentrations of 1½% to 2%, mixed with water, are most in use. To the mixture an additional toxic material, such as rotenone or pyrethrum, is often added to increase the effectiveness of the spray. Lime-sulphur sprays, as well as sulphur applied as a dust, are important insecticides, especially for thrips and red mites. Other dust materials used as insecticides are some of the organic compounds, such as dinitro-o-cyclohexylphenol, which are especially toxic to red mites, and nicotine sulphate, which is used for aphid control (H. J. Quayle, 1938).

**Production and Consumption.**—The sweet orange and the mandarin orange are the principal species produced commercially in the following countries, listed in approximate order of importance: United States, Spain, Brazil, China, Japan, Palestine, Italy, Union of South Africa, Egypt and Mexico. The world production of oranges, of these and other countries, ranges from the equivalent of 200,000,000 to 225,000,000 boxes (70 lb. net, each) annually. This enormous production of oranges, in comparison with that of other citrus fruits, is evidence of their world-wide popularity. The United States produced nearly 39% of the average annual crop for the five-year period ending in 1942. An estimate of the oranges produced in the United States during the shipping season 1941–42 was 85,000,000 boxes, the production, by states, during this season being: California, 51,532,000 boxes; Florida, 29,300,000 boxes; Texas, 2,850,000 boxes; Arizona, 660,000 boxes; and other states, 198,000 boxes. The mandarin oranges are produced more extensively in Florida than in any other area of the U.S. In 1937, mandarins constituted 8½% of the total crop of oranges in Florida. In the U.S., oranges are consumed the year round, with consumption of summer oranges nearly as great as that of winter varieties. Prior to 1920 the orange was considered principally as a dessert fruit for winter use. The drinking of orange juice, in contrast to the eating of the fresh fruit, increased greatly during the two decades 1923–43; it is estimated that by the latter year 80% of the fruit marketed was consumed as juice. This use of the fruit was a major factor in the increase in per capita consumption. Another important factor was the increase in knowledge, gained in this period throughout the whole world, of the dietary value of all citrus fruit. Per capita consumption of oranges in the United States increased from 50.8 oranges in 1921 to 101.7 oranges in 1941. One of the primary reasons for the important dietary value of oranges is their high vitamin C content, which averages 54 mg. per 100 gr. of juice. Of the other fruits and of the vegetables commonly constituting a part of the human diet, only the lemon exceeds the orange in vitamin C content.

The most important by-product made from surplus oranges is the concentrated juice. This is prepared in a manner comparable to that used in preparing lemon juice (*see* LEMON). Essential oils, pectin, candied peel and orange marmalade are among the other important by-products. Stock feed is made from the waste material left from the processing of some of the aforementioned articles. This dried residue, known as orange meal, compares favourably with beet pulp and other semiconcentrates used as stock feeds and conditioners in preparing cattle for market. The wood of the orange tree is of a fine yellow tint; it is hard and close-grained and is valued by the turner and the cabinetmaker for the manufacture of small articles.

BIBLIOGRAPHY.—H. S. Fawcett, *Citrus Diseases and Their Control* (New York and London, 1936); G. Gallesio, *Traité du Citrus* (Paris, 1811); H. J. Quayle, *Insects of Citrus and Other Subtropical Fruits* (Ithaca, N.Y., 1938); W. T. Swingle, "The Botany of Citrus and Its Wild Relatives of the Orange Subfamily (Family Rutaceae, Subfamily Aurantioideae)," in *The Citrus Industry* (Berkeley and Los Angeles, 1943), vol. 1, chap. iv; H. J. Webber, "History and Development of the Citrus Industry," vol. 1, chap. i, and "Cultivated Varieties of Citrus," vol. 1, chap. v, *The Citrus Industry* (1943). (L. D. B.)

**ORANGE, COUNCILS OF:** *see* COUNCILS OF ORANGE.

**ORANGEBURG,** a city of South Carolina, U.S.A., the county seat of Orangeburg county; on the North Edisto river and federal highway 21, at an altitude of 259 ft., 45 mi. S.E. of Columbia. It is served by the Atlantic Coast Line and the Southern railways. Pop. 7,290 in 1920 (45% Negroes); in 1940, 10,521 by the federal census. It is the financial, commercial and industrial centre of a rich section of the Atlantic Coastal plain, and is the seat of the State Agricultural and Mechanical college for Negroes (1896). Cotton, grain, live stock, poultry, tobacco and pecans are leading products of the county; and the city has lumber mills, veneer plants, cotton mills and various other manufacturing industries. It operates under a commission form of government. In 1704 a trader and trapper built his cabin here, and in 1735 a colony of Germans and Swiss established a settlement, naming it in honour of William, Prince of Orange. The town was incorporated in 1851, and was chartered as a city in 1883.

**ORANGE FREE STATE,** an inland province of the Union of South Africa. It is divided from Natal by the Drakenberg, from Basutoland by the Caledon river, from the Transvaal by the Vaal river and from the Cape Province by the Orange river, and in the west by a line drawn across the veld from the Orange to the Vaal. It lies between 26° 30′ and 30° 40′ S. and between 24° 10′ and 29° 40′ E. Its area is 49,647 sq. mi.

The country forms part of the inner plateau of South Africa, and most of it lies between 4,000 and 5,000 ft. above sea level. From the mountainous, eastern districts it slopes gradually westward, no natural boundary marking its western frontier. The aspect of the country is that of vast, undulating, treeless plains, with a certain number of willows and thorn trees along the streams. The latter were formerly more widely spread, but have nearly all been cut down for fuel. The Australian black wattle, gums and the pepper tree have been successfully introduced and are grown along the streets of the towns, and in plantations on farms, especially in the eastern districts, to provide shelter, poles and firewood.

The general level of the surface is broken by low ridges and isolated table mountains, the latter attaining considerable elevation above the plain. They are particularly numerous and well developed in the east, and are due to the outcrop of beds of sandstones and dolerites. The rivers, except the Orange, Vaal and Caledon, are dry or nearly dry, for three or four months during the dry winter season, but after rain even the small spruits may become raging torrents.

(For geology, climate, flora and fauna, *see* SOUTH AFRICA, UNION OF.)

**Population.**—The 1936 pop. of 772,060 included 200,978 Europeans, 553,110 natives, 29 Asiatics and 17,943 mixed and others. The largest element among the natives is probably the Basuto, who are largely represented in the districts of Harrismith, Bethle-

hem, Ficksburg and Ladybrand. A considerable number of Barolong live in the districts of Thaba'nchu and Bloemfontein, and the Amazulu are well represented chiefly in the northeastern area, adjoining Zululand. Other tribes include Fingoes, Ama-xosa, etc. The population of the country as a whole, which amounts to 8.05% of the union, and which has an average density of 15.55 per sq.mi. is concentrated in the eastern and better-watered districts.

**Towns.**—These call for little comment. They are mostly small administrative and provisioning centres for their surrounding districts. Only eight have a white population exceeding 2,000 and of these Bloemfontein, the capital, Kroonstad, Ladybrand and Ficksburg have been described in separate articles. Harrismith and Bethlehem are prosperous centres for the northeastern districts. The former, situated at the foot of the Plattberg, was formerly a military station and is a recognized resort for sufferers from chest diseases. Parys (whites [1936], 2,905; total [1936], 5,176) is situated on the Vaal river, and is developing as a pleasure resort. Jam making and fruit preserving are carried on and the town has spinning and weaving schools.

**Agriculture and Pastoralism.**—The Orange Free State is a healthy stock country. It is little affected by horse sickness and the number of horses in 1937 was 212,843. Cattle, numbering 2,093,384 in 1939, are most numerous in the eastern districts, especially about Ficksburg. Woolled sheep, totalling more than 7,000,000 in 1939, are most abundant in the Rouxville, Wepener and Smithfield districts, while goats, which exceed 70,000, are either kept largely by natives, or concentrated in the dry southwestern area about Philippolis. Among the chief crops, maize takes first place, the districts of Heilbron and Frankfurt forming part of the South African maize belt. Toward the west the area sown with maize varies greatly from year to year, according to the incidence of the rains.

The most fertile part of the country lies in the valley of the Caledon river. Here a considerable quantity of wheat is grown, especially in the districts of Ladybrand, Ficksburg, Bethlehem and Rouxville. The same districts and Harrismith also produce oat-hay. Here, too, there has been a considerable recent development of apple and plum orchards, the apples being among the best grown in South Africa. Potatoes, tobacco, pumpkins, etc., are also grown.

**Diamonds and Other Mining Industries.**—In the Orange Free State the occurrences of diamonds appear to cluster about Boshof, Koffiefontein, Jagersfontein, Kroonstad and Theunissen. The production in 1940 was valued at £56,452. The chief mines are at Jagersfontein. The alluvial diamonds, found in the gravels of the Vaal and some of its tributary streams, are of great purity. Coal approaching 1,500,000 tons was produced in 1940. The chief producers are the Cornelia colliery on the Vaal river, opposite to Vereeniging, and the Clydesdale, about 15 mi. to the south. The coal is not of the best quality. Flour milling is carried on at a number of local centres. Salt making is also carried on. The source of supply is the heavily saline waters of certain "pans" in the western districts, evaporated from shallow basins, in most cases by solar heat.

**Education,** other than higher education, is controlled by the provincial education department, subject to the sanction of the provincial administration. At the head of the department is the director. It has powers to establish and maintain primary, secondary and certain special schools, and to make grants in aid of private schools which comply with certain conditions and attain a satisfactory standard. There is a normal training college in Bloemfontein. The province is divided into 57 school districts, in each of which is an advisory board, consisting of elected members, and having certain powers of supervision. In 1939 there were in the province 605 primary and secondary schools, attended by 43,263 European scholars. There were also 380 primary and secondary schools for non-Europeans, attended by 45,457 scholars.

(R. U. S.)

## HISTORY

The country north of the Orange river was first visited by Europeans towards the close of the 18th century. At that time it was somewhat thinly peopled, mainly by tribes of the Bechuana division of the Bantus. Early in the 19th century Griquas established themselves north of the Orange. Between 1817 and 1831 the country was devastated by the chief Mosilikatze and his Zulus. Up to this time few white men had crossed the Orange. In 1834 Boer farmers from Cape Colony seeking pasture for their flocks settled in the country. They were followed in 1836 by the first parties of the Great Trek. These emigrants left Cape Colony from various motives, but all were animated by the desire to escape from British sovereignty. (*See* SOUTH AFRICA, UNION OF; and CAPE PROVINCE.) The leader of the first large party of emigrants was A. H. Potgieter, who concluded an agreement with Makwana, the chief of the Bataung tribe of Bechuanas, ceding to the farmers the country between the Vet and Vaal rivers. The emigrants soon decisively defeated Mosilikatze, who in Nov. 1837 fled northward. In the meantime another party of emigrants had settled at Thaba'nchu, where the Wesleyans had a mission station for the Barolong. The emigrants were treated with great kindness by Moroko, the chief of that tribe, and with the Barolong the Boers maintained uniformly friendly relations. In Dec. 1836 the emigrants beyond the Orange drew up in general assembly an elementary republican form of government. After the defeat of Mosilikatze the town of Winburg (so named by the Boers in commemoration of their victory) was founded, a *volksraad* elected, and Piet Retief, one of the ablest of the *voortrekkers,* chosen governor and commandant-general. The emigrants already numbered about 500 men, besides women and children and many coloured servants. Dissensions speedily arose among the emigrants, whose numbers were constantly added to, and Retief, Potgieter and other leaders crossed the Drakensberg and entered Natal.

Meanwhile a new power had arisen in the mountainous region of the upper Orange and in the valley of the Caledon. There a Bechuana chief named Moshesh had welded together a number of scattered and broken clans and had formed of them the Basuto nation. The Basuto were a menace to the white farmers, and the farmers were equally a menace to the Basuto. At that time the British government was not prepared to exercise effective control over the emigrant farmers, but on the advice of Dr. John Philip, the superintendent of the London Missionary society's stations in South Africa, a treaty was concluded in 1843 with Moshesh, placing him under British protection. A similar treaty was made with the Griqua chief, Adam Kok III. (*See* BASUTOLAND and GRIQUALAND EAST AND GRIQUALAND WEST.) By these treaties, which recognized native sovereignty over large areas on which Boer farmers were settled, it was sought to keep a check on the emigrants and to protect both the natives and Cape Colony. Their effect was to precipitate collisions between all three parties. Trouble first arose between the Boers and the Griquas in the Philippolis district. British troops were moved up to support the Griquas, and after a skirmish at Zwartkopjes (May 2, 1845), a new arrangement was made between Kok and Sir Peregrine Maitland, then governor of Cape Colony, virtually placing the administration of his territory in the hands of a British resident, a post filled in 1846 by Capt. (afterwards Major) H. D. Warden. The place chosen by Warden as the seat of his court was known as Bloemfontein, and it subsequently became the capital of the whole country.

**First Annexation by Great Britain.**—The *volksraad* at Winburg during this period continued to claim jurisdiction over the Boers living between the Orange and the Vaal and the relations between the Boers and the British were in a continual state of tension. Sir Harry Smith became governor of the Cape at the end of 1847. He recognized the failure of the attempt to govern on the lines of the treaties with the Griquas and Basutos, and on Feb. 3, 1848, he issued a proclamation declaring British sovereignty over the country between the Orange and the Vaal eastward to the Drakensberg. The justness of Sir Harry Smith's measures and his popularity among the Boers gained for his policy considerable support, but the Republican party, at whose head was Andries Pretorius (*q.v.*), did not submit without a struggle. They were, however, defeated by Sir Harry Smith in an engagement at Boomplaats (Aug. 29, 1848). Thereupon Pretorius, with those

most bitterly opposed to British rule, retreated across the Vaal.

Warden remained British resident until July 1852. A nominated legislative council was created, a high court established and other steps taken for the orderly government of the country, which was officially styled the Orange River Sovereignty. In Oct. 1849 Moshesh was induced to sign a new arrangement considerably curtailing the boundaries of Basutoland. The frontier towards the Sovereignty was thereafter known as the Warden line. The British resident had, however, no force sufficient to maintain his authority, and Moshesh and all the neighbouring clans became involved in hostilities with one another and with the whites. In 1851 Moshesh joined the Republican party in the Sovereignty in an invitation to Pretorius to recross the Vaal. The intervention of Pretorius resulted in the Sand River Convention of 1852, which acknowledged the independence of the Transvaal but left the status of the Sovereignty untouched.

The British Government, which had reluctantly agreed to the annexation of the country, had, however, already repented its decision and had resolved to abandon the sovereignty. A meeting of representatives of all European inhabitants of the sovereignty, elected on manhood suffrage, held at Bloemfontein in June 1852, nevertheless declared in favour of the retention of British rule. But the cabinet in London adhered to the determination to withdraw from the Sovereignty. Sir George Russell Clerk was sent out in 1853 as special commissioner "for the settling and adjusting of the affairs" of the Sovereignty. At that time there were some 15,000 whites in the country, among them numbers of farmers and tradesmen of British (chiefly Scottish) blood.

**Independence Forced on the Boers.**—The majority of the whites still wished for British rule provided that it was effective and the country guarded against its enemies, but Sir George Clerk announced that, as the elected delegates were unwilling to form an independent government, he would enter into negotiations with other persons. While the elected delegates sent two members to England to try to induce the Government to alter their decision Sir George Clerk came to terms with a committee formed by the Republican party and presided over by J. H. Hoffman.

A royal proclamation had already (Jan. 30, 1854) "abandoned and renounced all dominion" in the sovereignty. A convention recognizing the independence of the country was signed at Bloemfontein on Feb. 23 by Sir George Clerk and the Republican committee, and on March 11, 1854, the Boer Government assumed office and the Republican flag was hoisted. Five days later the representatives of the elected delegates had an interview in London with the colonial secretary, the duke of Newcastle, who informed them that it was impossible for England to supply troops to constantly advancing outposts, "especially as Cape Town and the port of Table bay were all she really required in South Africa." In withdrawing from the Sovereignty the British Government declared that it had "no alliance with any native chief or tribes to the northward of the Orange river with the exception of the Griqua chief Captain Adam Kok." Kok was not formidable in a military sense and in 1861 he sold his sovereign rights to the Free State for £4,000 and removed with his followers to the district now known as Griqualand East.

**Constitution of the Republic.**—On the abandonment of British rule representatives of the people were elected and met at Bloemfontein on March 28, 1854, and between that date and April 18 were engaged in framing a constitution. The country was declared a republic and named the Orange Free State. All persons of European blood possessing a six months' residential qualification were to be granted full burgher rights. The sole legislative authority was vested in a single popularly elected chamber styled the *volksraad*. Executive authority was entrusted to a president elected by the burghers from a list submitted by the *volksraad*. The president was to be assisted by an executive council, was to hold office for five years and was eligible for re-election. The constitution was subsequently modified but remained of a liberal character. A residence of five years in the country was required before aliens could become naturalized. The franchise was confined to European adult males; the grant of the suffrage to natives was never considered. It may be added here that subsequently the Free State prohibited the entry into its territory of Asiatics, so that it was never troubled with an Indian question. The first president was J. H. Hoffman, but he was accused of being too complaisant towards Moshesh and resigned, being succeeded in 1855 by J. N. Boshof, one of the *voortrekkers*, who had previously taken an active part in the affairs of Natal.

Distracted among themselves, with the formidable Basuto power on their southern and eastern flank, the troubles of the infant state were speedily added to by the action of the Transvaal Boers. Marthinius Pretorius, who had succeeded to his father's position as commandant-general of Potchefstroom, wished to bring about a confederation between the two Boer States. As peaceful overtures failed Pretorius, aided by Paul Kruger, made a raid in 1857 into the Free State territory. They found, however, little support; Kruger came into Boshof's camp with a flag of truce; and on June 2, 1857, a treaty of peace was signed, each State acknowledging the absolute independence of the other. This experience did not, however, heal the party strife within the Free State. The difficulties of the State were so great that the *volksraad* in Dec. 1858 passed a resolution in favour of confederation with Cape Colony. This proposition received the strong support of Sir George Grey, then governor of Cape Colony, but his view did not commend itself to the British Government and was not adopted. In the same year the disputes between the Basutos and the Boers culminated in open war. As the contest went against them the Free State appealed to Sir George Grey, who induced Moshesh, for a time, to come to terms. President Boshof now gave up the struggle of attempting to rule the country and in Feb. 1859 retired to Natal. His old opponent Marthinius Pretorius was elected president in his stead. Though unable to effect a durable peace with the Basutos, or to realize his ambition for the creation of one powerful Boer republic, Pretorius saw the Free State begin to grow in strength. The fertile district of Bethulie as well as Adam Kok's territory was acquired, and there was a considerable increase in the white population. The burghers generally, however, had not learned the need of discipline, of confidence in their elected rulers, or that to carry on a government taxes must be levied. Wearied like Boshof of a thankless task, and more interested in affairs in the Transvaal than in those of the Free State, Pretorius resigned the presidency in 1863, and after an interval of seven months Mr. (afterwards Sir) John Henry Brand (*q.v.*), an advocate at the Cape bar, was elected president.

**Brand's Rule.**—President Brand took office in Feb. 1864. His selection proved a turning-point in the history of the country, which, under his beneficent and tactful guidance, became peaceful and prosperous and, in some respects, a model state. But before peace could be established an end had to be made of the difficulties with the Basutos. At length, in 1867 the burghers gained a decisive victory, every stronghold in Basutoland save Thaba Bosigo being stormed. Moshesh now turned to the British at the Cape for preservation and in 1868 he and his country were taken under British protection. Thus the 30 years' strife between the Basutos and the Boers came to an end. The Boers reaped the reward of victory. By the treaty of Aliwal North (Feb. 12, 1869), the country lying to the north of the Orange river and west of the Caledon, formerly a part of Basutoland, was ceded to the Free State. This country, some 100m. long and nearly 30m. wide, lies at an altitude of nearly 6,000ft. and forms one of the richest corn-growing districts in South Africa.

The Basutoland difficulties were no sooner arranged than the Free Staters found themselves confronted with a serious difficulty on their western border. In the years 1870–71 a large number of diggers had settled on the diamond fields near the junction of the Vaal and Orange rivers, which were situated in part on land claimed by the Griqua chief Nicholas Waterboer and by the Free State. The Free State established a temporary government over the diamond fields, but the administration of this body was satisfactory neither to the Free State nor to the diggers. At this juncture Waterboer offered to place the territory under the administration of Queen Victoria. The offer was accepted, and on Oct. 27, 1871, the district, together with some adjacent territory to which the Transvaal had laid claim, was proclaimed, under the

name of Griqualand West, British territory. When the British annexation took place a party in the *volksraad* wished to go to war with Great Britain, but the wiser counsels of President Brand prevailed.

The matter involved no little irritation between the parties concerned until July 1876. It was then disposed of by the 4th Earl of Carnarvon, at that time secretary of state for the colonies, who granted to the Free State £90,000 "in full satisfaction of all claims which it considers it may possess to Griqualand West."

One thing at least is certain with regard to the diamond fields —they were the means of restoring the credit and prosperity of the Free State.

At this time, largely owing to the exhausting struggle with the Basutos, the Free State had drifted into financial straits. A paper currency had been instituted, and the notes—currently known as "bluebacks"—soon dropped to less than half their nominal value. Commerce was largely carried on by barter, and many cases of bankruptcy occurred. But the influx of British and other immigrants to the diamond fields, in the early '70s, restored public credit and individual prosperity to the Free State Boers. The diamond fields offered a ready market for stock and other agricultural produce. "Bluebacks" recovered par value, and were called in and redeemed by the government.

**Relations with the Transvaal.**—From 1870 until the time when it became involved in the second struggle between Great Britain and the Transvaal the story of the Free State was one of steady, quiet progress, marked by cordial relations with its neighbours. The state has been described as for 30 years a farmers' and transport riders' paradise. At the time of the first annexation of the Transvaal, Brand and the *volksraad* declined the invitation of Lord Carnarvon to federate with the other South African communities and when the Transvaalers rose against the British in 1880 they had the sympathy of the Free Staters. Indeed, many burghers joined the Transvaal forces in the Majuba campaign and it was due to the tact and statesmanship of Brand that a dangerous situation was prevented from developing. The danger passed and the Free State showed considerable ability in adapting itself to the change, political and economic, which, a few years later, following the discovery of the Rand gold mines, came over the whole of South Africa. Paul Kruger, instead of imitating the liberal policy of the Free State, sought to meet the problem presented by the large *uitlander* population on the Rand by reliance on continental European powers and by an alliance with the Free State. In Oct. 1887 Kruger visited Bloemfontein and tried to induce Brand to enter into an offensive and defensive alliance with the Transvaal "against the common enemy." Brand declined to be drawn into such an engagement. He refused to recognize the British as enemies—indeed, though opposed to federation, he was equally opposed to racial rivalries. He was for full co-operation with the other South African communities, and a few months later arranged with the Cape and Natal for a conference on customs and railway questions. That was in Jan. 1888; in the June following Brand died. He was one of the most upright and enlightened rulers South Africa had known, and he earned the title of peacemaker. The conference he had planned was held in 1889 and resulted in a customs union between Cape Colony and the Free State, while the Cape government obtained permission to extend the Port Elizabeth railway to Bloemfontein. This agreement was displeasing to the Transvaal, for the ultimate objective of the railway was the Rand, and Kruger had determined that the Rand's outlet to the sea should be through the Portuguese port of Lourenço Marques (Delagoa Bay).

In Brand's successor to the presidency—F. W. Reitz—the Transvaal found an ally. At one time an advocate at the Cape and after 1874 chief justice of the Free State, Reitz had been in 1881—at the time of Majuba—a leading organizer in the state of the Afrikander Bond, at that time a bitterly anti-British organization. Reitz was elected president in Jan. 1889; two months later he made a treaty of alliance with Kruger. The alliance looked to a contingency which, however, did not arise during Reitz's presidency and meanwhile the Free State continued to prosper. From its geographical position it reaped the benefit without incurring the anxieties consequent on the settlement of a large *uitlander* population on the Rand. The Jameson raid, Dec. 1895, re-awakened anti-British feeling in the Free State. Reitz had resigned the presidency a month before the raid and at the election in Feb. 1896 Judge M. T. Steyn, a strong nationalist, was elected president, receiving 41 votes against 19 cast for (Sir) John G. Fraser. Fraser was the most prominent of the burghers of Scots descent, of whom there were a considerable number in the state, and he represented Brand's policy. Many burghers supported Fraser in opposition to entangling engagements with the Transvaal; nevertheless, Steyn, though protesting against many of the manifestations of Krugerism, concluded a new defensive and offensive alliance with Kruger in March 1896.

**The South African War and After.**—In the four years which followed, the Free State revised its constitution, the period of residence to obtain naturalization being reduced (Dec. 1897) from five to three years; entered (1898) into a new customs union with the Cape and Natal and in other ways tried to live up to its reputation as a model community. It was alarmed at the developments of the *uitlander* troubles in the Transvaal and tried to get Kruger to enact reforms; its ex-president, Reitz, had become state secretary in the Transvaal. Bloemfontein was chosen as the place for the Milner-Kruger conference which met in June, 1899, when Steyn urged Kruger to grant the five-year franchise to the *uitlander* (and thus avoid war) and Kruger retorted by asking Steyn "not to play the tame elephant to get him into the English kraal." But when the war came in the October following, the Free State was solidly by the side of the Transvaal. A resolution had been passed by the *volksraad* on Sept. 27 declaring that the state would observe its obligations to the Transvaal whatever happened. It would probably have sided with its sister Boer republic in any case, alliance or no alliance, for racial ties were strong. The offer of the British government to respect the independence of the Orange Free State if it remained neutral had no response; and the bitterness against Great Britain was possibly greater in the Free State than in the Transvaal. The events of the war are told elsewhere. (*See* SOUTH AFRICAN WAR and SOUTH AFRICA, UNION OF.)

**Orange River Colony.**—Bloemfontein was occupied by the British under Lord Roberts on March 13, 1900; and on May 28 following the Free State was annexed by Great Britain under the title of Orange River Colony. For nearly two years longer the burghers kept the field under Christian de Wet (*q.v.*), and other leaders, but by the articles of peace signed on May 31, 1902, British sovereignty was acknowledged. A civil administration of the colony was established early in 1901 and in June 1902 a nominated legislative council was set up of which Sir John Fraser and a number of other prominent ex-burghers became unofficial members. In every direction vigorous and successful efforts were made to repair the ravages of the war. More than £4,000,000 was spent by the British government in the colony on these objects. At the same time efforts were made—with no great measure of success—to strengthen the British element in the country by means of land settlements. Special attention was also devoted to the development of the resources of the country and the education system was reorganized and greatly improved.

**Responsible Government.**—Having recovered from the worst effects of the war the Boers, both in the Transvaal and Orange Colony, began in 1904 to make organized efforts to regain their political ascendancy. This agitation, as far as the Orange River Colony was concerned, coincided with the return to South Africa of ex-President Steyn. Steyn had gone to Europe at the close of the war and did not take the oath of allegiance to the British crown until the autumn of 1904. A congress of ex-burghers was held at Brandfort in Dec. 1904, when among other resolutions passed was one demanding the grant of self-government to the colony. This was followed in July 1905 by a conference at Bloemfontein, when it was resolved to form a national union. This organization, the *Oranjie Unie,* was formally constituted in May 1906.

A counter-organization was formed by ex-burghers who had whole-heartedly accepted the new order of things. They took the title of the Constitutional party, and Sir John Fraser was chosen

as chairman. In Bloemfontein the Constitutionalists had a strong following; elsewhere their supporters were numerically weak. The programs of the two parties were very similar, the real difference between them being the attitude with which they regarded the British. While the ideal of the *Unie* was an Afrikaner state, the Constitutionalists desired the equality of both white races.

The advent of a Liberal administration under Sir Henry Campbell-Bannerman in Great Britain in Dec. 1905 completely altered the political situation in the late Boer states. The previous (Conservative) government had in March 1905 made public a form of representative government, intended to lead up to self-government for the Transvaal, and had intimated that a similar constitution would be subsequently conferred on the Orange Colony. The Campbell-Bannerman administration decided to do without this intermediary step in both colonies. It was not, however, until July 1, 1907, that the letters-patent conferring self-government on the colony were promulgated, the election for the legislative assembly taking place in November following. They resulted in the return of 29 members of the *Oranjie Unie,* 5 Constitutionalists and 4 Independents. The Constitutionalists won four of the five seats allotted to Bloemfontein, Sir John Fraser being among those returned. A ministry, which included Generals J. B. M. Hertzog and Christian de Wet, was formed by Abraham Fischer, one of the leading members of the old *volksraad.* Steyn's ill-health prevented his taking office, but he wielded almost as much power as when he had been president of the country.

**Union of South Africa.**—The responsible government entered upon its task in favourable conditions. The seven years of crown colony administration had achieved remarkable results. Materially the country had been restored to a sound state with every prospect of a prosperous future, and steady progress was made under responsible government, but political developments were rapid, and less than three years after Fischer took office the Orange River Colony, as such, had ceased to exist. The colony took part in May 1908 in an inter-state conference which determined to renew the existing customs convention and to make no alteration in railway rates. These decisions were the result of an agreement to bring before the parliaments of the various colonies a resolution advocating the closer union of the South African states and the appointment of delegates to a national convention to frame a draft constitution. In this convention Steyn took a leading and conciliatory part, and subsequently the Orange River Colony legislature agreed to the terms drawn up by the convention for the unification of the four self-governing colonies. Under the imperial act by which unification was established (May 31, 1910) the colony entered the union under the style of the Orange Free State Province. Fischer and Hertzog became members of the first union ministry, while Dr. A. E. W. Ramsbottom, formerly colonial treasurer, became the first administrator of the Free State as a province of the union.

**Education Controversy.**—During the period in which the province had been a self-governing colony much bitterness had been caused by the educational policy pursued by Hertzog, who was attorney-general and minister of education. From the date of the passing of an education act in the middle of 1908 until the absorption of the colony into the union, Hertzog so administered its provisions regarding the media of instruction as to compel every European child to receive instruction in every subject, partly in the medium of Dutch. This policy of compulsory bilingualism was persisted in despite the vehement protests of the English-speaking community, and of the desire of many burghers that the medium of instruction for their children should be English. Failing to obtain redress, the English-speaking section of the community proceeded to open separate schools. It was not until 1912 that through the intervention of the union parliament the dispute was settled by the provision that in the lower standards the medium of instruction should be the home language of the pupil. As to the Boer section, the *taal,* renamed Afrikaans, was by ordinance passed in 1920 recognized as a medium of instruction instead of Netherlands Dutch; the Free State Province being the first to adopt officially South African Dutch.

The province followed Hertzog when he parted from Botha on the racial issue and it became the stronghold of the Afrikaner nationalists. With the exception of one of the Bloemfontein divisions they had a majority in every parliamentary constituency in the province. Up to his death in 1916 Steyn's influence with the Afrikaans-speaking section of the people continued powerful. In the crisis caused by World War I Steyn, supported by Hertzog, opposed operations against the Germans in South-West Africa. There followed the rebellion of de Wet, who drew his chief strength from the Free State. On Steyn's death Hertzog became the undisputed leader of the Afrikaner nationalists and after the general election of 1924 he was chosen as prime minister of the union.

In internal affairs the province has been governed on progressive lines. Its interests remain predominantly agricultural.

BIBLIOGRAPHY.—A. H. Keane, *The Boer States: Land and People* (1900); W. S. Johnson, *Orangia* (a geographical work, 1906); G. McCall Theal, *History of South Africa since 1795* (to 1872) vols. ii, iii and iv (1908 ed.); Eric A. Walker, *A History of South Africa* (to 1924) bibl. (1928). *See* also the bibliographies in the *Cambridge History of the British Empire,* vol. viii (1940) and under TRANSVAAL and SOUTH AFRICA, UNION OF. (F. R. C.; Ho. F.)

**ORANGEMEN.** The Orange society was formed in Co. Armagh after a battle between Protestants and Roman Catholics at the Diamond. It was at first purely local and defensive. It soon spread from Armagh to other parts of Ulster. In the 19th century large numbers of Ulstermen emigrated to the United States and the British dominions. Branches were soon established in those countries and are now flourishing. In recent years the order has made great progress in Britain, especially in southern Scotland. The name was derived from William III (prince of Orange) who firmly established the Protestant dynasty in Britain. The society is founded for the maintenance of Protestantism and contains men (in recent years women) of all political parties. As the home rule controversy in Ireland was conducted largely on religious lines, Orangemen sided with the Unionist party but the order as an order has never been political. The most grotesque stories have been circulated about the bigotry of Orangemen, but they are discounted by the fact that every candidate for the order takes an obligation enjoining toleration and goodwill to Roman Catholics. On notable occasions Orangemen have shown their independence of political parties.

The principal anniversary is July 12, when the battle of the Boyne is celebrated.

**ORANGUTAN** ("man of the woods"), the giant red manlike ape of Borneo and Sumatra (*Simia satyrus*). The reddish colour of the long, coarse hair distinguishes the omias, as the Dyaks call it, from African apes; the arms are such that the animal in the upright posture can rest on its bent knuckles. In some races, in the old males, which may stand 5½ ft. high, there is a large expansion of the cheeks, due to growth of fibrous tissue and producing a broad and flattened type of face. Another peculiarity of the males is the presence of a huge throat-sac on the front of the throat and chest, which may extend even to the armpits; although present in females, it does not reach nearly the same dimensions in that sex. More than half a dozen separate races of orangutan are recognized in Borneo where the red ape inhabits the swampy forest tract at the foot of the mountains. These apes are comparatively slow and deliberate in their movements; they construct platforms of boughs in the trees, which are used as sleeping places, and apparently occupied for several nights in succession. Durian, the tough spiny hide of which is torn open with their strong fingers, forms their chief food. They also consume the mangustin and other fruits. (*See* PRIMATES.)

BY COURTESY OF THE N.Y. ZOOLOGICAL SOCIETY

ORANGUTAN (SIMIA SATYRUS)
A giant red ape of Borneo and Sumatra

**ORANIENBAUM,** a town of Russia in the Leningrad area, in 59° 54′ N., 29° 48′ E., lying 100 ft. above the sea on the south coast of the Gulf of Finland, opposite Kronstadt. Pop.

(1926) 7,061. It was formerly a summer residence of the imperial family. The site was given to Menshikov in 1714 by Peter the Great, and the palace he erected still stands. Confiscated in 1727, it became an imperial residence. In 1743 the empress Elizabeth presented Oranienbaum to the future Tsar Peter III., who built there a castle, now destroyed, for his Holstein soldiers. The palace became a hospital during the 1914–18 war, and is now a rest home for workers. A school of forestry was established in one of the wings. A railway has been built since the revolution to link the town with the fort of Krasnaya Gorka, which guards the entrance to Kronstadt bay. There are flour-mills and brick works and the saw-milling industry is important.

**ORAON,** an aboriginal tribe of the Chota Nāgpur plateau, India, also known as Dhāngars. They call themselves *Kurukh,* but being divided into various groups are apt to be designated by group-names (*e.g.* Modi, "navvy," Kisān, "cultivator"), when they emigrate. A short, sturdy race of Dravidian type, they are in demand as labourers. As Oraon mothers shape their babies' heads their dolichocephaly may be to some extent artificial. The village organization is advanced. Their speech is akin to Kanarese. Their religion is a mixture of nature-worship and magic, thinly overlaid with Hinduism, Dharmes being the supreme god. In recent years a religious movement, influenced by Christianity as well as by Brahmanism, known as the Tana Bhagat movement and manifesting itself in ghost-hunting and the addition of German Bāba to the pantheon, caused some excitement in 1915. It had begun with a crusade against belief in ghosts and was largely a revolt against social degradation and economic depression.

Sarat Chandra Roy, *The Oraons of Chota Nagpur Ranchi* (1915), gives full history and valuable information; *Man in India* I. (1921).

**ORATORIO,** the name given to a form of religious music with chorus, solo voices and orchestra, independent of, or at least separable from the liturgy, and on a larger scale than the cantata (*q.v.*). Its history is involved in that of opera (*see* ARIA and OPERA), but its antecedents are more definite. The term is almost certainly (but *see* Schütz's "stilo Oratorio" on p. 844) derived from the fact that St. Filippo Neri's Oratory was the place for which Animuccia's settings of the *Laudi Spirituali* were written; and the custom of interspersing these hymns among liturgical or other forms of the recitation of a Biblical story is one of several origins of modern oratorio. A more ancient source is the use of incidental music in miracle plays and in such dramatic processions as the 12th century *Prose de l'Âne,* which on Jan. 1, celebrated at Beauvais the Flight into Egypt. But the most ancient origin of all is the Roman Catholic rite of reciting, during Holy Week, the story of the Passion according to the Four Gospels, assigning the words of the Evangelist to a tenor, distributing all *ipsissima verba* among appropriate voices, and giving the *responsa turbae,* or utterances of the whole body of disciples (*e.g.,* "Lord, is it I?") and of crowds, to a chorus. The only portion of this scheme that concerned composers was the *responsa turbae,* to which it was permitted to add polyphonic settings of the Seven Last Words or the eucharistic utterances of the Saviour. The narrative and the parts of single speakers were sung in the Gregorian tones appointed in the liturgy. Thus the settings of the Passion by Victoria and Soriano represent a perfect solution of the art-problem of oratorio. "Very tame Jews" is Mendelssohn's comment on the 16th century settings of "Crucify Him"; and it has been argued that Soriano's and Victoria's aim was not to imitate the infuriated Jews, but to express the contrition of devout Christians telling the story. On the other hand, ancient tradition ordained a noisy scraping of feet on the stone floor to indicate the departure from the place of the judgment seat! And so we owe the central forms of Bach's Lutheran Passion-oratorios to the Roman Catholic ritual for Holy Week.

With the monodic revolution at the outset of the 17th century the history of oratorio as an art-form wholly controlled by composers begins. There is nothing but its religious subject to distinguish the first oratorio, Emilio del Cavalieri's *Rappresentazione di anima e di corpo* from the first opera, Peri's *Euridice,* both produced in 1600. Differentiation was brought about primarily by the fact that oratorios without stage-presentation gave opportunity for a revival of choral music. And oratorios on the stage discouraged, by reason of their sacred subjects, whatever vestiges of dramatic realism could survive the ascendancy of the aria (*q.v.*). For lesser composers than Bach and Handel this ubiquitous form represented almost the only possibility of keeping music alive, or at least embalmed, until the advent of the dramatic and sonata styles. The efforts of Carissimi (d. 1674) in oratorio clearly show how limited a divergence from the method of opera was possible when music was first emancipated from the stage. Yet his art shows the corruption of Church music by a secular style rather than the rise of Biblical music-drama to the dignity of Church music. Normal Italian oratorio remains indistinguishable from serious Italian opera as late as *La Betulia liberata,* which Mozart wrote at the age of 15. Handel's *La Resurrezzione* and *Il Trionfo del Tempo* contain many pieces simultaneously used in his operas, and they contain no chorus beyond a perfunctory operatic final tune. *Il Trionfo del Tempo* was a typical morality play, and it became a masque, like *Acis and Galatea* and *Semele,* when Handel at the close of his life adapted it to an English translation with several choral and solo interpolations from other works. Yet between these two versions of the same work lies half the history of classical oratorio. The rest lies in the German Passion-oratorios that culminate in Bach; after which the greatest music avoids every form of oratorio until the two main streams, sadly silted up, and never afterwards quite pure, unite in Mendelssohn.

Luther was so musical that while the German Reformation was far from conservative of ancient liturgy, it retained almost everything which makes for musical coherence in a Church service; unlike the English Church, which with all its insistence on historic continuity, so rearranged the liturgy that no possible music for an English Church service can ever form a coherent whole. The four *Passions* and the *Historia der Auferstehung Christi* of H. Schütz (who was born in 1585, exactly a century before Bach) are as truly the descendants of Victoria's Passions as they are the ancestors of Bach's. They are Protestant in their use of the vulgar tongue, and narrative and dialogue are set to free composition instead of Gregorian chant, although written in Gregorian notation. The *Marcus Passion* is in a weaker and more modern style and stereotyped in its recitative. It may be spurious. But in the other Passions, and most of all in the *Auferstehung,* the recitative is a unique and wonderful language. It may have been accompanied by the organ, though the Passions contain no hint of accompaniment at all. In the *Auferstehung* the Evangelist is accompanied by four viole da gamba in preference to the organ. The players are requested to "execute appropriate runs or passages" during the sustained chords. A final non-scriptural short chorus on a chorale-tune is Schütz's only foreshadowing of the contemplative and hymnal element of later Passion oratorios.

The *Auferstehung,* the richest and most advanced of all Schütz's works, has one strange convention, in that single persons, other than the Evangelist, are frequently represented by more than one voice. If this were confined to the part of the Saviour, it would have shown a reverent avoidance of impersonation, as in Roman Catholic polyphonic settings of the Seven Words. But Schütz writes thus only in *Die Auferstehung* and there on no particular plan. While the three holy women and the two angels in the scene at the tomb are represented naturally by three and two imitative voices, Mary Magdalene is elsewhere always represented by two sopranos.

Shortly before Bach, Passion oratorios were represented by several remarkable works of art, most notably by R. Keiser (1673–1739). Chorale-tunes, mostly in plain harmony, were freely interspersed in order that the congregation might take part in what was, after all, a church service for Holy Week. The meditations of Christendom on each incident of the story were expressed in accompanied recitatives (*arioso*) leading to arias or choruses, and the scriptural narrative was sung to dramatic recitative and ejaculatory chorus on the ancient Roman plan. On slightly different lines was Graun's beautiful *Tod Jesu,* which was famous when the contemporary works of Bach were ignored.

The difference between Bach's Passions and all others is simply the measure of his greatness. Where his chorus represents the

whole body of Christendom it has as peculiar an epic power as it is dramatic where it represents tersely the *responsa turbae* of the narrative.

In the Matthew Passion the part of Christ has a special accompaniment of sustained strings, generally at a high pitch, though deepening at the most solemn moments. And at the words "Eli, Eli, lama sabacthani" this musical halo has vanished. In power of declamation Bach was anticipated by Keiser; but no one approached him in sustained inspiration and architectonic greatness. The forms of Passion music may be found in many of Bach's Church cantatas; a favourite type being the *Dialogue*; as, for instance, a dispute between a fearing and a trusting soul with, perhaps, the voice of the Saviour heard from a distance; or a dialogue between Christ and the Church, on the lines of the Song of Solomon. The Christmas Oratorio, a set of six Church cantatas for performance on separate days, treats the Bible story in the same way as the Passions, with a larger proportion of non-dramatic numbers. Many of the single Church cantatas are called oratorios, a term which by Bach's time seems definitely to have implied dialogue, possibly on the strength of a false etymology. Thus Schütz inscribes a monodic sacred piece "in stilo Oratorio," meaning "in the style of recitative." The further history of oratorio radiates from the heterogeneous works of Handel.

There are various types and several mixtures of style in Handelian oratorio. The German forms of Passion music evidently interested Handel, and it was after he came to England, and before his first English oratorio, that he set to music the famous poetic version of the Passion by Brockes, which had been adopted by all the German composers of the time, and which, with very necessary improvements of taste, was largely drawn upon by Bach for the text of his Johannes-Passion. Handel's Brockes Passion does not appear ever to have been performed, though Bach found access to it and made a careful copy; so Handel must have composed it for his own edification. He soon discovered that many kinds of oratorio were possible. The emancipation from the stage admitted of subjects ranging from semi-dramatic histories, like those of *Saul, Esther* and *Belshazzar,* to cosmic schemes expressed entirely in the words of the Bible, such as *Israel in Egypt* and *The Messiah.* Between these types there is every gradation of form and subject; besides an abrupt contrast of literary merit between the mutilated Milton of *Samson* and the amazing absurdities of *Susannah.*

The very name of Handel's first English oratorio, *Esther,* and the facts of its primary purpose as a masque and the origin of its libretto in Racine, show the transition from the stage to the Church; and, on the other hand, Haman's lamentation on his downfall is scandalously adapted from the most sacred part of the Brockes Passion.

We may roughly distinguish three main types of Handelian oratorio, not always maintained singly in whole works, but always available as methods. First, there is the operatic method, in which the arias and recitatives are the utterances of characters in the story, while the chorus is a crowd of Israelites, Babylonians or Romans (*e.g., Athalia, Belshazzar, Saul,* etc.). The second method retains the dramatic rôles both in solos and in choruses, but (as, for instance, in "Envy, eldest born of Hell," in *Saul*) also uses the chorus as the voice of universal Christendom. Handel's audience demanded plenty of arias, most of which are accounted for by futile, when not apocryphal, love affairs. The haughty Merab and the gentle Michal are characterized with fatal ease, and make parts of *Saul* almost as impossible as most of *Susannah.* The third Handelian method is a series of choruses and numbers on a subject altogether beyond the scope of drama, as, for instance, the greater part of *Solomon* and, in the case of *The Messiah* and *Israel in Egypt,* treated entirely in the words of Scripture, and those not in narrative but in prophecy and psalm.

After Bach and Handel, oratorio fell upon evil days. The rise of the sonata style, which brought life to opera, was bad for oratorio; since not only did it accentuate the fashionable dislike of that polyphony which is essential even to mere euphony in choral writing, but its dramatic power became more and more disturbing to the epic treatment that oratorio naturally demands.

Philip Emanuel Bach's oratorios, though cloying in their softness and sweetness, achieved a true balance of style in the earlier days of the conflict; indeed, a judicious selection from *Die Israeliten in Wüste* (1769) would perhaps bear revival almost as well as Haydn's *Tobias* (1774).

*The Creation* (*Die Schöpfung*) and *The Seasons* (*Die Jahreszeiten*) will always convey to unspoilt music-lovers the profound message of the veteran Haydn, who could not help "worshipping God with a cheerful heart." This spirit was well known to Bach, the composer of *"Mein glaübiges Herze,"* and it is compatible with the romantic sound-pictures and Handelian sublimity of the opening Representation of Chaos and the great chord of C major at the words "and there was light." The childlike gaiety of much of the rest ought not to blind us to its fundamental greatness, which brings the naïvely realistic birds and beasts of *The Creation* into line with even the wine-chorus in the mainly secular *Seasons,* and removes Haydn from the influence of the vile taste which henceforth pervaded oratorios, until Mendelssohn effected a partial improvement. Haydn strenuously resisted the persuasion to undertake *The Seasons* which had a close connection with Thomson's poem, as *The Creation* had a distant connection with *Paradise Lost.* He thought the whole scheme "Philistine" (his own word) and, both before he yielded to persuasion and after he had finished the work, said all the hard things about it that have ever been said since.

Roman Catholic oratorio was under the disadvantage that it was not permitted to take Biblical texts except in the Latin language. Jomelli's *Passione* for once had the benefit of a meditative text with some distinction of style; and in closing the first part with a dominant seventh on the word *"pensaci"* he achieved a stroke of genius which at the present day would still startle the listener and leave his mind in the desired frame of meditative astonishment.

But words fail to characterize the libretto of Beethoven's unfortunate *Christus am Oelberge* (*c.* 1800). The texts of Lutheran church-music had often been grotesque and even disgusting; but their barbarity was pathetic in comparison with the sleek vulgarity of a libretto in which not only is the agony of the garden of Gethsemane represented by an aria (as in Handel's lamentation of Haman), but Christ sings a brilliant duet with the ministering angel. In after years Beethoven had not a good word for this work, which, nevertheless, contains some beautiful music exquisitely scored. And justice demands praise for the idea of making a Hallelujah chorus conclude the work as soon as the betrayal of Christ has been accomplished, thus compensating for the irreverent opening by avoiding all temptation to treat the rest of the passion-story with the same crassness. A well-meant effort was made to provide the *Mount of Olives* with an inoffensive subject in English, but the stupidity of *Engedi: or David in the Wilderness* passes belief.

Schubert's interesting fragment *Lazarus* is strangely prophetic of Wagnerian continuity and has a morbid beauty that transcends its sickly text. There are signs that the despair of the Sadducee was going to be treated with some power. The result might have been a masterpiece; but fate ruled that the next advance should again be Protestant.

Bach's Passions were rediscovered by the boy Mendelssohn after a century of ignorance of their very existence; and in *St. Paul* (*Paulus*) and *Elijah* (*Elias*) rose upon the early middle 19th century like the sunrise of a new Handel.

To-day *St. Paul* has almost sunk below the horizon; and *Elijah,* which still shares with *The Messiah* the Christmas repertoire of every British urban choral society, is in many points an easy target for criticism. Yet the ascendancy of Mendelssohn is the one redeeming feature in the history of oratorio during the first three quarters of the 19th century. Let us admit the defects of *Elijah;* the all too lifelike tiresomeness of the widow (achieved after strenuous revision), the parochial softness of the double quartet, the Jewishness of the Jews (but is this a defect?), and the snorts of the trombones whose third summons causes the Almighty to capitulate: when all these unconscious profanities are discounted, there remains a vivid and coherent oratorio that, musically and

dramatically, towers above later works by many accomplished composers who despise it. (*See* MENDELSSOHN.)

Spohr is the only contemporary of Mendelssohn whose sacred music is still known. So tremendous a subject as that of *The Last Judgment* ought, indeed, to be treated with reserve; but the softness and slowness which pervades nine-tenths of Spohr's work is not reserve but self-indulgence. Spohr has moments of vision; but an almost random glance at the pages of *St. Paul* shows that even in eclipse Mendelssohn has characterization, movement and the capacity for thrilling dramatic moments.

In England, the influence of Mendelssohn completed the devastation begun by our inveterate habit of praising the inspired literary skill of the sacred narrative, as a preface to our restatement of it in 40 times as many words of our own. Deans and chapters listened in graceful official pride and imperfectly secret glee to the strains in which the cathedral organist celebrated with equal realism the destruction of Sennacherib's hosts and his own octuply-contrapuntal doctorate of music. Before 1880 our composers had, as Dr. Walker says, "set with almost complete indiscrimination well-nigh every word of the Bible." Had they confined themselves to the second chapter of Ezra they would have escaped dangers of unconscious humour that lurk in the opportunities for "naturalness" in declaiming the dialogues and illustrating the wonders of scriptural narrative.

Neither Sterndale Bennet nor Macfarren improved matters; but Parry and Stanford, towards the end of the century, completely changed the situation. Stanford's *Eden* has a libretto by Robert Bridges. The disgruntled professional librettists, who were also musical critics, had the effrontery to say that this magnificent poem would be the better for extensive cuts. The real truth is that Stanford's music, especially in its orchestral introductions, is diffuse. But it has many beautiful features, and achieves a coherent scheme on exactly such lines of Wagnerian continuity as can be applied to oratorio. Parry preferred to be his own librettist, and by this means he achieved more significant results. The lapses of the amateur poet are less distressing than the *clichés* of the ordinary professional librettist; and the works of Parry and Stanford permanently raised English oratorio from squalor and made it once more an art-form which educated people could enjoy. Some of Parry's architectonic and dramatic ideas will never lose the power to thrill, if only the works as wholes can live in spite of a certain dryness of melody and heaviness of texture. For example, the exploit of Judith is shown with a total avoidance of the cheap and salacious opportunity for a scene between her and Holofernes. Instead, we listen to the watchmen anxiously making their circuit of the city walls in darkness. The music of their march is at a low pitch. It is reaching a normal close when, high above the tonic chord, the cry of Judith bids the watchmen open the gates to her. If this moment cannot thrill, there is no meaning in art. In *King Saul* Parry made a significant discovery as to the emancipation of dramatic oratorio from the stage conditions of time and space. The Witch of Endor prophesies the battle of Gilboa. Her tale becomes real in the telling and is immediately followed by the final dirge.

As with opera, so, but more easily, with oratorio, the method of Wagnerian continuity at last enabled composers to take extant poems and set them to music in their entirety. Thus the fragrant mysticism of Roman Catholic oratorio, dimly adumbrated in Schubert's *Lazarus,* at last came to fruition in Elgar's wonderful setting of Newman's *Dream of Gerontius,* while the old miracle play *Everyman* was very successfully composed by Walford Davies. In his later works, *The Apostles* and *The Kingdom,* Elgar pursues a comprehensive religious design on texts arranged by himself. Oratorio on the basis of Wagnerian continuity and *Leit-motif* is unquestionably a living art-form. Its greatest difficulty is its fatal facility. The oratorio-composer is lost who omits to transcend the limits of the stage; yet when these are transcended only the stedfastness of genius can prevent the composer from sinking to the fashion-storming eclecticism of Honegger's *Le Roi David* which, with the aid of a reciter to read the Bible, takes up the arts of all periods from Handel on and drops each of them before anything like an art-problem arises.

Why not follow more often the method of *The Messiah* and of *Israel in Egypt;* and deal with religious subjects in terms of prophecy and psalm? Brahms's *Deutsches Requiem* is really an oratorio; and since its production (all but one later movement) in 1866 it continues year by year to tower over all other choral music since Beethoven's Mass in D. Form, disciplined form, is not the only thing needed to save future oratorios from the limbo of vanity; but it is their first need. (D. F. T.)

**ORATORY,** the art of speaking eloquently or in accordance with the rules of rhetoric (*q.v.*).

**ORATORY OF ST. PHILIP NERI, CONGREGATION OF THE,** or ORATORIANS, a religious order consisting of a number of independent houses, first organized in 1575 by the Florentine priest, Philip Neri (*see* NERI, PHILIP.)

**ORBIGNY, ALCIDE DESSALINES D'** (1802–1857), French palaeontologist, was born at Couërzon, Loire Inférieure, on Sept. 6, 1802, and was educated at La Rochelle. His first appointment was as travelling naturalist for the Museum of Natural History at Paris. He went in 1826 to South America, and gathered much information on the natural history and ethnology, embodying the results in his great work *Voyage dans l'Amérique Méridionale* (1839–1842). Then, in 1840 he began to publish his *Paléontologie Française, ou description des fossiles de la France,* a monumental work, accompanied by figures of the species. Eight volumes were published by him dealing with Jurassic and Cretaceous invertebrata, and since his death many later volumes have been issued. In 1853 he was appointed professor of palaeontology at the Museum of Natural History in Paris, but died on June 30, 1857, at Pierresitte, near St. Denis.

His works include *Cours élémentaire de paléontologie et de géologie stratigraphiques* (3 vols., 1849–52), and *Prodrome de paléontologie stratigraphique* (3 vols., 1850–52).

**ORBIT,** in astronomy, is the path of a heavenly body revolving around an attracting centre (from Lat. *orbita,* a track, *orbis,* a wheel); in particular, it denotes the path of a planet or comet around the sun, or of a satellite around its controlling planet.

**Kepler's Laws.**—In 1609 Johann Kepler announced two laws of planetary motion, and by 1619 he added a third. Kepler's first law is as follows:—A planet moves around the sun in an elliptic orbit, the sun being situated in one focus of the ellipse. If the straight line joining any two points S and T is produced equal distances beyond S and T to A and B, and if P is any point such that the sum of the distances P S and P T is equal to the distance A B, then the aggregate of all such points as P is the curve known as the ellipse. The points S and T are the foci. The curve passes through A and B and A B is called the major axis of the ellipse. If C is the mid-point of A B, the ratio

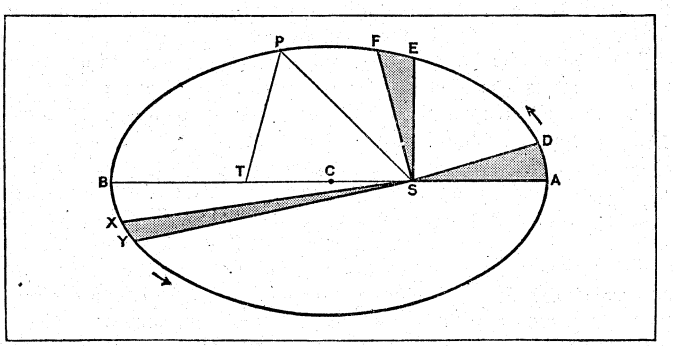



FIG. 1.—DIAGRAM ILLUSTRATING KEPLER'S LAWS OF PLANETARY MOTION

of the length of C S to the length of C A is called the eccentricity. The ellipse then is specified by means of (i) the semi-major axis and (ii) the eccentricity. If the eccentricity happens to be zero, the two foci must coincide at the centre C and the resulting curve is simply a circle; if the eccentricity is precisely unity, then the curve is known as a parabola. Kepler's first law simply states that if the sun is supposed situated at the focus S, the planet's path around the sun—in other words, its orbit—is an ellipse such as is represented in the diagram above. The time required for a complete revolution in the ellipse is the planet's

revolution period; for example, the earth's period of revolution is a little over 365 days; Mercury describes its orbit in 88 days, and Neptune requires 165 years. At A—the point of the ellipse nearest S—the planet is said to be in *perihelion,* and when it reaches B, the most remote point of the ellipse from S, it is said to be in *aphelion.*

Kepler's second law states that the straight line joining the sun to the planet (the radius vector) sweeps out equal areas in equal times. In the preceding figure let D be the position of the planet in its elliptic orbit a month after it reached perihelion (A); similarly let E F be two positions of the planet separated by an interval of a month; the pair of points X, Y are defined in the same way. The shaded area S D A, for example, is the area swept out by the radius vector in one month and by the second law the three shaded areas are equal. Now it is clear from the figure that the arc A D is greater than the arc X Y, for the areas S D A and S X Y are equal and S A and S D are less than S X and S Y; consequently, the velocity of the planet in its orbit must be greater between A and D than between X and Y. More definitely, the velocity of the planet is greatest at perihelion, decreasing gradually until aphelion is reached and thereafter increasing to a maximum again at perihelion.

The figure also shows that the angles described in equal intervals of time by the radius vector vary throughout the orbit; for example the angle D S A is clearly greater than the angle X S Y. The angular velocity is greatest at perihelion and least at aphelion. In one complete revolution around the sun, the radius vector sweeps out 360° and as the period of revolution is accurately known, the average angular velocity is easily deduced. This is known as the "mean motion" and is expressed as so many degrees (or seconds of arc) per day.

Kepler's third law is a relation connecting the semi-major axes of the several planets with their periods of revolution. In Kepler's time, the mean distance of any one planet from the sun was not known in miles but it was known fairly accurately in terms of the earth's mean distance from the sun regarded as the unit of the distance; in other words, the planetary system had been fairly correctly mapped out but the scale of the map was lacking. Also, the periods of the several planets were known with considerable accuracy. The third law expressed in words is: the cube of the semi-major axis of any planetary orbit divided by the square of the period of revolution is the same whatever planet is considered. If the year is regarded as the unit of time and the earth's mean distance from the sun as the unit of distance (this is known as the astronomical unit of distance) the quotient above for the earth is plainly unity and consequently by the third law the cube of the semi-major axis of any other planet (expressed in terms of the astronomical unit) must be equal to the square of the planet's period (expressed in years).

**The Orbit in Space.**—We have seen that the elliptic orbit of a planet is specified by the eccentricity and the semi-major axis. To apply Kepler's first and second laws to predict the positions of the planet in its orbit at any time it is necessary to know in addition the time when it occupied any definite position in the orbit or the time when it passed through perihelion. The eccentricity, the length of the semi-major axis and the time of perihelion passage constitute three elements of the planet's orbit.

The planetary motions do not all take place in the same plane and consequently the plane of the orbit of a particular planet must be specified with reference to some fundamental plane: the plane chosen is that of the earth's orbit and is called the plane of the ecliptic. Imagine a sphere drawn with the sun at the centre. The plane of the earth's orbit will cut the sphere in a circle (the ecliptic) and the orbital plane of any other planet will cut the sphere in another circle inclined at some definite angle to the plane of the ecliptic. The two circles intersect at two points N and M—called the Nodes. Let V denote a definite reference point on the ecliptic—the direction S V may be thought of as the direction of a particular star as seen from the sun. The point V is known as the "vernal equinox" or "First point of Aries"; it is not necessary here to specify it more particularly. The plane of the planet's orbit is completely specified—with reference to the ecliptic and the point V—by (i) the inclination of the planet's plane to the plane of the ecliptic and (ii) the position of the node N with respect to the point V. The latter is evidently given by the angle subtended at the sun by the radii S V and S N, and this angle is known as the longitude of the node. One thing more requires to be done and that is to specify the orientation of the orbital ellipse in its plane; this is accomplished by specifying the direction of perihelion—in the figure this is indicated by the direction S A. The sum of the angles subtended at S by the arcs V N and N A is called the longitude of perihelion. It should be noticed that there is an ambiguity as to the meaning of the expression "longitude of the node" for there are two nodes N and M. If the upper hemisphere in the figure contains the north pole of the heavens, the radius vector of the earth's orbit moves in the direction S V towards S N as indicated by the arrow; and if the radius vector of the planet moves in the direction S N towards S A, as indicated by the arrow, then N is called the ascending node and M the descending node and (ii) above more precisely should be "the longitude of the ascending node." The ambiguity consequently disappears.

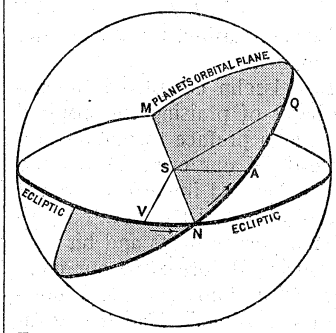


FIG. 2.—PLANET'S ORBITAL PLANE IN RELATION TO THE ECLIPTIC

To summarize; a planet's orbit in space is completely specified by the six elements: (i) the semi-major axis, (ii) the eccentricity, (iii) the time of perihelion passage, (iv) the longitude of the ascending node, (v) the longitude of perihelion, (vi) the inclination of the orbital plane to the plane of the ecliptic.

When the six elements of a planet's orbit are known the position of the planet (the effects of the attractions of the other planets not being taken into account) with reference to the sun and the fundamental plane (the ecliptic) can be calculated for any future date by principles essentially contained in Kepler's laws. The earth's orbit also being known, the position of the planet in the heavens, as seen from the earth, can then be deduced.

**The Orbit from Observations.**—The reverse problem is to determine the elements of the orbit from actual observations of position made from the earth. When a minor planet or comet is discovered it is important to determine the six elements of its orbit, thus enabling the astronomer to follow subsequently its wanderings even without the aid of observational appliances. A single complete observation of a planet consists in determining its right ascension and declination; three such complete observations at intervals, say, of a month are sufficient to allow the calculation of the six orbital elements.

BIBLIOGRAPHY.—G. Stracke, *Bahnbestimmung der Planeten und Kometen* (Berlin, 1929); R. T. Crawford, *Determination of Orbits of Comets and Asteroids* (1930), both for the specialist reader; Russell, Dugan, and Stewart, *Astronomy* (vol. i. Boston, U.S.A. 1926), for the non-specialist reader. (W. M. S.)

**ORCAGNA** (*c.* 1308–*c.* 1368), Italian painter, sculptor, worker in mosaic and architect, whose full name was ANDREA DI CIONE, called ARCAGNUOLO, was the son of a Florentine goldsmith, Maestro Cione, said to have been one of the principal artists who worked on the magnificent silver frontal of the high altar of San Giovanni, the Florentine Baptistery. The result of Orcagna's early training in the use of the precious metals may be traced in the extreme delicacy and refined detail of his principal works in sculpture. His brothers, Lionardo or Nardo, the eldest, a painter; Matteo, a sculptor and mosaicist, and Jacopo, also a painter, were often associated with Orcagna in his varied labours.

From the time of Giotto to the end of the 14th century Orcagna stands pre-eminent among the many excellent artists of that time.

1. *Orcagna as a Painter.*—He was admitted to the guild of the Medici and Speziali, where his name first occurs in the documents of 1344. His chief works in fresco were at Florence, in the church of Sta. Maria Novella. He covered the walls of the retro-choir

with scenes from the life of the Virgin. These, unfortunately, were much injured by damp very soon after their completion, and towards the end of the following century were replaced by other frescoes of the same subjects by Ghirlandaio, who, according to Vasari, made much use of Orcagna's motives and invention. Vasari says that Orcagna also painted the Strozzi chapel in the same church in company with his brother. But Ghiberti attributes these works to his brother Nardo alone. These frescoes still exist though much restored; modern criticism is inclined to attribute them to Nardo. The finest composition is that on the west wall, unbroken by any window. It represents paradise, with Christ and the Virgin enthroned in majesty among rows of brilliantly coloured cherubim and seraphim tinged with rainbow-like rays of light. Here Andrea Orcagna may have had a share in the execution.

In 1357 Orcagna painted one of his finest panel pictures, as a retable for the altar of the same chapel, where it still remains. In the centre is Christ in majesty between kneeling figures of St. Peter and St. Thomas Aquinas, attended by angel musicians; on each side are standing figures of three other saints. It is painted with extreme miniature-like delicacy, and is on the whole very well preserved. This retable is signed, "An. dni. mccclvii. Andreas Cionis de Florentia me pinxit." It is the only certified painting by Orcagna in existence. According to Vasari, he also painted some very fine frescoes in Sta. Croce. Of these only a small fragment remains. Orcagna's figures are plastically conceived, and clearly defined by a firmly drawn contour. They stand out against the background like statues.

2. *Orcagna as a Sculptor and Architect.*—Orcagna was admitted as a member of the Sculptors' Gild in 1352. His name occurs in the roll as "Andreas Cionis vocatus Arcagnolus, pictor." According to Vasari, Orcagna worked under Andrea Pisano as a pupil in sculpture. His style, however, constitutes an advance on Andrea's art and prepares the way for the coming Renaissance. In 1359 he completed the great marble tabernacle for the chapel of Or San Michele. This, in its combined splendour of architectural design, sculptured reliefs and statuettes, and mosaic enrichments, is one of the most important and beautiful works of art which even rich Italy possesses.

AUTHORITIES.—Vasari, ed. Milanesi, i. p. 593 (Florence, 1878); Crowe and Cavalcaselle, *Painting in Italy* (ed. by Langton Douglas 1903); Fumi, *Riv. d'Arte* (1905); *Riv. d'Arte* (1907); *L'Arte* (1907).

**ORCHARDSON, SIR WILLIAM QUILLER** (1832–1910), British painter, was born in Edinburgh on March 27, 1832. At 13½ he went to the Trustees' academy. At 20, Orchardson had mastered the essentials of his art, and for seven years after this he worked in Edinburgh, devoting himself partially to "black and white." In 1862 he came to London, and established himself in 37, Fitzroy square, where his friend John Pettie joined him.

The English public was not immediately attracted by Orchardson's work, which was too quiet to compel attention at the Royal Academy, and Pettie, Orchardson's junior by seven years, at first outshone him. Orchardson confined himself to the simplest themes and designs and the most reticent schemes of colour. In 1865 Pettie married, and the Fitzroy square *ménage* was broken up. Orchardson married Miss Helen Moxon in 1873. In 1868 he was elected A.R.A. and in 1877 R.A. He died on April 13, 1910.

Orchardson's first great success was gained in 1881, when he exhibited "On Board the 'Bellerophon'" (now at the Tate gallery) at the Royal Academy, and for the next ten or twelve years his exhibits enjoyed unfailing popularity. "The Voltaire" (1883) (now in the Kunsthalle, Hamburg) is perhaps his finest composition. The "Mariage de convenance" (1884) and "A Tender Chord" (1886) were two of his most famous paintings, and about this time he exhibited a series of period pictures.

Among his portraits are "Master Baby," "The Provost of Aberdeen" and "Sir Walter Gilbey, Bart." Other paintings are "After" (sequel to "Mariage de convenance"), and "The Young Duke."

**ORCHESTRA.** In ancient Greece the ὀρχήστρα was the space between the auditorium and the proscenium or stage, in which were stationed the chorus and the instrumentalists. In its modern acceptation the word means either that portion of a theatre or concert-hall provided for the accommodation of the instrumentalists or the body of instrumentalists itself; by extension in the U.S.A. it means the main floor of the theatre.

The modern orchestra is composed of (1) a basis of strings—first and second violins, violas, violoncellos and double basses; (2) flutes, sometimes including a piccolo; (3) the reed contingent, consisting of two complete families, (*a*) the oboes with their tenors and basses (the cor anglais, the fagotto or bassoon and the contrafagotto or double bassoon), (*b*) the clarinets with their tenor and basses (the basset horn and the bass and pedal clarinets), with the addition sometimes of saxophones; (4) the brass wind, consisting of the horns, a group sometimes completed by the tenor and tenor-bass Wagner tubas, the trumpet or cornet, the trombones (tenor, bass and contrabass), the tubas (tenor, bass and contrabass); (5) a harp or harps; (6) the percussion instruments, including the kettledrums, bells, Glockenspiel, cymbals, triangle, etc.; to which are sometimes added a celesta and a pianoforte, to say nothing of such "extras" as the rattle employed by Richard Strauss in *Till Eulenspiegel,* the wind machine required by the same composer in *Don Quixote,* the iron chains introduced by Schönberg in his *Gurrelieder,* and so on.

Although most of the instruments from the older civilizations of Egypt, Chaldea, Persia, Phoenicia and of the Semitic races were known to the ancient Greeks, they did not share in any way their neighbours' love of orchestral effects, obtained by combining harps, lyres, guitars, tanburs, flutes, trumpets, bagpipes, cymbals, drums, etc., playing in unison or in octaves. The Greeks only cultivated to any extent the various kinds of citharas, lyres and aŭloi, and these were seldom used in concert. To the predilection of the Romans for wind instruments of all kinds we owe nearly all the wind instruments of the modern orchestra, each of which had its prototype among the instruments of the Roman empire: the flute, oboe and clarinet, in the tibia; the trombone and trumpet in the buccina; the tubas in the tuba; and the French horn in the cornu and buccina.

The 4th century A.D. witnessed the downfall of the Roman drama and the debasement of instrumental music, which was placed under a ban by the Church. During the convulsions which the migrations of Goths, Vandals and Huns caused in Europe after the fall of Rome instrumental music was preserved from absolute extinction by wandering actors and musicians.

The earliest instrumental compositions extant are certain 15th century dances and pieces in contrapuntal style preserved in the libraries of Berlin and Munich. The late development of notation, which long remained exclusively in the hands of monks and troubadours, personally more concerned with vocal than with instrumental music, ensured the preservation of the former, while the latter was left unrecorded. But indications are not wanting of an independent energy and vitality which must surely have existed in unrecorded mediaeval instrumental music, since there is such evidence of this in the instruments themselves. It is, for example, significant of the attitude of the 10th century instrumentalists towards musical progress that they at once assimilated Hucbald's innovation of the *organum,* a parallel succession of fourths and fifths, accompanied sometimes by the octave, for two or three voices respectively, and that they produced in the same century the *organistrum,* named after Hucbald's *organum.*

At the time of the revival of the drama with music, afterwards modified and known as opera, at the end of the 16th century, there was as yet no orchestra in our sense of the word, but merely an abundance of instruments used in concert for special effects, without balance or grouping; small positive organs, regals, harpsichords, lutes, theorbos, archlutes, chittarone (bass and contrabass lutes), guitars, viols, lyras *da braccio* and *da gamba,* psalteries, citterns, harps, flutes, recorders, cornets, trumpets and trombones, drums and cymbals.

Monteverde was the first to see that a preponderance of strings is necessary to ensure a proper balance of tone. With the perfected models of the Cremona violins at his disposal, a quartet of strings was established and all other stringed instruments not played with the bow were ejected from the orchestra, with the exception of the harp. Under the influence of Monteverde and his

successors, Cavalli and Cesti, the orchestra won for itself a separate existence with music and laws of its own. As instruments were improved, new ones introduced, and old ones abandoned instrumentation became a new and favourite study in Italy and in Germany, and musicians began to find out the capabilities of the various families of instruments and their individual value.

At first the orchestra was an aristocratic luxury, performing privately at the courts of the princes and nobles of Italy; but in the 17th century performances were given in theatres, and Germany eagerly followed. Dresden, Munich and Hamburg successively built opera houses, while in England opera began with the masque, and in France Lully, with the collaboration of Molière, also greatly raised the status of the entertainments known as *ballets,* interspersed with instrumental and vocal music.

The revival of the drama seems to have exhausted the enthusiasm of Italy for instrumental music and the field of action was shifted to Germany, where the perfecting of the orchestra was continued. Most German princes had at the beginning of the 18th century good private orchestras or *Kapelle,* and they always endeavoured to secure the services of the best available instrumentalists. Kaiser, Telemann, Graun, Mattheson and Handel contributed greatly to the development of German opera and of the orchestra in Hamburg during the first quarter of the century. Gluck, the reformer of opera, and Mozart; Haydn, the father of the modern orchestra and the first to treat it independently as a power opposed to the solo and chorus, by scoring for the instruments in well-defined groups; Beethoven, who individualized the instruments, writing solo passages for them; Weber, who brought the horn and clarinet into prominence; Schubert, who inaugurated the conversations between members of the wood wind—all left their mark on the orchestra, leading the way up to Wagner, Strauss and their successors.

**ORCHESTRATION:** *see* INSTRUMENTATION.

**ORCHESTRION,** a name applied to three different kinds of musical instruments: (1) a chamber organ, designed by Abt Vogler at the end of the 18th century; (2) a pianoforte with organ pipes attached, invented by T. A. Kunz of Prague in 1791; (3) a mechanical wind orchestra, automatically played by means of revolving cylinders, invented in 1851 by F. T. Kaufmann of Dresden.

**ORCHHA** (also called *Tehri* or *Tikamgarh*), an Indian state in the Bundelkhand agency of Central India. It is the oldest and highest in rank of all the Bundela principalities, and was the only one not held in subjection by the peshwa. Area, 1,999 sq.mi., pop. (1941) 363,405. The maharaja, Shri Vir Singh Deo, K.C.S.I. (born in 1899, succeeded in 1930), bears the hereditary title of "First of the Princes of Bundelkhand." The state exports grain, *ghi,* and cotton cloth, but trade suffers from imperfect communications.

The town of Orchha, the former capital, is on the river Betwa, not far from Jhansi. It possesses an imposing fort, dating mainly from the early 17th century, with two magnificent palaces —the Rajmandir, a massive square erection of which the exterior is almost absolutely plain, and the Jahangirmahal, a singularly beautiful specimen of Hindu domestic architecture. Elsewhere about the town are fine temples and tombs, among which may be noticed the Chaturbhuj temple on its vast platform of stone. The town of Tehri or Tikamgarh, where the chief now resides, is about 40 mi. S. of Orchha; population 14,096. The maharaja has a salute of 15 guns.

**ORCHIDS,** the name given to members of the orchid family (Orchidaceae), one of the most numerous and interesting groups of flowering plants, usually with beautiful and often with exceedingly handsome and highly fragrant flowers. Orchids are found in most climates throughout the world, except in the polar regions, but they occur in by far their greatest diversity and abundance in humid tropical forests. The orchids are all perennial herbs or vines, as in *Vanilla,* and are comprised in two groups: (1) terrestrial orchids, which grow in the ground, and (2) epiphytic orchids, epiphytes, which grow perched upon trees, found in the tropics, where they form an important feature of the vegetation. Most orchids of the temperate zone are terrestrial.

**Floral Structure.**—The flowers of orchids, though extremely diverse within certain limits, are all formed upon one common plan, which is only a modification of that observable in such flowers as those of the narcissus. Such flowers consist essentially in the presence of a six-parted perianth, the three outer segments of which correspond to a calyx, the three inner ones to a corolla. These segments spring from the top of the ovary which is inferior instead of superior as in the lily. Within the perianth, and springing from its sides, or apparently from the top of the ovary, are six much modified or suppressed stamens. These stamens encircle a style which is the upward continuation of the ovary and which shows at its free end traces of the three originally separate but now blended carpels of which the ovary consists.

An orchid flower has an inferior ovary, but with the ovules on the walls of the cavity (not in its axis or centre), a six-parted perianth, a stamen or stamens and stigmas. The main distinguishing features consist in the fact that one of the inner pieces of the perianth becomes in course of its growth much larger than the rest, and usually different in colour, texture and form. So different is it that it receives a distinct name, that of the "lip" or "labellum." In place of the six stamens we commonly find but one (two in *Cypripedium*), and that one is raised together with the stigmatic surfaces on an elongation of the floral axis known as the "column." Moreover, the pollen, instead of consisting of separate cells or grains, consists of cells aggregrated into usually sticky "pollen masses," the number varying in different genera, but very generally two, four or eight. In *Cypripedium* all three stigmas are functional, but in most orchids only the lateral pair form receptive surfaces, the third being sterile and forming the rostellum, which plays an important part in the process of pollination, often forming a peculiar pouch-like process in which the viscid disk of the pollen masses is concealed.

It would appear, then, that the orchid flower differs from the more general monocotyledonous type in the irregularity of the perianth, in the suppression of five out of six stamens, and in the union of the one stamen and the stigmas. In addition to these modifications, which are common to nearly all orchids, there are others generally but not so universally met with; among them is the displacement of the flower arising from the twisting of the inferior ovary, in consequence of which the flower is so completely turned round that the "lip," which originates in that part of the flower conventionally called posterior, or that nearest to the supporting stem, becomes in course of growth turned to the anterior part of the flower nearest to the bract. Other common modifications arise from the union of certain parts of the perianth to each other, and from the varied and often very remarkable outgrowths from the lip. These modifications are associated with the structure and habits of insects and their visits to the flowers.

**Cross-Pollination by Insects.**—In the common orchids of British meadows, *Orchis maculata, O. mascula* (Shakespeare's long purples), etc., the general structure of the flower is as described. In addition there is in this particular genus, as indeed in many others, a long tubular spur or horn projecting downwards from the back of the lip, whose office it is to secrete and store a honeyed juice; the forepart of the lip forms an expanded plate, usually larger and more brightly coloured than the other parts of the flower, and with hairs or ridges and spots of various kinds according to the species. The remaining parts of the perianth are much smaller, and commonly are so arranged as to form a hood overarching the "column." This column stands up from the base of the flower, almost at right angles to the lip, and it bears at the top an anther, in the two hollow lobes of which are concealed the two pollen-masses, each with its caudicle terminating below in a roundish gland, concealed at first in the pouch-like rostellum at the front of the column. Below the anther the surface of the column in front is hollowed out into a greenish depression covered with viscid fluid—this is the two united stigmas.

In the process of pollination a bee alights on the lip. There, guided by the hairs or ridges, it is led to the orifice of the spur with its store of honeyed juice. The position of this orifice, as we have seen, is at the base of the lip and of the column, so that the in-

PAINTED FOR THE ENCYCLOPÆDIA BRITANNICA BY ISABEL COOPER AFTER SPECIMENS GROWN BY JOSEPH MANDA

## EIGHT VARIETIES OF CULTIVATED ORCHIDS

The orchid family, one of the most interesting groups of flowering plants, comprises upwards of 7,000 species, found most abundantly in the Tropics. Several hundred species are grown in greenhouses; from these, gardeners have developed many varieties and an immense number of hybrid forms

1. Thwaites' Dendrobium (*Dendrobium Thwaitesiae*). 2. Venus Dendrobium (*D. Falconeri* x *nobile*). 3. Moth orchid (*Phalaenopsis Lueddemanniana*). 4. Alexander's Cymbidium (*Cymbidium Alexanderi*). 5. Argus lady slipper (*Cypripedium Argus*). 6. Sander's lady slipper (*Cypripedium insigne Sanderae*). 7. Queen Cattleya (*Cattleya Dowiana aurea*). 8. Triana Cattleya (*Cattleya Trianae*)

sect, if of sufficient size, while bending its head to insert the proboscis into the spur, almost of necessity displaces the pollen-masses. Liberated from the anthers, these adhere to the head or back of the insect by means of the sticky gland at the bottom of the caudicle. Having sipped the nectar the insect withdraws, taking the pollen-masses with it, and visits another flower. The two anther-cases in an orchis are erect and nearly parallel to each other; the pollen-masses within them are of course in the like position. Immediately, however, the pollen-masses are removed, movements take place at the base of the caudicle so as to effect the bending of this stalk, bringing the pollen-mass in a more or less horizontal position, or, as in the case of *O. pyramidalis,* the two pollen-masses originally placed parallel diverge from the base like the letter **V**. The movements of the pollen-masses may readily be seen with the naked eye by thrusting the point of a needle into the base of the anther, when the disks adhere to the needle as they would to the antenna of an insect, and may be withdrawn. Sometimes the lip is mobile and even sensitive to touch, as are also certain processes of the column. In such cases the contact of an insect or other body with those processes is sufficient to liberate the pollen often with elastic force, even when the anther itself is not touched.

In other orchids movements take place in different ways and in other directions. The object of these movements will be appreciated when it is remembered that if the pollen-masses retained the original direction they had in the anther in which they were formed, they would, when transported by the insect to another flower, merely come in contact with the anther of that flower, where of course they would be of no use; but owing to the divergences and flexions above alluded to, the pollen-masses come to be so placed that, when transplanted to another flower of the same species, they come in contact with the stigma and so effect the pollination of that flower. The adaptions of orchid flowers to fertilization by insects are very numerous and often remarkably complicated. Darwin devoted two volumes to the subject.

**Propagation and Growth.**—The fruit of orchids is a capsule which usually splits by three lengthwise slits, forming valves that remain united above and below. The seeds, minute and innumerable, are well-adapted to wind dissemination. In many species the seeds lose their viability after a few months and often are slow and difficult to germinate after planting, some requiring from three months to two years. The roots of terrestrial orchids are often bulbous and still more frequently more or less tuberous, the tubers being partly radical and partly budlike, so that propagation of new individuals by division from the parent takes place. Often there is a marked alternation in the production of vegetative and flowering shoots; sometimes the flowering shoots are not produced for several years in succession. This accounts for the profusion with which various orchids are found in flower in some seasons and for their scarcity in others.

Tropical orchids are mostly epiphytal—that is, they grow upon trees without deriving nourishment from them. They are frequently provided with pseudobulbs, large solid swellings of the stem in the tissues of which water and nutritive materials are stored. They derive this moisture from the air by means of aerial roots developed from the stem and bearing an outer spongy structure, or *velamen,* consisting of empty cells kept open by spiral thickenings in the wall; this sponge-like tissue absorbs dew and rain and passes it on to the internal tissues.

**Classification.**—In number of species the orchid family is exceeded by only two or three other families of flowering plants. Conservatively stated, it contains at least 7,500 species comprised in 450 genera; some authorities place the number of species as high as 15,000.

The family is divided into two main groups based on the number of the stamens and stigmas. The first, Pleonandrae, has two or rarely three fertile stamens and three functional stigmas. It contains two small genera of tropical Asia and Africa with almost regular flowers, and the large genus *Cypripedium,* containing about 350 species in the north temperate zone and tropical Asia and America. In *Cypripedium* two stamens are present, one on each side of the column, instead of one only at the top, as in the group Monandrae, to which belong the remaining genera in which also only two stigmas are fertile.

The Monandrae have been subdivided into 20 tribes, the characters of which are based on the structure of the anther and pollinia, the nature of the inflorescence, whether terminal or lateral, the vernation of the leaf and the presence or absence of a joint between blade and sheath, and the nature of the stem. The most important are the following:

*Ophrydeae,* terrestrial orchids, mainly north temperate, including the genera *Orchis, Aceras, Ophrys, Herminium, Gymnadenia* and *Habenaria.*

*Neottieae,* also terrestrial, contains 13 more or less widely distributed tropical or subtropical subtribes; one, *Cephalanthereae,* which includes the genera *Cephalanthera* and *Epipactis,* is chiefly north temperate. The genera *Spiranthes, Listera* and *Neottia* are also included in this tribe, as is also *Vanilla,* the elongated stem of which climbs by means of tendril-like aerial roots.

*Coelogyneae,* mostly epiphytes, and inhabitants of tropical Asia. A single internode of each shoot is swollen to form a pseudobulb.

*Liparideae,* terrestrial, two, *Malaxis* and *Corallorhiza,* are Eurasian and North American. *Liparis* is a large genus widely distributed in the tropics.

*Pleurothallidieae,* natives of tropical America, one of which, *Pleurothallis,* contains about 500 species. *Masdevallia* is common in cultivation and has often brilliant scarlet, crimson or orange flowers.

*Laelieae,* natives of the warmer parts of America, including three of those best known in cultivation, *Epidendrum, Cattleya* and *Laelia.*

*Phajeae,* chiefly tropical Asiatic, some—*Phajus* and *Calanthe*—spreading northward into China and Japan.

*Cyrtopodieae,* tropical, but extending into north temperate Asia and South Africa; *Eulophia* and *Lissochilus* are important African genera.

*Cataseteae,* with tropical American genera, two of which, *Cataselum* and *Cycnoches,* have di- or tri-morphic flowers.

*Dendrobieae,* in the warmer parts of the old world; the chief genus is *Dendrobium,* with 750 species, often with showy flowers.

*Cymbidieae,* in the tropics of the old world. The leaves are generally long and narrow. *Cymbidium* is well known in cultivation.

*Oncidieae,* in the warmer parts of America. *Odontoglossum* and *Oncidium* include some of the best-known cultivated orchids.

*Sarcantheae,* in the tropics. *Vanda* (Asia) and *Angraecum* (Africa and Madagascar) are known in cultivation. The flower of *Angraecum sesquipedale* has a spur about 1 ft. in length.

**British Orchids.**—The family is well represented in Great Britain by nearly 40 species representative of 18 genera; among these are several species of *Orchis, Gymnadenia* (fragrant orchis), *Habenaria* (butterfly and frog orchis), *Aceras* (man orchis), *Herminium* (musk orchis), *Ophrys* (bee, spider and fly orchis), *Epipactis* (helleborine), *Cephalanthera, Neottia* (bird's-nest orchis), one of the few saprophytic genera, which have no green leaves but derive their nourishment from decaying organic matter in the soil, *Listera* (tway blade), *Spiranthes* (lady's tresses), *Malaxis* (bog-orchis), *Liparis* (fen-orchis), *Corallorhiza* (coral root), also a saprophyte, and *Cypripedium* (lady's slipper), represented by a single species, now very rare, in limestone districts in the north of England.

**North American Orchids.**—In North America north of Mexico about 140 species of orchids are found, representing some 40 genera (*see* O. Ames, *An Enumeration of the Orchids of the United States and Canada,* 1925). Many are widely distributed across the continent, some extending to Alaska and even to Greenland, but they occur most numerously in the eastern and especially the southeastern states. The generic groups having the largest number of species are the rein-orchises (*Habenaria*), 40 species; lady's-tresses (*Spiranthes*), 15 species; lady's-slippers (*Cypripedium*), 14 species; and bog-orchises (*Malaxis*), 8 species. The tropical epiphytes are represented by *Epidendrum,* 9 species, and *Oncidium,* 6 species, found in Florida. Among the many attractive

orchids native to the eastern states and provinces are the showy lady's-slipper (*C. reginae*), the yellow lady's-slipper (*C. parviflorum*), the moccasin-flower (*C. acaule*), the showy orchis (*Orchis spectabilis*), the shin plasters (*O. rotundifolia*), the white-fringed orchis (*H. blephariglottis*), the yellow-fringed orchis (*H. ciliaris*), the small purple-fringed orchis (*H. psycodes*), the rose-pogonia or snake-mouth (*Pogonia ophioglossoides*), the dragon's-mouth (*Arethusa bulbosa*) and the grass-pink (*Calopogon pulchellus*).

In the Rocky mountain region and adjacent plains some 40 species of orchids occur; fully half of these are found also in the eastern states and a dozen or more extend northward to Alaska. Among them are the mountain lady's-slipper (*Cypripedium montanum*), the oval-leaved orchis (*Habenaria Menziesii*). About 35 species of orchids occur in the Pacific states; among these are the California lady's-slipper (*Cypripedium californicum*), the Sierra rein-orchis (*Habenaria leucostachys*), the giant helleborine (*Epipactis gigantea*) and the rare phantom orchis (*Cephalanthera Austinae*).

**Cultivation.**—The only orchid of substantial economic importance, furnishing a staple article of extensive use, is vanilla (*q.v.*). But the number of tropical orchids grown in greenhouses in Europe and North America for the flower markets, and as objects of horticultural and scientific interest, is immense. More than 3,000 species, many of them epiphytes, are in cultivation, as well as many thousand hybrid forms derived from them. Among the genera thus represented in orchid culture are *Cattleya, Cypripedium, Dendrobium, Epidendrum, Laelia, Odontoglossum* and *Phalaenopsis*. Many bi-generic hybrids have been developed by orchid fanciers. Propagation of these cultivated forms is by division, cuttings and growth from seed. Many terrestrial orchids practically defy all efforts at cultivation, due to lack of knowledge regarding soil conditions, to saprophytic habits, and to their growth in association with special fungi (*see* MYCORRHIZA).

BIBLIOGRAPHY.—*Descriptive:* A. Engler and K. Prantl, *Die Natürlichen Pflanzenfamilien* (1887–1909); F. Kraenzlein, *Orchidacearum Genera et Species* (Berlin, 1897–1901); A. D. Webster, *British Orchids* (2 ed., 1898); W. H. Gibson and H. L. Jeliffe, *Our Native Orchids* (1905); O. Ames, *Orchidaceae* (1905–30) and *An Enumeration of the Orchids of the United States and Canada* (Boston, 1924). *Cultivation:* J. Veitch, *Manual of Orchidaceous Plants Cultivated under Glass in Great Britain* (1887–94); F. Boyle, *About Orchids* (1893); C. H. Curtis, *Orchids for Everyone* (1910); C. Harrison, *Commercial Orchid Growing* (1914); C.F., F.K. and L.L. Sander, *Sander's Orchid Hybrids* (1921) and *Sander's Orchid Guide* (1927); A. E. White, *American Orchid Culture* (1927); F. Norris and E. A. Eames, *Our Wild Orchids: Trails and Portraits* (1929). (N. TR.; X.)

**ORCHOMENUS** (on coins and inscriptions, *Erchomenos*), the name borne by two cities of ancient Greece.

1. A Boeotian city, between the Cephissus river and its tributary, the Melas, on a long, narrow hill projecting south from Mt. Acontium, on every side admirably situated to be the stronghold of an early kingdom. The acropolis is situated at the north end of the ridge.

In prehistoric times Orchomenus is revealed alike by archaeological finds and by legends, as one of the most prosperous towns of Greece, once a continental and a maritime power. It controlled the greater part of Boeotia, especially the fertile lowlands of Lake Copaïs, upon the drainage of which its early kings bestowed great care. Its original inhabitants, the Minyae, were a seafaring people, and Orchomenus remained a member of the Calaurian League of naval States till historical times. Then, however, Orchomenus no longer figures as a great commercial State, and its political supremacy in Boeotia has passed to the people of Thebes. Nevertheless, it long exercised some overlordship over towns of northern Boeotia, and an independent policy within the Boeotian League. In 447 it was the headquarters of the oligarchic exiles who freed Boeotia from Athenian control. In the 4th century Orchomenus was actuated throughout by an anti-Theban policy, partly a recrudescence of old rivalry, but chiefly inspired by aversion to the new democracy at Thebes. In the Corinthian war the city supported Lysander and Agesilaus in their attacks upon Thebes, and Orchomenus again sided with the Spartans in 379. After the battle of Leuctra the Thebans, first, on Epaminondas's advice, readmitted it into the Boeotian League, but in 368 destroyed the town. By 353 it had been rebuilt, probably by the Phocians, as a bulwark against Thebes. After the subjection of the Phocians in 346 it was again razed by the Thebans, but was restored by Philip of Macedon as a check upon Thebes (338). In 85 B.C. Orchomenus provided the battle-field on which the Roman general Sulla destroyed an army of Mithridates VI. of Pontus. But its later history is obscure, and its decadence is attested by the encroachments of Lake Copaïs. Since mediaeval times the site has been occupied by a village named Skripou. Since 1867 drainage operations have been resumed, and an English company has reclaimed much fertile land. The so-called "treasury of Minyas," outside the ancient city at Mycenae (*see* MYCENAE), is almost exactly the same size as the "treasury of Atreus." The admiration of Pausanias is justified by the beautiful ornamentation of the roof of the inner chamber brought to light by Schliemann. Excavation by Doctors Furtwängler and Bulle revealed three prehistoric settlements, superposed. The first represents the Neolithic "painted-ware" culture of Thessaly and other parts of north-east Greece; in the second, oval huts replace the earlier round ones, and dull smeared pottery ("Urfirniss") the painted ware; the third has rectangular houses and characteristic grey "Minyan" pottery, finely modelled but without ornament. All these cultures precede the "Late Minoan" occupation, to which the great "Treasury" tomb belongs.

The worship of the Charites (*see* GRACES) was the great cult of Orchomenus, and the site of the temple is now occupied by a chapel of the Virgin (Κοίμησις τῆς Παναγίας). The Charites were worshipped under the form of rude stones, which had fallen from heaven during the reign of Eteocles; and it was not till the time of Pausanias that statues of the goddesses were placed in the temple. Near this was another temple, dedicated to Dionysus, in whose festival, the *Agrionia* (*q.v.*), are apparent the traces of early human sacrifice.

2. An Arcadian city north of Mantineia and west of Stymphalus. Its district was mountainous, but had two valleys—the northern containing a lake drained by a *katavothron;* the southern below the city, separated from Mantineia by the ridge Anchisia. The old city, in a strong situation, was a ruin in Strabo's time. Till the late 7th century the kings of Orchomenus held some sort of sovereignty over all Arcadia. In the 5th century it was overshadowed by Mantineia, and in 418 B.C. Orchomenus fell for a time into its power; in 370 it held aloof from the new Arcadian League which Mantineia was organizing. About this time it also lost some possessions on the east to the new Arcadian capital, Megalopolis. In the 3rd century it belonged in turn to the Aetolian League, to the Lacedaemonians, and, since 222, to the Achaean League. Its history after it passed under the Roman rule is quite obscure.

**ORCINOL,** a homologne of resorcinol (*q.v.*), found in many lichens, e.g., *Rocella tinctoria, Lecanora,* and formed by fusing extract of aloes with caustic potash. It is 3:5-dihydroxy-1-methylbenzene ($C_6H_3(CH_3)(OH)_2$). It may be synthesized from toluene; or from acetonedicarboxylic ester by condensation with the aid of sodium. It crystallizes in colourless prisms with one molecule of water, which redden on exposure. Ferric chloride gives a bluish-violet coloration with the aqueous solution. Unlike resorcinol it does not give a fluorescein with phthalic anhydride. Oxidation of the ammoniacal solution gives *orcein,* $C_{28}H_{24}N_2O_7$, the chief constituent of the natural dye archil (*q.v.*). Homopyrocatechol is an isomeride ($CH_3$:OH:OH = 1:3:4), found as its methyl ether (creosol) in beech-wood tar.

**ORDEAL,** a term of varying meaning but bearing the special sense of the mediaeval Lat. *Dei iudicium,* a miraculous decision as to the truth of an accusation or claim. The ordeal in principle, and often in the very forms used, belongs to ancient culture. Some ordeals, which possibly represent early stages of the practice, are simply magical, being processes of divination turned to legal purpose. Thus in Burma suits are sometimes still determined by plaintiff and defendant being each furnished with a candle, equal in size and both lighted at once—he whose candle outlasts the other being adjudged to have won his cause (Shway Yoe, *The*

*Burman,* ii. 254). In Borneo, the two parties are represented by two shell-fish on a plate, which are irritated by pouring on some lime-juice, and the one first moving settles the guilt or innocence (as has been before arranged) of its owner (St. John, *Forests of the Far East,* i. 89). The administration of ordeals has been much in the hands of priests, the intervention of a deity being invoked and assumed to take place even when the process is in its nature one of symbolic magic. The ordeal is related to divination (*q.v.*). *Coscinomancy* (the use of a sieve for divination) served anciently to discover a thief when, with prayer to the gods for direction, the names of the suspected persons were called over it (Potter, *Greek Antiquities,* i. 352). When a suspended hatchet was used in the same way to turn to the guilty, the process was called *axinomancy*. The sieve-ordeal is mentioned in Hudibras (ii. 3):

> . . . th' oracle of sieve and shears
> That turns as certain as the spheres.

In the modern Christian form of the key and bible, a psalter or bible is suspended by a key tied in at Psalm l. 18: "When thou sawest a thief, then thou consentedst with him"; the bow of the key being balanced on the fingers, and the names of those suspected being called over, he or she at whose name the book turns or falls is the culprit (*see* Brand, *Popular Antiquities*).

One form of divination passing into ordeals is the appeal to the corpse itself for discovery of its murderer. Thus the natives of Australia will ask the dead man carried on his bier of boughs, who bewitched him; if he has died by witchcraft he will make the bier move round, and if the sorcerer who killed him be present a bough will touch him (Eyre, *Australia,* ii. 344). Among the negroes of Ashanti, the corpse causes its bearers to dash against the guilty party (R. S. Rattray, *Religion and Art in Ashanti* [1927] p. 167, *see* also B. Malinowski, *Crime and Custom in Savage Society,* H. V. Russell, *Tribes and Castes of the Central Provinces,* [1916] iii. p. 90). The well-known ordeal of the bier in Europe in the middle ages seems founded on a different principle, the imagination that a sympathetic action of the blood causes it to flow at the touch or neighbourhood of the murderer. Apparently the liquefaction of the blood which in certain cases takes place after death may have furnished the ground for this belief. On Teutonic ground, this ordeal appears in the *Nibelungenlied,* where the murdered Siegfried is laid on his bier, and Hagen is called on to prove his innocence by going to the corpse, but at his approach the dead chief's wounds bleed afresh. In Shakespeare (*Rich. III.,* act 1, sc. 2):

> O gentlemen, see, see! dead Henry's wounds
> Open their congeal'd mouths, and bleed afresh!

Certain ordeals are closely related to oaths, so that the two shade into one another. Let the curse which is to fall on the oath-breaker take effect at once, it then becomes a sign condemning the swearer—in fact, an ordeal. Thus the drinking of water on which a curse or magical penalty has been laid is a mere oath so long as the time of fulfilment is unfixed (*see* OATH). But it becomes an ordeal when, as in Brahmanic India, the accused drinks three handfuls of water in which a sacred image has been dipped; if he is innocent nothing happens, but if he is guilty sickness or misfortune will fall on him within one to three weeks (for accounts of these and other Hindu ordeals *see* Ali Ibrahim Khan in *Asiatic Researches,* i. 389, and Stenzler's summary in *Z. D. M. G.,* vol. ix.). Numbers v. describes the mode of administering to a woman charged with unfaithfulness the bitter water mixed with the dust of the tabernacle floor, with the curse laid on it to cause her belly to swell and her thigh to fall if guilty. The term "bitter" is applied to the water before it has been cursed, which suggests that it already contained some drug, as in the poison-water ordeal still in constant use over a great part of Africa. The result of the ordeal depends partly on the patient's constitution, but more on the sorcerer who can prepare the proper dose to prove either guilt or innocence, and thereby acquires boundless influence. The poison-ordeal is also known to Brahmanic law, decoction of aconite root being one of the poisons given, and the accused if not sickening being declared free (Stenzler, *l.c.*). Theoretically connected with the ordeal by cursed drink is that by cursed food. The ordeal by bread and cheese, practised in Alexandria about the 2nd century, was practically the same as that known to English law five to ten centuries later as the *corsnaed* or "trial slice" of consecrated bread and cheese which was administered from the altar, with the curse that if the accused were guilty God would send the angel Gabriel to stop his throat, that he might not be able to swallow that bread and cheese. In fact, if guilty and not a hardened offender he was apt to fail, drymouthed and choking through terror, to get it down.

The passing through the fire is described in the Hindu codes of Yâjnavalkya and others, and in the *Râmâyana* the virtuous Sitâ thus proves her innocence to her jealous husband Râma (Stenzler, p. 669; Pictet, *Origines Indo-Européennes,* part ii. p. 457). In European law and chronicle, Richardis, wife of Charles the Fat, proves her innocence by going into a fire clothed in a waxed shift, and is unhurt by the fire (Grimm, *Deutsche Rechtsalterthümer,* p. 912). Yet more minutely prescribed in the Hindu ordeal-books is the rite of carrying the glowing hot iron seven steps, into the seven or nine circles traced on the ground, the examination of the hands to see if they show traces of burning, and the binding them up in leaves. In a Scandinavian law it is prescribed that the red-hot iron shall be carried nine steps (Grimm, *op. cit.,* p. 918). In Anglo-Saxon laws the iron to be carried was at first only one pound weight, but Athelstan's law (in *Ancient Laws and Institutes of England,* iv. 6) increased it to three pounds. Another form well known in old Germany and England was the walking barefoot over glowing ploughshares, generally nine. The law-codes of the early middle ages show this as an ordinary criminal procedure (*see* the two works last referred to). Queen Emma, mother of Edward the Confessor, accused of familiarity with Alwyn bishop of Winchester, triumphantly purged herself and him by the help of St. Swithin—each of the two thus acquitted giving nine manors to the church of Winchester, in memory of the nine ploughshares, and the king being corrected with stripes (John Bromton, *see* Freeman's *Norm. Conq.,* vol. ii. App.). To dip the hand in boiling water or oil or melted lead and take out a stone or ring is another ordeal of this class. Some of these fiery trials are still in use, in regions of Africa or further Asia—the negro plunging his arm into the caldron of boiling oil, the Burman doing feats with melted lead, while the Bedouin will settle a conflict of evidence by the opposing witnesses licking a glowing hot iron spoon (Kennett, *Arabian justice*). This latter feat may be done with safety, provided the iron be clean and thoroughly white hot, while if only red-hot it would touch and burn the tongue. Probably the administerers of the ordeal know this, and the possibility of dipping the hand in melted metal; and there are stories of arts of protecting the skin (*see* the recipe in Albertus Magnus, *De Mirabilibus*), though it is not known what can be really done beyond making it horny like a smith's, which would serve as a defence in stepping on hot coals, but not in serious trials like that of carrying a heavy red-hot iron. The fire-ordeals are still performed by mountebanks. Fire walking is still practised by Hindus and was performed in Natal in the autumn of 1925. The Hindu code of Manu (viii. 115) avers that "He whom the flame does not burn, whom the water does not cast up, or whom no harm soon befalls, is to be taken as truthful in his oath." This water-ordeal is well known in Europe, where the accused is thrown bound into the water, which receives him if innocent, but rejects him if guilty. The directions given by Archbishop Hincmar in the 9th century provide that he who is let down into the water for trial is to be fastened by a rope, that he may not be in danger if the water receives him as innocent, but may be pulled out. In the later middle ages this ordeal by "swimming" or "fleeting" became the most approved means of trying a suspected witch: she was stripped naked and cross bound, the right thumb to the left toe, and the left thumb to the right toe. In this state she was cast into a pond or river, in which it was thought impossible for her to sink (Brand iii. 21). Cases of "ducking" witches which used to occur in England were remains of the ancient ordeal.

When in the warfare of Greeks and Trojans, of Jews and Philistines, of Vandals and Alamans, heroes come out from the two sides and their combat decides the victory, then we have the ordeal by battle. A passage from old German law shows the single

combat accepted as a regular legal procedure: "If there be dispute concerning fields, vineyards, or money, that they avoid perjury let two be chosen to fight, and decide the cause by duel" (Grimm, *Rechtsaltert.*, p. 928). In England, after the Conquest, trial by combat superseded other legal ordeals, which were abolished in the time of Henry III. A lord often sent his man in his stead to such combats, and priests and women were ordinarily represented by champions. The wager of battle died out so quietly in England without being legally abolished that in the court of king's bench in 1818 it was claimed by a person charged with murder, which led to its formal abolition (*Ashford* v. *Thornton* in Barnewall and Alderson 457; *see* details in H. C. Lea, *Superstition and Force,* ii.). A distinct connection may, however, be traced between the legal duel and the illegal private duel. (*See* DUEL.)

(E. B. T.; X.)

**ORDER,** a row or series, hence grade, class or rank, sequence or orderly arrangement (Lat. *ordo,* rank, arrangement). For its various meanings *see* MINISTRY, THE CHRISTIAN; MONASTICISM; KNIGHTHOOD AND CHIVALRY; ORDER IN COUNCIL; BILL OF EXCHANGE.

For technical mathematical uses of "order" *see* NUMBER; CURVE; SURFACE; DIFFERENTIAL EQUATION.

**ORDER,** (1.) in classic architecture, a column or pilaster, with its base, shaft and capital, and the entablature (*q.v.*) above it (sometimes called epistyle), consisting of architrave, frieze and cornice, considered as a single architectural feature; the "orders" are systematized classifications of five different types, Tuscan, Doric, Ionic, Corinthian and Composite. (2.) In mediaeval architecture, in an arched door or other opening, where the opening is larger on the outer face of a thick wall than on the inner face, one of the breaks in the steps in the thickness of the wall, consisting of an arch above and a pier on each side, by which the transition from larger exterior to smaller interior opening is effected.

**Classic Orders.**—Greek architecture had developed three easily recognizable classes of order which had been adopted by the Romans, with modifications, by the middle of the 1st century, B.C. It was natural, therefore, that Vitruvius, in his remarkable treatise on architecture (last quarter of 1st century, B.C.) should have attempted to give rules for the construction of these three orders. Moreover, as the Etruscan architects had developed a simple order of their own, using a wooden entablature, he added a section dealing with that. With the republication of Vitruvius in the second half of the 15th century, he was at once hailed as the authority on all things architectural, and architectural writers of the later Italian Renaissance attempted to imitate him by giving ideal rules for the orders, which should be efforts to reconcile the standards of Vitruvius with the many varying examples of Roman work that they knew. They added as a fifth order the Composite type of capital. The two most famous of these Renaissance compilations, those of Vignola (Giacomo Barocchio, or Barozzi), published in 1563, and Palladio (1570), exerted a tremendous influence over 17th and 18th century architecture throughout Europe, and gave rise to the idea that these compilations were not merely statements of average usage, but rules to be absolutely followed, an idea contradicted by the architectural work of the two authors themselves. Lacking knowledge of Greek remains, and of the structural systems and details of Etruscan temples, the Tuscan order, which they described, is merely a simplified Roman Doric. Their passion for regularization showed also in the fact that they specify a definite pedestal and even a definite baluster as a part of each order. Various 18th century and modern architectural writers have attempted to simplify the order descriptions of Vignola and Palladio, and have thus perpetuated the Renaissance myth of the immutability of the orders. In general, Vignola's work was followed in France and Palladio's in England. The orders, as thus systematized, are as follows:—

**Tuscan.**—This is the simplest of the orders. It is characterized by a column seven diameters high, the capital and base each occupying one-half the diameter in height. The base consists of a plain, square plinth (*q.v.*) with a large torus (*see* BEAD-MOULDING) and a fillet above. The capital has an astragal (*q.v.*) at the top of the shaft, a necking (*q.v.*), which is merely a short continuation of the line of the column, and above that an echinus (*q.v.*) consisting of a simple ovolo (*q.v.*) or quarter round with a fillet below it, and carrying a simple, square abacus (*q.v.*). The entablature, as in all the orders, is supposed to be one-quarter of the height of the column, and consists of a plain architrave (*q.v.*), or lower member, with a simple square projection or taenia (*q.v.*) at the top, a plain frieze, or central member, and a cornice with a single moulding as a bed-mould (*q.v.*), an undecorated corona (*q.v.*) or projecting rectangular portion, and a cymatium (*q.v.*) or crowning moulding that is an ovolo.

**Doric.**—The column is eight diameters high, and carries 20 flutes, separated by arrises or sharp edges. The base has two toruses, the lower one larger than the upper, and the capital is given a projecting moulding at the top of the echinus and additional fillets or an astragal below the ovolo. The necking is ornamented with eight rosettes. The achitrave in the entablature is sometimes given two faces, the upper one projecting slightly, being wider than the lower. The taenia is decorated with a moulding and beneath each triglyph of the frieze, a small block called a regula (*q.v.*), with six guttae, or small conical forms on its under side. The frieze is ornamented by triglyphs, or vertical projections decorated with a series of vertical grooves. Between each two triglyphs is a square metope (*q.v.*), a plain surface carrying sculpture; a triglyph is arranged over the centre of each column. Two forms of cornice are described; the denticular, in which the chief feature of the bed-mould is a row of dentils or little projecting blocks, and the mutular, in which the under side of the corona is decorated with projecting blocks, one over each triglyph. In both cases guttae are used on the soffit or under side of the cornice. In the denticular cornice they ornament square panels over each triglyph; in the mutular, the under side of the projecting blocks or mutules. The cymatium consists either of a cavetto or a cyma recta, a moulding of double curvature, the convex portion below and concave portion above.

**Ionic.**—The column is nine diameters high. The base is of the type known as an Attic base with a plinth carrying two toruses, separated by a scotia or hollow moulding. The capital is characterized by the volutes (*q.v.*) or spiral scrolls that are the ends of a band (usually consisting of a hollow portion called a canalis, and a raised fillet) represented as passing horizontally across the top of the echinus, and winding up on either side in a volute or helix. The capital is thus rectangular, and the volutes of the two faces of the capital are connected by a generally cylindrical form known as a cushion. This sometimes takes the form of two vases, end to end, and is sometimes decorated with leaves. The echinus, of ovolo profile, is carved with the egg and dart (*q.v.*), and where, as it follows the curve of the column, it disappears behind the rolls of the volutes, a little half anthemion (*q.v.*) or radiating petalled form hides the intersection. The entablature has an architrave decorated with either two or three bands, each wider and projecting farther than the one below it, and a taenia ornamented with mouldings. The frieze is plain, and the cornice has a bed-mould of three parts—a dentil band separating two mouldings, the lower one a cyma reversa, the upper one an ovolo. The cymatium is a cyma recta with a smaller cyma reversa below it.

**Corinthian.**—The column is ten diameters in height, and the base resembles the Attic base of the Ionic order, with the exception that in the centre of the scotia there is a third, small torus, with fillets above and below. The capital is much deeper than in the Doric and Ionic orders, and consists of a generally bell-shaped core, carrying a moulded abacus whose sides are concave, so that the corners project. At the bottom of the bell of the capital is an astragal, and the surface of the bell is surrounded by a characteristic decoration of acanthus leaves and scrolls. The lower two-thirds has 16 acanthus leaves in two rows of eight each, the centres of the upper leaves being placed between the joints of the lower leaves. Between the leaves of the upper row are cup-shaped leaf ornaments known as cauliculi (*q.v.*), which grow on stalks, and out of each cauliculus grow two stalks, one large and one small, so arranged that the voluted ends of the two adjacent large scrolls meet under each projecting corner of the abacus.

while the two adjacent smaller stalks come together under the centre of each concave abacus space; above their juncture is a large rosette. The architrave of the entablature, like that of the Ionic, has three bands and a moulded taenia, but additional richness is given by tiny mouldings between the bands. The frieze is plain, though sometimes pulvinated, or given a profile of convex curve. The cornice resembles that of the Ionic order with the addition of the band of modillions (*q.v.*). These are small scrolled brackets under the soffit of the corona, and are usually decorated on the sides with S-scrolls and on the bottom and front face with acanthus leaves. They are crowned by a little cyma reversa moulding. The soffit of the corona is panelled between the modillions, and in each panel there is a rosette.

**Composite.**—This is, in reality, merely a varied form of the Corinthian order and, like it, the column is fluted and ten diameters high. A special base is given to it by doubling the small torus in the centre of the scotia between the two large toruses. The capital, its main distinguishing feature, consists of a bell surrounded with 16 acanthus leaves, in two rows, arranged similarly to those of the Corinthian capital.

But above them, instead of the scrolls and cauliculi, there are volutes, like those of the Ionic order, except that they are on the four sides of the capital and brought out at an angle at the corners. In the bed-mould of the cornice, large rectangular blocks take the place of the modillions, and in some codifications a part of the bed-mould as well.

**Scamozzi Ionic.**—In addition to the five orders listed above, certain authorities have given a variant of the Ionic order, known as the Scamozzi Ionic after the Italian architect (Vincenzo Scamozzi, 1552–1616), who first codified it. Its chief difference from the ordinary Ionic order is in the fact that its capital is four-sided, the volutes occurring on all four faces, and at the corners brought out in an angle, so that the abacus above is concave-sided, like the Corinthian.

Moreover, the bands forming the volutes are not connected on each face by a horizontal line, but curve over and down into the top of the echinus; in the empty space thus left in the centre of each face there is a rosette. At times garlands connect the centres of the volutes.

**Purpose.**—The object of each codification of the orders is to furnish exact proportionate dimensions for every small feature, so that given the diameter of the column, the entire order may be constructed mechanically. The rules of all these attempted codifications vary slightly.

**Origins.**—The origin of the earliest of the orders, the *Doric,* was, at least partially, in wooden construction and seems to be a purely Dorian, or at least Hellenic, development, as far as the entablature is concerned. The question of the column is, however, more complex. In the Aegean culture, columns were common and their capitals consisted of a square abacus with a convex echinus below. The resemblance of this type, shown not only in wall paintings, but also in certain remains of the stair hall of the palace at Cnossus (*c.* 1500 B.C.), the column on the Lion Gate and those of the tholos of Atreus, both at Mycenae (both *c.* 1200 B.C.) to primitive Greek Doric capitals, is too close to be mere coincidence. On the other hand, Aegean columns universally tapered downward, were principally of wood and sometimes extremely slender in proportion, those at the tholos of Atreus being almost 11 diameters high, while those of the primitive Doric have an extreme taper upward and are short and stumpy. Moreover, the Aegean entablature, as shown in wall paintings, is entirely different from the Greek Doric, its chief features being round, projecting beam ends, close together, supported on a simple girder. The Greek Doric entablature has forms which seem to indicate a wooden origin, but one based on a different system of construction from that employed by the Aegean peoples. The architrave represents the original wooden beam running from post to post; the taenia, a board above this, to give a perfect bearing for the cross beams. The triglyphs are the ends of these cross beams, held in place by pegs through the taenia board, represented by the guttae. The metopes are merely closing boards between the beams. The mutules, or sloping blocks on the under side of the projecting cornice corona, represent the under sides of slanting roof rafters, supported on a timber or plate, above the cross beams, and perhaps decorated on the under side by flat boards or wooden pegs whose heads become the guttae in the stone version.

It is known that the primitive temple of Hera, at Olympia, had, originally, wooden posts, which were replaced from time to time during historic times, as they rotted, by stone columns. Nevertheless, the extreme taper and squat proportions of early Doric columns seem to demand an origin of masonry, and especially a masonry made of small stones. The origin would thus appear to be triple; the shaft, from early rubble construction; the capital borrowed and adapted from Aegean sources; while the entablature is an interpretation in stone of traditional Dorian wood construction. The earliest example known of the Greek Doric order is that of the temple at Corinth, probably dedicated to Apollo, which must be as early as the 6th century, and may go back to the 7th. Other early examples exist at Segesta, Selinus, Girgenti and Paestum, which are all of uncertain date, but undoubtedly prior to the Persian wars. Two of those at Selinus may go back to the 7th century B.C. The latest ancient example is that of the Agora gate at Athens (12 B.C.–A.D. 2). During these 700 years the basic elements of the Doric order did not change; the development, which was great, was only in the gradual refinement of every feature, and a continual experimentation in the exact treatment of each form, to give the desired result. Columns became taller and more slender, and the entasis (*q.v.*), or curved taper, more and more delicate. The ovolo of the echinus changed from the obese projections of Corinth and Paestum to the extremely refined and subtle curves of the Periclean period. The entablature, which in early examples had been almost half the height of the column, was gradually reduced in size, till in the Parthenon it is approximately one-fifth. The Greek Doric order was probably, in all cases, richly decorated in colour, so that its present appearance of austerity and over-restraint is illusory.

The *Roman Doric* order has plainly a double origin. The differences between it and the Greek Doric are not due entirely to Roman inability to appreciate the subtleties of Greek work, but merely to the fact that the Etruscans, and perhaps the north Italians, generally, had, at a very early period, developed a column and entablature of their own, with a long, slender, wooden column, having an ovolo echinus similar to the Aegean, and an entablature of wood, sometimes decorated with terra-cotta appliqués. It is this Etruscan column and entablature which Vitruvius endeavoured to describe, and which was misunderstood by the Renaissance, so that the name Tuscan came to be applied to a simplified Doric. It was also the origin of the unfluted, Roman Doric column, with its simple, quarter round echinus. To this the Romans applied an entablature embodying certain Greek features. In Roman architecture, the use of the Doric was reserved for small scale columns, as in many of the house courtyards at Pompeii (the forum colonnade at Pompeii was originally Greek), and to engaged or attached columns between arches. When used on a larger scale it was frequently much modified. Thus, in the temple of Hercules at Cori (attributed to Sulla, *c.* 80 B.C.), a base has been added, consisting of a single torus, but without a plinth. The entablature is extremely delicate in proportion, and the capital profile approximates that of the Greek Doric. A triglyph occurs on the corner, as in Greek work. In the theatre of Marcellus, at Rome (completed 13 B.C.), there is no base, and in the Colosseum (A.D. 80) there are no triglyphs. The Renaissance codifiers, however, took these two as the most typical, and their order is a sort of average between them. Another Doric order, coming originally from Albano, has no base except a fillet with apophyge, and the mouldings of the capital are richly carved. Other Roman Doric orders of extreme richness, in which the echinus of the capital is formed by a cyma recta instead of an ovolo are those from a temple on the Aventine, probably of the 2nd century A.D., and one from the baths of Diocletian (A.D. 305).

The *Ionic* order had manifestly an Asiatic origin. Its capital is a development from stele (*q.v.*) capitals of Phoenicia and the eastern end of the Mediterranean, which were themselves based

originally on the tri-lobed lotus. A famous example of the primitive type was found at Neiandreia, and another in Messa, in Lesbos. Excavations on the Acropolis at Athens, and elsewhere, have revealed many examples of the intermediate stages between the flaring volutes and awkward proportions of the early type and the refined perfection of the developed Ionic of the temple of Nike Apteros (probably between 440 and 410 B.C.), or the Erechtheum (407 B.C.). The characteristic features of the Greek Ionic order as found in Greece itself are the bold size and exquisite curvature of the volutes, the remarkable perfection of carved ornament that decorates the whole, and the variety of the types of base found.

The treatment of the order at the corners of a portico was difficult. The corner capital was formed with volutes on two adjacent, rather than two opposite, faces; where they met, the volutes were curved out at an angle together under the corner of the entablature. This created a new difficulty on the opposite corner, inside the colonnade, as it brought two half volutes together in an awkward way. It was this difficulty that led to a development of a variation of the Ionic capital with four faces the same and angle volutes. The most beautiful Greek example is that of the temple of Apollo at Bassae, designed by Ictinus, the architect of the Parthenon (probably *c.* 425 B.C.). In this the columns of the interior of the cella are connected by short walls to the exterior wall, and evidently, in order to have them present the same decorative face toward the entrance as toward the narrow nave between them, Ictinus adopted a four-sided Ionic capital.

A much more virile Ionic at enormous scale was developed in the great Hellenistic temples of the Asia Minor coast, such as those at Miletus and Priene. The archaic temple at Ephesus had set the style as early as the 6th century B.C., and its rebuilding, shortly after 350 B.C., by Dinocrates, while keeping certain of the more archaic features, such as the sculptured drums of the lower portions of the columns, was in the complete new Hellenistic Ionic style. The characteristics of this are: (1) a capital with volutes relatively smaller than in Athenian examples; (2) a cornice whose most striking feature was the very large dentils of the bed-mould, so large and so widely spaced, in fact, that in appearance they became almost separate brackets.

The *Roman Ionic* was based more on the Asia Minor than on the Attic types. Its details, throughout, were heavier than the usual Greek type. This heaviness appears even in the temple of Fortuna Virilis, which is not only the earliest purely Roman Ionic order, but also probably the earliest building in Rome in a good state of preservation to-day. It is variously attributed to the beginning of the 2nd and the beginning of the 1st century B.C. In general, the three chief differences between the Greek and Roman Ionic orders are: (1) the band connecting the volutes is perfectly horizontal, both at top and bottom, in Roman examples, and without the central dip of most Greek capitals; (2) the relative height and importance of the bed-mould of the cornice is much greater in the usual Roman examples. This is true, even in the most delicate and the most Greek of the monumental Roman orders—that of the theatre of Marcellus; (3) the base of the Roman order has, almost always, a square plinth as its lowest member. An exceptional type of Roman Ionic order is that of the temple of Saturn, on the Roman forum, the ancient treasury of Rome, whose ugly heaviness is characteristic of its date, after the great fire of A.D. 283.

Whatever the date of the original invention of the *Corinthian* order, it did not come into general use until the middle of the 4th century B.C. The capital perhaps owes its bell shape to Greek travellers' memories of the campaniform capitals of Egypt. But the Greek expression of this form is characteristically gracious. (For the charming Greek myth of its creation, *see* Vitruvius, Bk. IV.) Certainly the simplest form of the capital, in which a bell, decorated with flat and delicately pointed leaves, close together, has its lower portion surrounded by eight boldly curving acanthus leaves, suggests a basket around the bottom of which an acanthus plant has grown, as the myth states. The most famous example of this simple type decorated the "Tower of the Winds," at Athens, originally built in the 1st century B.C. to contain a water clock. The more complicated type, which is well represented by the exquisite capital of the tholos at Epidorus (middle 4th century B.C.), had two rows of leaves below and corner and central scrolls above. An even simpler form of the same type of capital, found alone in the ruins of the temple at Bassae, may be as early as the temple itself. The most popularly known example of the Greek Corinthian order, is that of the little choragic monument of Lysicrates, at Athens (335 B.C.).

The extremely lavish capital is, however, exceptional in many ways, and its silhouette unpleasantly broken. The existing columns and capitals of the great temple of Zeus at Athens were originally considered to be duplicates of the capital that Sulla took to Rome, and which served as a model for early Roman Corinthian. It is now known that the present remains are of the time of Hadrian. The order is, therefore, Roman, and not Greek. The Greeks never developed a separate entablature for the Corinthian order, using, instead, one of purely Ionic type; that of the tholos at Epidaurus owes its peculiar flat cornice to the fact that it was an interior order, rather than to any attempt to develop special entablature forms to crown the Corinthian capital.

Roman tradition found the origin of the *Roman Corinthian* order in a capital of the Athenian temple of Zeus, which Sulla brought with him to Rome. Long before that date, however, the Etruscans had been using forms Corinthianesque in type, and Pompeii also shows capitals which approach the Corinthian. In any case, the use of the Corinthian order on a monumental scale, as the Roman order *par excellence,* was well established by the time of Augustus, and the temple of Mars Ultor, dedicated in 2 B.C. as part of the forum of Augustus, and the portico of Octavia, of approximately the same date, both have completely developed magnificent Corinthian orders. It is noteworthy that in these the modillion (*q.v.*) had already reached a complete form. New light on the origin of this new feature which transformed the Ionic entablature into the Corinthian and which is the great Roman contribution to the development of the orders, is furnished by fragments of the order of the basilica Aemilia (dedicated 29 B.C.). These fragments are of the typically pure Augustan type, and therefore, probably due to this date and not to any of the succeeding rebuildings, and indicate a cornice with modillions which are deeper at the outer end than at the inner; that is, they slope down like the Doric mutules. Their outer ends are, however, scrolled.

The Roman Corinthian order is found in infinite variations. In certain small examples in tombs, gateways and the like, its proportions are thick and stumpy, as in the triumphal gateway at Saintes, of the time of Tiberius. In other cases it is extremely slender, as in the arch of Augustus at Susa. At times there are no modillions in the cornice, as in the temple of Antoninus and Faustina, at Rome (A.D. 141), and in the great temple of Venus, at Rome (A.D. 135), rebuilt by Maxentius (after 307). The modillions are replaced by the square, projecting blocks adopted by the Renaissance for the Composite order. Moreover, many types of capital exist. In some the two rows of leaves are at approximately equal height and kept tight to the bell, so that the effect is very vertical. In others, the lower row of leaves is made tall, so that the projecting leaf ends of both rows are close together and project markedly, giving almost the effect of a wreath around the capital. In other smaller examples, such as many at Pompeii, the ornament is hardly more than a frosting of the stucco surface of the bell. In the colonnade of the temple of Apollo, at Pompeii (rebuilt *c.* A.D. 63), a Doric entablature is supported by Corinthianesque columns. In some examples, rampant animals take the place of the corner volutes, as in the order of the temple of Concord, at Rome (A.D. 10) and in the capitals of the Roman gateway at Eleusis, in Greece (1st century A.D.). Another type, common in pilasters, substitutes for the cauliculi, with their double scrolls, an S-scroll at each side, turned in to the centre below and out to the corners above. This type gave rise to many 15th century early Renaissance capitals.

The most characteristic examples of the best type of the Roman Corinthian order are those of the round temple of Vesta,

at Tivoli (probably Augustan); the portico of the Pantheon, perhaps from the original building by Agrippa (27 B.C.); the interior of the Pantheon (A.D. 115–125); the portico of Octavia; the temple of Castor and Pollux on the forum (either of the rebuilding under Tiberius A.D. 6, or of the time of Hadrian), which is remarkable for the decoration of the middle band of the architrave and for the large, interlacing, central volutes of the capital; and that of the temple of Jupiter at Baalbek in Syria (time of Hadrian). An interesting order in brick and terra-cotta, evidently never stuccoed, is a doorway from an ancient Roman police station in Rome (early 3rd century); a more elaborate type of cut brick Corinthian with octagonal columns recessed into the wall is in the tomb of Annia Regilla (late 2nd century).

The *Roman Composite* order was actually only one of many variations of the Corinthian, and its erection into another order is a purely Renaissance idea. Vitruvius makes no mention of it and the earliest example known is one from a small garden pavilion in a house court recently (1928) excavated in Pompeii; an early monumental type is that of the arch of Titus, at Rome (completed A.D. 81), in which the exquisite composite capitals carry a normal Corinthian entablature. The bold richness of this type of capital was particularly popular during the later empire and the most magnificent example, remarkably delicate in execution for its late date, is one in the baths of Caracalla (211–216).

**Renaissance.**—During the middle and late 15th century in Italy and the early 16th century in France, the early Renaissance architects developed modified Corinthianesque orders of the most exquisite delicacy, in connection with doors, tombs and the like. The most characteristic feature of these orders is the general use of S-scrolls instead of volutes and cauliculi, and the use frequently of only small leaves beneath them at the corners of pilaster capitals. In the working out of the details of capitals of this type, the personalities of such sensitive designers as the Della Robbias, Desiderio da Settignano (1428–64) and Mino da Fiesole (1431–84) achieved some of their most characteristic and delicate expression. At times dolphins, birds and even cherubs' heads replaced the scrolls under the cornice of the capital. The entablatures of these orders are almost always without modillions, but characterized by a jewel-like delicacy in the carving of the ornamented mouldings. In the arrangement of this there is the greatest variety. During the high and late Renaissance the orders tend to become more normal, but little strict archaeology is found and much individuality of design is still present. The work of B. Peruzzi (1481–1537), of D. Bramante (1444–1514), of Vignola and of Palladio is particularly noteworthy. Typically Renaissance variations are rusticated orders like those in the gates of Verona by San Michele (1530) and the banded columns developed by Philibert Delorme for the Tuileries in Paris (1564), and followed in the Grande Gallerie (1578) and twisted columns like those of Bernini's baldacchino in S. Peter's at Rome (1633).

During the Baroque period, especially in Spain, all kinds of forms were used which approximate the orders, but are so broken up and contorted, and so varied in detail, that they can be assigned to no definite classification.

The 20th century has seen a reaction against the archaeological correctness of orders of the revival period. Orders, where occurring, are treated with the utmost freedom, and those styles seem most popular in which a like freedom prevailed, such as the late Georgian style of the Adam brothers, and American colonial, with its slimness and attenuation. In so-called modernist work, the order tends to pass from use as a superfluous ornament. In exceptional cases, however, especially in Scandinavia, extremely free and modified orders are still used, as in the concert hall at Stockholm, by Ivar Tengbom, and in America in portions of the interior of the Nebraska State capitol by B. G. Goodhue and the Goodhue associates.

(*See* also GREEK ARCHITECTURE; RENAISSANCE ARCHITECTURE; ROMAN ARCHITECTURE.)

BIBLIOGRAPHY.—Vitruvius, *De Architectura,* English trans. by M. H. Morgan (1914); Vignola, *Five Orders of Architecture* (1563); A. Palladio, *I quattro libri dell' architettura* (1570); W. Chambers, *Orders, . . .* (1839); R. and J. Adam Brothers, *Work* (1773–78; reprinted 1900–02); J. Guadet, *Éléments et théorie de l'architecture* (4th ed., 1909); W. R. Ware, *American Vignola* (1910); C. P. J. Normand, *Parallel of the Orders of Architecture* (English trans., 1928).

(T. F. H.)

**ORDERIC VITALIS** (1075–*c.* 1142), the chronicler, was the son of a French priest, Odeler of Orleans, who had entered the service of Roger Montgomery, earl of Shrewsbury, and had received from his patron a chapel in that city. Orderic was sent at the age of five to learn his letters from an English priest, Siward by name, who kept a school in the church of SS. Peter and Paul at Shrewsbury. When eleven years old he was entered as a novice in the Norman monastery of St. Evroul en Ouche. Orderic did not know a word of French when he reached Normandy; his book, though written many years later, shows that he never lost his English cast of mind or his love of England. His superiors rechristened him Vitalis, after a member of the legendary Theban legion. But in the title of his Ecclesiastical History he prefixes the old to the new name and proudly adds the epithet *Angligena.* He became a deacon in 1093, a priest in 1107. He left his cloister on several occasions, and speaks of having visited Croyland, Worcester, Cambrai (1105) and Cluny (1132). For many years he appears to have spent his summers in the scriptorium. His superiors (at some time between 1099 and 1122) ordered him to write the history of St. Evroul. The work grew under his hands until it became a general history of his own age. St. Evroul was a house of wealth and distinction. War-worn knights chose it as a resting-place of their last years. It entertained visitors from southern Italy, where it had planted colonies of monks, and from England, where it had extensive possessions.

Thus Orderic, though he witnessed no great events, was often well informed about them. His narrative gives us much invaluable information for which we should search the more methodical chroniclers in vain. He throws a flood of light upon the manners and ideas of his own age; he sometimes comments with surprising shrewdness upon the broader aspects and tendencies of history. His narrative breaks off in the middle of 1141, though he added some finishing touches in 1142.

The *Historia ecclesiastica* falls into three sections. (1) Bks. i., ii., which are historically valueless, give the history of Christianity from the birth of Christ. After 855 this becomes a bare catalogue of popes, ending with the name of Innocent I. These books were added, as an afterthought, to the original scheme; they were composed in the years 1136–1141. (2) Bks. iii.–vi. form a history of St. Evroul, the original nucleus of the work. Planned before 1122, they were mainly composed in the years 1123–1131. The fourth and fifth books contain long digressions on the deeds of William the Conqueror in Normandy and England. Before 1067 these are of little value, being chiefly derived from two extant sources, William of Jumièges' *Historia Normannorum* and William of Poitiers' *Gesta Guilelmi.* For the years 1067–1071 Orderic follows the last portion of the *Gesta Guilelmi;* hence this is of the first importance. From 1071 he begins to be an independent authority. But his notices of political events in this part of his work are far less copious than in (3) Bks. vii.–xiii., where ecclesiastical affairs are relegated to the background. In this section, after sketching the history of France under the Carolingians and early Capets, Orderic takes up the events of his own times, starting from about 1082. He has much to say concerning the empire, the papacy, the Normans in Italy and Apulia, the First Crusade (for which he follows Fulcher of Chartres and Baudri of Bourgueil). But his chief interest is in the histories of Duke Robert of Normandy, William Rufus and Henry I. He continues his work, in the form of annals, up to the defeat of Stephen at Lincoln in 1141.

The *Historica ecclesiastica* was edited by Duchesne in his *Historiae Normannorum scriptores* (Paris, 1619). This is the edition cited by Freeman and in many standard works. It is, however, inferior to that of A. le Prévost in five vols. (*Soc. de l'histoire de France,* Paris, 1838–55). The fifth volume contains excellent critical studies by M. Leopold Delisle, and is admirably indexed. Migne's edition (*Patrologia latina,* clxxxviii.) is merely a reprint of Duchesne. There is a French translation (by L. Dubois) in Guizot's *Collection des mémoires relatifs à l'histoire de France* (Paris, 1825–1827); and one in English by T. Forester in Bohn's Antiquarian Library (4 vols., 1853–56). In addition to the *Historia* there exists, in the library at Rouen, a manuscript edition of William of Jumièges' *Historia*

*Normannorum* which Leopold Delisle assigns to Orderic (*See* this critic's *Lettre à M. Jules Lair* [1873].) (H. W. C. D.; X.)

**ORDER IN COUNCIL,** in Great Britain, an order issued by the sovereign on the advice of the privy council, or more usually on the advice of a few selected members thereof. It is the modern equivalent of the mediaeval ordinance and of the proclamation so frequently used by the Tudor and Stuart sovereigns. In practice it is only issued on the advice of ministers of the Crown, who are, of course, responsible to parliament for their action in the matter. Orders in council were first issued during the 18th century, and their legality has sometimes been called in question. Consequently in several cases parliament has subsequently passed acts of indemnity to protect the persons responsible for issuing them, and incidentally to assert its own authority. At the present time the principle seems generally accepted that orders in council may be issued on the strength of the royal prerogative, but they must not seriously alter the law of the land.

The most celebrated instance of the use of orders in council was in 1807 when Great Britain was at war with France. Orders in council are used to regulate the matters which need immediate attention on the death of one sovereign and the accession of another.

In addition to these and other orders issued by the sovereign by virtue of his prerogative, there is another class of orders in council, viz., those issued by the authority of an Act of parliament, many of which provide thus for carrying out their provisions. At the present day orders in council are extensively used by the various administrative departments of the government, who act on the strength of powers conferred upon them by some Act of parliament. They are largely used for regulating the details of local government and matters concerning the navy and the army, while a new bishopric is sometimes founded by an order in council. They are also employed to regulate the affairs of the crown colonies, and the lord-lieutenant of Ireland, the viceroy of India, the governor-general of Canada, and other representatives of the sovereign may issue orders in council under certain conditions.

In times of emergency the use of orders in council is indispensable to the executive. The Regulation of the Forces Act 1871 empowers the government in a time of emergency to take possession of the railway system by the issue of such an order; and during the World War the use of orders in council was frequent.

**ORDERS OF KNIGHTHOOD:** *see* KNIGHTHOOD AND CHIVALRY.

**ORDINANCE,** in mediaeval England, a form of legislation. The ordinance differed from the statute because it did not require the sanction of parliament, but was issued by the sovereign by virtue of the royal prerogative, although, especially during the reign of Edward I., the king often obtained the assent of his council to his ordinances. Legislation by ordinance was common during the reigns of Henry III. and Edward I. when laws were issued by the king in council or enacted in parliament indifferently. Both were regarded as equally binding. In 1389 the Commons presented a petition to King Richard II. asking that no ordinance should be made contrary to the common law, or the ancient customs of the land, or the statutes ordained by parliament. For this and other reasons this form of legislation fell gradually into disuse, becoming obsolete in the 15th century. The modern equivalent of the ordinance is the order in council (*q.v.*), but in the crown colonies legislation is both by orders in council and by local ordinance issued by the governor with the assent of his council.

In the 17th century the use of the word ordinance was revived, and was applied to some of the measures passed by the Long Parliament, among them the famous Self-denying Ordinance of 1645.

**ORDINANCE** or **ORDONNANCE,** in architecture, a composition of some particular order or style; not restricted to columnar composition, the term applies to any kind of design which is subjected to conventional rules for its arrangement.

**ORDINARY,** in canon law, the name commonly employed to designate a superior ecclesiastic exercising "ordinary" jurisdiction (*iurisdictionem ordinariam*), *i.e.*, in accordance with the normal organization of the Church. It is usually applied to the bishop of a diocese and to those who exercise jurisdiction in the name of the bishop or by delegation of his functions. In English law, however, the term ordinary is now confined to the bishop and the chancellor of his court. The pope is the *ordinarius* of the whole Roman Catholic Church, and is sometimes described as *ordinarius ordinariorum*. Similarly in the Church of England the king is legally the supreme ordinary, as the source of jurisdiction.

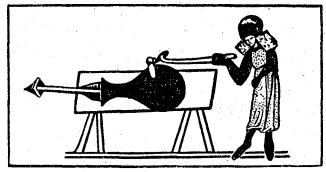
In England the only instance of the term ordinary being employed in its civil application was that of the office of judge ordinary created by the Divorce Act of 1857, a title which was, however, only in existence for about 18 years owing to the incorporation of the divorce court with the high court of justice by the Judicature Act, 1875. But in Scotland the ordinary judges of the inner and outer houses are called lords ordinary, the junior lord ordinary of the outer house acts as lord ordinary of the bills, the second junior as lord ordinary on teinds, the third junior as lord ordinary on exchequer causes. In the United States the ordinary possesses, in the States where such an officer exists, powers vested in him by the constitution and acts of the legislature identical with those usually vested in the courts of probate. In South Carolina he was a judicial officer, but the office no longer exists, as South Carolina has now a probate court.

**ORDINATE:** *see* CO-ORDINATES.

**ORDNANCE,** a general term for great guns for military and naval purposes, as opposed to "small arms" and their equipment; hence the term also includes miscellaneous stores under the control of the ordnance department as organized. In England the Master-General of the Ordnance, from Henry VIII.'s time, was head of a board, partly military, partly civil, which managed all affairs concerning the artillery, engineers and matériel of the army; this was abolished in 1855, its duties being distributed. The making of surveys and maps (*see* MAP) was, for instance, handed over eventually (1889) to the Board of Agriculture, though the term "ordnance survey" still shows the origin.

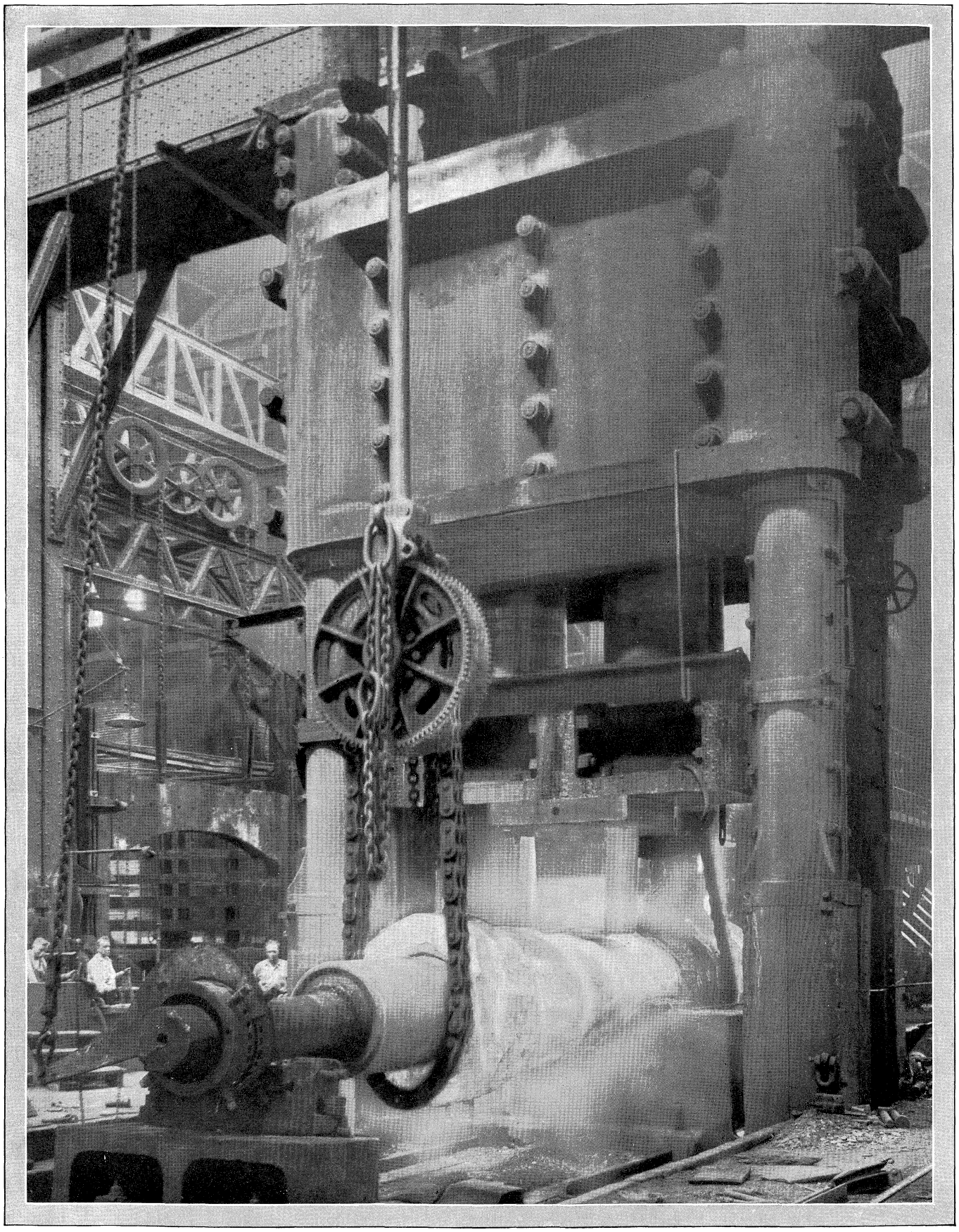
## HISTORY

The invention of guns may be said to date from the first quarter of the 14th century. At this period gunpowder (*q.v.*), which had been known as an explosive for at least sixty years, appears to have been first used as a propellent. Although incendiary compounds and fire-projecting machines were known to the Greeks, Arabs and Chinese in very early times and were used on the sailing-galleys of Constantine Pogonatus in the year 673 for the destruction of enemy vessels, there is no good evidence that any explosive resembling gunpowder was discovered before the 13th century. Roger Bacon refers, in 1249, to such an explosive and may even have been its discoverer. Too little is known of the man who first applied gunpowder to the projection of missiles for military purposes but the ascription of the invention of cannon to a German monk, Berthold Schwartz, appears to have gained acceptance among most military historians. The cannon was probably evolved at the beginning of the 14th century from some such engine as the *madfaa* referred to in an anonymous Arabic manuscript of that period. This *madfaa* seems to have been a small wooden mortar-like instrument on the muzzle end of which a ball rested like an egg in an egg-cup until projected by the firing of the charge. Another primitive machine, from which an arrow-like bolt was shot, is illustrated in the Millemete ms. (*c.* 1326). The bottle shape of this suggests the name "pot de fer" found in early records. (*See* fig. 1.) It is natural to suppose an evolution by which the narrow neck of this weapon was enlarged until the bottle became a straight tube and the arrow bolt was replaced by a ball. All the early guns were very small and were made of iron or cast bronze; they fired iron or lead balls and there is evidence of their general use in western Europe from about 1325 onwards. They are reported to have been used at a siege of Metz in 1324 and iron balls and metal cannon are mentioned in a Florentine document of 1326. John Barbour, writing in 1375, refers to the "crakys of war" used by Edward III. in



BY COURTESY OF LT. COL. H. W. L. HIME

FIG. 1.—EARLY TYPE OF CANNON

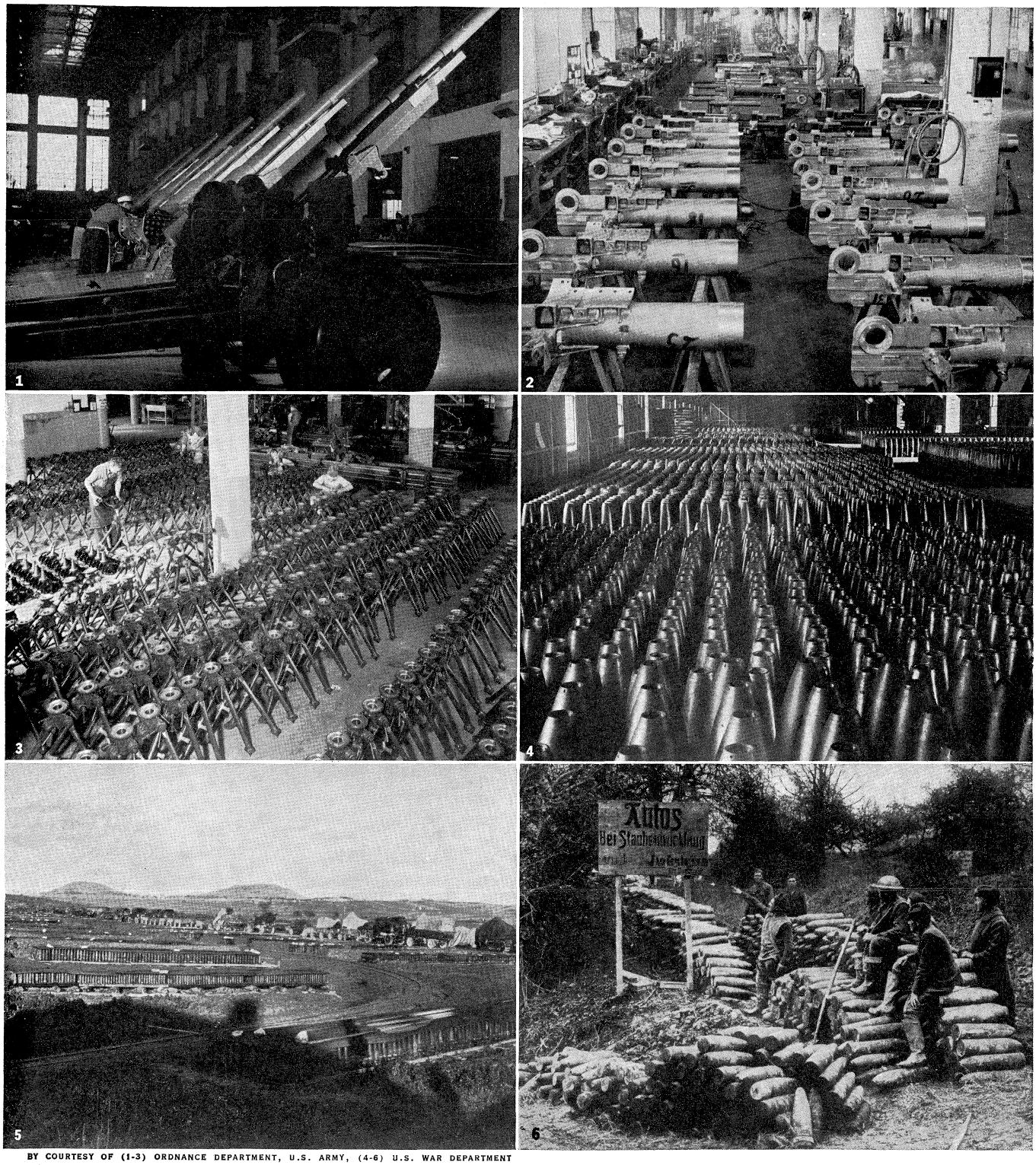


BY COURTESY OF THE BETHLEHEM STEEL COMPANY

## GUN FORGING

Forging a large pressure vessel in a 14,000-ton hydraulic forging press. Under great pressure, the hot plastic metal is pressed into the required shape, following which it is machined and heat-treated to obtain the desired physical properties

# ORDNANCE




BY COURTESY OF (1-3) ORDNANCE DEPARTMENT, U.S. ARMY, (4-6) U.S. WAR DEPARTMENT

## MANUFACTURE AND STORING OF ORDNANCE AND AMMUNITION

1. New 75-mm. field guns being completed at Rock Island arsenal, U.S.A.
2. Sub-assembly for 3″ anti-aircraft carriages
3. Assembling tripods for .30 calibre machine guns
4. Finished shell in storage without fuses
5. Ammunition dump behind a theatre of operation, World War (1914–18)
6. Ammunition dump for brigade near line of action during World War (1914–18)

his Scottish campaign of 1327. The same king provided himself with cannon when he invaded France in 1346. Guns were carried in an English ship, the "Christopher of the Tower," as early as 1338 and a "pot de fer" is recorded to have been in one of the French vessels which attacked Southampton in that year. Guns were used in the English fleet at the battle of Sluys in 1340 and in a sea-fight between the Moors of Tunis and the Moorish King of Seville in 1350. The history of guns falls naturally into three epochs; the first being the smooth-bore era, from the 14th century to about 1845; the second, the evolutionary era from about 1845 to 1885; the third, the high velocity smokeless powder era from about 1885 onwards.

### THE FIRST EPOCH (EARLY 14TH CENTURY TO 1845)

This period is marked by the use of smooth-bore weapons of low striking velocity. It is notable for the small progress made in five centuries of considerable warfare, beginning with the Hundred Years' War. Wrought iron pieces came largely into use in the latter part of the 14th century, owing, no doubt, to the difficulty of obtaining sufficiently sound metal castings for the bigger guns and to the high cost of copper. These guns were constructed of rods or bars which were beaten and welded together lengthwise and reinforced by iron rings clamped round the outside of the gun. This radically unsound form of construction survived during the 15th century notwithstanding many accidents, the most notable of which caused the death of King James II. of Scotland in 1460.

Stone balls came into general use for the larger pieces during the 14th century; such balls were cheaper than those of lead or iron and, being relatively much lighter, were better suited to the feeble guns of the period as these increased in size. Before the middle of the 15th century guns had developed from small weapons firing a 1 lb. or 2 lb. pellet to large "bombards" capable of throwing balls of 300, 400 and even 700 lb. weight. One of the most famous of these, Dulle Griete, the giant bombard of Ghent with a 25-inch calibre, was built as early as 1382. (*See* fig. 2.) Exceptionally large bombards were used by the Turks at the siege of Constantinople in 1453. The Turkish bombards were of cast bronze, but wrought iron construction was more general and is exemplified by Mons Meg, a 15th century gun now at Edinburgh Castle. It is noteworthy that many early guns were loaded from the breech end by a detachable chamber. (*See* fig. 3.) Another interesting feature of primitive gunnery was the common use of the *ribauld* or *ribauldequin* between 1350 and 1400. This was the prototype of the *mitrailleuse* and consisted of a number of small iron gun tubes clamped together in a bundle and fired in quick succession from the breech end, the whole being mounted on a wheeled carriage.

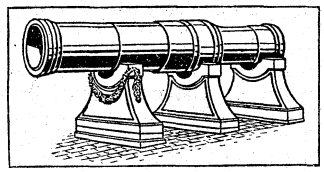


FIG. 2.—DULLE GRIETE, GHENT

The art of casting improved in the latter part of the 15th century (it had been introduced into England about 1353), and the large cast bronze guns of that time were often beautifully ornamented with renaissance workmanship. Cast iron shot came into use at the end of the 15th century and by the end of the 16th century stone shot only survived for use in *petrieros, slyngs, fowlers, murtherers* and other relics of the preceding period. As cast iron shot displaced stone, its greater efficiency as a projectile tended to encourage the manufacture of a smaller and stronger type of gun and medium calibre muzzle-loading pieces, made first of forged iron and later of cast iron, came into use. These and cast brass weapons were developed steadily for field and naval service, whereas hitherto siege purposes had been the predominant consideration. It was not until the 17th century that cast iron muzzle-loading guns came into general use and they then continued as the principal weapons ashore and afloat until the end of the epoch. The improvement in the composition and strength of gunpowder after the introduction of "corned" gunpowder about 1429 had long made these stronger weapons a requirement. The use of cast steel was tried during the 16th and 17th centuries, but was generally found objectionable and finally abandoned, the metallurgical ignorance of the time making it impossible to obtain sound castings.

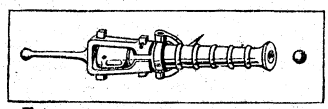


FIG. 3.—EARLY BREECH-LOADER

*Principal Guns of the 16th Century Compiled from What Appear to Be the Most Trustworthy Ancient Authorities*§

| Name of piece | Calibre | Length* | Weight of gun | Weight of shot | Charge of powder | Later designation |
|---|---|---|---|---|---|---|
| | Ins. | Ft. In. | Lb. | Lb. | Lb. | |
| Cannon Royal | 8·54 | 12 0 | 8,000 | 74 | 30 | .. |
| Cannon | 8·0 | 9 10 | 6,000 | 60 | 27 | .. |
| Cannon Serpentine | 7·0 | .. | 5,500 | 42 | 25 | .. |
| Bastard Cannon | 7·0 | 9 6 | 4,500 | 42 | 20 | 42 pounder |
| Demi-cannon | 6·4 | 11 0 | 4,000 | 32 | 18 | 32 „ |
| Cannon Pedro, or Petro† | 6·0 | .. | 3,800 | 26 | 14 | 24 „ |
| Culverin** | 5·2 | 10 11 | 4,840 | 18 | 12 | 18 „ |
| Basilisk | 5·0 | .. | 4,000 | 14 | 9 | 12 „ |
| Demi-culverin | 4·0 | .. | 3,400 | 8 | 6 | 9 „ |
| Culverin Bastard | 4·56 | 8 6 | 3,000 | 11 | 5·7 | .. |
| Saker‡ | 3·65 | 6 11 | 1,400 | 6 | 4 | 6 pounder |
| Minion | 3·5 | 6 6 | 1,050 | 5·2 | 3 | .. |
| Falcon | 2·5 | 6 0 | 680 | 2 | 1·2 | .. |
| Falconet¶ | 2·0 | 3 9 | 500 | 1 | ·4 | .. |
| Serpentine | 1·5 | .. | 400 | ·5 | ·3 | .. |
| Rabinet or Robinet | 1·0 | 5 6 | 300 | ·3 | ·18 | .. |

§*See* Sir W. Monson's "Tracts" in Churchill's *Voyages*, iii.; *"Archaeologia,"* vi. 189, xi. 170, xiii. 27, etc. Tartaglia's *"Three Books of Colloquies,"* translated by Lucar (London, 1588); and S.P.Dom. Eliz. ccxlii. 64. Hardly any two of these agree.

*Monson puts the length of the guns mentioned by him at 8 ft. 6 in.; but specimens still extant, dating from about his time, indicate that this was not always correct.

†"Cannon Pedro" was the English form of *"canon pierrier,"* and means a gun primarily intended for throwing stone shot.

**I.e. couleuvrine—serpent. Compare Basilisk.

‡Named after the Saker hawk. Compare Falcon.

¶In the grounds of the Seigneurie, Sark, is a well-preserved brass gun, apparently a falconet, 57 inches in length, and 1⅞ inches in calibre, bearing the following inscription:—*"Don de sa Majesté la Royne Elizabeth au Seigneur de Sarcq,* A.D. *1572."*

The above table, taken from *The Royal Navy, A History* by Laird Clowes, vol. i., p. 410, shows the guns mounted in ships during Queen Elizabeth's reign. A column has been added to this table, indicating the weapons in general use in the 17th and 18th centuries, with the classification in terms of the projectile's weight, which was carried out under Cromwell's government when a greater uniformity in the size of shot and in the clearance between the shot and the bore (windage) was demanded.

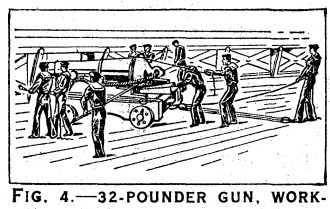
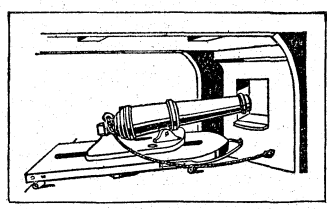


FIG. 4.—32-POUNDER GUN, WORKING WITH REDUCED CREW OF NINE MEN



FROM H. GARBETT, "NAVAL GUNNERY"

FIG. 5.—32-POUNDER CARRONADE

In the middle of the 18th century progress was made in ordnance by boring from a solid casting instead of relying on hollow casting; this resulted in greater uniformity of bore. Also a more scientific attitude to ballistics (*q.v.*) was adopted. This attitude was mainly due to Benjamin Robins, inventor of the ballistic pendulum, who in 1742 published an important work, *The New Principles of Gunnery*. A result of his research and

experiments was the introduction in 1779 of *carronades*. These were light short weapons of various calibres from 6 to 68 pounders in which windage was greatly reduced. A contrast between this weapon on its ship's mounting and a gun of the same calibre on a truck carriage is shown in figs. 4 and 5. More attention was also paid to the shape and weight of guns in relation to the stresses to be borne and less to external ornament. Trunnions were placed near the axis of the gun instead of below it, thus lessening the stresses on the carriage.

Hollow shot filled with explosive or incendiary mixtures were used from mortars in the middle of the 16th century, but explosive shell did not come into general use for guns until early in the 19th century. Their advent sounded the death knell of the wooden warship and soon became an incentive to the development of steel through the impetus given to the production of protective armour. The 65 cwt. 8 in. shell gun was introduced into the British Navy after 1838 and took the place of the 32 pounder as the lower deck armament in line of battle ships and the main deck armament of frigates. The gun was 9 ft. long and fired a 56 lb. shell. (*See* C. ffoulkes, *The Gun Founders of England*, 1937). (J. G. M. McH.; X.)

### THE SECOND EPOCH (1845–1885)

This may be described as the "evolutionary era." It is notable for the great advance made in a short period through the introduction of rifling for cannon and of a "built-up" construction involving shrinkage, resulting in medium velocity weapons firing elongated projectiles of considerable penetrative power. This epoch embraced the Russian, American Civil and Franco-Prussian Wars. These contributed to the remarkable developments in ordnance, revived the armament firms of Europe that had gone into obscurity since the Napoleonic Wars, particularly Krupp (Germany) and Schneider (France), and brought others into being, notably Armstrong Whitworth (Britain). The progress in mechanics and engineering of this industrial era, which included the introduction of the Bessemer and Siemens open-hearth method of making steel, was reflected in the advance in gun mechanisms, in recoil appliances and in the application of power to the working of guns. The inventive genius of the time was particularly exemplified by the production of machine guns and automatic guns.

**Introduction of Rifling.**—The introduction of rifling owes much to Benjamin Robins who, in 1747, wrote: "Whatever state shall thoroughly comprehend the nature and advantage of rifled barrel pieces and . . . shall introduce into their armies their general use . . . will by this means acquire a superiority which will almost equal any thing that has been done at any time by the particular excellence of any one kind of arms."

Rifling, by imparting a spin to the projectile as it travels along the spiral grooves in the bore, permits of the use of an elongated projectile and ensures its flight point first, which greatly increases accuracy. The longer projectile being heavier than round shot has a greater striking energy for the same muzzle velocity. The shape of the head can be designed to reduce air resistance, thereby increasing range. Though Robins was probably the first to give reasons based on sound principles why rifling was desirable, the fact that it was helpful in external ballistics had been appreciated since the early 16th century and a barrel exists at Woolwich, dated 1542, which is rifled with six fine spiral grooves. Straight grooving was applied to firearms (muskets) as early as 1480 and this practice of grooving the bore of a musket without any twist was extensively used during the 16th century. Probably rifling evolved from the early observation of the action of the feathers on an arrow and from the practical experience of cutting channels in a musket, originally to reduce fouling, being found beneficial to the weapon's accuracy. Towards the end of the 18th century the importance of rifled small arms and their necessity had been appreciated. The War of Independence contributed to this result; the Americans early realised the value of the rifled musket. Elongated bullets, however, did not begin to replace spherical until 1828. It was not until a hundred years after Robins' experiments that any attempt to rifle guns was successful. In 1846 a Sardinian officer, Major Cavalli, and a Swedish officer, Baron Wahrendorff, both independently produced breech-loading rifled iron guns. The Cavalli gun had two grooves cut separately along the bore on opposite diameters, in which two projections, ¼-inch deep, on the 69 lb. cylindro-conical projectile, engaged. Promising results were obtained with both guns, though they were of a somewhat weak construction.

About the same time Charles Lancaster endeavoured to rotate projectiles by giving the gun an elliptical bore of small eccentricity, the spiral increased gradually towards the muzzle, and rotation was effected through rifling "surfaces" instead of by grooves. Guns rifled on this principle were used in gunboats during the Crimean War, but were not a success. An improved form of this principle of rifling was adopted by Joseph Whitworth a few years later. The advantages of an elongated rotating projectile both in range and penetrative properties were now thoroughly established. The muzzle velocity of guns during the last 100 years of the 1st epoch compared favourably with that of the earlier rifled guns; the elongated projectiles of the latter however lost their velocity slowly whereas the smooth bore round shot lost velocity so rapidly that at 2,000 yards' range the striking velocity has only about one third of the muzzle velocity.

**Introduction of Shrinkage Construction.**—The idea of reinforcing cast iron or bronze guns to reduce the number of accidents with cast pieces had been under investigation from time to time. In 1833 a gun was produced by M. Thiery (France), by whom the virtue of shrinking on hoops was to some extent appreciated. The interior of the gun was made of cast iron, and this was encased in a longitudinal armature of wrought iron bars, which were further reinforced by wrought iron hoops shrunk on.

In 1857 General Rodman (United States) developed the principle of interior cooling of cast-iron cannon by the application of which the metal surrounding the bore was put under a permanent compressive strain which increased the resistance of the gun to interior pressure.

In 1855 W. G. Armstrong (afterwards Lord Armstrong, *q.v.*) designed a rifled breech-loading gun embodying so many considerable improvements as to be in effect revolutionary. The main feature of the construction was the introduction of hoops and tubes formed by wrought iron bars, which were coiled hot on a mandrel and welded into a closed helix, the fibre of the wrought iron running in the direction most suitable for circumferential strength. Longitudinal strength was obtained by a forged hollow breech piece. These helical cylinders were shrunk over a steel tube or liner in the original Armstrong gun. In later construction the steel tube was replaced by a wrought iron helical tube (*see* fig. 6). The gun was rifled with a large number of grooves and fired lead-coated projectiles, thus eliminating windage; breech-loading was effected by a powerful screw holding a sliding vent-piece tightly against the face of the breech.

Various types of guns, having a built-up form of construction involving shrunk hoops, were produced about the same period as the Armstrong gun, notably Chambers gun (United States, 1849); Treadwell gun (United States, 1855); Blakely gun (Britain, 1855); Parrot gun (United States, 1861). Many rival claims to originality were made after the success of the Armstrong gun, but its superiority was due more to the manner in which the difficulties of manufacture were overcome than to the introduction of new principles. In Britain the gun which competed most successfully with the Armstrong gun was that produced by Whitworth. This distinguished engineer had already become prominent for improvements effected by him in the Enfield rifle. He designed a steel gun of a hoop form of construction which was principally remarkable for the accuracy of its manufacture. Reliance was not

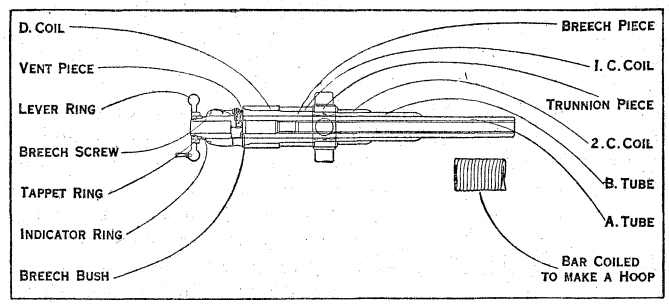



FIG. 6.—ORDNANCE WROUGHT FROM IRON H.B.L., 40 PR. 35 CWT. MARK I

placed on heat shrinkage, but the tension and compression effect was produced by building the members under hydraulic pressure, forcing a slightly larger tube into a cylinder. The improvement in technique of construction owes much to the methods adopted and great accuracy of workmanship insisted on by this scientific engineer, who was also a pioneer in the heat treatment of steel forgings which was later to play such an important part in the strength of guns. Oil-hardening of steel tubes and subsequent tempering came into practice about 1863.

Another gun of this period (1855–63) which calls for mention is the Krupp steel breech-loading monobloc gun which owed its strength to the good quality crucible steel used. A feature of this gun was the breech mechanism which proved more efficient and safer than that introduced by Armstrong. Its general principles have survived in the modern quick-firing Krupp guns of built-up

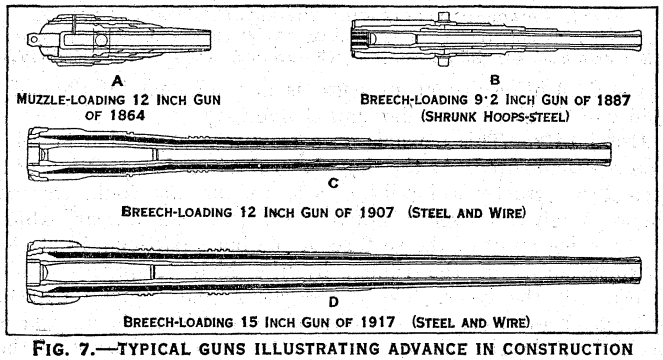



FIG. 7.—TYPICAL GUNS ILLUSTRATING ADVANCE IN CONSTRUCTION

hoop construction. The British guns of the period 1855–63 were mainly rifled breech-loading guns, designated R.B.L., but in 1864 after repeated experiments and in view of failures and accidents due to defects in breech mechanism, Great Britain reverted to muzzle-loading guns. These were rifled and designated R.M.L. (*See* fig. 7, A.) Many smooth-bore guns were converted on Sir William Palliser's system by enlarging the bore of the cast iron gun and inserting a rifled barrel of coiled wrought iron. Having reverted to a muzzle-loading policy, Great Britain adhered to it for several years longer than the other great powers, thus falling behind them in efficiency of armament. But in 1880, after a serious accident caused by the inadvertent double-loading of one of H.M.S. "Thunderer's" guns in the previous year, the adoption of an improved system of breech-loading was decided on. Towards the end of the epoch, the advantage of steel as a material for guns was more clearly appreciated as the former difficulties in forging large masses were overcome. Steel hoops were preferred to either steel or wrought iron coils and by 1885 steel tubes were replacing hoops in British construction.

**Recoil Appliances.**—During this epoch the progress in recoil appliances was remarkable. With the increased power of guns and the greater recoil energy involved by the use of rifling and low windage projectiles it became essential to devise means of limiting the recoil, especially in ships' guns. This had to be done by more effective methods than those hitherto used of surface friction, skids, inclined planes or rope breechings. The "compressor," which now replaced these, consisted of friction plates capable of being set up or released as necessary for firing or subsequent running out. Before the end of the epoch recoil cylinders were introduced in the mounting. In these the recoil is overcome through the resistance offered by a liquid contained in the cylinder to the passage of a piston attached to the gun. The liquid passes through a hole or port in the piston head, the size of the port being controlled by a valve key fitted to the cylinder. The recoil pressure can thus be suitably regulated.

**Machine Guns.**—Before the end of the epoch the energy of recoil had been applied, in particular by the inventive genius of Hiram Maxim, to automatic guns, *i.e.*, guns in which some of the recoil energy was employed in the work of reloading the gun. After the introduction of the French *mitrailleuse* in 1870, other inventors of the time, notably Gatling, Gardner and Nordenfeldt, had produced machine-guns of increasing effectiveness.

### THE THIRD EPOCH (1885 TO THE PRESENT DAY)

This period may be distinguished as the steel era of high velocity guns. The epoch begins with the advent of smokeless propellents (cordite, *q.v.*). The much greater gas yield efficiency of these permitted of lighter charges or higher velocities and required longer and stronger guns for the suitable combustion of the slower burning high pressure powders. (The 68-pounder

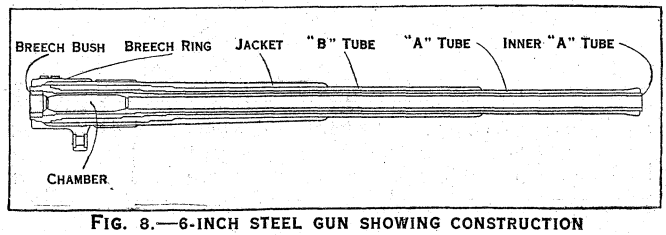



FIG. 8.—6-INCH STEEL GUN SHOWING CONSTRUCTION

was fired with 18 lb. of gun powder and gave a muzzle velocity of 1,100 f.s., whereas the 100 lb. projectile fired with 14½ lb. of cordite had a muzzle velocity of 2,630 f.s.) By 1890 nitro cellulose and nitro-glycerine powders (so-called, but in the usual form cords or small cylinders) had generally replaced gunpowder in the ordnance of all first class powers. The ordnance developments of this epoch are as remarkable as those of the preceding one, but the advances have been due to the great progress in metallurgical knowledge and practice, in engineering science, and in the technique of construction, rather than to radical innovations such as those for which the previous epoch was conspicuous. This era is notable for the steady advance in the power of guns through the increase in calibre and hence in the weight of the projectile, and increase in muzzle velocity; also for the development in automatic machine guns and semi-automatic quick-firing guns.

**Q.F. and B.L. Guns.**—The quick-firing (Q.F.) gun is distinguished from the breech-loading (B.L.) gun by the method adopted for obturation or sealing the gases at the breech end. In a B.L. gun this is effected by some feature of the breech mechanism, such as a pad or ring which expands against a seating in the bore of the gun under the pressure of firing. The charge being in a bag such guns are called "bag guns" in U.S.A. In the Q.F. gun obturation is effected, as in a rifle and shot gun, by the expansion of the metal cartridge case which contains the propellent. Such guns are called "case guns" in the U.S.A. If the projectile is attached to the cartridge case, forming one loading unit, the ammunition is called "fixed" to distinguish it from the "separate" type.

**All Steel or Wire Construction.**—Between 1885 and 1890 "all steel" rifled B.L. and Q.F. guns of considerable length came into general use. They were of built-up construction, steel tubes and hoops being shrunk on at suitably calculated shrinkages. (*See* fig. 8.) Since 1890, wire wound guns (*see* fig. 9) have come into use in many countries, particularly Great Britain, Italy and Japan.

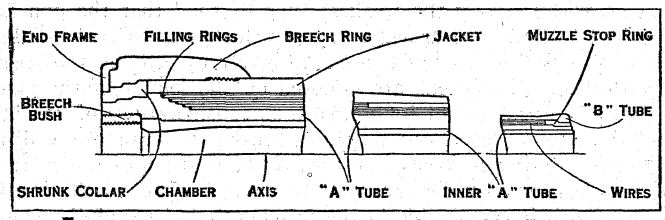
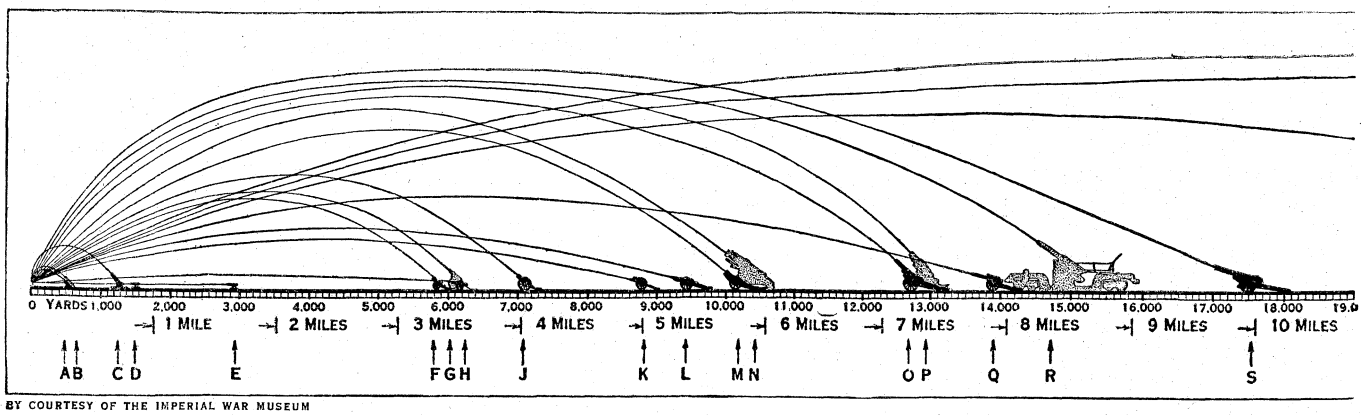



FIG. 9.—15-INCH WIRE WOUND GUN SHOWING CONSTRUCTION

Various systems of wire construction had already been put forward during the preceding epoch.

It is noteworthy that Germany adhered throughout to an "all steel" construction and preferred a Q.F. mechanism for all natures of guns. In the Krupp gun of medium and heavy calibre a hoop form of construction is used in preference to tubes. Since the war of 1914–18 an "all steel" construction for medium calibre guns is more general in view of the greatly improved properties of high grade alloy steels. For smaller guns a monobloc form of construction is sometimes preferred, owing to the success of a




BY COURTESY OF THE IMPERIAL WAR MUSEUM

FIG. 11.—DIAGRAM ILLUSTRATING THE RELATIVE EXTREME RANGES OF (A) 3-in. Stokes Mortar, (B) 2-in Trench Mortar, (C) 9.45-in. Trench Mortar, (D) Machine Gun (effective range), (E) Machine Gun (distant range), (F) 3.7-in. Mountain Howitzer, (G) 6-in. 30 cwt. Howitzer, (H) 2.75-in. Mountain Gun, (J) 4.5-in. Howitzer, (K) 13-Pndr, (L) 18-Pndr (Mark IV.),

cold working (auto-frettage) process which results in an economical and rapid production of light guns capable of sustaining high pressures. The post-war progress in ordnance has been marked by greater efficiency and simplicity in both the design of the gun and in the mechanism.

## GUN CONSTRUCTION

In the early days of ordnance, gunnery was in the realm of the magic arts. It was not until the sixteenth century that it was treated in a scientific spirit by Niccolo Tartaglia. Later Benjamin Robins advanced the study, but results of his research and experiment were not fully applied until the evolutionary epoch, when gunnery passed into the realm of science.

### DESIGN CONSIDERATIONS

During the twentieth century much attention has been devoted not only to the structure of the gun, but to its interior design to obtain improved ballistics, so that higher efficiency and greater accuracy might be achieved. The nature and form of rifling, the size and form of chamber, the character (particularly in regard to regularity in combustion and freedom from age deterioration), weight and form (size) of the propellent are matters for research and experiment in which progress still continues to be made. Four important general requirements of a gun are (1) high muzzle velocity; (2) accuracy; (3) good life; (4) rapidity of fire. The relative importance of these depends on the special conditions for which the gun is required. All affect the prospects of hard and frequent hitting which are the main desiderata.

**High Muzzle Velocity.**—This depends on the pressure developed during the projectile's passage down the bore and the distance through which this pressure acts, and the frictional resistance encountered by the projectile. Limitations in maximum pressure are decided by the strength of the steel of which the gun is constructed, and to some extent by the pressure that can be withstood by the weakest type of shell that the gun is required to fire, such as large capacity high explosive shell. In modern guns this maximum pressure rarely exceeds 22 tons per square inch. Limitations are imposed on the length of the gun by the circumstances of its use, such as considerations of weight and the stresses produced on the mounting or structure which carries it; by requirements in regard to the position of the centre of gravity; and by the amount of deflection or gravitational droop which is permissible in the unsupported chase of the gun. Modern guns are generally between 45 and 60 calibres in length, that is, the length of the bore and chamber of a 50 calibre 6-inch gun is 25 feet. (In some countries the overall length of the gun is referred to.)

**Accuracy.**—This depends upon the uniformity of pressure and of friction for successive rounds and on the stiffness of the gun structure. Both pressure and friction are affected by the wear which they occasion in the bore and chamber. The wear increases the size of the chamber by allowing the projectile to seat further forward and affects the frictional resistance to the driving band of the projectile and possibly the efficiency of the gas seal. Uniformity of pressure is also affected by the suitability of the size of chamber and charge used.

**Good Life.**—This depends on a slow rate of erosion in relation to rounds fired. As the time down the bore is a fraction of a second the actual working life of a heavy gun that could fire 300 rounds is only a few seconds. Erosion is principally "wear" which is a washing away of the surface of the bore, particularly at the commencement of the rifling, by the high temperature and velocity of the gases. This temperature and velocity depend for a given propellent on the rate of combustion, which again is decided by the size of chamber and the weight and form of the charge. The rate of erosion is also affected by the friction of the projectile, which depends on the nature of rifling, type of driving band, and efficiency of centring and seating the projectile and of sealing the gases. Bad sealing results in "scoring."

**Rapidity of Fire.**—This depends on the efficiency of the mechanism for operating the breech and for absorbing the recoil and replacing the gun in the firing position, and on the loading arrangements. It is of importance that the gun should be kept as cool as possible under rapid fire conditions, particularly in view of the exposure of the charge in the chamber during loading, which also necessitates provision for extinguishing all smouldering residue.

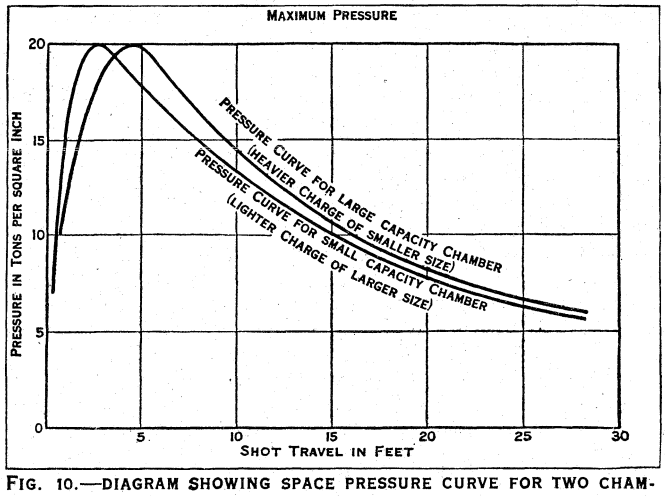
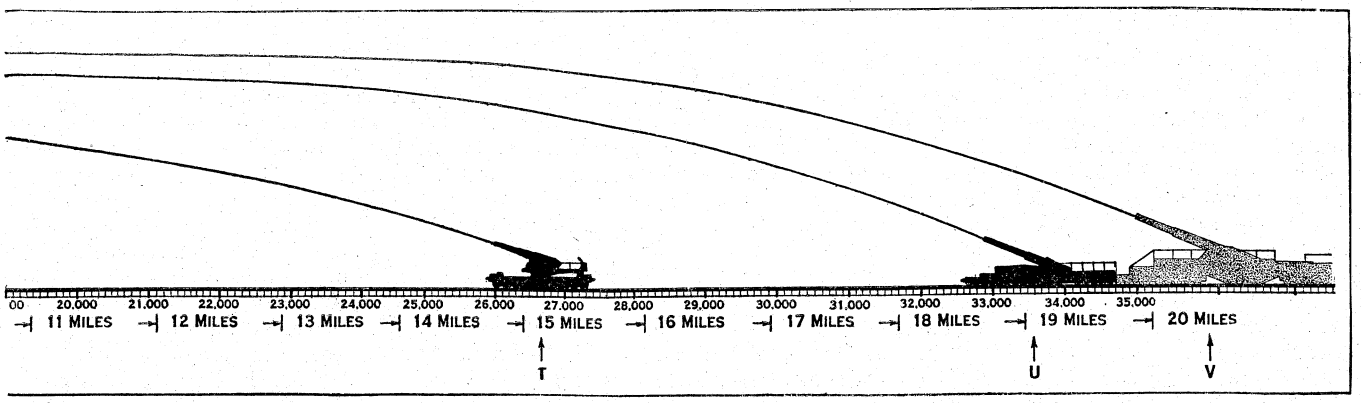



FIG. 10.—DIAGRAM SHOWING SPACE PRESSURE CURVE FOR TWO CHAMBERS OF DIFFERENT SIZE, GIVING SAME MUZZLE VELOCITY

**Size of Chamber.**—The designer being given a required muzzle velocity and length of gun and a limiting maximum pressure, is confronted with the problem of deciding the most suitable size of chamber. A gun may be viewed as a single stroke internal combustion engine, the piston of which, represented by the projectile, is blown through the open end of the cylinder at each stroke, after being rotated by the rifled walls of the cylinder. The latter engage in the copper driving band, which also serves as a piston packing ring and seals the gases. The same muzzle velocity and maximum pressure can be obtained in the same length of




THE BRITISH PIECES OF ORDNANCE USED IN THE WORLD WAR OF 1914–18

(M) 6-in. 26 cwt. Howitzer, (N) 15-in. Howitzer, (O) 8-in. (Mark VII.) Howitzer, (P) 9.2-in. (Mark II.) Howitzer, (Q) 60-Pndr (Mark I.), (R) 12-in. (Mark V.) Howitzer, (S) 6-in. (Mark XIX.) Gun, (T) 9.2-in. (Mark X.) Gun, (U) 12-in. Gun (Mark IX.), (V) 14-in. Gun (Mark III.)

gun by chambers of different capacity, provided suitable variations are made in the weight and form of the charge. Different sizes of chambers are favoured by different nations; the point is important as it has a direct bearing on the accuracy or regularity of the gun. By means of internal ballistic calculations based on theory and supported by data obtained from experiments with gases in closed vessels, pressure curves can be produced for different sizes of chamber and weight and form of charge. The form of charge or size of the elements of which it is composed, affects through the surface exposed, the rate of burning.

In the diagram (fig. 10) the pressure developed along the bore is given for two different chambers with charges adjusted to give the same maximum pressure and muzzle velocity. In the case of the smaller chamber, the weight of charge is less, but it occupies a relatively larger volume of its chamber and this increase in the "density of loading" results in a more rapid rate of combustion through the greater confinement of the gases. This is modified to some extent by the lighter charge being composed of individual cords or elements of larger size, thereby exposing less surface to the igniting gases and tending to reduce the rate of burning. Features of importance in these pressure curves are the position of maximum pressure in the bore and the extent of the muzzle pressure. Both these features affect the position of the gun's centre of gravity as the pressure curve is reflected in the thickness of the gun walls. At first sight it would appear that all the advantages are with the lighter charge giving the lower forward pressure, which reduces the muzzle vibration and, in combination with the earlier maximum pressure, brings the centre of gravity towards the breech end, but consideration must be given to the effects on the muzzle velocity of usage and of small variations incidental to the gun, the charge and the projectile. The smaller chambered gun is naturally more sensitive to such changes and its regularity in muzzle velocity may be inferior. The life of such a gun may be shorter through loss in accuracy, though the measured wear or enlargement of bore be less than with the larger chambered gun.

The regularity in the muzzle velocity from round to round is an important characteristic of a gun and generally defines the minimum size of chamber and weight of charge. The "form" of the chamber as opposed to its capacity is to some extent influenced (particularly at the forward end) by the type of driving band fitted to the projectiles, and this also affects the character of the rifling. The form of chamber and shot seating is responsible for the centring of the projectile and its initial steadiness which are of importance as affecting both accuracy and wear. Generally modern gun chambers are of medium capacity obtained by length rather than width and with small changes in section.

## FUNDAMENTAL PRINCIPLES

During the evolutionary epoch the value of shrinking tubes or hoops over each other to obtain increased circumferential strength in a gun had gradually emerged and been confirmed by experience. It was appreciated that in a monobloc gun such as the cast-iron gun of the early 19th century there was a limit to the increase of circumferential strength obtained by increasing the thickness of the material (this limit is practically reached when the thickness of the gun walls equals the radius of the bore). Towards the end of the first epoch, Thomas Barlow had shown that the stresses produced by pressure in a cylinder are greatest on the interior surface and diminish in a ratio affected by the square of the distance from the centre to the exterior. Thus, as the thickness of a cylinder increases, the value of the material towards the exterior rapidly diminishes.

**Basic Law.**—It was further realised that the bore of the gun must not be permanently expanded on firing, in other words, that *the gun must work elastically* and in no circumstances must any of the material be permanently strained (stressed beyond its elastic limit). This is the basic law of gun construction. Steel has a certain elastic range, depending on its quality, both under tension and under compression stress. Thus if it is put in a state of compression it will have an increased elastic range for subsequent tension stresses. The principle of initial tension or compression is the principle of making use of the compressive as well as the extensive elasticity of material such as steel. Initial compression is generally obtained by shrinking one tube on another. This produces compressive stresses in the inner tube at the expense of tension stresses in the outer. The theoretically ideal gun would be one in which the circumferential stresses produced on firing were uniform throughout the thickness of the walls. Such a gun would be in initial tension on the exterior gradually passing to compression in the interior, and on firing, all parts of the gun would be equally stressed circumferentially. This ideal effect can be partially achieved by shrinking a series of thin tubes or hoops over each other.

**Wire Winding.**—The effect can be more nearly reached through a definite section of the gun by winding wire at varying tensions for successive layers. It can be still more completely achieved in a monobloc steel gun by the cold forging process, sometimes known as "auto-frettage."

**Cold Working.**—This process takes advantage of Barlow's law and by the application of fluid pressure to the bore of the gun or tube permanent expansion is produced through overstraining the inner layers of the material. The pressure is so controlled, however, as not to overstrain the outer layers which remain stressed within the elastic limit. After removal of the pressure the inner layers do not return to their original form, and the outer layers therefore remain in a state of tension and act compressively on the inner. This condition is stabilised by "ageing" the metal by suitable mild heat treatment.

## THEORY OF GUN CONSTRUCTION

The important effect already noted is that the shrinkage pressure produces circumferential compression on the inside tube at the expense of circumferential tension in the outside tube. This opposes the radial pressure and circumferential tension which result from radial powder pressure in the bore of the gun.

**Circumferential Strength.**—A theory of gun construction, which is based on Barlow's law and has stood the test of

experience, is known as Lamé's theory. It relates the radial powder and shrinkage pressures to the induced tensions and compressions with respect to the internal and external radii of the tubes concerned. This relation is known as the gunmaker's formula, and it enables the designer to calculate pressures, tensions or compressions in any position in the walls of the gun both when the gun is in repose, and only affected by shrinkages, and also when it is firing and affected by both shrinkages and powder bore pressures. A design can thus be produced giving the necessary thickness of tubes and degree of shrinkage estimated as of suitable circumferential strength not only to resist fracture longitudinally, but to avoid straining any of the material beyond the elastic limit. Several theories of construction are followed, but in all certain assumptions are made, particularly in regard to the mutual effects of stresses in different directions. To cover any inaccuracies in calculation due to these and to ensure a margin of security in the use of the gun, a suitable safety factor is allowed. The gun is generally designed to stand pressures ranging from twice the normal pressure experienced at the muzzle end to one and a half times at the breech end.

**Longitudinal Strength.**—Provision must also be made for suitable longitudinal strength in the gun to meet the stresses produced by the pressure of gases on the face of the breech block and on the base of the projectile, forces which stress the material in a direction tending to produce circumferential rupture. Minor longitudinal stresses are also brought into play by the resisting action of the recoil brake. The maximum bore pressure is considered fully effective on the breech surface exposed and it is necessary to distribute the stresses as far as possible to the other members of the gun. This is done in an all-steel gun with a screw breech mechanism through the medium of a screwed breech bush in which the threads of the breech screw engage, while in a gun with a sliding breech mechanism the direct thrust brought on the surface of the sliding block is transmitted to the breech ring and so to the other hoops or tubes which are connected longitudinally by means of shoulders. In a wired gun, the arrangement at the breech end must be such as to connect the tubes inside the wire with those outside, since the wire itself is incapable of contributing in any way to the longitudinal strength of the gun.

**Girder Strength.**—In addition to the longitudinal and circumferential strength, the gun is required to have a certain degree of girder strength so that the gravitational deflection is kept as small as possible. The gun resting in its mounting may be regarded as a beam supported at a certain distance from one end and its girder strength depends on the rigidity with which the various parts are connected. In a wired gun the wire makes no contribution to this strength, which is therefore dependent upon the tubes and the means taken to connect them rigidly in place.

## MANUFACTURE

The design of a post-war (1914–18), all-steel British gun is shown in fig. 9. This gun is fitted with an inner "A" tube or liner so that when the rifling is considerably worn the gun may be economically repaired by introducing a new liner in place of the old one. (This arrangement is very general but not universal as some guns, usually those of small calibre, have no liners and are repaired by replacing the entire "A" tube.) The liners are usually tapered on the exterior and are driven in to the tapered bore of the outer "A" tube by hydraulic pressure or other suitable means so that when in place there is a certain shrinkage pressure operating. In medium calibre guns, since the war of 1914–18, "loose" liners have also been tried, *i.e.*, liners with a small clearance or air space. Such liners are necessarily of high quality steel with a large elastic range so that when they temporarily expand on firing they receive support from the walls of the gun before they have been strained beyond their elastic limit. The material of the liner contracts to its original dimensions after firing and is easily removable. The liner is keyed at the ends to prevent rotation under the action of the projectile and is shouldered at the rear end to prevent forward movement. Such a system of ready repair has obvious advantages in connection with guns which wear out rapidly or which, like anti-aircraft guns, are subject to very considerable use in a short space of time. The repair is of such a simple nature that it can be effected without dismounting the gun. The "B" tube, the jacket and the breech ring are built by shrinkage, which is effected by machining the internal diameter of the tube to be built to a smaller diameter than the surface on which it is built. The difference in diameters must be such as will give the required compression and must permit of sufficient expansion for building at a temperature below that which could affect the temper of the material. Sudden changes in the section of tubes are avoided to obviate longitudinal weakness and to prevent difficulties in building through the thinner section of the tube cooling more rapidly than the thicker and possibly seizing before properly in place. In all guns the aim is to relieve from all longitudinal stress the metal which bears the brunt of the circumferential stress. Consequently, the breech bush is free from the liner and attached to the "A" tube.

**Material.**—All gun body members are made of steel (*q.v.*) of a specified chemical composition and physical properties. The more important tubes are usually of a high grade alloy steel, the essential physical property being a high yield point to give a good elastic range. American specifications permit the use of steel made by the acid open-hearth, the basic open-hearth or the electric process. The steel is cast as an ingot which in the case of large forgings may weigh 100 tons or more. There is a large discard from the top and a small discard from the bottom of the ingot and the core may be removed by trepanning before or after shaping up the ingot into a billet.

**Forging.**—The material is then forged under a hydraulic press and in certain cases on a water-cooled mandrel in a series of heats to draw it into a tube of the required dimensions. In this forging operation the length may be increased five times and the diameter halved. The forging, after straightening and rough machining, is normalized or annealed in a furnace to remove the forging stresses. Oil hardening is then carried out by heating the forging to a suitable degree and immersing it in oil, after which it is tempered as necessary and the required properties are tested mechanically by breaking and bending test pieces taken from the two ends of the tube.

There has been developed in the United States a method of gun construction known as the "centrifugal casting" process. In this process molten steel is poured into a rapidly revolving chill (cast-iron) mould pre-fabricated to give a casting of the approximate size and contour of the finished gun. By reason of the action of centrifugal force and controlled cooling, the physical properties of the gun casting are equal, or superior, to those obtained from a forged steel gun.

**Building and Wiring.**—In the case of "built up" guns, the tubes are machined to the finished dimensions for assembling, the exterior of an inner tube being turned to conform to the measurements given by the bored interior of the corresponding outer tube, allowing for the design shrinkages. The outer tube is heated sufficiently to obtain the necessary clearance by expansion and is then lowered over the inner tube or gun which is placed vertically in a pit for this purpose and kept cool by water running through the bore. As soon as the outer tube is properly in place, that is, the rear or building shoulder is in contact, it is rapidly cooled from this shoulder, which is near the breech end, by the application of water. This cooling requires careful control to prevent the tube seizing at any forward position. The forward portion is kept heated by gas rings, which are gradually withdrawn as the cooling proceeds, and the water moves up the exterior of the tube, thus ensuring that the tube is held or drawn towards the breech end throughout the shrinking operation. In the case of a wire-wound gun, after insertion of the liner or inner "A" tube, which is slightly conical and a driven fit, the rear end of the "A" tube is threaded inside to take the breech bush (*see* fig. 9). A stepped collar is shrunk over the rear end of the "A" tube. This reinforces the breech bush and forms the connecting link between the "A" tube and jacket through the medium of the breech ring so that the longitudinal stresses can be suitably distributed. The muzzle stop ring is shrunk over the muzzle of the "A" tube. This ring forms the front support for the wire which is wound over the "A" tube. The wire consists of a steel ribbon ¼ in. wide and .06 in. thick. The breaking strength of this material is over 100 tons per square inch and all the wire used is, previous to winding, subjected to a very severe load to ensure that it is

BY COURTESY OF (1, 4, 5) THE U.S. WAR DEPARTMENT, (2, 3, 6) THE U.S. ARMY SIGNAL CORPS

## MODERN ARTILLERY

1. A 75-mm. field artillery gun and crew in action
2. American 37-mm. anti-tank gun
3. Standard U.S. 75-mm. gun on split-trail carriage
4. 37-mm. infantry gun and crew in action
5. 4-in. mortar for chemical shells used in trench firing
6. Mortar scout car with 4.2-in. chemical mortar

# ORDNANCE

BY COURTESY OF THE U.S. ARMY SIGNAL CORPS

## AMERICAN ANTI-AIRCRAFT GUNS AND EQUIPMENT

1. 37-mm. mobile anti-aircraft gun in action at Aberdeen proving grounds, Maryland
2. Battery of 3″ anti-aircraft guns
3. .50 calibre anti-aircraft gun
4. 90-mm. anti-aircraft gun on platform mount
5. Anti-aircraft director being demonstrated at Aberdeen proving grounds
6. Aircraft height finder

perfectly sound. The fact that wire can be so tested throughout is a great merit of this form of construction. It is wound on the gun in a continuous length, the number of turns varying in the case of a 15 in. gun from 20 at the muzzle end to 79 at the breech. Approximately 22 tons of wire, about 186 mi. in length, are required for such a gun. The winding tension is such as to produce the required design tension after completing the winding operation, allowance being made for the effects of subsequent layers of wire on those already wound. This tension is controlled during winding by a readily adjustable friction brake. On completion of the wiring, the external layer of wire is turned with a fine cut to obtain a good building surface for the "B" tube and jacket which are shrunk on. The breech ring is finally screwed and shrunk on. The exterior of the gun is finish machined and the bore and chamber are bored and lapped to size.

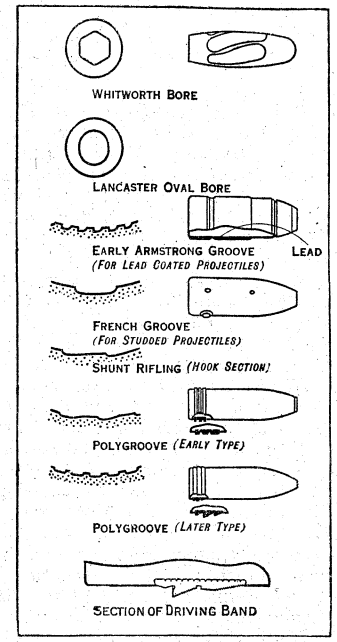



FIG. 12.—FORMS OF RIFLING

**Rifling.**—The gun is then rifled: the spiral grooves are cut by a special machine, several grooves being cut at the same time, to the required depth and form. The number of grooves, their depth and general form and the relative width of the groove and land (intervening bore surface) vary considerably in different guns. The general form of groove is one of plain section in which the width of "land" is approximately half the width of the groove (*see* fig. 12 which contrasts different and earlier types of rifling). The twist of rifling is generally uniform, one turn occurring in a length of 30 calibres, but increasing twist is also used and a combination of increasing and uniform twist. A typical modern form of driving band is also illustrated. It has three functions to perform:—(1) To rotate the projectile. (2) To act as a gas seal and so prevent the bore of the gun being scored or guttered by gas escaping over the projectile, which would result in irregularity in the muzzle velocity. (3) To hold the projectile at any elevation after loading so that it does not slip back into the chamber, and to ensure that a certain pressure is generated before the projectile starts to travel.

The copper of the driving band is engraved and pressed by the lands into the grooves as the projectile proceeds. To avoid copper deposition in the bore, which would reduce its diameter and affect the form of grooves, tinfoil is combined with the propellent.

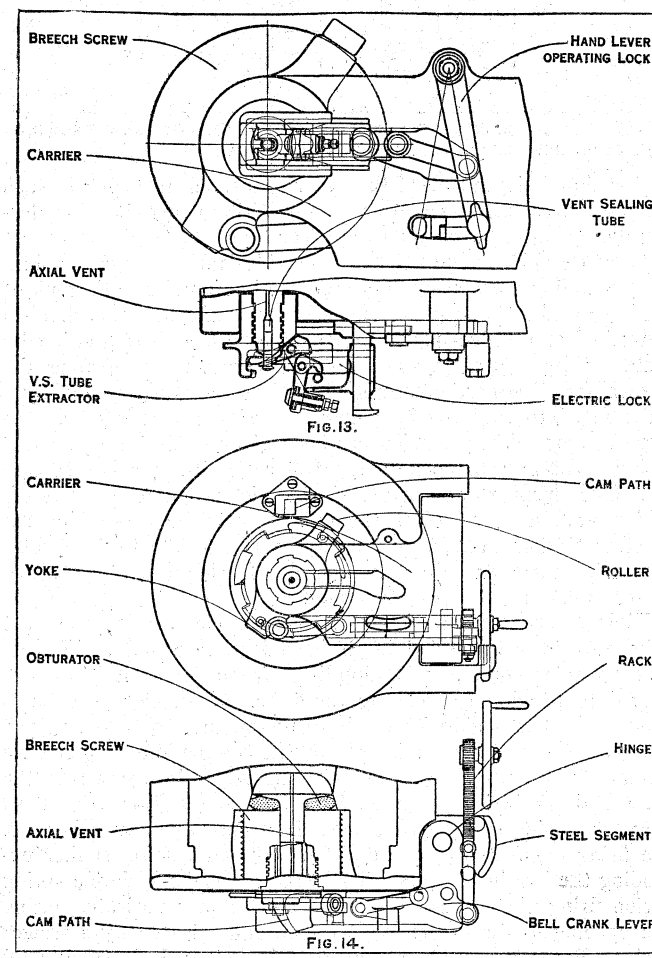
## BREECH MECHANISM

A breech mechanism is a mechanical device for closing the rear end of the chamber of a gun. It includes the mechanism for firing the gun, and safety arrangements for preventing the gun from being fired before the breech is fully locked. It also embraces the necessary operating gear which may be "hand" or "power." If the latter, "hand" alternative is generally provided which can be readily connected or clutched in. The chief requirement is safety, with ease and rapidity of operation. Two main types of mechanism prevail:—(1) The "screw plug" with interrupted threads, held in a carrier hinged to the gun, so that the action is a swinging and rotating one. This "swinging" type may be used for both B.L. and Q.F. guns. (2) The vertical or horizontal sliding wedge shaped block, travelling in a mortice across the rear face of the gun. This "sliding" type is only suitable for a Q.F. gun. Other types are:—The sliding and rotary combination, the rotating eccentric block and the sliding bolt. Certain automatic and machine guns employ a "breech action" in which the operations of opening, extracting, reloading and closing are effected by the recoil and counter-recoil motion augmented by springs.

**B.L. Mechanism.**—For B.L. guns (in which the charge is bagged) the breech screw is fitted with an obturator for sealing the escape of gas to the rear. It requires a channel or vent to convey the flash from the tube to the charge to fire the gun.

The illustrations (figs. 13 and 14) of an Asbury "hand" and "power" mechanism show an example of a modern screw plug type. The screw is of the Welin form, an arrangement in which the surface is divided circumferentially into a number of segments of different radii. The number of plain segments is less than half the total number, thus giving an increased bearing surface compared with a plain cylindrical screw with interrupted threads. The Welin compared with the cylindrical screw allows of equal strength with a reduced length and weight of screw. The reduced length enables the screw to be swung into the breech opening instead of having to be first swung and then entered in a separate movement. Direct swing entry can also be obtained by a breech screw in which the rear portion is cylindrical and the front conical.

**Obturation.**—The obturator, fitted at the front end of the block and carried on the vent axial bolt, known as the De Bange system, comprises a plastic gas check pad between two steel discs. The pad is statically compressed in manufacture, which gives it semi-elastic properties. It readily conforms to any irregularities in the coned annular seating at the rear end of the gun chamber. The obturator is seated on the closing of the breech with a moderate initial pressure which can be adjusted by discs




FIGS. 13 AND 14.—SECTION DETAILS OF BREECH MECHANISM FOR NAVAL ORDNANCE PIECE

behind the pad and which is obtained by the forward movement of the screw on turning. Its gas-sealing efficiency is due to the heavy firing pressure which tends to reduce the thickness of the pad and increase its diameter. The sealing action may therefore be described as due to *compression* as opposed to the sealing action of the metal case in a Q.F. gun which is due to *expansion*. Features of this mechanism are:—(a) The single motion action. The one direction movement of the rack (operated by "hand" or "power") performs both the swinging and rotation required. The system of levers for revolving the breech screw are locked

during the swinging operation and do not come into action until the mechanism has swung clear of the steel segment shown in fig. 15. (b) The momentum of swinging is converted into momentum of rotation through roller on the screw engaging with a cam path on the face of the gun, thereby preventing rebound effects.

**Q.F. Mechanism.**—In Q.F. guns (in which the charge is in a metal case) the sealing is effected by the expansion of the case

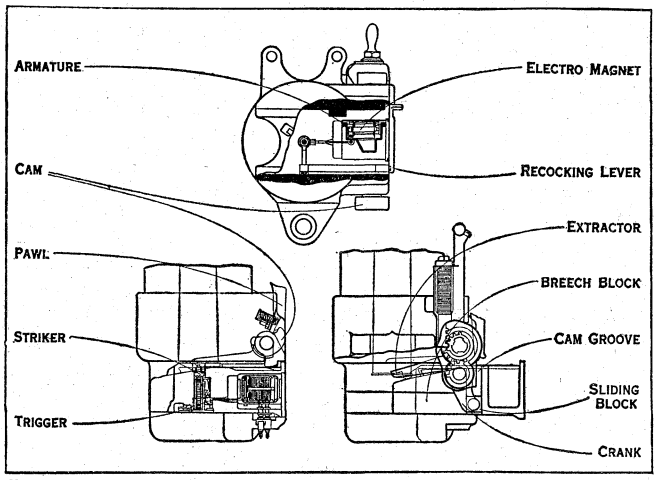



FIG. 15.—Q.F. SLIDING BLOCK FOR SEMI-AUTOMATIC GUN SHOWING ELECTRIC RELEASE OF PERCUSSION FIRING GEAR

and is thus independent of the breech mechanism, which in such circumstances includes extractors for withdrawing the case during the operation of opening the breech.

**Sliding Q.F. Mechanism.**—The illustrations give an idea of the sliding mechanism used for semi-automatic Q.F. guns of medium calibre. The block which contains the firing mechanism is worked in a wedge-shaped mortice in the breech ring either by hand or automatically. The automatic action of opening the breech and ejecting the case is effected as the gun runs out by a pawl fitted to the mounting engaging a cam connected to the breech block. When rotation has been given to the cam sufficient to open the breech block to the full extent the pawl is thrown off. The opening movement of the block operates extractors which withdraw and eject the empty cartridge case. The extractors hold the block open until the rim of the live cartridge case trips them on reloading, thereby freeing the block which closes under the action of a spring.

**Firing Mechanism.**—In Q.F. guns the electric or percussion tube or primer is carried in the cartridge case and the breech mechanism is consequently simplified in so far as it is not required to provide for loading the tube. If an electric tube is used, contact is made with the head of the tube when the breech is fully closed and the gun is fired by the completion of an electric circuit, the current heating a platinum silver bridge within the tube and so igniting the surrounding composition, the flash thereby passing to the propellent. If a percussion tube is used, the firing is effected by a blow from the percussion striker exploding the cap in the tube. The striker may be a simple spring action firing pin cocked either by hand or automatically during the opening of the breech mechanism, and released by a trigger action. Percussion strikers may also be released electrically by means of an electro-magnet or solenoid, the movement of the armature operating the trigger, as in the illustration. In the case of B.L. mechanism, arrangement must be made for loading the tube which is inserted in the rear end of the vent axial. A novel method of ignition was adopted in the case of the long range German gun used for bombarding Paris during the World War. By surrounding the rear portion of the charge with gas, more efficient initiation of combustion was obtained.

**Safety Arrangements.**—In all firing arrangements safety features are introduced designed to prevent the gun from being fired before the breech is closed, and to ensure that the first action of opening the breech prevents the gun from being fired. A very general method of effecting this is to leave a small idle movement in the breech mechanism operating gear (which also operates the firing mechanism). This movement is used to break or to make contact between the lock and the tube when firing electrically or to lock or unlock the percussion striker. The idle movement may perform another useful safety service in locking the breech mechanism gear thus making it impossible for the breech block to be forced open by the firing pressures.

(J. G. M. Mc.H.; C. M. Wn.)

BIBLIOGRAPHY.—*Historical: British,* Norton, *The Gunner* (1670); Nye, *The Art of Gunnery* (1670); Venn, *The Compleat Gunner* (1672); Sir Jonas Moore, *Treatise of Artillery* (1683); Robins, *New Principles of Gunnery* (1742); Muller, *Treatise on Artillery* (1780); Hutton, *Tracts* (1812); Sir Howard Douglas, R.A., *Naval Gunnery* (1855); Mallet, *Construction of Artillery* (1856); Boxer, *Treatise on Artillery* (1856); Owen, *Modern Artillery* (1871); James, *Naval History of Great Britain;* Lloyd and Hadcock, *Artillery: its Progress and Present Position* (Portsmouth, 1893); Garbett, *Naval Gunnery* (1897); Oman, *History of the Art of War in the Middle Ages* (1898); Robertson, *The Evolution of Naval Armaments* (1921); Hime, *Our Earliest Cannon* (1900) and *The Origin of Artillery* (1905); Laird Clowes, *The Royal Navy—A History,* 7 vols. (1897–1903).

*Historical: Foreign.* Tartaglia, *La Nuova Scienta* (Venice, 1562); E. Simpson, *Ordnance and Naval Gunnery* (New York, 1862); Holley, *Ordnance and Armour* (New York, 1865); *Catalogue of Museum of Artillery in the Rotunda* (Woolwich, 1906).

*Modern Technical: British.* Longridge, *Artillery of the Future and the New Powders* (1891); Longridge, *The Progress of Artillery* (1896); Sir Andrew Noble, *Artillery and Explosives* (1906); Greenhill, "The Dynamics of Gun Recoil," *The Engineer* (Aug. 23, 1907); *Treatise on Service Ordnance* (London 1908); Dawson, *The Engineering of Ordnance* (1909); Bethell, *Modern Guns and Gunnery* (1910); Brassey, *Naval Annual;* Jane, *Fighting Ships* (annual); *League of Nations Armaments Year Book* (Geneva 1924).

*Modern Technical: Foreign.* Lissak, *Ordnance and Gunnery* (New York, 1907); *Naval Ordnance* (U.S. Naval Inst., 1925); *Army Ordnance,* vol. viii. (New York, Nov.–Dec. 1927); "Making Big Guns at the Watertown Arsenal," *Machinery* (New York, March 1928); "Resistance of Guns to Tangential Rupture" (Annual *Report* of Chief of Ordnance, Washington, 1892). Castner, "Development of the Recoil Apparatus," *Journal U.S. Artillery* (1904); Jacob, *Resistance et construction des bouches à feu* (Paris 1909); *Manuel du cannonier* (1907); Alvin, *Leçons sur l'Artillerie* (Paris, 1908); Kaiser, *Konstruktion der gezogenen Geschutzrohre* (Vienna, 1900); Indra, *Die wahre Gestalt der Spannungskurve* (Vienna, 1901); Bianchi, *Materiala d'Artiglieria* (Turin, 1905); Reichenau, *Munitionsausrustung* (Berlin, 1905); Bahn, *Die Entwicklung der Romrrucklauf-Feldhaubitze* (Berlin, 1907); S. Brown, *The Story of Ordnance in World War* (Wash., 1920); W. Crozier, *Ordnance and the World War* (1920); H. C. Hodges, *Notes on Post-War Ordnance Development* (1923); T. J. Hayes, *Elements of Ordnance* (1938).

## MILITARY

Artillery (*q.v.*) as employed in land warfare has such a great variety of tasks to perform, that a modern army must necessarily be provided with many different types of artillery weapons. The calibre of these weapons ordinarily varies from about 3″ to 15″, although calibres outside these limits may be used for special purposes. The pieces themselves may be guns, howitzers or mortars, the name depending mainly on the length, and they are identical with naval ordnance (*see* below) as regards design, construction, and general characteristics, though mortars are generally of simplified construction.

**General Requirements of a Land Service Artillery Equipment.**—An equipment must in the first place provide a stable support for the gun for firing, and secondly, where mobility is required, it must act also as a support for travelling. In addition to these fundamental requirements means must be provided to enable the gun to move laterally, so that it can be readily aligned in any required direction ("Traverse"); to move vertically, so that the elevation required for any particular range may be obtained ("Elevation"); and to move axially when it recoils ("Recoil").

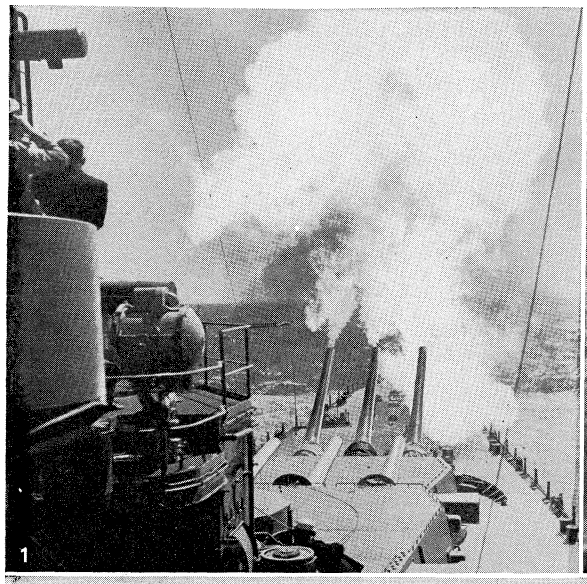
**The Structure of a Land Service Equipment.**—It is very convenient to consider an artillery equipment as consisting of a *basic structure* and a *superstructure.* The former is the support and the latter provides the necessary gears and instruments which enable the gunner to aim and fire his gun rapidly, accurately and easily. In general, the superstructure provides for traverse, elevation and recoil, and also carries the sights. It consists principally

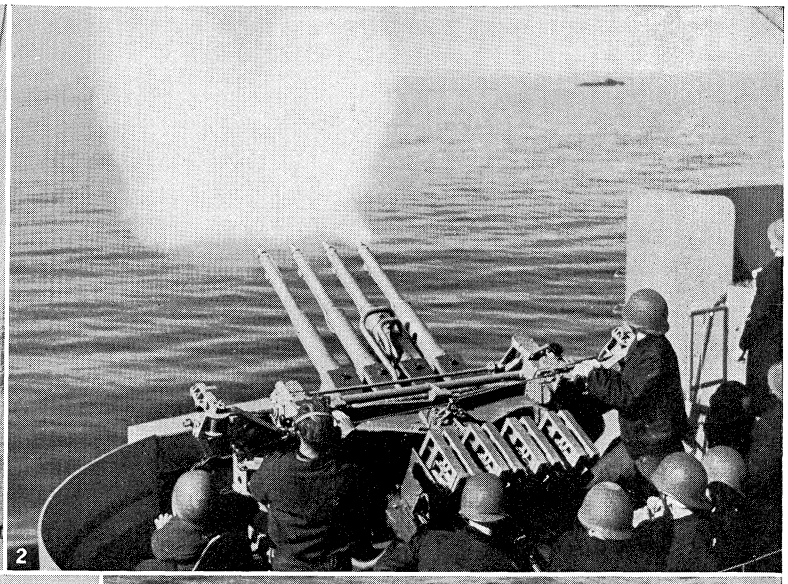
BY COURTESY OF (3, 4) THE U.S. ARMY SIGNAL CORPS; PHOTOGRAPHS, (1, 2, 6) UNDERWOOD AND UNDERWOOD, (5) EWING GALLOWAY

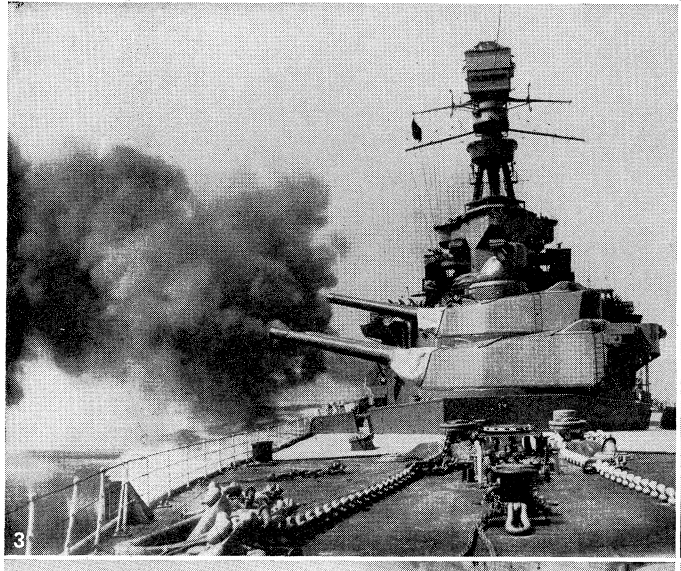
## UNITED STATES COAST DEFENCE ORDNANCE

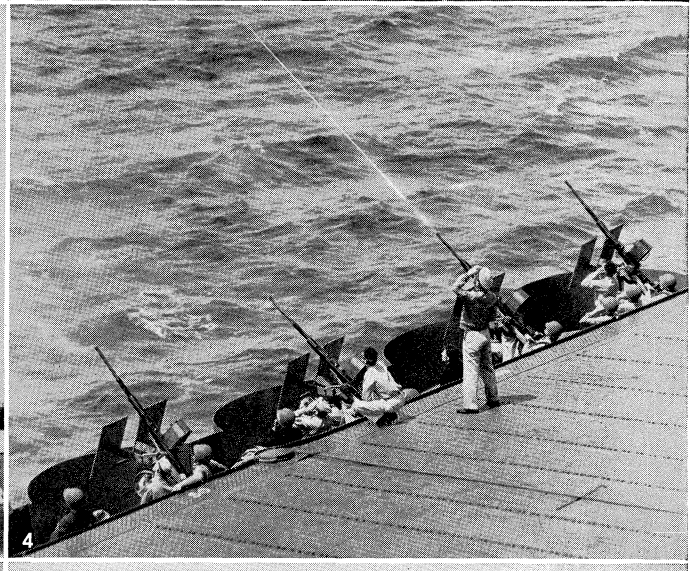
1. A 14-in. mobile coast defence rifle mounted on a railway carriage. The big gun has an effective range of 27 miles
2. A 14-in. rifle on railway mount having an effective range of more than 27 miles
3. A 12-in. railway mortar going into firing position at Fort Monroe, Virginia
4. Firing 12-in. mortars at Fort Monroe, Virginia
5. Midshipmen of the U.S.S. "Nevada" at the 5-in. guns used for torpedo boat defence
6. Coast Guardsmen operating a 3-in. gun on the U.S. Coast Guard cruising cutter "Modoc"

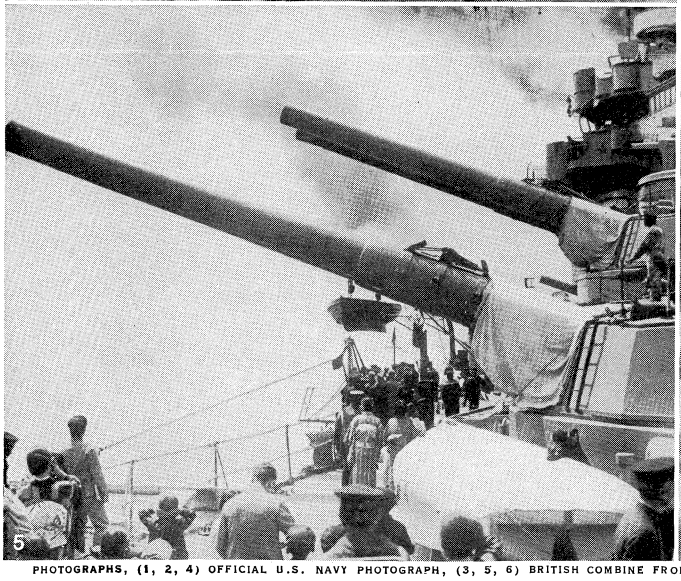
# ORDNANCE







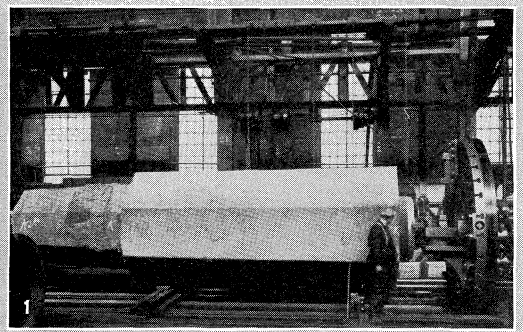


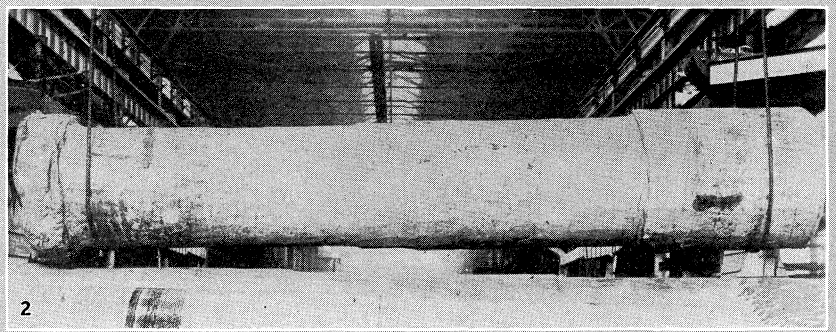


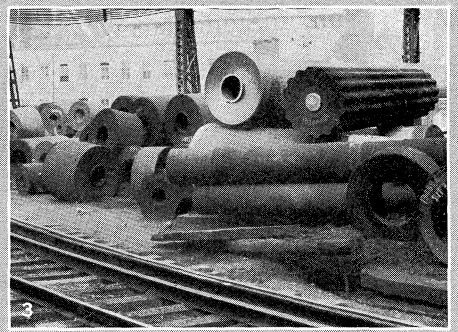
PHOTOGRAPHS, (1, 2, 4) OFFICIAL U.S. NAVY PHOTOGRAPH, (3, 5, 6) BRITISH COMBINE FROM PUBLIX

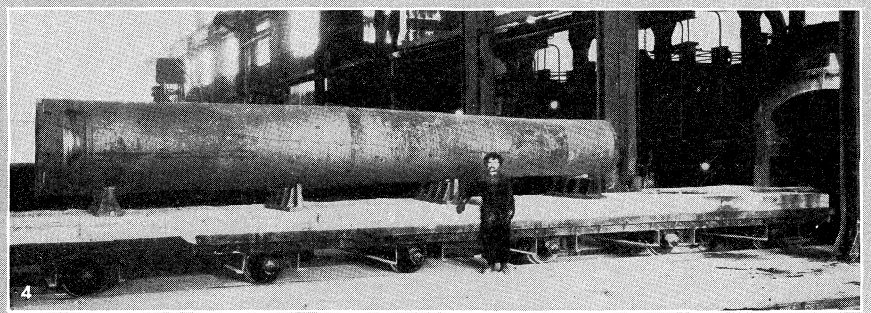
## NAVAL ORDNANCE

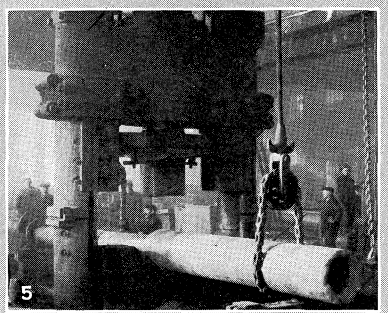
1. Sixteen-inch guns of the number one turret of the U.S.S. "North Carolina" firing over the bow
2. U.S. multiple pompom 1.1 machine gun, used against low-flying aircraft. The British call this gun the "Chicago piano"
3. A salvo from the 15-in. guns of the British battle cruiser "Repulse," sunk Dec. 10, 1941 off Malaya
4. Firing incendiary tracer shells from 20-mm. anti-aircraft guns on the flight deck of a U.S. aircraft carrier
5. Fourteen-inch, 45-cal. guns of the Japanese battleship "Ise"
6. Forward turrets of H.M.S. "Duke of York," with 14-in. guns

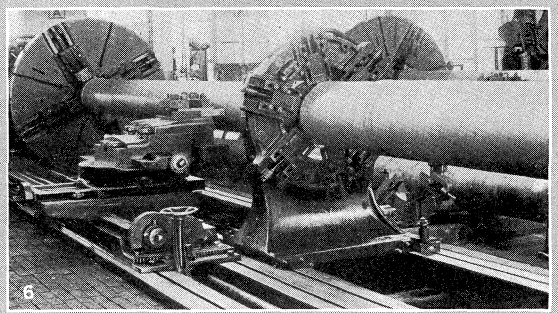


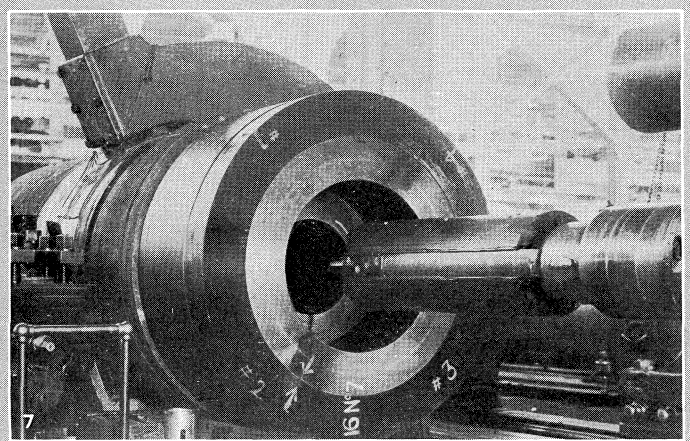



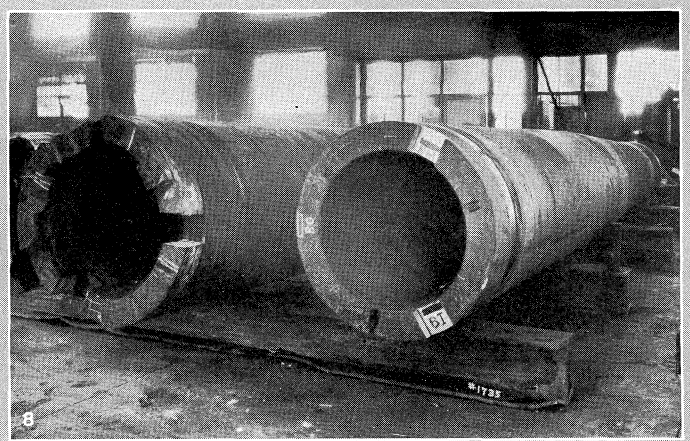



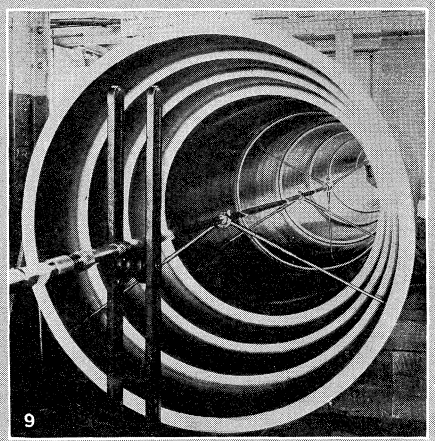



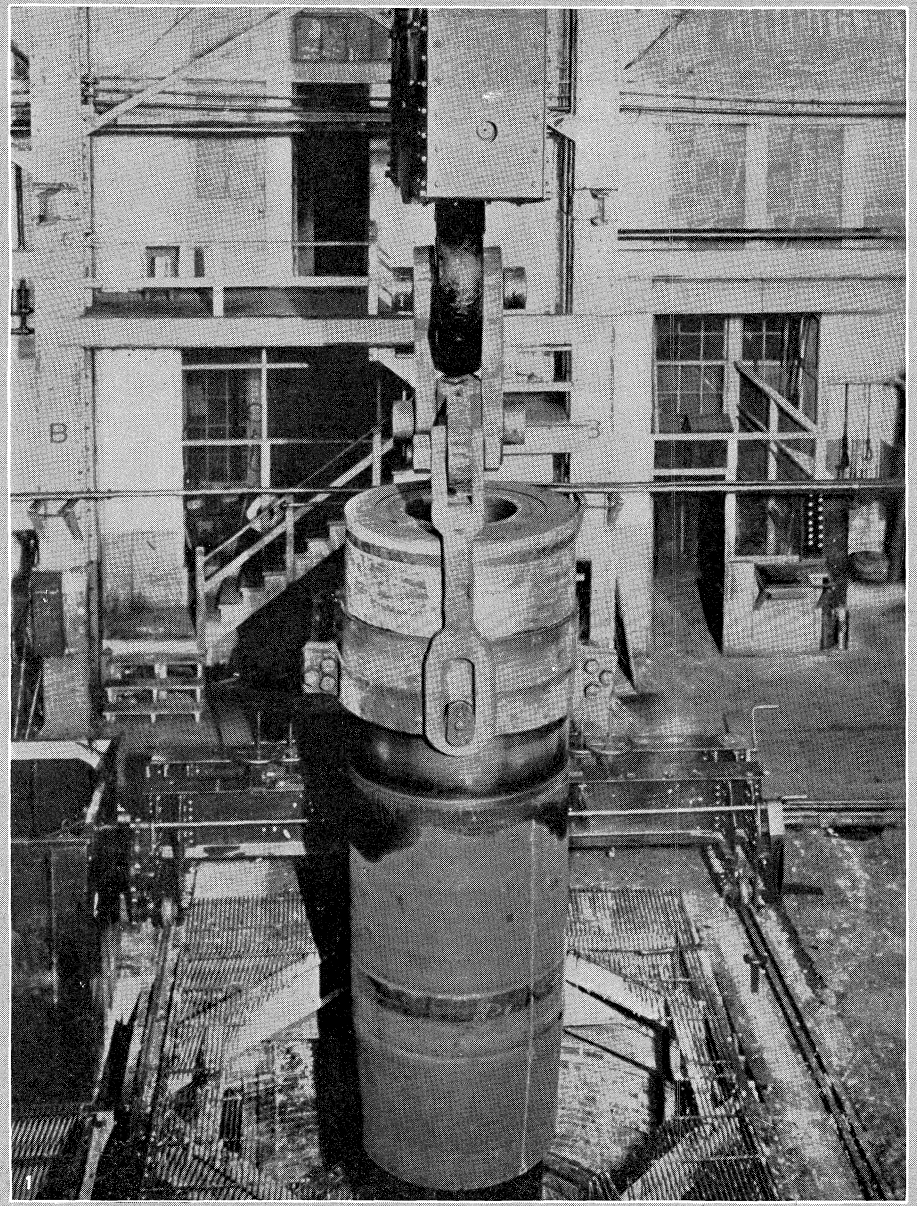



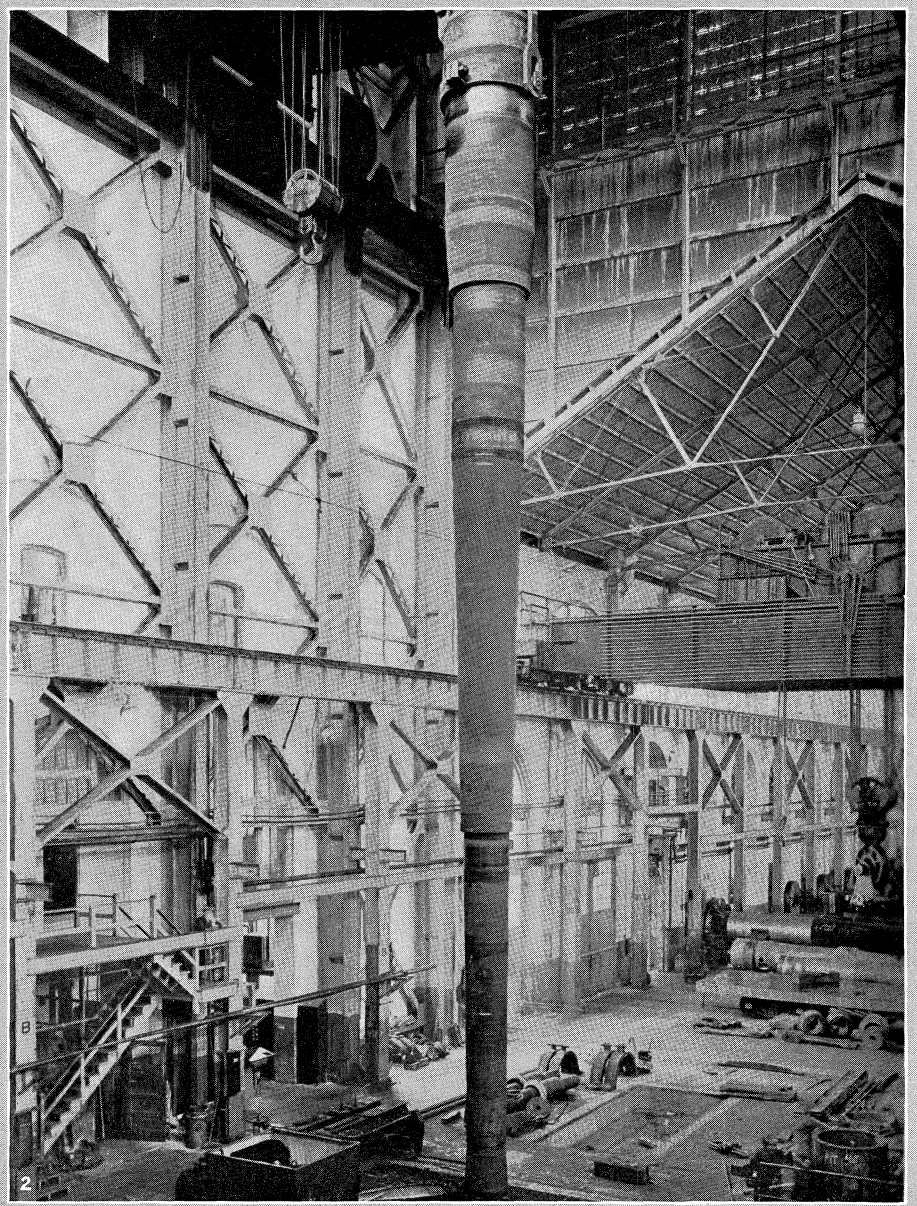




BY COURTESY OF (1, 3, 4, 5, 8) THE BETHLEHEM STEEL COMPANY, (2) THE MIDVALE STEEL COMPANY, (6, 7, 9) THE ORDNANCE DEPARTMENT, U.S. ARMY

## GUN TUBE CONSTRUCTION

1. Corrugated ingot for 16-in. tube
2. Finishing forging of jacket
3. Ingots for breech blocks, breech bushings and locking rings
4. Rough machined hoop forging on car preparatory to being placed in annealing furnace
5. Gun press; gun under press being forged on mandril
6. Battery of engine lathes cutting tube to proper diameter and putting finishing on tube
7. Boring the powder chamber with pack-bit
8. Hoop forging indicating locations for physical test specimens on breech end
9. Star gauging for accuracy of boring





BY COURTESY OF THE ORDNANCE DEPARTMENT, U.S. ARMY

## FITTING GUN JACKETS

1. 16-in. gun jacket being lowered into a pit and heated to be expanded to fit gun

2. 16-in. gun being taken out of the pit where jacket has been cooled by water and allowed to shrink, making a tight fit

of two components called the *carriage body* and the *cradle*.

The carriage body is pivoted to the basic structure so that it can turn in a plane more or less horizontal, and so enable the gun to be traversed to the right or left. It is anchored to the basic structure so that it cannot lift when the gun is fired. The cradle, which houses the recoil system, supports the gun on slides so that the latter may recoil and be returned to the firing position under the control of the recoil system. Small guns are provided with guide-ribs which engage the cradle guide-ways: in larger guns the guide-ribs are separate in the form of a slipper or sleigh to which the gun is secured, as in naval practice. The cradle is provided with trunnions which rest in bearings in the carriage body, so forming the horizontal axis about which the cradle, and so the gun, is elevated.

**Traversing and Elevating Gears.**—Except in the case of the fixed armament of a fortress, and certain other very special circumstances, power is neither available nor necessary for traversing and elevating land service equipments, and some form of hand operated gear is employed.

Where traverse is limited to a few degrees, as is usual in the case of the wheeled carriage, the traversing gear is generally of a simple nut and screw type, but where more traverse is obtainable, spur gearing in conjunction with a toothed arc is frequently used. The traversing gear is fitted between the carriage body and the basic structure, so that the necessary movement of the former is obtained. The elevating gear is placed between the cradle and carriage body and is generally of the arc and spur pinion type.

In all these gears, some form of self-locking device is necessary, so that there shall be no tendency for the gun to traverse or elevate of its own accord when fired.

**The Recoil System.**—The recoil system performs two functions: firstly it acts as a brake during recoil, bringing the recoiling gun to rest by absorbing the energy of recoil, and secondly, it returns the gun to the firing position after recoil has ceased. The braking action is supplied by an hydraulic buffer, and the gun is returned to the firing position by the "recuperator," in which either springs or air are compressed during recoil. At the end of recoil, the springs or air expand, so that the gun is forced back to the firing position. The compression of the springs or air in the recuperator assists the buffer in checking recoil.

The recuperator must initially be in a state of compression to prevent the gun slipping back in the cradle when elevated; and its action, moreover, must be controlled, otherwise the speed at which the gun is forced forwards would continually increase, and the gun would finally reach the firing position with such violence as to cause damage to the equipment. Although with pneumatic recuperators it is possible to embody a throttling device to control the action to a certain extent, the control is mainly provided by the buffer.

Many different buffer systems are in use on modern equipments: some are more suitable for short than for long recoil, and, generally speaking, these are the less complicated varieties. One designer or armament firm may favour one particular type of buffer while another will adopt some other system as standard. The chief merit of the *spring recuperator* lies in its simplicity, but the great overall length required prohibits its use on a modern long recoil carriage unless a telescopic system is employed: this, however, has inherent disadvantages and such systems do not work satisfactorily. Spring recuperators to-day are mainly confined to light short recoil equipments such as anti-aircraft guns, light coast artillery, and tank mountings. *Pneumatic recuperators* are complicated owing to the difficulty of preventing the escape of air at the high working pressures required; and for this reason a liquid system is always introduced, for liquid can be sealed satisfactorily at much higher pressures than air. The liquid may be included as an entirely separate sealing system, or it may be arranged so that the air is compressed through the medium of the liquid. In this case the recuperator is referred to as a "Hydro-pneumatic" system. This latter type is convenient for a long recoil carriage as it can more easily be arranged in a confined space than the pneumatic type. The latter type, however, does not suffer from aeration of the liquid, which always causes erratic action.

Although the buffer and recuperator are usually entirely separate systems, designs exist in which they are combined. The well known French 75 mm. field carriage uses such a system, which is said to be very satisfactory. It is generally accepted that a combined system is more complicated, more expensive and more difficult to maintain in the field than separate systems.

Buffers of modern design are generally fitted with reservoirs which may feed the system either by gravity or pressure, in order that the buffer may be kept full of liquid. A partially empty buffer will cause erratic and violent action both during recoil and recuperation. Liquids used in recoil systems vary, but that most generally adopted is a high grade mineral oil of low viscosity. Pneumatic recuperators are generally charged with air, but nitrogen has been successfully used in France. The great disadvantage of using air is that its moisture content is sufficient to cause serious corrosion of cylinders and piston rods, from which leakage ensues.

**The Position of the Cradle Trunnions.**—If the cradle trunnions are situated near the centre of gravity of the elevating parts, natural balance will be obtained, but as the gun is elevated the breech will approach the ground. Where long recoil is employed, as in the case of a mobile carriage, it will be necessary to shorten recoil at the higher elevations and this is done automatically by a device called the "Cut-off gear" which regulates the action of the buffer in the required manner: recoil is then said to be "controlled." Alternatively, the trunnions may be placed so near to the breech that the latter will not sensibly approach the ground when the gun is elevated. Thus, with "rear trunnions" a constant long recoil is possible, but the elevating parts must be artificially balanced by a spring or pneumatic equilibrator. Centre trunnions combined with a cut-off gear are standard in the British service, while rear trunnions are common in other countries.

**Shields.**—These are provided for light field equipments and for coast artillery, but not usually elsewhere. In the former case, the shield is of light steel plate and is designed to give protection from rifle and machine gun fire. Pieces of a heavier nature normally operate out of effective range of these weapons; their shields would therefore be required to afford protection from shell fire, and the weight involved would be excessive.

Coast artillery equipments, since considerations of weight do not arise, are very heavily armoured, the shield providing front, side and overhead protection.

**Sights.**—Sighting systems, for field, coast, and anti-aircraft artillery have necessarily developed on distinct lines. With field artillery, except in open warfare, the target is seldom visible from the gun: guns are then laid from some visible aiming point, and laying is said to be "indirect." The target will not, in general, be at the same height above mean sea level as the gun, so that with indirect laying allowance must be made for "angle of sight." Most field artillery targets are stationary except when the battle is moving—when fleeting opportunities are presented.

Two systems of sighting are used for field equipments: the "rocking bar" system and the "independent line of sight." The former has the disadvantage that every alteration in the elevation of the gun throws the sight off the target or aiming point and the layer has to relay every time this happens, corrections to range being constantly required during a shoot. With the independent line of sight changes in gun elevation are not imparted to the sight, so that the service of the gun may be more rapid than with rocking bar sights. A much more complicated elevating gear is, however, necessary. With each of these systems the sight is fitted with holders for a telescope for laying direct, and with a carrier for a prismatic sight for indirect laying.

Coast artillery is chiefly intended for anti-ship work, though guns may be specially sited for repelling land attacks. Their targets, therefore, are generally moving, and, except when obscured by fog or smoke screens, are visible. Laying then is normally direct, and neglecting the effect of tide and curvature of the earth's surface, the gun is always at the same height above the target. On this important fact is based the principle of the

automatic sight, which is fitted to most coast artillery equipments. The cradle and sight are mechanically connected in such a way that the layer has only to elevate the gun until the sight is aligned on the water line of the target: the gun is then layed at the required elevation. This sight loses its accuracy rapidly as the range increases until a range called the "auto-sight limit" is reached, when the sight can no longer be used. The greater the height at which the gun is sited, the longer will be the auto-sight limit. In addition to the automatic sight most coast artillery equipments are fitted with a rocking bar sight.

The anti-aircraft problem is to hit a very rapidly moving target, the course, height and speed of which may be continuously changing. Since alterations to line and range during a shoot will be large, and since rapid service is essential, the independent line of sight is suitable for anti-aircraft artillery not equipped for "director" control, provided it is independent both for line and elevation. Sights on these lines have been designed and are in use, but they involve great complications in the traversing and elevating arrangements. Otherwise, the rocking bar system is used, two sights being fitted, one on each side of the mounting. The sights are cross-connected, one layer laying for line, the other for elevation.

All equipments are provided with some form of range or elevation indicator, which is set at the elevation ordered to the gun. Many modern range indicators are fitted with adjustable readers and specially engraved scales so that the errors in shooting due to wear of the gun may be counteracted without the necessity of calculating and applying a special correction.

Most modern sighting systems embody means for correcting certain other errors in shooting. Thus, a sufficiently accurate correction for "drift," which is the lateral deviation of the projectile due to the spin imparted to it by the rifling of the gun, is obtained by tilting the sight so that the line of sight is deflected in the required direction as the gun is elevated. A correction for the error in line caused by the wheels of a field carriage being on unlevel ground is obtained by providing means for cross-levelling the sight. Automatic sights embody arrangements which give compensation for the error in range due to the rise and fall of tide, and to atmospheric conditions which affect the shooting: a device is also usually fitted which corrects the error in range due to want of level in the mounting.

Sights of modern artillery equipments are invariably fitted to a non-recoiling portion of the carriage, so that the layer need not stand clear at each round and time is saved. In order to improve and maintain accuracy, special attention is given to providing means for taking up wear and play in sighting mechanisms, and the readers, scales, etc., are adjustable.

## CLASSIFICATION OF EQUIPMENTS

Land Service Artillery falls conveniently into three categories, viz., (*a*) mobile equipments, (*b*) semi-mobile equipments and (*c*) fixed mountings. These three classes differ radically from one another as regards their basic structure, and also among themselves as regards size and weight.

**Mobile Equipments.**—Light, horse, field, medium and certain heavy artillery equipments are included in this category. They possess considerable tactical mobility, particularly as regards the lighter natures. The gun carriage is a two-wheeled vehicle and forms the travelling and firing support for the gun.

The basic structure comprises the trail, axletree and wheels, and when in action the end of the trail, which is provided with a spade, rests on the ground. At the first round, the spade digs itself in and prevents the carriage recoiling on its wheels. For travelling the trail is hooked to another two-wheeled vehicle called the limber, which is fitted either with a pole for horse draught, or with an engine draught connector. The combined gun carriage and limber thus form a four-wheeled vehicle having sufficient flexibility to negotiate rough ground. The balance of the equipment when limbered up and the distribution of the weight between gun carriage and limber wheels are matters of importance, and, in view of this, guns of some medium equipments are drawn to the rear for travelling, the breech resting on the rear part of the trail. Field artillery limbers carry a certain amount of ammunition.

A fore-carriage is sometimes used in place of a limber for tractor or truck drawn medium artillery: its steering gear, which is similar to that of a motor car, is connected directly to the tractor, and its wheels are of small diameter.

*Stability of the Mobile Carriage in Relation to Mobility.*—From the firing point of view stability is essential for accurate shooting. This demands as much weight as possible on the ground, a low centre of gravity, and a long trail—factors which combine to counteract the tendency for the carriage to overturn to the rear when the gun is fired. A field artillery equipment is, however, restricted as regards weight; moreover, from the point of view of mobility, the wheels should be of large diameter to give easy draught, and the trail should be short so that the carriage may be manoeuvred easily in a confined space. Although a cranked axletree enables a low centre of gravity to be obtained with large wheels it is evident that the factors upon which stability largely depends are in direct contrast to those which secure mobility, so that the designer of a mobile carriage must effect the best compromise possible, having due regard to particular requirements of each case.

This problem applies also to the heavier natures, for even where mechanical transport is used axle loads must be reasonably limited and the equipment must not be too heavy to be man-handled for short distances.

*The Mobile Carriage.*—Mobile carriages in use have either a "box" trail or a "split trail." In the box type a space is formed between its two side members into which the gun may recoil at high elevations. The carriage body is pivoted to the trail near the axletree, and is capable of being traversed 4° to the right or left by the traversing gear. The cradle supports the gun on slides and rests in trunnion bearings in the carriage body. It is in the form of a trough in which is housed the recoil system, secured to the gun at the breech end.

Some designers, notably Schneider of France, favour what is known as "Cross-axle Traverse" for field carriages. The carriage body is dispensed with and trunnion bearings are fitted in the sides of the trail, which are curved upwards in front for this purpose. The traversing gear causes the trail to slide to the right or left along the axletree, the point of the spade becoming the centre of the traversing circle. The amount of traverse obtainable depends on the length of the axletree which is limited by the overall width of the carriage, and is generally about 4° each way. When traverse in excess of that provided on the carriage itself is required, the spade must be dug out and the trail carried round until the gun is roughly aligned in the required direction. Such a procedure is too slow where moving targets such as tanks or armoured cars are being engaged, and this has led to the introduction of the "split trail," this being made up of two single trails connected to the axletree by ball and socket joints, so that when they are opened out, the spades may adapt themselves to uneven ground. For travelling, the legs are locked together, and one of them carries an eye for the limber hook. Owing to the loose joints between the axletree and trail legs, the carriage body obtains no support from the trail. A somewhat complicated connection between carriage body, axletree and trail legs is therefore essential. With this type of trail about 80° of traverse is obtainable without moving the trail legs.

*Wheels.*—These are built of wood, steel or aluminium alloy. Many modern carriages use commercial type disk wheels equipped with balloon tires and puncture proof tubes. The wooden wheel suffers from the disadvantage that even when thoroughly well seasoned materials are used, it is seriously affected by climatic changes, and since the World War of 1914–18 considerable attention has been given to the possibility of replacing the wooden wheel by one of steel or aluminium alloy.

An important advantage of the wooden wheel is the ease with which it can be repaired in the field. Wheels are usually dished to give strength to withstand lateral stresses when travelling. They must also be sufficiently robust to withstand the shock when the gun is fired.

*Problems Due to Mechanical Draught.*—The introduction of mechanical draught for artillery has made possible great increase

in speed, particularly in the case of the heavier natures. This in turn has set up excessive strains in the carriage and has led to the adoption, in many instances, of rubber tires, both in Europe and in the United States.

In order to improve matters still further, considerable attention has been given to the question of mounting mobile equipments on springs.

Light field equipment was in general use in 1940 in which springs are embodied in the naves of the wheels.

*Brakes.*—These are an essential feature of mobile artillery equipments both from the firing and travelling aspects. They are applied in action to prevent the carriage running forward on its wheels when the gun is running out to the firing position after recoil. Tire, rim and hub brakes are all in use. In the case of the disk type wheel with pneumatic tires, brake drums are mounted on the hubs. Brakes are usually cross-connected and equalized, and in many cases may be operated either from in front or in rear of the axletree. Those of light field equipment are often provided with a rapid acting device for use when firing; this is a particularly desirable feature where cross-axle traverse is employed as the brake must be released on each occasion the gun is traversed.

*Pack Artillery.*—Equipments for use in mountainous country, or where roads are non-existent are designed to be dismounted for transport, their components being carried by pack mules. When in action, the equipment resembles a mobile carriage of conventional form except that small wheels may be used as it is not intended for draught.

The special requirements of a pack equipment are:—(*a*) it must be capable of being assembled or packed very rapidly; (*b*) loads must not be bulky or unwieldly; (*c*) the weight of each load including saddle should be within the limit which the pack animal can carry without undue fatigue.

In order to keep within the load limit, the guns of pack equipments are generally transported in two parts, which, when assembled, are secured by a nut on the interrupted screw principle. The gun is secured to a slipper which slides on the cradle; this obviates the provision of guide ribs on the gun, which would make it an awkward load to pack.

**Semi-mobile Equipments.**—This category embraces equipments which, by reason of their size and consequent weight, possess little tactical mobility. It comprises two classes, viz., equipments for artillery designed to travel (*a*) by road, and (*b*) by rail.

*Road Mountings.*—In order to keep each axle load within the recognized limit of roughly five tons, equipments whose total weight would exceed ten tons when limbered up are designed to travel on more than two pairs of wheels. A departure from the conventional form of the mobile carriage is thus necessitated, and the various components of the carriage travel as separate loads. Such a carriage, therefore, does not fire from its wheels and this involves the operation of mounting and dismounting the equipment whenever a new position is taken up.

The basic structure consists of some form of temporary anchorage of wood and steel beams, usually called the holdfast or platform, to which a firing bed is secured. The ground must be prepared for the holdfast, which is prevented from lifting in front when the gun is fired by a mass of earth contained in a steel box or sand-bags, and by pickets driven into the ground. The firing bed contains a pivot in front and at the rear a cross-member carries a toothed arc by means of which about 60° of traverse is obtained by the carriage body. The pivot and the arc both contain roller bearings on which the carriage body is supported so that easy traverse is ensured. The carriage body is comparatively larger than that of an ordinary field carriage, but in other respects the superstructure is of normal design.

The number of loads in which the equipment travels depends on its total weight. Lifting screws and jacks are provided for mounting and dismounting the various loads. Large numbers of these equipments were used by the belligerents of 1914–18, British examples being the 9·2″, 12″ and 15″ howitzers.

*Railway Mountings.*—These are of two types, viz., (*a*) those which are lowered on to the track for firing, and (*b*) those which fire from their wheels.

In the first the basic structure consists of a truck, the ends of which are raised and supported by bolsters resting upon bogies. The total number of axles depends as before upon the total weight, and is usually limited to about 15 tons for the British standard gauge. In the travelling position the bolsters take the weight through the medium of sliding blocks; when these are drawn clear the ends of the truck may be lowered by lifting screws until the centre portion, or "well," rests on the ends of the sleepers. The truck, now in the firing position with all the weight removed from the wheels, is then anchored by means of steel ropes and pickets or other devices. The carriage body rests on a roller ring in the well of the truck, so that all around traverse is obtainable.

The lateral stability of these mountings is not great, and is usually improved by the use of steel arms which project from the side of the truck and rest on the ground. Where no provision of this kind is made, firing below certain elevations may have to be prohibited except when the direction of the target is close to that in which the truck lies. In the case of howitzers this difficulty is sometimes obviated by increasing the elevation to obtain shorter ranges; for, since maximum range is obtained at an elevation of about 50°, any increase in elevation gives a shorter range. But this solution generally sacrifices accuracy in aim.

In a typical design of the second type of railway mounting, the truck itself forms the carriage body and is provided with bearings for the cradle trunnions. The truck body is supported by a bolster at each end, each bolster resting on one or more bogies; as before, the number of axles depends on the total weight. The bogies and bolsters form the basic structure in this case, and the truck body is allowed a limited amount of traverse on roller bearings across each bolster.

This type of mounting is only made use of in the case of very heavy guns of large calibre. A petrol or similar engine provides power for elevating if required, and the mounting is furnished with an air compressor plant for its pneumatic system. The equipment includes a winding gear for pulling the carriage forwards, for it runs back slightly on the track at each round.

Railway mountings are used for 9·2″ and larger guns and for howitzers of 12″ calibre and upwards. They possess considerable strategic mobility and are valuable in areas with good railway systems.

**Fixed Mountings.**—These are permanently emplaced and are mainly used to protect harbours, naval bases, etc., from action by enemy ships and aircraft, and strategic points inland from aircraft.

Generally speaking, all-around traverse is a feature of fixed mountings, and the basic structure is therefore circular in form, consisting of a holdfast or base and a pedestal. The holdfast comprises a concrete bed, the depth and size of which depend on the weight and size of the mounting. Buried in the concrete is a number of long steel bolts which project through a steel ring resting on the top of the concrete. After the concrete has thoroughly set, the pedestal is lowered on to this ring, and is secured to it by nuts screwed on to the long bolts. Pedestals are usually provided with levelling screws to correct any subsidence of the holdfast. In other cases extreme care must be exercised to obtain a truly level foundation for the pedestal.

Power is usually available in some form, and may be used for elevating, traversing and shell hoisting with the heavier natures. Hand operated gear is retained for use should the power fail.

Short recoil is a normal feature of fixed mountings: owing to the massiveness of the basic structure the question of stability does not arise, the chief factor affecting the length of recoil being the maximum stresses which the mounting can withstand. Short recoil has the advantage that it accelerates the service of the gun and simplifies the design of the cradle and recoil system. Apart from this, however, considerations of space would generally prohibit the use of long recoil in a fixed emplacement. The length of recoil for a modern 6″ mounting of this nature is about 18″.

**Anti-aircraft Mountings.**—The essential features of these necessitated by their peculiar rôle are:—(*a*) all-round traverse, (*b*) elevation up to about 90°, (*c*) rapidly acting and easily operated gears, (*d*) loading at any angle and (*e*) short recoil.

Mountings may be mobile, semi-mobile or fixed, depending upon the nature of the holdfast. In other respects they resemble fixed mountings of the ordinary type, except that the pedestal becomes a base ring. This enables the carriage body to be of sufficient height to permit of loading at high angles of elevation, without greatly increasing the overall height of the mounting. The base ring supports the superstructure through the medium of steel rollers.

In the case of the mobile equipment the holdfast may be a motor truck or a special trailer with the base secured to the chassis. When in action the latter may be lowered to the ground or supported on long transverse baulks, so that firing stresses are not imparted to the springs of the vehicle, and a certain degree of lateral stability is ensured. This type of equipment possesses considerable tactical mobility, but is only suitable for light guns up to about 90 mm. calibre. The holdfast of the semi-mobile equipment consists of a travelling platform to which the base ring is secured. The platform is towed behind a tractor and travels on one pair of wheels. It has two steel arms at each end, which when in action are swung outwards. The wheels are then removed and the whole is lowered to the ground by jacks. It is then secured by steel pickets. Heavier weapons can be mounted on this type of platform than on a motor truck, but the time taken to get into and out of action is considerably longer.

The base ring of the fixed anti-aircraft mounting is secured to a holdfast identical with that described for other fixed mountings.

Anti-aircraft guns are longer and develop a higher muzzle velocity than field guns and are provided with semi-automatic or full automatic breech mechanisms. This entails the provision on the mounting of a device to regulate the speed at which the gun runs forward at the higher elevations. The mountings are not usually fitted with shields.

**Mortars.**—The war of 1914–18 saw the reintroduction of the mortar, which up till then had been regarded as an obsolete weapon. The modern mortar is a short range piece giving a low muzzle velocity, so that only a small propellent charge is necessary. This enables a thin-walled bomb of large capacity to be used (*see* AMMUNITION), and the piece itself is short and of light construction.

A number of different designs of mortar of varying calibres were used during the period 1914–18. The mountings in some cases closely resembled those of ordinary field carriages in general character, being provided with traversing and elevating gears and recoil systems: others, such as the "Stokes" mortar were of much simpler design (*see* ARTILLERY). (G. G. T.; C. M. WN.)

## NAVAL ORDNANCE

Naval Ordnance[1] is distinguished from Field Ordnance by the circumstance that the guns are carried on a rapidly moving platform subject to the uncertain oscillations of a ship at sea, and are required to hit a rapidly moving object. This entails special mountings, with very sensitive training, elevating, and sighting gear, suitable for counteracting such motion, and special firing arrangements and means of controlling the fire from favourable positions in the ship. The military artillerist is confronted with a task comparable to that of discharging a projectile from a gun in the Capitol in Washington and placing it on the lawn at Mount Vernon, Virginia. The task of the naval artillerist, however, may be compared to firing from a rapidly moving train to hit another train, many miles away, moving at an unknown speed in an unknown direction. The anti-aircraft gunner has to deal with a rather similar problem, but the difficulties of the naval artillerist are considerably increased by the ship's motion, especially in a heavy sea.

[1]The subject is restricted to naval weapons and their mountings for the discharge of projectiles by propellents, and does not include destructive engines which contain their own propelling machinery, such as torpedoes and rockets.

Though the war of 1914–18 developed certain special weapons peculiar to each Service and associated with such special conditions as trench and anti-submarine warfare, the general character of naval service guns is similar to that of land service, the construction of which has been outlined. It is not the gun, but the means of working it, that differs considerably, hence the difference in the design of the mounting and in the fire control system is very marked. The mounting design is further affected by the centralized position of the ammunition supply and the availability of power in a ship—conditions which do not prevail in the field.

The development of naval guns has naturally been in the direction of increase in muzzle velocity and in size, giving greater accuracy, longer range, and greater striking energy. The progress during this century is indicated below:

| Year | Gun | Approx. muzzle energy in foot tons |
|---|---|---|
| 1900 | 12 in.–42 cal. | 40,000 |
| 1908–09 | 12 in.–50 cal. | 50,000 |
| 1912 | 13.5 inch | 60,000 |
| 1915 | 15 inch | 80,000 |
| 1925 | 16 inch | 100,000 |

This increase in power and working pressure means a corresponding increase in the strength of the gun which has been obtained by progressive improvements in the quality of steel and the technique of construction. The power of the gun is decided by the primary purpose for which it is required such as penetration of armour at long range or repelling attacks by destroyers and aircraft. For the penetration of armour the higher the power the better, on the principle that success comes to the ship that can hit hardest and most often at the longest range. For defence from aircraft and both attack and defence in the case of destroyers, rapidity of fire is of greater importance than power.

In the nature of things, the size of the gun is related to the size of the ship, but the war of 1914–18 produced notable exceptions such as submarines armed with 12 in. and monitors with 18 in. guns. Attempts have been made without success by certain naval powers to reach agreement limiting the size of guns for certain classes of ships. As the result of the Washington conference (*q.v.*) in 1922 it was agreed between the signatories to restrict battleships to 16 in. and cruisers to 8 in. guns. At Geneva in 1927 agreement was reached between Britain, U.S.A. and Japan, to limit destroyers and submarines to 5 in. guns, but failure to solve the cruiser problem left this matter adjourned *sine die*.

### NAVAL GUNS

It is convenient to classify naval guns in four categories:—

(1) **Automatic Guns.**—These are small calibre machine guns in which the loading action is entirely performed by the recoil energy.

Such guns, of which the one pounder is typical, are used for anti-aircraft purposes, arming boats and operations on shore.

(2) **Semi-automatic Guns.**—These are light Q.F. guns in which part of the loading operation may be automatically performed by the counter-recoil of the gun. These weapons are used where rapid bursts of fire are specially necessary, as in defence against aircraft and destroyer attack. They form the main armament in many destroyers and the anti-aircraft armament in battleships and cruisers, in the latter case being mounted in special mountings capable of very high elevation. Guns in this class are generally supplied with fixed ammunition but the use of separate ammunition may be entailed by the confined situation.

(3) **Hand-worked Guns.**—These are light and medium calibre Q.F. or B.L. guns and form the main armament in some destroyers and cruisers and the secondary armament in battleships and large cruisers. A 6 in. projectile weighing 100 lb. is the heaviest weight which one man can conveniently load by hand; consequently, this size of gun is very generally adopted by all nations. The difficulty, however, of hand loading such a gun at high angles of elevation, such as are experienced in anti-aircraft defence, has led to it being mounted in power worked mountings in some

warships.

The weight of ammunition which is a consideration of particular importance in small vessels, is less for a B.L. than a Q.F. gun of the same calibre owing to the absence of the metal cartridge case.

(4) **Power-worked Guns.**—These are heavy guns, above 6 in. calibre, and are generally B.L., but may be Q.F. as in the case of German Krupp guns. They form the primary armament in battleships and heavy cruisers.

### NAVAL GUN MOUNTINGS

These may be divided into two main classes:—(*A*) *Deck Mountings* attached to the ship taking guns in classes (1), (2) and (3). (*B*) *Turret Mountings* built into the ship to take guns in class (4). These are invariably worked by power, usually electric, though certain nations, among them Great Britain, prefer hydraulic power, and others a combination of both.

**Considerations Affecting the Design of Naval Guns and Mountings.**—The gun design is to some extent affected by the mounting conditions particularly as regards the gun's weight and the position of its centre of gravity. If the gun is for a deck mounting and for high angle purposes, it is desirable to keep its axis of suspension as low as possible for reasons connected with the ship's stability and for convenience in hand loading. Consequently, the centre of gravity must be close to the breech end, and the recoil must be short to avoid fouling the deck at high elevation. Also the gun should be heavy rather than light, or severe stresses may be brought on the mounting and deck structure during the short recoil.

If the gun is required for mounting in a turret, its axis of suspension should be as nearly as possible over the roller path on which the turret revolves, to reduce structural stresses incurred by the weight of the gun which in the case of 16 in. guns exceeds 100 tons. The axis should be as close to the front shield as possible, so that the opening in the armour necessary for full elevation is as small as possible. Consequently the position of the gun's centre of gravity may affect the diameter of the turret on account of the length of gun within it and so may affect the beam of the ship. This may be limited by available docking accommodation. The weight of the gun, mounting, and turret armour appreciably affect the ship's displacement, and should be kept as light as possible. This has led to double and triple gun turrets. The turret as a whole must be balanced, hence the weight of the gun must be compensated by the disposition of the loading machinery in the revolving structure. The heavier the gun the greater is the weight entailed in such machinery or in the thickness and overhang of the rear shield. The design of the mounting is affected by the class of ship for which the gun is required and by the position in the ship in which it is mounted.

The first consideration in selecting the position for mounting a gun is to obtain as large an arc of fire as possible. The centre line is naturally the most favourable for this purpose, and this has been universally adopted for the primary armament of battleships since the "Dreadnought" era. The selection of position has a large influence on the arrangement of the ship as in addition to the disposition of magazines and shell rooms, the effects of severe blast on the deck, superstructures and personnel must be met. Freeboard, or height above the waterline, is of importance, and lack of this severely handicapped the British ships in the Coronel action (1914).

Important requirements of a naval gun mounting are:—(1) Safety under all conditions of use. (2) Protection by armour from enemy action. For the safety of the ship, it is essential to reduce fire and explosion risk to a minimum, particularly as the gun's ammunition is in close proximity to the gun. This is effected by suitable breaks in the train of ammunition supply between the magazine and gun, also by enclosing the ammunition in flash-proof cases in addition to hoists. For heavy guns, air blast is provided, which operates automatically on opening the breech mechanism, and expels gases out of the muzzle of the gun. Water sprays also are fitted to drown any smouldering residue which may be left in the gun chamber or on the breech block and so secure the safety of the crew operating the gun. The ship's personnel and structure are safeguarded by suitable interlocking arrangements and automatic danger signals, which ensure the proper sequence of operations, and prevent the gun from being trained on a bearing where the line of fire is masked by ship's fittings, or where blast effects would be serious.

Protection is given by a shield carried on the mounting or by placing the gun in an armoured gun house. In the case of turret mountings, fixed armour surrounds the revolving structure extending below the water line; and the roof and sides of the turret above this armour are made of armour plate. The functions of a gun mounting are (1) to absorb the recoil and replace the gun in the firing position without incurring undue stresses on the deck structure. (2) To enable the gun to be rapidly and accurately laid and trained (*i.e.*, directed in the vertical and horizontal planes) through a wide arc whether the target be in view at the gun position or not. This demands very sensitive control for alinement, effected at the gun either directly through telescopic sights or indirectly as signalled from a control position. (3) To permit of rapid loading and a high rate of fire.

(1) **Recoil Arrangements.**—Guns are generally carried in a cradle in which they are free to recoil, the cradle being pivoted or supported by trunnions in the mounting. In the case of heavy guns the cradle is replaced by a carriage and slide. The carriage may be regarded as part of the gun to which it is rigidly attached, and the slide is pivoted to enable the gun to be laid, and forms a path on which the carriage can travel during recoil. The gun or carriage is attached to a piston which works in a cylinder attached to the cradle or slide. In some cases the piston is connected to the cradle and the cylinder is secured to, and recoils with, the gun. For heavy guns two pistons and cylinders may be employed. The energy of the recoil is absorbed mainly by the resistance offered to the passage of liquid from one side to the other of the piston, either through tapered grooves in the recoil cylinder or through a valve or orifice in the piston. In a 16 in. gun the initial velocity of recoil is 21 fs. and the recoiling mass (approximately 110 tons) is brought to rest in the short travel of 3·8 feet. Efficient buffering is arranged at the end of recoil to bring the gun quietly to rest before it is returned to the firing position either by springs, or by air compressed during the recoil action, and contained in a separate compartment fixed to the cradle. In "recuperator" mountings, the run out is effected by the pressure of air contained in a communicating cylinder or reservoir, acting on the liquid in a "run out" cylinder through a valve which controls the speed of run out. Suitable arrangements are made by a liquid seal to prevent any air from passing into the run out cylinder. In power-worked mountings the gun may be run out by hydraulic pressure acting on a ram or piston attached to the slide. It will be noted that the system of overcoming the recoil is hydraulic, whereas the counter-recoil may be mechanical (*i.e.*, springs), pneumatic, hydraulic or a combination of these systems. The primitive expedient of arranging for the gun to recoil up an inclined plane and to run out by gravity is no longer used.

(2) **Training and Elevating Arrangements.**—The training of a gun is effected by rotating the entire mounting about its vertical axis. In a hand-worked deck mounting which is supported on a live roller ring or pivoted on ball-bearings, this is carried out by worm gear fitted in the mounting which engages in a rack secured to the deck. In the case of light guns, this gear is usually arranged to disconnect, so as to allow the mounting to be trained from a shoulder piece in smooth weather. A turret mounting generally carries with it a hanging chamber and ammunition trunk. Moreover it must be supported on a live roller ring which travels on a fixed roller path built into the ship and the turret is rotated by an electric motor which works a driving pinion gearing into a vertical rack fixed to the hull. The great weight of the revolving structure, which may exceed 1,000 tons in triple gun turrets, entails very powerful machinery to obtain the necessary nicety in movement required for accurate training, one minute of arc being of importance at long range.

In double or triple gun turrets, though the guns cannot be trained independently, the elevation or laying is generally inde-

pendent. Elevation is effected in British ships by moving the gun slide in the vertical plane by hydraulically operated rams, connected to it and working in cylinders fixed to the mounting. Another method of laying commonly adopted (U.S.A.) is by the rotation of a long screwed shaft driven by an electric motor which takes the place of the ram. Where very high angles of elevation are required involving a large movement the laying may be performed by a hydraulic swash plate engine (*q.v.*). Hand-worked guns are generally laid by the rotation of a pinion geared into a toothed arc attached to the cradle. In all cases the elevating gear is connected to the non-recoil portion of the mounting. In some turrets it is possible to lock the slides so that the guns are elevated together, and in other mountings (known as "twin" mountings) independent elevation is not possible.

(3) **Loading Operations in Turret Mounting.**—The possible rate of fire depends upon the rapidity with which successive rounds can be loaded. The loading cycle for a turret gun involves the following events:—

(a) The recoil and counter-recoil of the gun.

(b) Opening the breech and ejecting the fired tube (primer).

(c) Bringing the gun to the loading position which is a fixed angle varying in different turrets from 4° to 10° of elevation. In some turrets, such as that shown in the illustration, loading can be performed at any elevation through a loading arm at the rear end of the slide, which is designed for the automatic attachment of the ammunition cage, which then moves up and down as the gun is depressed or elevated. This enables the loading operation to proceed without the gun being brought to a fixed position. The loading arm carries on its extreme end a chain rammer for ramming home the projectile and charge, hence this operation also is independent of the angle of the elevation.

(d) Bringing the ammunition cage with projectile and charge from the waiting position in the chamber to the loading position or loading arm. (Bringing the ammunition from the shell room and magazine by the main trunk and transferring it to the loading cage is an operation which can be performed at any time and is not dependent on the working of the gun.)

(e) Ramming home the projectile and charge. In some mountings, where fixed loading is carried out, telescopic rammers are used and the charge is automatically picked up by the rammer behind the projectile and carried into the gun chamber in the same ramming operation with the projectile.

(f) The withdrawal of the rammer and cage.

(g) Closing the breech with a new primer in position.

When the loading is completed a hand-operated switch is put over. This break in the firing circuit is introduced to ensure safety from firing during the loading operations. The gun is now ready for firing, and this can be performed by completing the firing circuit by pressing a key either in a sighting position in the turret or in the director tower, according to which position is connected up.

### NAVAL GUN SIGHTS AND GUNLAYING

Sights fitted with telescopes are attached to the cradle or connected with the trunnions of the slide. Setting the range on the sight gives it an angle of depression with the gun's axis. The movement of the gun necessary to aline the sight on the target gives elevation to the gun corresponding to the range on the sight.

It will be appreciated that change in the direction or bearing of the target may entail continuous training to keep on the object, and that change in range may entail constant alterations in the elevation of the gun. Such movements are, however, usually small, and readily adjusted by the responsible members of the gun's crew. A more difficult task in keeping the gun continuously laid is caused by the oscillatory motion of the ship, which, since it is of a harmonic and composite character, is very difficult to compensate. This motion is, as far as possible, discounted by means of "director firing" in which a definite position in the roll can be selected for discharging the gun. In this method of firing, an indicator is operated at the gun by an electrically connected master sight in the control position. This is followed by the action of the gun-layer, who keeps a pointer attached to the gun in coincidence with the director indicator, thus giving the gun an elevation corresponding to the setting of the master sight.

The setting of this sight involves the rangefinder range, and the "spotting" correction obtained from observation of the fall of the shot, which may be assisted by aircraft observation. This spotting correction is inevitable as the actual muzzle velocity of the gun may differ from that for which the sights are graduated owing to wear of the gun and to the temperature of the charge. Also the retardation of the projectile may differ from the normal on account of its form and weight and because of the density of the atmosphere. Such effects are as far as possible allowed for by calculation in the initial setting of the sight; but there remains a margin of error, which in most cases is chiefly due to the discrepancy between the rangefinder range and the true range of fire control personnel.

### FIRING GEAR

Under the conditions that prevail in a naval action, it is of great importance that the means of firing the gun should be as instantaneous and as reliable as possible. Where guns are directly fired from a control or director position, it is necessary for the main chain to the gun to be electrical, and the "firing interval" is reduced if this circuit fires an electric tube. Where a percussion primer is employed to fire the gun, the fire control circuit is arranged to release a striker by energizing an electro-magnet and attracting an armature which releases the trigger. Owing to the mechanical movements involved, this latter method entails a longer delay.

The firing interval in the case of an electric primer is determined by the following train of events:—(1) Brain impulse interval between the director layer or gunlayer seeing his sight alined with the target and deciding to fire, and his finger pressing the contact button. (2) Completion of the circuit by the physical movement of the contact button, push or switch. (3) Heating the bridge and burning the powder in the primer. (4) The passage of the tube flash along the vent of the breech screw. (5) Ignition of the primer on the end of charge. (6) Ignition of charge. (7) Time taken by the projectile in passing down the bore.

An efficient firing gear reduces the firing interval to a minimum and makes the prospect of firing as reliable as possible. The possibility, however, of a misfire is usually provided for by some alternative system. In some cases an alternative electrical circuit is fitted which is brought into operation by a switch, and in other cases percussion firing is resorted to by either exchanging the electric tube for a percussion one or by employing a tube which is capable of being fired electrically and by percussion. Electrical firing lends itself very readily to the introduction of safety arrangements, *e.g.*, the circuit can be broken by the recoiling action of the gun and only completed when the gun is out in the firing position. It can be also broken when the breech is not closed and only completed when it is fully closed.

It will be evident from the foregoing that the use of a heavy naval gun and the entire ship's battery entails great proficiency in drill, a complex organization and intelligent co-operation among personnel. The machinery and instruments concerned must be kept in a highly efficient condition to ensure that no link in the chain of operations fails. Alternative methods of loading and operating turret guns are provided in many cases, such as mechanical hand-loading or a secondary source of power in the event of the main system being put out of action. These add to the degree of training and skill required in the gun's crew. However great the power and mechanical perfection of the weapons, the spirit, resource, and efficiency of the man behind the gun will continue to be a matter of the highest importance. Other things being equal—the human element will decide the issue in a naval engagement. (J. G. M. McH.; W. R. V. A.)

**ORDOS:** *see* SHENSI.

**ORDOVICIAN SYSTEM,** in geology a term introduced by Lapworth in 1879 to include those rocks—well developed in the Welsh region formerly inhabited by the Ordovices—which had been classed by Murchison as Lower Silurian and by Sedgwick

as Upper Cambrian (*see* SILURIAN). In the early part of last century all the rocks which lie beneath the Carboniferous Limestone were grouped together under the general name of Transition Series and it was not till 1831 that Sedgwick and Murchison made the first serious attempt to reduce them to order. Sedgwick started work in the Snowdon district and Murchison began upon the Welsh borders. By 1835 they had advanced so far that Murchison gave the name of Silurian system to the group of rocks with which he was dealing, while Sedgwick called his group the Cambrian series. At that time it was supposed that the Cambrian lay entirely below the Silurian. Subsequently it was shown that the two formations overlap, the upper part of Sedgwick's Cambrian being the same as the lower part of Murchison's Silurian. A prolonged controversy followed which has left its effects in a confusion of nomenclature even to the present day. It has, however, long been recognised that the Cambrian and Silurian of Sedgwick and Murchison include three natural groups, and in 1879 Lapworth proposed that these groups should be called Cambrian, Ordovician, and Silurian. Murchison's terminology is still often used, especially in Germany, and the three groups are called the Cambrian, the Lower Silurian and the Upper Silurian.

Although under all the variations of terminology the three groups are now universally recognised there are still differences of usage with regard to their precise limits. Whereas in extra-British areas there is a general concurrence of opinion as to the horizon at which the base should be drawn (zone of *Dictyonema flabelliforme*), most British geologists still adhere to the older classification, based largely upon structural considerations, in which the base is taken above instead of below the Tremadoc. There is also some divergence of opinion as to the horizon at which the upper limit should be drawn, the fossil evidence suggesting that it should include beds up to the time of appearance of the true Pentamerids and Monograpti, though mainly on lithological grounds it is generally taken below this level.

The various strata composing the System may be divided into several contemporaneous facies or types of deposit, controlled by different physical conditions at the time of formation, and since these same physical conditions also govern the nature of the organisms living in different parts of the sea, each facies of deposit tends to have a distinctive set of fossils.

The three principal facies can be recognized:

1. Shallow water marine facies
   (a) grits, sandstones and shales indicative of heavy sedimentation; fossils mainly trilobites and brachiopods.
   (b) shelly limestones evidently laid down in clean water; fossils mainly brachiopods, cystids, ostracods, and bryozoa.
2. Deeper water marine facies
   (a) nodular limestones; fossils mainly cephalopods (*Orthoceras*).
   (b) black shales; fossils, blind trilobites or trilobites with over-developed eyes. Often occurring in association with
   (c) fine black shales; fossils mainly graptolites.
3. Volcanic facies especially characteristic of British Isles.

The natural relationships of these different types are indicated by their field relations, the shallow water facies of either type may have a considerable lateral extension running parallel with the old coast line, but in a direction approximately at right angles passes into one or other facies of the deeper-water type, the subdivisions of which are often intercalated into one another, though the type with the most widespread development is undoubtedly that of the Graptolite Shale. The graptolites do not really belong to the black shale since it is likely that they were planktonic or pseudo-planktonic, but since quietness of the waters and absence of coarse sediment are the determining factors governing the distribution of both, the two are almost invariably associated.

**Life.**—The life of the Ordovician period presents a distinct advance in type upon that of the preceding Cambrian; as a whole it may be said to be characterised by three main features: (*a*) Acme of development of the trilobites. (*b*) Rise and dominance of the articulate brachiopods over inarticulate types. (*c*) Incoming in force and great development of the graptolites. The fauna consists on the one hand of a trilobite-brachiopod fauna characteristic of the shallow water facies, and a graptolite fauna characteristic of the deeper water facies, and it is by means of these great groups of organisms that the rocks belonging to the System have been divided up into a series of life zones. The graptolites utilised as *zone fossils* differ in different parts of the world, but though the *Index Fossil* may be different, there is a very wide agreement in the *General Assemblage* found at the same horizon within the Graptolite Shales all over the world, and there is likewise the same change from the early many branched forms to those with fewer branches, and from the pendent to the scandent direction of growth. The cell form too changes in the same manner from the straight to the slightly sinuous, and eventually to the decidedly sinuous type. Hence *Clonograptus, Dichograptus, Tetragraptus* and *Didymograptus* are characteristic of the Lower Ordovician; *Nemagraptus, Dicellograptus* and *Climacograptus* characterise the Middle Ordovician, and *Dicellograptus, Dicranograptus, Climacograptus* and *Diplograptus* the Upper Ordovician. The articulate brachiopods include the various subgenera of *Orthis, Strophomena Leptaena,* and *Plectambonites,* and, more particularly towards the top, forms with a definite internal brachial apparatus such as *Atrypa* and *Zygospira* make their appearance.

The trilobites reach their zenith of development and exhibit great variety in form, but whilst *Ceratopyge* is found only at the base, and forms like *Chasmops* and *Phillipsinella* only in certain beds in the Upper Ordovician, many genera or families have a long range; *Ogygia* for example is characteristic of the Lower Ordovician when it occurs, but the nearly allied *Asaphus* is found at all horizons. The forms of commonest occurrence are *Asaphus, Ogygia Acaste, Calymene, Placoparia, Illaenus, Homolanotus, Remopleurides, Cheirurus, Lichas,* and *Phillipsinella;* there are also blind trilobites such as *Trinucleus* and *Ampyx,* both of which are common, as is also *Aeglina* with its over-developed eyes.

Various Orthoceratidae are abundantly represented in the Orthoceras Limestone of Scandinavia; taken as a whole however the mollusca (*q.v.*) play a far more important part in the fauna of America than they do in Europe, both gasteropods and lamellibranchs being abundant at certain horizons, whilst the bryozoa are also important in America, and probably on account of the physical conditions, are far more abundantly represented.

**Distribution.**—Ordovician rocks have an almost world-wide distribution since they have been recorded from both Arctic and Antarctic regions, Europe, North America, South America (Bolivia), Asia (China, Burma, northern Himalayas, Shan States), northern Africa and Australia. The classic areas of development however are those of Europe and North America, and the other areas may be regarded in terms of these. In Europe they may be considered as having been laid down in two main areas, a northern area and a southern area. The northern area of deposition comprised the British Isles, the greater part of Scandinavia and the Baltic Provinces; it consisted of two gulfs penetrating far into the north Atlantic continent, the outermost of which was probably a true geosyncline and the inner an epicontinental sea; these were partially separated by a long island or peninsula extending from Scandinavia to Britain. The southern area is considered to have lain to the south of a land mass extending through Central Europe and comprising southern France, Spain and Portugal, Thuringia, the Fichtelgebirge, Kellerwald and Bohemia.

The differences in the faunas of these two areas has been regarded as in large measure dependent upon the existence of the separating land barrier, but it is possible that these differences may be due in part to facies, and the possibility of the effect of migration and counter-migration along the shore line must not be overlooked. Towards the close of the period at any rate this difference in faunas disappeared, for a uniform type of fauna characterises all areas of deposition whether they belong to the shallow-water or deeper-water facies.

In America shallow water facies of varied type predominated all along the submerged margin of the Canadian shield (epicontinental sea), but in the east and west, definite geosynclines originated, known as the Cordilleran and Appalachian geosynclines respectively, and it is to these that the Graptolite Shale facies mainly belong.

*British Isles.*—The British Ordovician rocks have always been much folded since their formation. They were laid down originally within the geosyncline of the northern area of deposition, part of

ORDOVICIAN SYSTEM

| Europe | | | | | | | | America | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| British Isles | | Scandinavia | | N. W. Europe | | Bohemia | | New York State | | Canada | |
| Shelly | Graptolitic | Shelly | Graptolitic | Shelly | Graptolitic | Shelly | Graptolitic | Shelly | Graptolitic | Shelly | Graptolitic |
| Ashgill | ?Lowest Birkhill Shales<br>Upper Hartfell Shales | Brachiopod Shales<br>Upper Leptaena Lst.<br>Trinucleus Shales | ?Lowest Rastrites Shales<br>Upper Dicello-graptus Shales | | | $D_5$ | | (Taconic uplift) | Dicellograptus complanatus Shale | | |
| Caradoc | Lower Hartfell Shales | Lower Leptaena Lst.<br>Chasmops Lst.<br>Cystidean Lst. | Middle Dicellograptus Shales | Schistes Supérieures<br>Grès de May. | | $D_4$<br>$D_3$ | | Richmond<br>Lorraine<br>Utica | Cincinnatian<br>Upper part of New York Slate belt (Hudson River Shales) | Lorraine<br>Utica | Graptolite Shales |
| Llandeilo | Glenkiln Shales and Cherts | Orthoceras Limestone | Lower Dicello-graptus Shales | Schistes à Calymènes or Schistes Angers | Schistes à D.Euodus | $D_2$ | | Trenton<br>Black River | Mohawkian<br>Norman's Kill Beds | Quebec City | Dicellogr. Shales |
| Llanvirn | Llanvirn | | Upper Didymo-graptus Shales | | Schistes de Boutory | | $D_{1\gamma}$ | Chazy | Deep Kill Beds | | Levis Shales |
| Arenig | Skiddaw Slates | Ceratopyge Lst.<br>Shumardia Beds | Lower Didymograptus Shales | Grès Armoricain | Assise de Huy (Belgium) | $D_{1\alpha}$ | $D_{1\beta}$ | Beekmantown | Canadian | | |
| Tremadoc | Dictyonema Beds | Obolus Appolinis Beds | Dictyograptus Shales | | Assise de Viel-salm (Belgium) | | | | Dictyonema Beds (Schaghticoke) | Sillery | |

| | Wales | | | Shropshire | | | Lake District | | S. Scotland | |
|---|---|---|---|---|---|---|---|---|---|---|
| | S. Wales | N. Wales | | W. of Longmynd | E. of Longmynd | | | | Girvan | Moffat |
| Ashgillian | Slade, Redhill Beds | | Chirbury Series | | | Coniston Limestone Series | Upper Ashgill Shales | | | |
| | | | | | | | Middle Ashgill P. mucronatus Beds | Ardmillan Series | Drummock Group | Upper Hartfell Shales |
| | Shoalshook Lst. | Rhiwlas Lst. | | Marrington Stage (Whittery Shales) | | | Lower Ashgill Phillipsinella Beds (Keisley Lst.) | | | |
| | | | | | ?Onny River Shales (Up. Trinucleus Shales) | | | | Barren Flags | Barren Mudstones |
| | | | | | Acton Scott Beds | | | | Whitehouse Group | |
| Caradocian | Robeston Wathen Lst. | Bala Lst. | | Hagley Stage | Longville Flags | | Sleddale Group | | | |
| | | | | | Chatwall or Soudley Sandstones | | | | Ardwell Group | Lower Hartfell Shales |
| | | Bala Mudstones | | | Harnage Shales | | Roman Fell Group | | | |
| | Dicranograptus Shales | | | Aldress Stage | | | | | | |
| | | Sandstones | | | Hoar Edge Sandstone Grits | | | | | |
| | Shales with Mydrim Lst. | Dicranograptus Shales | Middleton Series | Rorrington Stage | | | | Barr Series | Balclatchie Beds | |
| | | | | | | | | | Benan Conglomerate | Glenkiln Shales and Cherts |
| Llandilian | | Volcanic Series | | | | | Borrowdale Volcanic Series | | Stinchar Limestone | |
| | | | | | | | | | Kirkland Conglomerate | |
| | Llandilo Flags | | | Meadowtown Stage | | | | | | |
| | Llandilo Limestone | | | Betton Stage | | | | | | |
| | | | | Weston Stage | | | | | | |
| Llanvirnian | | | Shelve Series | Stapeley Stage | | | | | | |
| | Lower Llanvirn | Lower Llanvirn | | | | | Skiddaw | | | |
| | | | | Hope Stage | | | | | | |
| | | | | | | | Slates | | Ballantrae Volcanic Series | |
| Arenigian | Tetragraptus Beds with volcanics | Tetragraptus Beds | | Mytton Stage with Stiper Stones Quartzite at base | | | | | | |

the northern margin of which appears to have lain along the Highland border, whilst its southern shore-line ran obliquely through the Welsh borderland and thence south into Cornwall. Hence in the neighbourhood of the Highland border (Girvan) and the Welsh borderland there is an extensive development of the shallow-water facies, which traced south-east on the one hand and more generally west and north-west on the other, pass into deposits of the deeper water facies characterised by graptolites. These sediments are however interrupted at different horizons by volcanic rocks though the intensity and duration of vulcanicity varied in different places. It is the folding of the sediments and the occurrence of these volcanic rocks on a grand scale that is responsible for the rugged mountain scenery of both north Wales and the Lake District. There appear in general to have been two main volcanic episodes, an earlier one (Arenig) characteristic more particularly of the marginal areas, of the geosyncline, and a later one (Llandilo-Caradoc) belonging to its more central portions. The table shows the succession in the classic areas of development.

*European Continent.*—In Scandinavia the Ordovician rocks have escaped the severe tectonic disturbances that have so generally affected the rocks of this age in other regions. In Norway their main development occurs in the Christiania (Oslö) basin, but in Sweden the best sections are those seen in the many table-mountains that have been cut out by circumdenudation, where the rocks can be studied lying horizontally one above the other. The recognition of the different facies of deposition is here particularly important; the classic areas are those of Skåne, Öland, Östergotland, Västergotland and Dalarne, and in these the shallow water and deeper water facies show varying degrees of development. In Skåne is found the most complete development of the Graptolite Shale facies, but this is associated in places with some Trilobite Shales and some thin bands of Orthoceras Limestone. In Dalarne on the other hand the facies is largely shallow water throughout and almost entirely calcareous, a similar facies being found in Öland where however the succession is incomplete above the horizon of the Cystid Limestone, and Dictyograptus Shales largely replace the Ceratopyge Limestone; in Östergotland the Ceratopyge Limestone is again replaced by Dictyograptus Shales but the upper part of the succession is complete, and in Västergotland Graptolite Shales not only replace the Ceratopyge Limestone but also the lower part of the Orthoceras Limestone. Hence the general succession in the different areas may be regarded as dependent upon the degree to which the various limestones are replaced by Graptolite Shale.

In the Baltic Provinces the succession is mainly of shallow water type, and affords perhaps the best development of the rocks of that type recognized in Europe. The succession presents some striking analogies with that of the Scandinavian shallow-water development of which it is no doubt the counterpart on the southern shore line; hence the Vaginatenkalk and Echinosphaerite Kalk show many features in common with the Orthoceras Limestone and Cystid Limestone of the northern region. It does not appear possible however, to correlate exactly the beds that are said to overlie the Echinosphaerite Kalk, namely the Jewe Itfer, and Kuckers Schiefer, beyond the fact that they appear to belong to the Upper Ordovician.

At the base of the Ordovician succession in Bohemia, there is an unconformity of considerable importance so that the basal beds are naturally of a littoral character ($D_{1}\alpha$); above, Graptolite Shales of Arenig age occur, and the beds of Llanvirn age ($D_{1}\beta$) contain a mixed fauna of trilobites and graptolites; the remainder of the succession is formed of a richly fossiliferous shallow-water series of sandstones and shales representing everything up to the top of the Ashgillian.

*North America.*—In the geosynclinal areas of North America, both shallow water and deeper water facies of deposit are found and these are often highly disturbed by the movements in which they have been involved since their deposition; outside these geosynclinal areas the beds show very little signs of any disturbance, are thinner and consist very largely of calcareous beds with different varieties of shallow water faunas.

The Graptolite Shale facies is best known in the area belonging to the Appalachian geosyncline, but includes also beds now lying outside it in the St. Lawrence valley which have probably been brought by thrusting into their present position. The classic development of the Graptolite Shale facies of the Lower Ordovician is that known as the Levis Shales of the Quebec group seen on the south shore of the St. Lawrence immediately opposite Quebec; the remainder of the Graptolitic facies is best known from New York State where they form the Hudson river Shales of Albany. The shallow water facies is found extensively in the north in the Hudson bay region (Manitoba, Hudson bay and the Arctic archipelago), and in the south or Mississippean region along the margins of the Canadian shield in Michigan, Wisconsin and Minnesota, and on the domes of Cincinnati and Nashville.

*Australia.*—In Australia the same three facies of the Ordovician are characteristically developed. Beds belonging to the shallow water facies have only up to the present been definitely recorded along the east to west line in Northern Territory in the heart of the continent (Tempe Downs, and Levi Range, south of the MacDonnell Ranges) the dominant type, which is found mainly in the eastern half of the continent, belonging to the Graptolite Shale facies; these are best seen in Victoria where the Lower Ordovician rocks of this type have become well known through their occurrence in the most productive gold field; Upper Ordovician of similar type, though less auriferous, occur east of a line running north from Melbourne, and are also found in New South Wales. Volcanic rocks of the age have an extensive development in central New South Wales and in Tasmania (*see* AUSTRALIA). (G. L. E.)

**ORDU** (anc. *Cotyora,* where the "Ten Thousand" embarked for home), the chief town of a Turkish vilayet, on the north coast of Asia Minor, connected with Zara, and so with Sivas, by road, and with Istanbul and Trebizond by steamer. Filberts are exported. Pop. of vilayet (1935) 283,054.

**ORDUIN-NASHCHOKIN, ATHANASY LAVRENTEVICH** (?–1680), Russian statesman, was the son of a poor official at Pskov. He was the only Russian statesman of the day with sufficient foresight to grasp the importance to Russia of the Baltic seaboard.

Orduin abolished the onerous system of tolls on exports and imports, and established a combination of native merchants for promoting direct commercial relations between Sweden and Russia. He set on foot a postal system between Muscovy, Courland and Poland, and introduced gazettes and bills of exchange into Russia. With his name, too, is associated the building of the first Russian merchant-vessels on the Dvina and Volga.

*See* V. Ikonnikov, "Biography of Orduin-Nashchokin" (in *Russkaya Starina,* Nos. 11–12) (St. Petersburg, 1883).

**ÖREBRO,** a town of Sweden, capital of the district (*län*) of Örebro, lying on both banks of the Svartå a mile above its entrance into Lake Hjelmar, 135 mi. W. of Stockholm by rail. Pop. (1943), 56,135. Örebro was in existence in the 11th century. Its castle was erected by Birger Jarl in the 13th century, and twenty diets or important assemblies were held either in the castle or in the town. Such were the Örebro *concilium* of 1537, the diet of 1540 in which the crown was declared hereditary, and that of 1810 when Bernadotte was elected crown prince. In great part rebuilt since a fire in 1854, Örebro has a modern appearance. An ancient castle, however, with four round towers, still remains, and is used as a museum. There may be mentioned also the church of St. Nicholas, of the 13th century; and the King's House (*Kungsstuga*), an old and picturesque timber building. The patriot Engelbrecht (d. 1436) was born here. The Swedish reformers of the 16th century, Olaus and Laurentius Petri, are commemorated by an obelisk. Örebro is the centre of the Swedish shoe industry; trade is carried on, by way of the Örebro canal and lakes Hjelmar and Mälar, with Stockholm.

**ORE DEPOSITS.** The word "ore" is defined in the Oxford Dictionary as "a native mineral containing a precious or useful metal in such quantities and in such chemical combination as to make its extraction profitable," and this is the sense in which it is used in commerce and by miners, although the word is also applied to metalliferous minerals without the above-mentioned limitations. (*See* also PHYSICAL RESOURCES.)

Ore deposits are accumulations in Nature which have arisen by some form of concentration, either chemical or mechanical, or both. Prof. Kemp has made a useful comparison between the average percentages of the metals in the earth's crust and those necessary to constitute an ore suitable for profitable working. The two tabulations, slightly modified in the case of manganese and copper to conform with later improved practice, are here put side by side:—

| *Metals* | *Average percentage in Earth's crust* | *Percentage necessary for profitable working* |
|---|---|---|
| Aluminium | 8·13 | 30 |
| Iron | 4·71 | 35–65 |
| Manganese | 0·07 | 25–50 |
| Nickel | 0·01 | 2–5 |
| Tin | 0·000X–·0000X | 1·5–3 |
| Copper | 0·0000X | 1–10 |
| Lead | 0·0000X | 2–2·5 |
| Zinc | 0·0000X | 5–25 |
| Silver | 0·000000X | 0·03–0·16 |
| Gold | 0·0000000X | 0·003–0·00016 |
| Platinum | 0·00000000X | 0·00005 |

The letter X indicates some undetermined digit.

A comparison of the two tabulations gives an idea of the degree of concentration that has been instrumental in the formation of ore deposits from the materials of the earth's crust. Research has shown that it is to the igneous magmas that we must look for the original source of these concentrations of the metals. The agents by which the metallic components of the magmas are segregated, or extracted from the rocks to which the magmas consolidate, and finally concentrated, are numerous. In the case of the molten magmas it is by the process known as *differentiation,* or by the escape of gases and vapours carrying volatile metallic compounds to the adjacent rocks—a process which is known as *pneumatolysis.* From the consolidated igneous rocks extraction is effected by hydrothermal solutions, whether of deep-seated or of meteoric origin. Further concentration takes place (1) by oxidation, hydration and solution in the zone of weathering and re-precipitation in the zone of secondary enrichment; (2) by the mechanical agents of erosion and sedimentation, and (3) by chemical and bacterial agents leading to precipitation in seas, lakes and swamps.

It will be seen from these considerations that ore deposits can be divided into two great classes according as they are of *primary* or of *secondary* origin.

**The Primary Deposits** may be subdivided into:—

(*a*) Magmatic differentiations within the boundaries of the igneous mass;
(*b*) Deep-seated injections of materials extracted from the magma by differentiation;
(*c*) Infillings and replacements at moderate depths by magmatic waters or by meteoric waters heated by descent;
(*d*) Infillings and replacements near the surface by waters of meteoric origin.

**The Secondary Deposits** are:—

(*a*) Oxidation and reduction ores in the zones of weathering and secondary enrichment;
(*b*) Residual ores;
(*c*) Detrital ores;
(*d*) Precipitated ores.

The form assumed by ore deposits will be referred to later. As regards their mineral composition, it is necessary in the first place to distinguish between the *ore* and the *gangue,* the latter being the name given to the minerals that accompany the ore.

In the deep-lying parts of the deposit, or what is often called the *primary sulphide zone,* the ore-forming metals occur in combination with sulphur, tellurium, arsenic and antimony (as sulphides, tellurides, arsenides and antimonides of one or other of the metals—gold, silver, mercury, lead, vanadium, zinc, nickel, cobalt, etc.), or as silicates (of iron, manganese), or oxides (of iron, tin, chromium). Occurrence in the native state is in this zone confined to a few of the metals (gold, platinum, iridium, palladium, etc.).

In the upper portion of the lodes, in the *zone of oxidation,* the metals occur as carbonates, sulphates, phosphates, arseniates, antimoniates, chromates, silicates, chlorides, oxy-chlorides and hydrates. Where special conditions involving strong reduction prevail certain metals appear in the native state (copper, silver, mercury).

The commonest gangue minerals in the deeper parts of the lodes are quartz and the sulphides of iron (pyrites, marcasite, arsenopyrite). Nearer the surface the hydrated forms of silica (opal and chalcedony), the carbonates of iron, calcium, barium and magnesium (siderite, calcite, aragonite, witherite, dolomite) and the sulphates of calcium and barium (gypsum, anhydrite, barytes) are common.

Important deductions as to the origin of an ore deposit can be drawn from the nature of its mineral associates, always provided that care is taken to distinguish between the different epochs of mineralization, *i.e.,* to say whether the mineral in question belongs to the primary period of mineralization, or has been introduced at a later date from without, or derived from the original mineral by the chemical action of permeating solutions. Thus, for example, the presence of fluorine, boron and phosphorus-bearing minerals, such as fluorspar, apatite, tourmaline and axinite, indicates deposition at a temperature above the critical temperature of water, by the aid of the so-called "mineralizers." Heavy anhydrous silicates such as the pyroxenes, the hornblendes and the dark micas, also imply a deep-seated origin at high temperatures. On the other hand, the presence of hydrated minerals, such as chlorite, opal, chalcedony and members of the zeolite group, points to an origin near the surface at comparatively low temperatures. The association of minerals belonging to the same epoch of formation is connoted by the term *paragenesis.*

## MAGMATIC DIFFERENTIATIONS

Concentration by magmatic differentiation gives rise to ore-bodies associated mainly with plutonic rocks. These, because of the slowness with which they cool, offer the greatest facility for such concentration. A marginal segregation of the heavier minerals is brought about in the cooling magma either by fractional crystallization and gravitation of the crystals thus formed or by liquation, the latter process being a separation into two immiscible fluids, the heavier of which sinks to the bottom of the magma basin.

The density increases with the number of molecules of metallic oxides, such as those of iron, chromium, nickel, copper, calcium, magnesium. Hence these molecules will be more abundant in the lower than in the upper portion of a magma basin. In general, therefore, the net result is the formation of a basic peripheral zone and an acid (that is siliceous) central portion. As a rule the ores are concentrated in the peripheral portion, although exceptionally they occur in the heart of the igneous mass itself.

**Deep-seated Injections.**—The examples referred to in the preceding paragraphs are segregations within the igneous magma itself; but the majority of ores, although derived in the first instance from igneous magmas, are concentrated beyond the limits of the magma basins.

The formation of tin and copper deposits as the result of the consolidation of a granite magma is worthy of consideration in this connection. An undifferentiated granite magma may be considered as a solution containing, among other constituents, a certain amount of water and the chemically active elements boron, fluorine, chlorine, phosphorus, sulphur, tellurium, etc., which are spoken of as "mineralizers," since they possess the property of forming volatile compounds with the heavy metals. As the magma cools it separates into differentiates of varying composition; and consolidation of the different fractions takes place in the order of decreasing viscosity, the final residuum containing an excess of silica, a portion of the alkalies, practically all of the water and compounds of the metals, tin, tungsten, molybdenum, uranium, lead, copper, iron and many of the rarer metals.

In the early stages of consolidation cracks and fissures are formed in the cooling crust, into which the liquid residuum of the magma is injected. The earliest injections give rise to quartz-porphyries and felsites; later differentiates are pegmatites and aplites; while the most acid extract consolidates as almost pure quartz. While the temperature of the crust is still high and before

it has fallen below the critical temperature of the acid vapours, a proportion of the latter escapes into the surrounding rocks. These gaseous emanations deposit their mineral burden to a minor extent in fissures in the solidified crust of the igneous mass itself; but the main deposition is in the older rocks beyond, to which access is gained through bedding planes, joints, faults and crush-zones.

The tin-ore deposits contain the metal in the form of the oxide, $SnO_2$ (cassiterite) which is probably derived from the granite in the form of fluoride of tin—$SnF_4$—a volatile compound which, emitted at a high temperature, decomposes at a lower temperature in the presence of water vapour to a dioxide of tin, as shown by the following equation:

$$SnF_4 + 2H_2O = SnO_2 + 4HF$$

The deposits are characterized by the presence of the fluorine-bearing minerals—fluorspar (fluoride of calcium) and topaz (a fluoride and silicate of aluminium) and the boron-bearing minerals —tourmaline and axinite; whilst among metallic compounds are found wolfram (a tungstate of iron and manganese), ilmenite (a titanate of iron) and various sulphides and arsenides of copper, iron, lead and silver. Some of these compounds often constitute valuable ore-deposits of the respective metals. For instance, in Cornwall the upper portions of the lodes, to-day being mined exclusively for tin, carried copper in such quantities as to have made that county the world's chief producer of that metal in the early part of the 19th century. This depth-change in mineral content is a function of the temperature and pressure of the ascending mineral-bearing vapours and solutions and is sometimes referred to as the *zonary distribution* of ores. Experience has shown that the order of the zones of ore occurrence in the Cornish lodes from below upwards is tin, tungsten, copper, zinc, lead, silver, and this is the order of increasing solubility of the compounds of these metals in the ascending magmatic waters.

The highly-heated soluble constituents of the intrusions as they pass into the invaded formations profoundly modify their mineral composition. Among the sediments, the aluminous (shales and slates) and the calcareous (limestones) are the most subject to modification. The aluminous rocks develop tourmaline, sillimanite, staurolite, andalusite and topaz—all silicates of alumina, while the calcareous rocks yield garnet, axinite, wollastonite, diopside, scapolite, vesuvianite and epidote—all lime-bearing silicates.

In places these contact phenomena are accompanied by the development of ores, and thus give rise to an important class of ore-bodies generally described as *contact-deposits.* As a rule they are metasomatic replacements of limestone. Excellent examples are found in the so-called porphyry-copper deposits of the Western States of America (*e.g.,* in Arizona, New Mexico and Utah), where copper ores occur in limestone at its contact with intrusive monzonite and quartz-porphyry. The principal contact minerals are garnet (andradite) and epidote. The primary ores are cupriferous iron pyrites and zinc-blende to which must be added the high grade copper sulphides—chalcocite and bornite, in the zone of secondary enrichment. Near the surface, subsequent leaching by meteoric waters generally gives rise to a zone which may be barren, but in places contains oxides and carbonates of copper.

Equally important are the iron-ore deposits, which occur in limestone at its contact with igneous intrusions of an acid or intermediate type. Magnetite is the principal ore mineral, although haematite also occurs but in smaller quantity. Characteristic associates are the iron-garnet (andradite), the iron-pyroxene (hedenbergite), olivine and ilvaite. Deposits of this character are found in the Banat province of Hungary, on the island of Elba and in the Oslo district of Norway.

### HYDROTHERMAL DEPOSITS

The part played by water in the formation of ore deposits is of the first importance, for on account of its mobility and solvent action, which is enormously increased at high temperatures and pressures, it is the universal vehicle for the transference of mineral matter.

In the hydrothermal circulation the mineral-bearing solutions are in part directly connected with igneous magmas, namely in so far as they are formed by the cooling of aqueous vapours given off at a late stage in their consolidation. A considerable proportion, however, are no doubt surface waters (*i.e.,* meteoric in origin), which, descending along fractures, derive their thermal properties from the secular heat of the earth, or by coming in contact with, or into the near neighbourhood of, igneous intrusions.

Of the water that falls as rain one part is the *run-off,* that is to say, water that reaches the rivers without having penetrated the surface. A second part is returned into the atmosphere by *evaporation;* while a third part disappears into the soil and under-lying rocks by *percolation.* Under the influence of gravity the water of percolation penetrates into the earth's crust, first through the superficial weathered and disintegrated layers and then through the more solid rocks by way of the fractures of jointing and faulting, the planes of bedding or the pore-spaces between their constituent minerals.

It is a matter of common observation that at a variable depth below the surface, there is a connected body of water, which permanently fills all openings. The surface of this sea of water is called the *level of the ground-water,* the *permanent water level,* or the *water-table;* it is the upper level of the *belt of saturation.*

Above the permanent water level is the *zone of percolation* in which the openings in the rocks are only intermittently filled with water. This water is in active movement and air is present. The thickness of the zone of percolation varies greatly. At sea-level and at, or near, streams or lakes the level of the ground-water reaches the surface; in average areas it is from 10 to 1,000ft. below the surface; in high-lying districts with small rainfall it may be 100 to 300ft. below the surface, and in elevated desert regions as much as 1,000 to 2,000ft. below the surface.

The belt of saturation is divisible into two portions. The upper portion, or that part which has a means of horizontal escape and discharge, is the *zone of discharge.* In general, it lies between the water-table and sea-level. In it the circulation is vigorous, as is evidenced by the vast volume of water discharged by springs.

The bottom part of the belt of saturation is the *static zone.* In it the waters are practically stagnant, or at best move very slowly. Near the bottom limit of the static zone the water gradually diminishes until the *dry zone* is reached. The boundary between these two zones is quite irregular, descending to great depth along fractures and rising high in solid ground. The lower levels of most deep mines are in the dry zone, in some places reached at a depth of not more than 1,000 to 1,500ft. below the surface.

The waters circulating in the zone of percolation are cold, contain free oxygen and are acid with dissolved carbon dioxide. Such waters have been termed *vadose* (Lat. *vadosus,* shallow) by Pošepný. They have a strong oxidizing effect on sulphides, pyrites for instance being decomposed with formation of oxide of iron and sulphuric acid. The net effect of the vadose circulation, therefore, is destruction, and the zone of percolation is practically coincident with the *zone of weathering,* although the latter overlaps the upper portion of the zone of discharge.

In the zone of discharge the waters, as they descend, lose their oxygen and carbon dioxide and deposit material brought from the zone of weathering. When they have access to open channels they penetrate deeper and deeper, absorb heat and thus become powerful solvents of the metallic sulphides and tellurides.

Ultimately these heated waters, together with those of magmatic origin, ascend, and as they cool and mingle with the descending vadose waters deposit their mineral burden, either in the main channels of circulation, thus forming *ore-veins,* or in the pores of the rocks forming the so-called *cemented* ore-bodies.

As the openings become closed by cementation, however, the circulation becomes feeble and ultimately completely stops, although earth movements may refracture the rocks and inaugurate a new circulation. The vertical movement of the water is confined to the zone of fracture and cementation. Below this zone, the pressure is sufficiently great to produce a differential movement of the rock particles, and thus to close all openings by *rock-flow.* For free upward movement the ground must be fissured, fault-fractures, especially when brecciated, and shear-zones are preferentially used by the ground waters, and these, therefore,

frequently become the seat of the deposition of ores. The existence of impervious formations is an important factor in directing the general circulation of underground waters, and in the localization of ore deposits.

The deposition of minerals from solution is brought about in a variety of ways. Solutions which are unsaturated at depth become, as they ascend, saturated by decrease of temperature and pressure. Chemical reactions also come into play—for instance, between solutions of different origin, between solutions and solids and between gases and solutions. Under one or more of these conditions the metallic burden is precipitated, lining and ultimately filling the channels traversed by the solutions. But not only are open channels filled: the wall rocks of the fissures may be affected or the constituent minerals of the rocks attacked by the penetration of the circulating waters. Consequently, two distinct classes of hydatogenetic ore-bodies must be distinguished, namely *cavity-fillings* and *metasomatic replacements*.

Cavities in rocks are due to a variety of causes. The openings may be those of discission, *i.e.*, fractures of dislocation (faults), or contraction-joints; they may be the interstices of sediments or gas-pores in lavas; they may be due to the folding of sedimentary beds (saddle and trough openings); or they may be solution-cavities in limestone and dolomite, *i.e.*, caves, sink-holes and enlarged joints and bedding planes. The filling of fault-fissures, zones of brecciation, interstitial openings and the vesicular cavities of lavas, gives rise to important ore deposits.

Metasomatic replacement is responsible for the formation of perhaps the largest class of ore-bodies. By metasomatism is meant the replacement molecule by molecule of a constituent of a rock by new mineral matter. Such replacements can be effected not only by water below the critical temperature, as in the hydrothermal circulation, but also by gases, as in the case of pneumatolytic replacement.

Since different minerals are differently affected by solutions, rocks will be more or less completely replaced according as they are made up of aggregates of the same or of different minerals. Limestones and dolomites, which are composed almost entirely of either calcite or the mineral dolomite, are far more liable to extensive and complete replacement than any other type of rock. They lend themselves to replacement both by the facilities they offer for circulation and by the solubility of the carbonates of which they are composed.

Where rocks of differing susceptibility to replacement occur in alternate beds the more soluble will be preferentially replaced, thus giving rise to a bedded type of ore deposit. Impervious beds crossing the paths of vertical fissures retard or stop the flow of solution, with the result that the latter, by spreading out beneath or above the impervious layer, tends to form characteristic pear-shaped replacements. In cases where there is a rapid alternation of impervious and permeable layers, selective action leads to the formation of serrated or tooth-shaped ore-bodies.

In sandstones whose cement is calcareous, the replacement of the calcite by ores is common; but it is sometimes difficult to say whether the disseminated ore particles have been produced by replacement, or by the filling of inter-granular spaces. Disseminated ore-bodies may also be produced by the differential alteration of igneous rocks, since these are aggregates of minerals varying in susceptibility to alteration.

Among the best examples of metasomatic replacement are the lead and zinc deposits found in limestone. Sulphides of lead and zinc are soluble in alkaline sulphides without decomposition. In contact with limestone such solutions deposit these sulphides as galena and zinc blende. Two types are common, viz., *flats* and *pitches*. A flat is a replacement which has progressed outwards into the limestone from bedding planes. On the other hand, a pitch is a replacement which has been effected from joints in the limestone. The names refer to the horizontality, on the one hand, and to the steep dip, on the other, of the respective deposits.

### OXIDATION AND REDUCTION ORES

The free circulation in the zone of percolation of waters charged with oxygen and carbon dioxide makes it, in effect, one of oxidation, in which rocks and ore deposits become disintegrated and their component minerals decomposed with removal of the soluble constituents. The chief chemical processes involved are hydration, oxidation and carbonation. Silicates are broken down, the alkalies and alkaline earths being removed as soluble bi-carbonates, whilst silica is set free. Sulphides give place to soluble sulphates or to sulphuric acid.

The soluble compounds are carried down to the belt of saturation. A portion is lost in the waters escaping in the zone of discharge. The remainder is deposited as the descending acid waters become neutralized by the alkaline waters of the lower zone.

The changes produced in ore deposits by the process described above are most striking, and of the greatest economic importance. Those metals that form soluble compounds are removed from the zone of weathering, leaving in most cases an impoverished residual material. On the other hand, the precipitation of new metallic compounds or of the metals themselves at lower levels leads to enrichment at those levels. As a rule oxy-salts, halogen salts and native metals are precipitated above the water-table, while secondary sulphides are deposited below it.

The dictum of the mining camp that lodes become richer in depth, is therefore only true as regards their upper portions. In progressing from the outcrop downwards, a barren or lean portion of the lode is first passed through. As the water-table is approached, the metal content increases, attaining a maximum in a zone of secondary sulphides below it; the grade then falls until a minimum is reached in the unenriched zone of lean primary sulphides.

The *zone of secondary enrichment* is of prime importance for the mining of copper and silver, the bulk of these metals being won from it. Copper mines, rich in their upper levels, become poor in depth and ultimately unpayable when the lean primary ores are reached, unless the deposits are sufficiently large to be worked at a very low cost. The primary ore is almost invariably a cupriferous iron pyrites. On oxidation the copper goes into solution either as sulphate or as a bi-carbonate, and is removed, leaving behind the iron oxides. Consequently a prominent feature of copper lodes is the existence at or near the surface of a *gossan* or *iron-cap* (*chapeau de fer*), from which the valuable copper content has been removed. In wet climates the gossan consists almost entirely of hydrated oxides of iron. In drier climates, the anhydrous oxide (haematite) occurs; and in still drier climates (for instance the rainless regions of Arizona and Chile) gossans contain chlorides and sulphates of copper, which in wet climates are unable to exist in the solid state.

The copper minerals especially characteristic of the upper portion of the zone of secondary enrichment are the hydrated carbonates—malachite ($CuCo_3 \cdot Cu[OH]_2$) and ($2CuCO_3 \cdot Cu[OH]_2$), chessylite, the hydrated silicates—chrysocolla ($SiO_2 \cdot CuO \cdot 2H_2O$), and an oxy-chloride—atacamite ($CuCl_2 \cdot 3Cu[OH]_2$), together with native copper. Lower down, the sulphides—chalcocite ($Cu_2S$), bornite ($3Cu_2S \cdot Fe_2S_3$) and covellite ($CuS$), are found.

**Detrital Ores.**—The work of weathering is twofold; namely, mechanical disintegration and chemical change. Comparatively few minerals resist the attack of the chemical agents, but amongst them there are some that are of importance from the economic point of view—*e.g.*, gold, platinum, magnetite, ilmenite, cassiterite, wolfram, monazite, corundum, diamond, etc. The agents of mechanical disintegration are the diurnal and other variations of temperature, the expansion of water on freezing, the erosion due to running water, the sand-blast action of wind, etc. The detritus is carried down the slopes of the hills by running water and distributed according to specific gravity and size of grain.

The transported material accumulates in the valleys of rivers, in lakes or on sea beaches, and the resulting deposits are accordingly classed as alluvial, lacustrine and marine gravels ("placers"). A large proportion of the world's gold has in the past been won from them. On account of its high specific gravity the metal is concentrated in the coarse gravels and among the boulders at the bottom of the placers, the most valuable accumulations being often actually on the bed-rock itself. If the latter happens to con-

sist of steeply-dipping schists or slates, the upturned edges of the latter act as natural riffles, or bars, which catch and retain the gold particles. Accumulation also takes place on what are known as "false bottoms," which are beds of clay or sand cemented by iron ("pan") and alternate with the beds of gravel.

Placer gold is usually associated with a heavy black sand consisting of magnetite, ilmenite and haematite, together with chromite, garnet, zircon, spinel and other heavy resistant minerals; but obviously the particular association is determined by the nature of the parent rock. The character of the gold is variable: it occurs in flat scales and flakes, in rounded particles, and as irregularly-shaped grains and nuggets bearing evidence of much attrition. In size it varies from the finest dust to nuggets weighing thousands of ounces. It is probable that these large nuggets have increased in size since they were first deposited. The fact that auriferous pyrites are found replacing the woody fibre of tree stems in the alluvial drifts of Victoria and California shows that under favourable conditions an enrichment through chemical action (that is, solution and recrystallization) can take place.

The richest gravels are formed by a re-sorting of earlier auriferous gravels, terraces of the latter being often situated several hundred feet above the workable deposits.

Placers occur in the river systems of every part of the world; but the greatest amount of gold has been won from the Recent and Pleistocene gravels of California, Alaska, Australia and Siberia. The older gravels are often deeply buried under a thick cover ("over-burden") of clay, soil, peat and moss, which is sometimes permanently frozen, as in the tundras of Siberia and Alaska; while in Australia and California the ancient river systems are concealed by later flows of lava, their auriferous gravels being then known as "deep leads."

Auriferous beach deposits or marine placers are formed on certain coasts where the conditions are favourable for the separation, by surf action, of the gold and heavy minerals from the sand and lighter stones. Such deposits occur in New Zealand, on the beaches of Oregon, Alaska (Nome and Cape Yagtag), Chile, and Nova Scotia. Usually the gold occurs in a black sand consisting of magnetite, ilmenite and haematite; but these mineral associations are not constant: for instance, while in New Zealand the black sands are so rich in iron that it has been seriously proposed to work them for that metal, in the Cape Yagtag deposit the iron-ores are absent, their place being taken by garnet.

The auriferous conglomerates (locally termed "banket") of the Witwatersrand in the Transvaal, which have produced so large a proportion of the world's gold since their discovery in 1886, are considered by some to be ancient placers. Against this view, and in favour of a secondary origin for the gold, it might be urged that the latter shows no evidence of detrital origin, occurring, as it does, in crystalline particles and minute flakes in close association with pyrites. Moreover, the rest of the cement consists of crystalline quartz which has evidently been introduced, like the pyrites, subsequently to the deposition of the gravels. The only unmistakably primary constituents, besides the quartz pebbles, are diamonds, chromite and zircon, while the following minerals of secondary origin occur in the cement: quartz, chlorite, chloritoid, pyrites, marcasite, pyrrhotite, galena and blende.

If it be conceded that the gold, derived from the denudation of quartz veins in the schists and granite of the Primitive System, was deposited simultaneously with the quartz pebbles of the gravels, it must, on the other hand, be admitted that the original alluvial gold has been completely dissolved and re-precipitated.

Platinum is occasionally associated with gold in the residual and alluvial gravels of California, British Columbia, Brazil, Colombia and Borneo.

In districts where granite prevails the residual and river gravels often contain cassiterite, and such stanniferous gravels form the source of the bulk of the tin production of the world. They occur in Cornwall, the Malay States, Australia, Tasmania and in South Africa (Swaziland and the Transvaal).

### RESIDUAL ORES

The residual deposits always attain their greatest development in those countries that have been unsubmerged for a vast period of time; and where the weathered products have neither been pared off by glacial erosion, nor the solid rocks protected by superficial accumulations. Under especially favourable conditions of climate and topographic relief, disintegration, accompanied by the removal of soluble material, has progressed to many hundreds of feet below the surface, the whole of this zone consisting then of soft decomposition products that bear no likeness to their parent rock, although certain original structures, such as bedding and foliation, may be retained.

The materials composing the bulk of the residual deposits are gravel, quartz-sand and clay or lithomarge (an amorphous hydrated aluminium silicate, having the composition of kaolinite, viz.: $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$ and more exceptionally the mixture of hydrated oxides known as *laterite*. This latter material occurs in tropical and semi-tropical countries like India, the Malay Peninsula, the Dutch East Indies, South America, and East, West and South Africa; in fact, it appears to be one of the commonest residual products of ferruginous and aluminous rocks under suitable climatic conditions.

A great number of analyses of laterite have clearly established the fact that it consists to a large extent of a mixture of oxides and hydrated oxides of iron, aluminium, titanium and manganese: they show also that the water is chiefly combined with the aluminium oxide, the iron oxide being mostly present in the anhydrous or slightly hydrated condition (haematite or turgite). The ratio between the iron oxides and the aluminium oxides may vary to any extent, so that, while some laterites approximate in composition to high-grade iron-ores, others are almost pure bauxite which is the chief source of the metal aluminium. When manganese is present, it usually occurs in nodular concretions of psilomelane, wad or pyrolusite, which are sometimes sufficiently abundant to constitute ores of manganese. Mixed with these oxides in varying proportion are a lithomargic clay and quartz sand.

There has been much discussion and considerable divergence of opinion as to the origin of laterite; but all are agreed that it may result from the decomposition of a great variety of rocks, whether of igneous, sedimentary or metamorphic origin. The generally accepted view is that laterite is a residual accumulation produced by the removal in solution of combined silica, lime, magnesia and the alkalies, assisted by metasomatic replacement with material brought from the underlying rock in periods of desiccation by capillarity, aided perhaps by the rootlets of forest trees.

Laterite, when exceptionally rich in iron, is of considerable economic importance. Such, for instance, are the iron ores of Cuba, which occur as residual mantles on the high-lying plateaux of Malaya and Moa. Similar deposits occur in the Philippines, in Borneo, and in West Africa. The iron ores of Bilbao in Northwest Spain are also in part residual deposits.

Workable manganese deposits are nearly always residual concentrations from manganese minerals sparsely distributed through igneous rocks and crystalline schists. Deposits of this character are widespread in India, United States, Brazil, West Coast of Africa and many other places.

The nickel deposits of New Caledonia are of residual origin, the nickel ores being hydrated silicates (garnierite and genthite) occurring as earthy and brecciated masses in a ferruginous and clayey mantle overlying serpentine and peridotite.

Residual gravels containing tinstone and wolfram occur on Bodmin Moor in Cornwall. Others containing galena have been profitably worked in North Wales and again others, containing zinc ores, have been exploited as a source of that metal in Galicia. They have originated by the weathering of veins in limestones, chemical action on the soluble limestone having outpaced the mechanical erosion of the resistant minerals of the veins.

**Precipitated Ores.**—Many deposits of iron ore owe their origin to the precipitation in seas, lakes and swamps of iron derived from the decay of rocks in the zone of weathering. Iron goes into solution in this zone either by the oxidation of the sulphides of that metal, or by the breaking up of ferro-magnesian silicates. Soluble iron compounds are also formed by the action of certain bacterial organisms present in the soil. Reduced by these organ-

isms to the ferrous state, the iron combines either with the organic acids of the humus, or with the carbonic acid of the atmosphere, to form a soluble bicarbonate.

On exposure to air, or in the presence of plant life, carbon dioxide is given off and iron carbonate is precipitated, as shown by the following reaction:

$$H_2Fe(CO_3)_2 = FeCO_3 + CO_2 + H_2O$$

The ferrous carbonate rapidly oxidizes to ferric hydrate, and is deposited as *bog-iron* or *iron-pan*. A continuous layer of this pan consequently tends to form below insufficiently drained clayey and peaty soils. The formation of ferric hydrate in stagnant swamp water, where ferrous carbonate is undergoing oxidation, may actually be seen in operation, the iridescent films that form on such water being an indication that the reaction is taking place.

When the waters deposit iron in the presence of much carbonic acid, or of decaying organic matter, siderite ($FeCO_3$) is deposited. In muddy waters the silt goes down with the iron carbonate leading to the formation of *clay-ironstone*. These clay-ironstones or spathic ores as they are also termed, occur in the coal measures of the British Isles and in those of Westphalia and North America, and are an important source of iron. Though the iron content does not on the average amount to much more than 30%, the comparative leanness of the ore is compensated by the low percentage of phosphoric acid, which seldom rises above one per cent. The *black-band* ores of the coal measures are a similar deposit, but differ from the bulk of the clay-ironstones by the high percentage of vegetable or peaty matter they contain; sufficient to furnish the fuel required to calcine them. Such ores represent what was once a carbonaceous mud in which ferrous carbonate was precipitated. The Scandinavian *lake-ores* are an interesting example of precipitated iron ores.

The Jurassic iron ores of England and the similar *minette* ores of Lorraine and Luxembourg on the Continent, which constitute the greatest reserves of iron ore in Europe, form well-defined beds in a sedimentary series of sandstones, shales and limestones. Although low in iron (25 to 40% metallic iron) in many cases their large lime content makes them largely self-fluxing, and having a high percentage of phosphorus they are admirably suited for the production of pig iron for the basic process of steel-making. Their oolitic structure (so named from the resemblance to fish roe) is produced by the deposition of carbonate of lime and carbonate of iron around sand grains or fragments of fossils. In the zone of weathering, the spathic ores are oxidized to limonite, a change in colour from green to red being characteristic. Some secondary enrichment also takes place under favourable conditions. These iron ores are worked in England on three horizons, namely the Inferior Oolite (*Dogger* or *Northampton stone*) the Middle Lias (*Marlstone*) and the Lower Lias (*Frodingham stone*).

The metal content of the copper-bearing sandstones so widely distributed throughout the world, owes its origin, partly to precipitation and metasomatic replacement, partly to sedimentation. The prevalence of these deposits in the red beds of the Upper Carboniferous, Permian and Trias formations indicates sedimentation in the shallow seas of desert regions where evaporation was rapid. The copper was no doubt leached out, from earlier copper deposits in continental areas, by meteoric waters rich in sodium chloride and calcium sulphate. Transported as sulphate or chloride it was precipitated in inland seas or lakes and reduced to chalcocite by decaying organic remains. The replacement of tree-trunks and other plant remains as well as of the cementing material of the sandstones by chalcocite is a feature of these deposits.

The accumulation of cupriferous detritus while sedimentation was in progress, was no doubt a factor of the concentration in some cases, but such material of the original deposit would, of course, be subsequently modified by the circulation of the ground waters. Associated minerals are calcite, gypsum and barytes. In the zone of weathering the copper ores are oxidized to the green and blue carbonates—malachite and azurite.

### THE FORM OF ORE DEPOSITS

Ore deposits occur in a multitude of different forms, but for convenience these may be reduced to two types—namely the tabular or *sheet-like* and the *non-tabular*.

*Tabular deposits* are either beds forming a part of the general stratification of the country, or veins or lodes that have been formed by the filling of fissures, or the replacement of their adjacent "country." As a rule, the veins cut across the stratification; more rarely they conform with the strike and dip of the formation in which they occur and are then termed *bedded veins*. Where a number of parallel fissures are irregularly connected the system is known as a *composite vein* or *lode*. The term *linked veins* is used in a similar sense. A system of closely spaced and parallel veins is spoken of as a *sheeted zone*. *Gash veins* are those that do not extend beyond a given bed of the formation in which they occur, usually limestone.

Although veins have been defined as tabular deposits, the parallelism of their bounding surfaces is only true in a very general sense, for unless they are fissure-fillings they have more often than not only one well-defined wall, and in some cases none at all. In mining, however, it is usual to speak of the hanging wall and the foot wall of a vein to distinguish the limits of the workable deposit whether they are well-defined or not.

Where the filling of the fissure has been followed by differential movement, one or both of the walls are usually smooth and polished (*slickensides* or *friction-planes*), and between the actual vein-filling and the wall of the country rock there is often a thin selvage of comminuted rock or clay known as *flucan*.

Where the fissuring was accompanied by dislocation, as is mostly the case, the veins have a lenticular character along both the strike and dip. This lenticular character is due to the differential movement of curved or warped surfaces. Between the lenses the fissure is often so constricted that no ore occurs at all. When the axes of the lenses lie in one plane the lenses are connected by stringers; when they lie *en échelon* they are usually disconnected.

Not every part of a vein is equally mineralized: the pay-ore tends to localization in certain definite portions of the vein separated by low-grade material or even by barren gangue. The richer portions are termed *ore-shoots*. If they have a tendency towards the horizontal, they are distinguished as *ore-courses* or *ore-horizons;* if, on the other hand, they tend towards the vertical, they are known as *columnar ore-shoots* or *chimneys*. But the term ore-shoot is not restricted to the occurrence of high-grade material in a low grade matrix; it is also applied to the development along a fissure of lenticular bodies of pay-ore, separated by barren country rock. It has been proposed to call this latter class of ore-shoot *shoots of occurrence,* and to use the term *shoots of variation* for the former. Shoots of variation are usually distinguished from shoots of occurrence by a gradual diminution of the values near the boundaries of the ore-shoot.

*Non-tabular deposits* vary greatly in shape and size. They may be large irregular masses or small pockets of solid ore, or they may be *stockworks, i.e.,* reticulated masses in which a multitude of small veins traverse a portion of the country rock. Of exceptional character are *chimneys* or *pipes,* which are ore-bodies having a rudely circular or elliptical cross-section with considerable vertical extent. *Saddle-reefs* are a special type of cavity-filling. Those of Bendigo in Victoria, Australia, have resulted from the folding of the Ordovician strata into a series of anticlines and synclines. The deposition of quartz in the openings formed at the crest of the anticline below a sandstone and above a shale bed has given rise to auriferous ore-bodies. Since the sandstone and shale beds alternate repeatedly the saddle-reefs occur, one above the other as disconnected ore-bodies, in what is known to the miners as the "centre country." Thus the New Chum and Victoria mine had 30 superimposed saddle-reefs, down to a depth of 2,300ft. The deepest mines are working at about 4,000ft.

BIBLIOGRAPHY.—Élie de Beaumont, "Sur les émanations volcaniques et métallifères" (*Bull. de la Soc. Géol. de France,* 1847, p. 1249); W. H. Emmons, "Relations of Metalliferous Lode Systems to Igneous Intrusions" (*Amer. Inst. of Min. and Met.,* 1916); J. W. Finch, "The Circulation of Underground Aqueous Solutions and the Deposition of Lode Ores" (*Proc. Col. Sci. Soc.,* vol. vii. 1904, p. 193); F. Pošepný, "Genesis of Ore-Deposits" (*Trans. Amer. Inst. Ming. Eng.,* vols. 23 and 24, 1893, reprinted as a book, 2nd ed. 1902); J. W. Gregory, "Magmatic Ores" (*Trans. Faraday Soc.* vol. 20, 1925, p. 449–451, containing a useful bibliography and followed by a discussion);

F. H. Hatch, *Historical Summary of Theories of Ore Genesis* (Presidential address to the Inst. of Min. and Met. 1914); W. Lindgren, *Mineral Deposits* (New York, 1920); R. H. Rastall, *The Geology of the Metalliferous Deposits* (1923); E. Suess, "Ueber heisse Quellen," *Verh. Ges. deutsch. Naturf. und Aertze* (Carlsbad, 1902); *Types of Ore Deposits* (San Francisco, 1911), containing chapters by H. Foster Bain, E. R. Buckley, S. F. Emmons, W. H. Emmons, F. H. Hatch, O. H. Hershey, J. D. Irving, J. F. Kemp, A. C. Lane, C. K. Leith, R. A. F. Penrose, Jr., T. A. Rickard and C. H. Smyth, Jr.; J. E. Spurr, *The Ore Magmas* (New York, 1923); J. H. L. Vogt, "Beiträge zur genetische Klassifikation der durch magmatische Differentiation-prozesse und durch Pneumatolyse entstandenen Erzvorkommen" (*Zeit. f. Prakt. Geol.*, 1894, 1895); P. Niggli, *Versuch einer natürlichen Klassifikation der im weiteren Sinne magmatischen Erzlagerstätten* (1925).

(F. H. HA.)

**ORE DRESSING** is an important process in the field of mining (*q.v.*). It may be defined as mechanical concentration whereby valuable minerals in an ore are separated from worthless impurities or gangue and is distinguished from metallurgy which employs chemical methods for recovering metals and metallic compounds from rich ores or from the concentrated products of the ore dresser. Without this relatively cheap process of enrichment as compared to expensive metallurgical processes, the cost of common metals, such as lead, zinc and copper and many mineral products, would be far above present prices, and, as richer ore deposits continue to be exhausted, ore dressing will become of still greater importance. As an illustration of what ore dressing is doing for copper alone, the so-called porphyry-copper mills may be cited. In some of these mills 100 tons of ore assaying not over 1% copper will yield three tons of concentrates assaying 30% copper and 97 tons of waste tailings assaying about 0·1% copper. Thus the copper lost in the tailings is not over one-tenth of the total copper in the original ore and the expensive metallurgical process has to treat only three tons of concentrates as compared to 100 tons of original ore if concentration were not used. A single mill may treat as high as 20,000 tons of ore in 24 hours. Terms also used more or less as practically synonymous with ore dressing are milling, washing and concentration.

Ores in the majority of cases do not consist of a single mineral in a high degree of purity, but are a more or less complex mixture of different minerals, some valuable and some worthless. Native gold, tin, stone and many gems may occur mixed with gravel in placer deposits. Native copper is found sprinkled through rock masses. Diamonds are enclosed in a matrix of hard rock. Native gold is also found encased in quartz veins. The minerals of base metals, such as lead, zinc and copper, are commonly sulphides, oxides or other chemical compounds of these metals and occur distributed through solid rock or gangue in veins and other types of ore deposits. A given deposit may contain minerals of only one metal, or two or more metals may be represented and in the latter case the problem of the ore dresser becomes harder as he has not only to eliminate the waste gangue but also to separate the minerals of one metal from those of another. Beside minerals of the metals, there are many non-metallic minerals which likewise require elimination of gangue by concentration before these minerals become marketable. Among such minerals are mica, graphite, feldspar, asbestos, fluorspar, phosphate rock and the abrasive minerals garnet, emery and corundum. Even common sand and gravel may be washed to get rid of undesirable constituents and likewise clay to free it from grit and mica. The best examples of ores which do not require concentration are the iron ores of the Lake Superior region. Much of our bituminous coal is also sufficiently free from impurities to be marketed direct but even on iron and coal considerable washing is in use for lower grade deposits and this is bound to increase as the richer deposits are worked out. The subject will be considered in three divisions: (1) Properties of minerals which aid their separation; (2) Individual machines and unit operations; (3) Complete mill systems.

**Specific Gravity** has been the most important property in concentration. Valuable minerals are usually heavy and gangue minerals light, although there are exceptions. Thus the rate of settling in water or air or the tendency of a mass of grains to stratify when acted on by currents of water or air makes it possible to separate a lighter mineral from a heavier one. Size has to be considered also since a large grain will settle faster than a small grain of the same mineral and, consequently, large grains of light minerals are equal settling with small grains of heavy minerals. Separation based on specific gravity is commonly called gravity concentration. Colour, lustre and fracture are of aid when valuable minerals are being separated from waste by the process of sorting or picking by hand selection. These properties also enable the operator to make the proper line of division between the products coming off a concentrating machine. Fracture and cleavage will affect the form of the grains produced by crushing. Flat grains settle less readily than rounded or cubical grains. Hardness, toughness, friability and brittleness affect the power used in crushing ores. Decrepitation which causes some minerals to fly to fine pieces when heated enables such minerals to be separated, by subsequent screening, from other minerals which do not decrepitate and thus remain coarse.

*Magnetism* is a property possessed by certain minerals in a greater or less degree and electro-magnets of varying strength will separate such minerals from one another and from non-magnetic minerals. Some minerals, notably pyrite, are made magnetic by heating and become susceptible to magnets. Pyrite is also made porous by heating or roasting which changes its apparent specific gravity and may aid its separation. Electrostatic charges which are taken on quickly from an electrode by good conductors such as metals and sulphide minerals, except zinc sulphide, cause such minerals to be repelled more quickly from the electrode than gangue minerals and zinc sulphide which are poor conductors and receive the charge more slowly. Adhesion makes gold stick to a copper plate which has been amalgamated or coated with mercury and diamonds stick to a greased plate while associated waste minerals are washed down over the plate in both cases without adhering. The flotation property of minerals is a complex action not fully understood but it involves intermolecular forces of surface tension, adhesion and adsorption along with static electric charges and even chemical action. This process has developed rapidly in recent years and now vies with gravity concentration in importance and is therefore treated under a separate heading.

**Crushing.**—Unless an ore occurs as a placer or gravel deposit, it must first be crushed to free the valuable minerals from the attached gangue and the amount of crushing necessary will depend on the fineness of dissemination of the mineral. Furthermore, the final separation of the crushed material usually involves preliminary preparation by sizing or classification to yield a series of graded products going to different types of concentrating machines since no one machine can make a satisfactory separation when fed with a mixture of coarse and fine. When all the ore is reduced directly to a fine state, as for flotation, this preliminary grading is unnecessary.

Crushing customarily proceeds in steps and the best practice is to remove from the feed to any one crushing machine all particles which are already as fine as the product of that machine. Some machines, such as stamps, have a screen as an integral part of the machine to guarantee that the product shall all be below a specified maximum size while other machines, such as rolls and ball mills, require that a screen or classifier be connected in "closed circuit" with the crushing device to size out the finished product and return the coarse unfinished material for further reduction. Roughly, the field of coarse crushing involves the use of breakers of the Blake or gyratory type which receive lumps up to 5 or 6 ft. in diameter and reduce in a series of steps, with a reduction in size of about one-quarter at each step, down to a final product 1 or $1\frac{1}{2}$ in. in size. For intermediate crushing, there are rolls, steam stamps, Symons disc crushers, both horizontal and vertical and Symons cone crushers. Rolls handle feeds up to 1 or 2 in., make about one-fourth reduction in size and can crush economically down to $\frac{1}{8}$ or $\frac{1}{16}$ inch. Steam stamps, which are limited to use on the special problem of native copper ore, strike an extremely powerful blow by a steam-driven pestle in a mortar. The feed is 2 or 3 in. in size and the product $\frac{1}{4}$ or $\frac{1}{2}$ inch. The Symons machines are relatively new but are finding wide application in the field of crushing between 6 or 8 in. feed and around $\frac{1}{2}$ in. product. In the Symons cone, the central gyrating cone is very flat and is overlain instead of surrounded

by the fixed ring. The Symons disc crushers have a wobbling or tipping disc and a fixed disc. At a given instant, a point on the circumference of the wobbling disc is approaching the fixed disc while a point 180° away or diametrically opposite, is receding. This motion progresses around the circle so that in a complete wobble the space between the discs has opened and closed at every point. Many devices have been used for fine crushing or grinding but the more important are gravity stamps, roller mills, grinding pans, ball mills, rod mills, tube mills, Chile edgestone mills, arrastras and hinged hammer mills. The gravity stamp is discussed under AMALGAMATION: *In Metallurgy*. The grinding pan is a modification of the amalgamation pan which is also referred to under Amalgamation. The arrastra or drag-stone mill grinds the ore by dragging flat stones around a circular stone pavement. Roller mills employ cylinders which roll around inside a circular ring and ore is crushed between the rollers and the ring by pressure developed through centrifugal force or springs. Chile mills have heavy horizontal rollers travelling around a circular path. Hinged hammer mills and other forms of beating mills utilize the crushing effect of blows delivered upon the ore in space by arms or blades revolving at very high speed. Ball mills, rod mills and tube mills are horizontal revolving cylinders in which are iron balls, steel rods or flint pebbles to grind the ore as it passes through the cylinder from end to end. These revolving mills are used almost universally in ore dressing for wet fine grinding of ore for tabling and flotation, in gold and silver milling for preparing ore for cyaniding and in reducing all sorts of commercial products wet or dry, even down to impalpable powder. Feed may be as coarse as 1 or 2 in., but $\frac{1}{4}$ or $\frac{1}{2}$ in. is more economical. Hinged hammer mills are best suited to soft materials. Arrastras are nearly obsolete, as also are grinding pans. Roller mills and Chile mills are no longer used to any extent in ore dressing but find some application in commercial grinding. The use of gravity stamps is confined to gold milling. Fine grinding consumes much power since the power required increases in geometrical ratio with the fineness of the product.

**Screens.**—To insure a definite maximum size of particle in crushing operations and also to prepare the ore into a series of products for final separation, ranging from coarse to fine, screens are commonly used for wet work above 1 or 2 millimetres. They may be made of parallel bars or grates, of plate with holes punched out or of woven wire cloth. Common types have the form of fixed incline screens, of gently sloping revolving cylindrical screens or trommels, of plane surfaces set nearly horizontal and shaken endwise or sidewise, of horizontal or gently sloping plane surfaces in which the whole screen and frame is given a relatively slow bumping motion, of an inclined woven wire screen which is given a very rapid vibration in a direction perpendicular to the plane of the screen or of an endless travelling belt of woven wire cloth. Fixed inclined screens are used only for coarse work above 1 or 2 in. and belt screens only for fine work below 1 mm. while vibrating screens are the favourite screen for work between 1 mm. and $1\frac{1}{2}$ inches.

**Classifiers** are used for wet grading of material below 1 or 2 mm. which is the practical limit of wet screening. Hydraulic classifiers consist of a trough with a series of pockets. The ore, carried along by water, is successively subjected to a rising current of water in each pocket. The velocities of the currents decrease in succeeding pockets so that the material discharged from the spigots ranges from coarse heavy particles in the first pocket to fine light particles in the overflow of the last pocket. Box classifiers or spitzkasten use no rising currents but increase the size of successive settling chambers so that finer and finer particles settle out from the horizontal carrying current. Mechanical classifiers employ raking devices which stir up the pulp so that only coarser particles can settle and be raked up an incline and thus removed from the pulp which still contains the finer particles in suspension. Settling tanks and thickeners are large vats in which the water moves extremely slowly so that solids settle out almost completely and are discharged from the bottom while clear water overflows from the top.

**Hand Picking** is used occasionally to remove either rich material or waste material by hand from a stream of ore on a conveying belt or moving table. The economical minimum limit of hand picking is around 2 inches. Where hammers are used in connection with hand picking to cleave lumps of mixed values and waste, the operation is called cobbing.

**Log Washers and Wash Trommels** serve to disintegrate certain types of ores such as nodules of iron oxide in a clay matrix. They agitate the mass of ore and water, thus freeing the nodules from the clay and washing away the clay in the overflow at the lower end of the log washer or in the undersize of the trommel.

**Jigs** are the almost universal machines for separating ore in sizes ranging from $1\frac{1}{2}$ or 2 in. down to $\frac{1}{16}$ inch. In the movable-sieve type the ore on a screen is stratified by moving the screen up and down in water, while in the fixed-sieve or Harz jig a plunger on one side of the partition causes an alternate up and down current through the ore on a fixed sieve. Heavy minerals settle into the bottom layer of the bed, while lighter minerals are in the top layer. These heavy minerals, if fine enough, pass through the sieve into the hutch below and issue from the spigot outlet at the bottom. If too coarse to pass the sieve the concentrates layer is removed continuously by a device known as an automatic discharge. Fresh water is added continuously. A jig may be used singly, or with two to six cells in series.

**Jerking Tables: Wilfley Table.**—These tables take up the work where jigs leave off at about $\frac{1}{16}$ in. and may handle graded material down as fine as $\frac{1}{8}$ millimetre. The Wilfley table represents the original of this type of table and consists of a four-sided plane surface having a slight slope downward. A series of riffles or thin cleats are tacked on a smooth linoleum-topped table and each riffle has its maximum vertical thickness at the right and tapers down to nothing at the left. Ore and water are fed at one end of the upper edge, while wash water is fed along the remainder of the upper edge. A differential reciprocating action moves the ore lengthwise of the table toward the left while the washing action of the water across the table at right angles to the shake causes the ore to spread out in the form of a fan with concentrates nearest the upper or wash water side. The concentrates are finally shaken over the end, while the tailings are washed over the lower edge.

**Vanners and Slime Tables** which are suited for finer material ($\frac{1}{2}$ mm. maximum) are much less used since the development of the flotation process. The vanner feeds the ore and water on an endless rubber belt which is shaken crosswise while moving uphill. Wash water, together with the slope of the plane and the speed of the belt travel, determines the character of the grain that can pass over the upper roller and be washed off into the concentrates tank. All other grains of lighter waste mineral are washed down the plane and into the tailings. A revolving type of slime table consists of a flat cone. Ore and water are fed at the centre over one-half of the circle. Light minerals reach the circumference of the table first and are discharged as tailings. Middlings are carried around by the revolution of the table and are washed off by a curved water jet while concentrates are finally removed by strong jets of water from a straight pipe. Many other forms of vanners and fixed and moving slime tables and buddles have been used for concentrating fine slimes.

**Electro-magnets** are in use in most modern mills to remove metallic iron, such as bolts, nuts and broken drills, which has become mixed with the ore during mining. Magnetic separation is also applied where one of the minerals to be separated possesses magnetic properties. Magnets are of many types to operate on different sizes of ore, wet or dry, or to give high or low strength of field.

**Dry or Pneumatic Concentrating Devices** may be classifiers, jigs or tables. In every case the separation is by specific gravity, and air currents replace water currents as the separating medium. Flotation machines are described under FLOTATION. Other miscellaneous separators based on principles outside of specific gravity, magnetism and flotation, are not of sufficient importance to warrant any description here.

**Accessory Apparatus.**—In addition to the machinery for crushing, grading and concentrating, an ore dressing plant includes

other apparatus which is absolutely essential even though performing no actual separation. Under such apparatus may be listed storage bins for ore and products; sampling devices; automatic feeders and distributors or dividers; chutes and troughs or launders for dry and wet material; conveyors, of which the belt and pan types are most common; bucket elevators for dry ore or ore with water; centrifugal pumps for water mixed with sand or slime or for water alone; unwatering devices for recovering water; filters for fine concentrates; driers for removing moisture from ore or from concentrates; dust collecting systems; automatic weighing machines.

**Complete milling processes** are of wide variety according to the nature of the material to be concentrated. Perhaps the simplest process is the treatment of sands and gravels which contain valuable minerals such as gold, platinum and gems. A long trough or sluice is used on the bottom of which are small depressions called riffles in which the heavy values settle. The rough concentrates thus produced are removed or "cleaned up" periodically and are usually further enriched by some finishing treatment such as amalgamation, hand panning, tabling or magnetic separation.

Sulphide ores consisting of gangue mixed with sulphide of a single metal such as of iron as pyrite or of zinc as sphalerite or of lead as galena or of copper as chalcocite, bornite or chalcopyrite, may have the sulphides occurring as relatively large masses in the gangue, in which case the ore is crushed in a series of steps using breakers and rolls or Symons crushers until the sulphide grains are largely freed from the adhering gangue. This size may vary from 1 in. down to 1 mm. according to the ore. The crushed material is next graded by screens and classifiers into one or more coarse sizes for jigs, one or more sand sizes for tables and slimes for flotation. The jigs, tables and flotation each make clean concentrates to be saved and waste tailings to be discarded and usually also a middling product which, if coarse, must be recrushed and retreated or, if fine, needs only retreatment without any crushing. If the sulphides are finely disseminated through the gangue, the ore is crushed down to $\frac{1}{4}$ mm. or finer, using ball mills or rod mills as the last step in crushing and all of it treated by flotation. Occasionally the metals occur, not as sulphides, but as oxides, carbonates or silicates but the process is similar to that for sulphides, except that special flotation reagents are required for these minerals.

Where ores are complex, that is, containing sulphides of two or more metals, the tendency of modern practice is to discard gravity concentration and separate the different metallic sulphides from one another and from the gangue by differential flotation.

Tin ore in Cornwall contains cassiterite associated with sulphides of other metals, with wolfram and with siliceous gangues. The ore is broken to about 3 in. and hand picked to remove any lumps of clean minerals and the residue is crushed in gravity stamps to about $\frac{1}{2}$ mm. and concentrated by gravity by a rather complex system of jerking tables, vanners and slime tables of various kinds. Wolfram may be removed from the final concentrates by magnets. Sulphides may be separated from cassiterite by flotation as is the common practice on tin ores in Bolivia.

Native copper ores at Lake Superior are crushed in breakers to about 3 in., further reduced in steam stamps to about $\frac{3}{8}$ in. and then graded by hydraulic classifiers into a series of products, usually six. The coarser products are jigged and the finer products are tabled. Coarse middlings are reground in ball mills and retabled. Flotation may be used for slimes.

Iron is a relatively cheap metal so the concentration of iron ores must be on a large scale and at low cost. If the mineral is magnetite, the process is to crush the ore in breakers and rolls sufficiently to free the mineral and then use low power electromagnets, either wet or dry, to take out the magnetite. On hematite and limonite ores, the concentration of the crushed ore is usually by log washers or similar devices, but sometimes by jigs and tables. Slimes are usually thrown away without any attempt to recover the iron in them.

Manganese ores containing pyrolusite as the valuable mineral are handled in much the same way as hematite iron ores. For the special problem of the franklinite ores at Franklin, N.J., the ore, after crushing and sizing is run dry over high power Wetherill magnets which take out the franklinite and send the residue to wet jigs and tables which separate oxide and silicate zinc minerals from the waste limestone tailings. The treatment of gold ores is covered elsewhere under AMALGAMATION and CYANIDE PROCESS.

Many non-metallic minerals require concentration which may involve special processes. Serpentine rock containing asbestos is first cobbed and hand picked for coarse masses of solid asbestos. The residue is disintegrated by a form of hammer mill which reduces the rock to sand and liberates the fibre as a fluffy mass which when sent to a screen remains on the screen as oversize, while the sand passes through as undersize. Diamondiferous rock in South Africa is crushed in breakers and rolls, agitated with water in large circular pans to remove light fine waste material and leave a concentrated residue to go to jigs. The diamonds are recovered from the jig concentrates by hand picking on the coarse, and greased tables on the fine.

Phosphate deposits in hard rock use crushers and log washers or in soft rock or pebble form only log washers. Graphite ores employ crushing and flotation with special electrostatic process for removing mica from the concentrates. Ores of corundum, emery, ilmenite and such like, generally require a combination of gravity treatment on tables followed by further cleaning on magnets.

Coal preparation is a form of ore dressing which is based on the same fundamental principles as ore dressing, but which employs some additional processes and apparatus to meet the needs of the special problem of saving the light weight coal from the heavier slate impurity on a large scale at a low cost and with a minimum loss of coal. (C. E. L.; X.)

**OREGON,** popularly known as the "Beaver State," is one of the north-western States of the United States of America, lying on the Pacific slope between 42° and 46° 18′ N. lat., and 116° 33′ and 124° 32′ W. longitude. It is bounded on the north by Washington, from which it is separated in part by the Columbia river and in part by the 46th parallel, on the east by Idaho, from which it is separated in part by the Snake river, on the south by Nevada and California and on the west by the Pacific ocean, upon which it has a tidal shore line, omitting islands, of 429 miles. It has an extreme length E. and W. of 375m., and extreme width N. and S. of 290 mi. and a total area of 96,981 sq.mi., of which 631 sq.mi. are inland water surface. Spanish, French and Indian sources for the name "Oregon" have been suggested but its definite origin is unknown. The first known use of the word is by Major Robert Rogers in his plans for an exploring expedition to the northwest coast in 1767. He applied it to a river flowing into the Pacific ocean of which he had heard, and it was later applied to the Columbia river and then to the entire territory drained by the river. Out of this original territory other states were created until only the present area was left to bear the name.

**Physical Features.**—The coast of the state extends in a general north and south direction for about 300 mi. and consists of long stretches of sandy beach broken occasionally by lateral spurs of the Coast range, forming small bays. Parallel with the coast and with its main axis about 20 mi. inland is an irregular chain of hills known as the Coast range. It does not attain a height greater than 4,097 ft., but has numerous lateral spurs, especially toward the west.

Several small streams, among them the Nehalem, Coquille, Rogue and Umpqua rivers, cut their way through the Coast range to reach the ocean. For the northern two-thirds of its length in Oregon, the Coast range is bordered on the east by the Willamette valley, a region about 200 mi. long and about 30 mi. wide, and the most thickly populated portion of the state; there, therefore, the range is easily defined, but in the south, near the Rogue river, it merges apparently with the Cascade and the Sierra Nevada mountains in a large complex group designated as the Klamath mountains, lying partly in Oregon and partly in California, and extending from the northern extremity of the Sierra Nevada to the sea. A number of ridges and peaks bearing special names, such as the Rogue river, Umpqua and Siskiyou mountains, belong to this group. The Cascade mountains, the most important range in Oregon, extend parallel with the coast

and lie about 100m. inland. The peaks of this system are much higher than those of the Coast Range, the highest of them being cones of extinct volcanoes. Mt. Hood (11,225ft.), the highest point in the State, Mt. Jefferson (10,495ft.), the Three Sister Peaks, Mt. Adams, Bachelor mountain and Diamond Peak, all have one or more glaciers on their sides.

The Cascade mountains divide the State topographically into two sharply contrasted parts. West of this range the country exhibits a great variety of surface structure, and is humid and densely wooded; east of the range it consists of a broken tableland, arid or semi-arid, with a general elevation reaching 5,000 feet. This eastern tableland, though really very rugged and mountainous, has few striking topographic features when compared with the more broken area to the west. In the north-eastern part of this eastern plateau lie the Blue mountains, which have an average elevation of about 6,000ft. and decline gradually toward the north. A south-western spur, about 100m. in length, and the principal ridge together enclose on several sides a wide valley drained by the tributaries of the John Day river. Draining the eastern slopes of the Cascade Range for the northern two-thirds of its length and flowing into the Columbia a few miles west of the mouth of the John Day river is the Deschutes river, flowing through a valley less arid than the plateau region to the south-eastward. South-east of the Deschutes river and south of the Blue mountains lies the Great Basin region. In Oregon this area extends from the Nevada boundary northward for about 160m. and embraces an area of about 16,000 sq. miles. All of its streams lose their waters by seepage or evaporation. Many of the mountains within the basin region consist of great faulted crust blocks, with a general north and south trend. One face of these mountains is usually in the form of a steep palisade, while the other has a very gradual slope. Between these ridges lie almost level valleys, whose floors consist partly of lava, partly of volcanic fragmental material, partly of detritus from the bordering mountains.

Some large permanent lakes occupy the troughs between faulted blocks in southern Oregon, among them Malheur and Harney lakes in Harney county, Lake Albert, Warner and Summer lakes in Lake county. All of these are salt and shallow, and shrink to small proportions in the dry season. East of the Steens mountains there is, besides a number of small alkaline lakes, a playa, or mud flat, known as the Alvord Desert, which in the spring is covered with 50 to 60 sq.m. of rain water but a foot or two in depth. In the north-western quarter of the basin, occupying a level tract 150m. long and 30–50m. wide, is the Great Sandy desert. Its surface consists of a thick sheet of pumiceous sand and dust, from which arise occasional buttes and mesas. There are no surface streams even in the wet region, and no potable waters have been found. South-west of the basin and draining the southern third of the eastern Cascade slopes is the Klamath valley and river, containing the Upper and Lower Klamath lakes, much noted for their scenic beauty. Near the north-western boundary of Klamath county is Crater lake, whose surface is 6,239ft. above the sea. This lake lies in a great pit or caldera created by the wrecking in prehistoric times of the volcano Mt. Mazama, which according to geologists once had an altitude of about 14,000ft. above the sea and of 8,000ft. above the surrounding tableland; the upper portion of the mountain fell inward, possibly owing to the withdrawal of interior lava, and left a crater-like rim, or caldera, rising 2,000ft. above the surrounding country. The lake is 4m. wide and 6m. long, has a depth in some places of nearly 2,000ft. and is surrounded by walls of rock from 500 to 2,000ft. high. In spite of its great elevation the lake has never been known to freeze, and though it has no visible outlet its waters are fresh.

East of the Great Basin and the Blue mountains is the region tributary to the Snake river. The southern half, drained by the Owyhee river, is much like the Great Basin, being arid and plain-like in character. North of the Owyhee the chief tributaries of the Snake are the Malheur, Burnt, Powder and Grande Ronde rivers flowing through small but beautiful and fertile valleys.

**Climate.**—Along the coast the climate is humid, mild and uniform; in the eastern two-thirds of the State, from which the moisture-laden winds are excluded by the high Cascade Range, the climate is dry and marked by great daily and annual ranges of temperature. Along the coast the temperature is never as high as 100° or as low as zero. In the Willamette valley a few degrees may be added to each extreme, but rarely is there freezing weather; flowers bloom at Portland the year round. Along the coast precipitation is 138in. annually; in the valleys east of the Coast Range it varies from about 20in. at the southern end to 45 in. at Portland; along the Columbia valley east of the Cascades, from 10 to 15in.; in the valleys and foothills of the Blue mountains, from 12 to 25in., and, in the plateau region of central and southeastern Oregon, from 2 to 22 inches. At Portland the normal temperature for the summer months is 64° and for the winter months 40°, and the average temperature has varied between 51° and 53°, with extremes of −2° and 102°; average annual rainfall 45·1 in.; and average annual humidity 74%. In the Columbia river valley east of the Cascades, records for the same period at Walla Walla, Wash., very near the Oregon boundary, show a summer normal of 72° and a winter normal of 35°, with extremes of −17° and 113°; average annual rainfall 17·7 in.

**Government.**—Oregon is governed under its original constitution adopted in 1857, though many amendments have changed it in a number of important respects. This constitution may be amended: (1) by a majority of the popular vote if the amendment has been passed by a majority vote of the legislature, (2) by direct initiative petition by the people or (3) by a constitutional convention, which may not be called, however, unless the law providing for it is approved by popular vote. The legislative power is vested in a legislative assembly of two houses, but limited by the direct action of the people who possess the initiative and referendum. The upper house is composed of 30 senators, and the lower house of 60 representatives (the maximum allowed under the state constitution is 30 and 60 respectively), elected for four and two years respectively. The regular session is held in January of odd-numbered years. A bill not vetoed by the governor in five days becomes a law; if vetoed, it must be repassed by a two-thirds vote in each house. The governor has a "single item veto" in addition to the general veto.

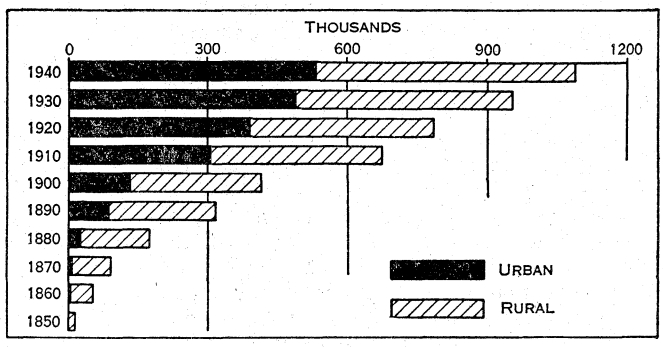
An amendment to the constitution, passed in 1902, initiated measures which have become widely known as the "Oregon system." Its distinctive features are: (1) the initiative, (2) the referendum, (3) constitutional amendment by direct action of the voters, (4) direct primary, (5) Corrupt Practices act, (6) presidential preference primary, (7) campaign textbooks, (8) the recall. For the initiative 8% of the number voting for justice of the supreme court at the last general election must sign petitions on which the proposed law is printed before it is put upon the ballot at the next election. Five per cent of the voters signing such petitions procure a referendum on any law passed by the legislature, and the legislature may itself refer any law it has approved to the people at the next election for their approval. All public officials are subject to the recall, adopted in 1908. It is rarely put into practice. An important and useful feature of the "Oregon system" is the campaign text-book. In the case of individual candidates the expense is borne partly by the candidates themselves.

The executive power in Oregon is vested in a governor elected for a four-year term. There is no lieutenant governor. The principal administrative officials of the State, all elected, are the secretary of State, treasurer, attorney general, superintendent of public instruction, dairy and food commissioner, and labour commissioner. A greater number of other administrative officers are appointed by the governor, among them the adjutant general, the State forester, State game warden, State health officer, State librarian, three State highway commissioners and three public service commissioners. A large number of State boards and commissions whose members are appointed are also necessary for the administration of Government, among them the board of control, land board, tax commission, board of education, public service commission, industrial accident commission, water board, parole board, board of health, industrial welfare commission and the Oregon State library.

The administration of justice is entrusted to a supreme court, circuit courts, county courts and justices of the peace. There are

also municipal courts in the cities and several special courts in Multnomah county. There are seven supreme court justices elected for a term of six years. The sessions of the court are held both at Salem and Pendleton. Circuit courts are held in 17 judicial districts, many districts having several justices. The constitution of Oregon provides that in civil cases three-fourths of a jury may render a verdict. The county court is an administrative, not judicial body, consisting of the county judge and two commissioners. The county judge, however, handles probate and juvenile court matters, in addition to his administrative duties.

**Population.**—The population of Oregon in 1850 was 13,294; in 1870 it was 90,923; in 1890, 317,704; in 1910, 672,765; and in 1940, 1,089,684. This last figure represents an increase of 14·2% over the population in 1930. The population per square mile was




BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF OREGON, 1850–1940

11·3, as compared with 44·2 for the United States as a whole. Of the 1940 population, 531,675, or 48·8%, lived in urban places, that is, in cities of 2,500 or more. The rural population, occupying the remainder of the state, thus constituted 51·2% of the total. The number of occupied dwelling units returned in the housing census of 1940 was 337,731, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 3·6 in 1930 to 3·2 in 1940. The white population of Oregon formed 98·7% of the total in 1940, as compared with 98·4% in 1930, practically all the nonwhite population being Indian, Chinese and Japanese. The number of males per 100 females in the entire population of the state was 108·0, though there was a slight excess of females in the urban population, the sex ratio being 97·9 for the urban and 118·7 for the rural population. The population of the state and of its principal cities is summarized below:

| Area | Population | | | Percent of increase | |
|---|---|---|---|---|---|
| | 1940 | 1930 | 1920 | 1930–40 | 1920–30 |
| The State | 1,089,684 | 953,786 | 783,389 | 14·2 | 21·8 |
| Urban | 531,675 | 489,746 | 391,019 | 8·6 | 25·5 |
| Rural | 558,009 | 464,040 | 392,370 | 20·3 | 18·1 |
| Percent urban | 48·8 | 51·3 | 49·9 | .. | .. |
| Principal cities: | | | | | |
| Portland | 305,394 | 301,815 | 258,288 | 1·2 | 16·9 |
| Salem | 30,908 | 26,266 | 17,679 | 17·7 | 48·6 |

**Finance.**—The value of all tangible property in Oregon was estimated in 1929 at $3,844,000,000 and in 1939 at $3,004,541,216. The assessed valuation of taxable property was $924,071,621 in 1935 and $896,787,005 in 1940. Receipts of the state treasury for the fiscal year 1940 were $93,920,075, and expenditures were $93,063,251. Of this the general fund received $47,474,913 and disbursed $48,636,877 during the year 1940, the World War veterans' aid fund disbursing $2,692,638. The cash on hand on June 30, 1940, the end of the fiscal year, amounted to $451,280. The state general fund revenue is derived largely from a direct property tax, also from fees, licences and special taxes. The direct property tax for the state general fund amounted to $2,667,997 in 1935 and $2,613,941 in 1936.

Oregon was the first state to levy a tax on gasoline as a means of financing highway construction and maintenance. Fees of the motor vehicle department amounted to $6,341,285 and were also used for highway purposes. The total revenue of the state in 1931 secured by direct and indirect taxation amounted to $30.85 per capita. The total revenue from taxation in 1938 was $64,199,721.

The total indebtedness of the state in 1939 was $40,425,660 of which the chief items were $17,841,750 for highway bonds and $20,375,000 for state veterans' aid. Provisions were made for the retirement of all these bonds as they came due. County indebtedness in 1940 amounted to $27,499,741, school districts indebtedness to $13,366,306, and city and town indebtedness to $47,479,174. In 1939 there were 75 banks in the state, 27 of them national banks, with total resources of $328,800,000. Their total deposits June 30, 1939, were $300,400,000, of which $122,700,000 were in savings accounts.

**Education.**—The school system of Oregon is under the control of a state board of education composed of the governor, secretary of state and the superintendent of public instruction. The progress of education in the state is represented in the following figures: the school enrolment of 175,510 in 1924 increased to 201,556 in 1934 and 205,928 in 1940. High school enrolment increased from 47,687 to 55,419 and 63,057 for the same years. The total cost of education increased from $19,119,271 in 1924 to $19,573,000 in 1930 and was $18,581,000 in 1940.

The number of teachers increased from 6,208 in 1930 to 8,057 in 1940. Of the 193,861 pupils for the year 1938, 133,374 were in grade schools and 60,487 in high schools. There were 10,040 enrolled in the private and parochial schools, of whom 2,481 were in high schools. There were 7,225 public-school teachers whose average salary was $1,286.

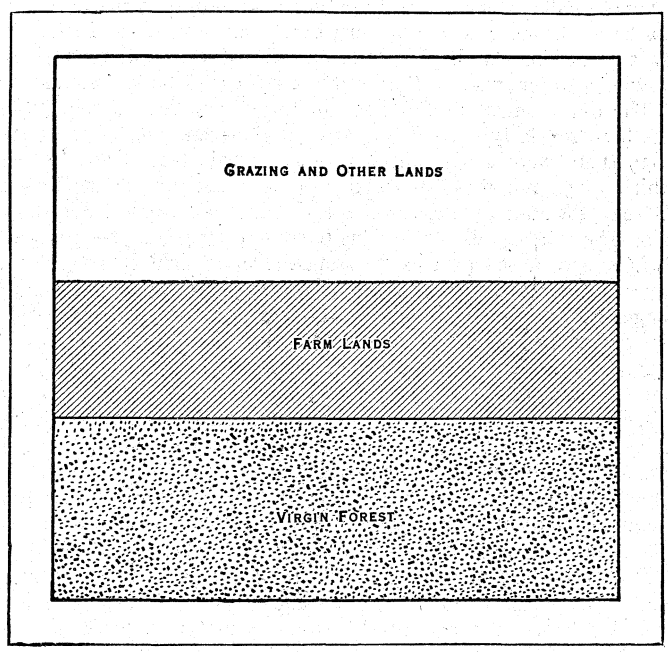
State institutions of higher learning are the state normal school at Monmouth, the Southern Oregon State Normal school at Ashland, Eastern Oregon College of Education, a normal school at La Grande, which opened its doors in 1929, after it was authorized by a vote of the people in 1926 (its enrolment in 1940–41 was 344); the Oregon State Agricultural college at Corvallis, and the University of Oregon at Eugene. The first was the only state normal school until 1925 when the legislature appropriated $175,000 as a special building fund for the Southern Oregon State Normal school and provided an annual tax levy of $\frac{1}{2}\frac{1}{5}$ of a mill for its support and maintenance. It opened in 1926. The normal school at Monmouth had an attendance in 1940 of 850 students, but it was unable to meet the demands of the state for trained teachers. Oregon state college had in 1940–41 an enrolment of 5,083. The school offers degrees in engineering, agriculture, home economics, commerce, forestry, pharmacy, vocational and educational courses. Degrees conferred in 1938 were 589. The agricultural college also has charge of the eight agricultural experiment stations located at Corvallis, Union, Moro, Hermiston, Talent, Burns, Astoria and Hood River. Its extension service work throughout the state is also of very great importance. The University of Oregon, founded in 1872, had in 1940–41 an enrolment of 3,600 full-time students. The number of degrees conferred in 1938 was 624. The University of Oregon under the state system of higher education conducts a medical school in Portland, which enrolls students from Oregon, Washington, British Columbia and Alaska and is the only medical school in the Pacific northwest. The North Pacific School of Dentistry, the only dental college in the Pacific northwest, is also located in Portland.

**Penal and Charitable Institutions.**—The Oregon state penitentiary, situated at Salem, is under the control of the governor. Its average daily population increased from 818 in the biennium 1932–34 to 1,029 in 1937–38. The prison has the most complete whipping, retting and scutching flax plant in the United States, also a lime plant doing excellent business, and a 43½-ac. farm. These industries furnish employment for the prisoners, who are paid a small wage for their labour, and help to support the institution. There is a prison library of 25,000 volumes. Under the direction of the Oregon state board of control are the Oregon state hospital for the insane at Pendleton and similar institutions throughout the state.

Oregon also provides state aid to a number of private charitable institutions in accordance with a law enacted in 1913. Such institutions make application to the board of health and, the

application being approved, receive $20 a month for each charity child under five years of age, and $16 per month for each child over five and under 17 years. The state child welfare commission passes on all petitions for adoptions, and inspects all institutions and maternity homes for which it issues licences.

**Agriculture and Livestock.**—Agriculture is the main industry of Oregon. Of 61,188,480 ac., the total area of the state, 29·2% or 17,988,307 ac. was in farm land in 1940. This represented an




CLASSIFICATION OF LAND AREA IN OREGON, 1936

increase of 630,307 over 1935. Public lands still unappropriated and unreserved amounted to 13,012,158 ac. in 1933 and 12,919,345 ac., in 1934. This represented less than one-fifth of the state. Homesteads in 1934 amounted to 118,853 ac. and in 1935 to 53,711 acres. Of the last named, 37,742 ac. were for stock raising only. The number of farms decreased from 64,826 in 1935 to 61,829 in 1940; the average acreage per farm increased from 267·8 to 290·9 during the same years. The value of farm land and buildings increased from $448,711,757 in 1935 to $476,817,354 in 1940 and the value of livestock decreased from $82,483,000 to $47,805,000. Farms operated by tenants, contrary to the general tendency in the United States, increased from 17·8% in 1930 to 21·7% in 1935. These statistics reveal that Oregon survived the period of agricultural distress following the depression with more success than most states. The good showing of the figures is due largely to steady production in the dairy and diversified farming valleys west of the Cascades. Dry-land farming suffered a serious setback in production.

Wheat is the principal grain, the acreage being 850,000 in 1940 and an average of 972,000 for the period 1929–38; the production was 17,184,000 bu. in 1940 and averaged 19,285,000 for the decade 1929–38. Wheat is raised mainly in eastern Oregon and north along the Columbia river; west of the Cascades farmers find their land too valuable as a rule to devote to the crop. Oats to the amount of 7,950,000 bu. were raised on 318,000 ac. in 1940; the average production for 1929–38 was 8,682,000 bu. Barley to the amount of an estimated 5,000,000 bu. was raised in 1940 on 200,000 acres. The production of Indian corn in 1940 was 1,860,000 bu. from 60,000 ac., slightly below the 1929–38 average of 1,862,000 bushels. The production and acreage of other important crops in 1940 were as follows, with average production for 1929–38 indicated in parentheses: tame hay, 1,532,000 tons from 823,000 ac. (1,549,000 tons); wild hay, 211,000 tons from 211,000 ac. (227,000 tons); alfalfa hay, 686,000 tons from 269,000 ac. (636,000 tons); potatoes, 8,510,000 bu. from 46,000 ac. (6,378,000 bu.).

Oregon is also an important fruit-raising state, and many western valleys are largely given over to the industry, notably the Rogue and Hood river valleys. Large orchards are found also in the Willamette valley and in the sheltered valleys of the Blue mountains in the northeast. The apple crop in 1940 was estimated at 3,160,000 bu., as against 2,900,000 bu. in 1939 and 3,462,000 bu. average for the five-year period 1934–38. The production of pears in 1940 amounted to 4,418,000 bu., of which 1,638,000 bu. were Bartlett pears. Oregon ranked third among the states in production of pears in that year. Cherry production for 1940 was 22,000 tons; peach production was 352,000 bu.; grapes, 2,300 tons; strawberries, 1,340,000 crates. Oregon led all other states in production of prunes, with 42,400 tons.

Irrigation is nowhere necessary west of the Cascade range but is necessary in eastern Oregon except in a few valleys along the Columbia and in the Blue mountains. There were but 1,478,128 ac. included in irrigation enterprises in 1930 as compared with 1,925,987 in 1920. However the acreage actually irrigated decreased from 986,162 to 898,713. Capital invested increased from $28,929,000 to $38,755,000, or from $21.52 to $33.46 per acre. The average cost of maintenance was in 1930 $1.41 per ac. as compared with $2.77 for all irrigated land in the United States. In 1934, 13,243 farms, or 20·4% of the total, reported using irrigated land. The total acreage of irrigated land from which crops were harvested was 578,838 in that year.

Great numbers of beef cattle are raised in eastern Oregon, while the Willamette and coast districts are especially favourable to dairying. The number of all cattle and calves was estimated at 1,042,000 on Jan. 1, 1941. Of these, 260,000 were milch cows, heifers and heifer calves. The value of all cattle on that date was $44,062,000. During 1940, 1,394,000,000 lb. of milk were produced on Oregon farms. Hogs on Jan. 1, 1941, numbered about 250,000, valued at $1,959,000. Eastern Oregon is noted for sheep raising. The number of sheep increased from 1,775,093 in 1925 to 3,319,271 in 1930, but thereafter decreased and was only 1,946,000 in 1941. Their total value in the same years amounted to $23,092,000, $22,396,586 and $14,665,000 respectively. These figures show the depression in the industry which began shortly after 1930. An increase in wool prices after 1933, however, helped the sheep raisers to some extent. Horses and colts on Oregon farms Jan. 1, 1941, were estimated to number 147,000, valued at $8,972,000. The average number for the ten-year period 1930–39 was 162,000, and the average value was $10,862,000. Mules and mule colts on Jan. 1, 1941, were estimated at 7,000, valued at $455,000; the average number during the period 1930–39 was 10,000, valued at $704,000. The aggregate value of livestock in Oregon Jan. 1, 1941, was estimated to be $70,113,000, as compared with the ten-year (1930–39) average of $55,810,000. Poultry raising is also an important industry. On Jan. 1, 1941, there were 2,938,000 chickens valued at $2,262,000 and 380,000 turkeys valued at $969,000.

**Mining.**—The value of the mineral products of Oregon was $6,170,000 in 1930, $4,211,000 in 1934 and $7,536,091 in 1938; it was estimated at $11,547,000 for 1940. The leading product in 1938 was gold, of which 81,729 troy oz. valued at $2,860,515 were produced. Second in importance was stone; the production in 1938 was 2,355,970 short tons (exclusive of granite) valued at $2,025,335. Oregon supplies its own needs in building stone. Volcanic tuff, occurring over a wide area in eastern Oregon and in parts of western Oregon, has proved valuable, for it is easily worked, of pleasing appearance, light in weight yet strong and durable. Sand and gravel valued at $926,661 (2,079,026 short tons) were produced in 1938. Clay products of 1938 were valued at $226,312. There is an abundance of materials for making lime and cement. The Coos Bay coal field is the only important coal-producing district in the state. Iron is found in commercial quantities in Columbia and Washington counties. Between 1860 and 1880 the mining of precious metals was a major industry in Oregon and was responsible for the early settlement of many localities; but by 1930 the total value of all metals mined was only $355,380. By 1940, however, the value had risen to an estimated $5,794,000. The production of silver in 1938 was 100,507 troy oz. valued at $64,974. Copper production was only 76,000 lb.

valued at $7,448, as compared with 820,000 lb. valued at $99,220 in 1937. In 1938, 4,610 flasks (76 lb.) of mercury, valued at $347,917, were mined. Small quantities of lead, platinum, diatomite and zinc are also mined. The value of miscellaneous minerals in 1938 was $1,074,030.

**Fisheries.**—The fisheries of Oregon in 1935 employed 4,300 persons, represented an investment of $5,000,000 and produced 26,458,000 lb. of fish. Of the 1935 catch, 22,980,000 lb. or about 83% of the total was salmon. Another fishing industry is the catching and processing of pilchards.

**Forests and Lumbering.**—It is Oregon's distinction that within her borders is more standing timber than in any other state. It amounts to about 438,000,000,000 board feet or nearly one-fifth of the supply of the whole United States. Of this, 234,000,000,000 ft. are privately or state owned, while 204,000,000,000 ft. are in the 13 national forests of the state, with a net total area of 13,701,834 ac. The national forests include all the higher mountain areas. The backbone of the Cascade range and its higher slopes from Mt. Hood to California comprise six forests of about 1,000,000 ac. each. In the Coast range are two forests with a combined area of 1,500,000 ac. while in the Wallowa and Blue mountains in eastern Oregon are six more totalling some 5,500,000 acres. On the western slopes of the Cascades especially at the lower elevation are some of the finest stands of timber in the world made up of such species as Douglas fir, western hemlock and western cedar. On the east slopes of the Cascades and in the Wallowa and Blue mountains where the climate is much drier the timber is more open, and Ponderosa pine replaces Douglas fir as the chief commercial tree.

Lumber production fell from 4,784,000,000 bd.ft. in 1930 to 1,604,000,000 bd.ft. in 1932, and 2,380,000,000 bd.ft. in 1934. Oregon's annual cut in lumber ranks second only to Washington. Oregon ranks first in the U.S. in the amount of spruce cut; first in western yellow pine; second in cedar; second in Douglas fir; third in sugar pine; and fourth in hemlock. The lumber industry in all its branches gives employment to about 52,000 men and women. The value of the cut in 1940 was about $177,000,000, of which $56,000,000 was for salaries and wages.

**Manufactures.**—In the years 1929–33 the value of Oregon's manufactures fell almost 235%. There were, in 1929, 2,450 factories employing an average of 65,390 workers, paying $86,728,000 in wages, producing goods valued at $408,160,000, of which $205,676,000 was added by manufacture. In 1933 there were 1,358 establishments, employing 41,052 workers, paying $34,787,000 in wages, producing goods worth $174,124,000 of which $86,553,000 was added by manufacture.

By 1937, however, industry in Oregon had recovered considerably. In that year there were 2,107 establishments with 65,982 wage earners; the total value of products was $363,142,053, of which $169,056,912 represented value added by manufacture. Total wages paid in that year amounted to $79,492,397; the cost of materials was $194,085,141. Lumber was the principal industry, with 693 establishments manufacturing products valued at $127,760,857. Second in importance was the canning of fruits, vegetables, juices, preserves, etc.; the total value of this industry's products was $24,212,542. The industries next in importance, with the value of their products, were as follows: flour and other grain-mill products, $19,138,231; meat packing, $17,255,182; paper, $16,643,999; bread and other bakery products, $11,175,578; butter, $10,972,515. In 1937 more than 4,000,000 cases of canned fruit were produced—about 6% of the total U.S. pack. More than 3,121,000 cases of canned vegetables were also packed, constituting nearly 3% of the total for the United States.

**Transportation and Commerce.**—The railway mileage of the state increased from 4,111 in 1925 to 4,893 in 1936, of which 560 mi. were electric roads operated by nine separate companies. The main steam railway lines were those of the Union Pacific, the Southern Pacific, the Great Northern and the Northern Pacific. The Union Pacific crosses the northeastern corner of the state to the Columbia river, which it follows to Portland. The Southern Pacific owns the main line between Portland and California, crossing the state north and south along the Willamette, across the Umpqua and Rogue river valleys and via the Klamath region. The mileage extension between 1910 and 1935 consisted mainly of branches from the Union Pacific into east central Oregon from the east, and into west central Oregon from the north; from the Southern Pacific line to the Pacific coast at Tillamook and Coos bay, and from the Willamette valley to Klamath Falls; and a line owned by the Great Northern from the Columbia river up the Deschutes river to a connection with the Southern Pacific Klamath Falls extension and then by common user to the southern border of the state. The Northern Pacific and the Great Northern by a joint line on the Washington side of the Columbia river provide a water grade to Portland, a terminus of both systems.

The development of the state highway system begun in 1917 has been regularly carried forward: at the beginning of the year 1939 there were 4,394 mi. of primary rural state highways, of which 4,254 mi. were surfaced and only 140 mi. nonsurfaced. In 1939, the state expenditure for highways amounted to $16,182,000. The funds available for this purpose during the year totalled $17,667,000, raised principally from motor vehicle fees and fuel taxes. Motor vehicle registrations for 1939, including both passenger cars and motor trucks, numbered 369,330. Receipts from the registration of motor cars amounted to $2,729,000 in 1939; from the five-cent gasoline tax (including tax on aviation gasoline), $10,591,000.

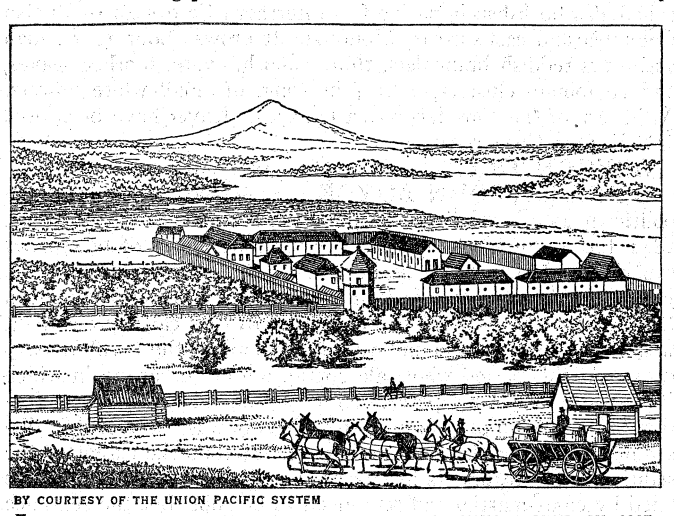
A deep-water channel in the Columbia and Willamette rivers makes Portland accessible for ocean-going vessels. The total cargo tonnage of exports from Oregon ports in 1938 was 861,940, of which Portland handled 694,161. Water-borne imports in 1938 amounted to 91,073 cargo tons, of which Portland received 86,771. The other principal ports are Astoria and Coos Bay.

**History.**—The Spanish pilot, Bartolomé Ferrelo, who in 1543 made the farthest northward voyage along the Pacific coast recorded in the first half of the 16th century, may have sighted the shores of Oregon. So also the famous English captain, Francis Drake, who in 1579 coasted these shores seeking a route home by a northwest passage, is supposed to have reached a point near 43° lat. before giving up the search and turning westward across the Pacific. In 1603 the Spaniards Vizcaino and Aguilar also passed 42° lat., Aguilar claiming to have reached a point of land near 43° which he called Cape Blanco. The Spanish, however, were too interested in the profitable trade between their colonies and the far east to give much attention to northwest exploration and it was not until 160 years later that the fear of Russian and English encroachment caused them to send out further expeditions. In 1774 Juan Pérez was sent out with orders to proceed to 60° latitude. He turned back at 54° but was the first to sail along the entire coastline of the Oregon country. The following year Bruno Heceta commanded another expedition which near Point Grenville made the first landing in the region. They erected a cross and in formal ceremony took possession for Spain.

The Spaniards made no effort to colonize northwestern America or to develop its trade with the Indians, but toward the end of the 18th century the traders of the great British fur companies of the north were gradually pushing overland to the Pacific. Upon the sea, too, the English were not idle. Capt. James Cook in March 1778 sighted the coast of Oregon in the lat. of 44°, and examined it between 47° and 48° in the hope of finding the Straits of Juan de Fuca described in Spanish accounts. Soon after the close of the Revolutionary War American merchants began to buy furs along the northwest coast and to ship them to China to be exchanged for the products of the east. It was in the prosecution of this trade that Capt. Robert Gray (1755–1806), an American in the service of Boston merchants, discovered in 1792 the long-sought river of the west, which he named the Columbia, after his ship. By the discovery of this river Gray gave to the United States a claim to the whole territory drained by its waters.

Land exploration soon followed these discoveries along the coast. Alexander Mackenzie, in the service of the North West company, in 1793 had explored through Canada to the Pacific coast in lat. about 52° 20′ N., and Meriwether Lewis and William Clark, American explorers acting under the orders of President Jefferson, in 1805–06 had passed west of the Rocky mountains

and down the Columbia river to the Pacific ocean. Both British and American adventurers were attracted to the region by the profitable fur trade. In 1808 the North West Company had several posts on the Fraser river, and in 1810 and 1811 they built others south of the 49th parallel. In 1811, also, the Pacific Fur Company, under the guidance of John Jacob Astor of New York, founded a trading post at the mouth of the Columbia which they



BY COURTESY OF THE UNION PACIFIC SYSTEM

FORT VANCOUVER OF THE HUDSON'S BAY CO. ESTABLISHED IN 1815, AFTER A SKETCH MADE BY STANLEY IN 1854

called Astoria, and set up a number of minor posts on the Willamette, Spokane and Okanogan rivers. On hearing of the war between England and the United States, Astor's associates, deeming Astoria untenable, sold the property in 1813 to the North West Company. The British took formal possession and renamed the post Ft. George.

Soon after the restoration of peace between England and the United States there arose the so-called "north-western boundary dispute" or "Oregon question" which agitated both countries for a generation and almost led to another war. The United States was willing at the time to extend the north-western boundary along the 49th parallel from Lake of the Woods to the Pacific, but to this the British Government would not consent, so in 1818 both nations agreed to a "joint occupation" for ten years of the country "on the north-west coast of America, westward of the Stony (Rocky) mountains." By treaty the following year Spain waived her claim to the territory north of 42° in favour of the United States, and in 1824 Russia likewise agreed to make no settlements south of 54° 40′. In 1827 the agreement of 1818 for joint occupancy by Great Britain and the United States was renewed for an indefinite term, with the proviso that it might be terminated by either party on 12 months' notice.

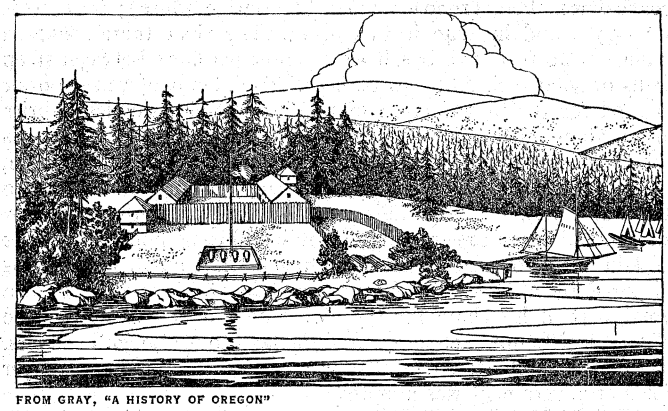
For the next three decades the history of Oregon is concerned mainly with the British fur traders and the American immigrants. The Hudson's Bay Company absorbed its rival, the North West Company, in 1821, and thus secured a practical monopoly of the trade of the Oregon region. Its policy was to discourage colonization so as to maintain the territory in which it operated as a vast preserve. The company sent to the Columbia river as its governor west of the Rocky mountains Dr. John McLoughlin who ruled the vast empire firmly and wisely for 22 years and became affectionately known as the "Father of Oregon." His capital was at Ft. Vancouver which he built on the north bank of the Columbia opposite the mouth of the Willamette river. In 1829 he also built an establishment at the falls of the Willamette which determined the site of Oregon City. Though it was against the company's interests he generously aided the American colonists who later came to the region, and later in life, after American Government was extended over the country, became himself a citizen of the United States.

The elderly employés of the company were urged by McLoughlin, when they wished to retire from active service, to settle with their families in the Willamette valley. There were a number of these first settlers, mostly Frenchmen, there by 1835. In 1834 Jason and Daniel Lee arrived from the United States and founded Methodist missions in the valley. In 1837 20 more missionaries arrived and a branch mission was opened at The Dalles. In 1838 Jason Lee started overland for the States, and his lecturing and preaching not only raised money for the mission but aroused great interest in Oregon, with the result that the American element was increased in 1840 by 50 more arrivals by sea. It now numbered 151. In 1842 the first immigrant train over the Oregon trail, headed by Elijah White and piloted by Thomas Fitzpatrick, arrived. The following was the year of the "Great Migration" when nearly 900 men, women and children likewise followed the trail and settled in the Willamette valley. After this the flow of immigrants steadily increased, about 1,400 arriving in 1844 and 3,000 in 1845.

The American settlers set in motion a movement for the immediate and permanent settlement of the Oregon dispute. They had in 1843 established for themselves a provisional Government, but settlement and business undertakings were held back until their future rulers and the nature of their permanent Government were settled. The western States rallied to their support with the result that the Democratic National convention in 1844 declared the title of the United States to "the whole of the Territory of Oregon" to be "clear and unquestionable," and the party made "Fifty-four forty or fight" a campaign slogan. Upon the success of the party, negotiations were entered into which resulted in a compromise treaty (1846) fixing the boundary between Oregon and British possessions at its present position, and giving the United States complete title to all land to the southward.

Territorial status and a Territorial Government were delayed until 1848 owing to opposition from the slavery element in Congress. As then constituted the Territory included the present States of Oregon, Washington, Idaho and parts of Montana and Wyoming. Its area was reduced in 1853 by the creation of the Territory of Washington. The discovery of gold in California drew many Oregon settlers to that country in 1848–50, but this exodus was soon offset as a result of the enactment by Congress in 1850 of the "Donation Land Act" by which settlers in Oregon were entitled to large tracts of land free of cost. The number of claims registered under this act was over 8,000.

In 1857 the people voted for Statehood; in the same year a Constitutional Convention drafted a Constitution which they adopted in November, and on Feb. 14, 1859, Oregon was admitted into the Union with its present boundaries. Gold had been discovered in paying quantities at Jacksonville in southern Oregon in 1815, and in 1861 was discovered in eastern Oregon along the John Day and Powder rivers. Each of these discoveries resulted in a stampede which settled a region which otherwise would have been settled very slowly. The increase of mining population in Oregon and Idaho encouraged agricultural development in that it provided markets. Permanent settlements were made in all the important valleys of eastern Oregon in the '60s. By 1870 the population of the State was 91,000. In the next 20 years it nearly doubled. This increase was due largely to the opening of railroad



FROM GRAY, "A HISTORY OF OREGON"

THE SETTLEMENT OF ASTORIA, OREGON, IN 1811, FOUNDED BY JOHN JACOB ASTOR AT THE HEAD OF THE COLUMBIA RIVER

connections with the outside world. Two lines, one on each side of the Willamette river, to connect with a line in California, were begun in 1868, but progress was so slow that the connection was not made until 1884. Meanwhile a line had been built up the Columbia river to meet the northern transcontinental lines being built west through Idaho, and this junction was effected in 1883. Many local lines were also built.

Politically the state has divided between the Republicans and Democrats, each party giving an almost equal number of governors. Only twice before 1932 did the state vote for a Democratic president. In that year and again in 1936 Oregon returned Roosevelt and the Democrats. Oregon cast its vote again for Roosevelt in 1940, although many of the other offices went Republican. The Bonneville dam, Columbia river, was completed in 1937 as part of the public works program.

BIBLIOGRAPHY.—The reports of the various state departments and state officials are invaluable for up-to-date general and specific information. Consult also the *Oregon Blue Book,* published biennially by the secretary of state; *The Mineral Resources of Oregon,* published irregularly, 1914 *et seq.,* by the Oregon bureau of mines and geology; *The National Forests of Oregon,* published (1923) by the U.S. department of agriculture: forest service. For government: G. L. Redges, *Where the People Rule; or the Initiative and Referendum, direct primary law and the recall in use in the State of Oregon* (San Francisco, 1914); H. B. Augur, *Government in Oregon* (1919); C. H. Carey, *The Oregon Constitution* (Salem, 1926). For history: W. H. Gray, *History of Oregon, 1792–1849* (Portland, 1870); H. H. Bancroft, *History of the Northwest Coast* (San Francisco, 1884), and *History of Oregon* (San Francisco, 1886–88); *Quarterly of the Oregon Historical Society* (1900 *et seq.*); H. S. Lyman, *History of Oregon* (1903), the best complete history of the state; R. G. Montgomery, *The White Headed Eagle, John McLoughlin* (1935); C. H. Carey, *History of Oregon* (Portland, 1922); J. B. Horner, *A Short History of Oregon* (Portland, 1924); H. W. Scott, *History of the Oregon Country* (1924); P. J. De Smet, *Oregon Missions* (various editions); J. H. Gilbert, "Trade and Currency in Early Oregon," *Columbia Univ. Studies in Economics* (vol. xxvi. No. 1, 1907); A. B. Hulbert, *The Call of the Columbia* (1934); A. Atwood, *The Conquerors* (1907); T. T. Geer, *Fifty Years in Oregon* (1912); George H. Putnam, *In the Oregon Country* (1915); D. Murphy, *Oregon the Picturesque* (Boston, 1917); W. J. Ghent, *The Road to Oregon* (1929); A. D. Pratt, *A Homesteader's Portfolio* (1922); Washington Irving, *Astoria* (various editions). For bibliography consult C. W. Smith, *Checklist of Pacific Northwest Americana* (1921); *Reports* of U.S. bureau of the census. (E. B. P.; X)

**OREGON CITY,** a city of Oregon, U.S.A., on the east bank of the Willamette river, 12 mi. S. by E. of Portland; the county seat of Clackamas county. It is on the Pacific highway, and is served by the Southern Pacific and electric railways and by motor coach lines. Pop. (1920) 5,686 (87% native white); in 1930 it was 5,761 and in 1940 it was 6,124. The river there makes a plunge of 40 ft. over a basalt ridge, and then flows between steep walls of solid rock 20 to 50 ft. high. The abundant water power is used for the manufacture of paper and pulp, woollen fabrics and various other commodities. Next to Astoria, Oregon City is the oldest settlement in the state. In 1829 Dr. John McLoughlin, chief agent of the Hudson's Bay company, established a claim to the water power at the falls and to land where the city now stands, and began the erection of a mill and some houses. In 1840 he laid out a town and named it Oregon City, but his claim was disputed by a Methodist mission, and in 1850 congress gave a great part of his claim for the endowment of a university. The Oregon legislature in 1862 restored the land to McLoughlin's heirs. The city was chartered in 1850. In 1924 a commission-manager form of government was adopted.

**OREGON-GRAPE** (*Mahonia aquifolium*), a North American evergreen shrub of the family of Berberidaceae, closely allied to the barberry (*q.v.*), found from British Columbia to Oregon. It grows from 3 to 10 ft. high and bears large pinnate leaves composed of five to nine thick, spiny-toothed, somewhat holly-like leaflets, bright yellow flowers in erect racemes, followed by showy clusters of small blue berries. The plant is the floral emblem or state flower of Oregon, and is widely grown as an ornamental.

**OREGON MYRTLE** (*Umbellularia californica*), a North American tree of the laurel family (Lauraceae, *q.v.*), called also California laurel, native to Oregon and California. It occasionally attains a height of 90 ft. and a trunk diameter of 5 ft., but is usually much smaller. The tree features lance-shaped, fragrant evergreen leaves, greenish-yellow flowers, in small clusters, and a somewhat olive-like, dark purple fruit (drupe). The wood is one of the most valuable cabinet timbers of the Pacific states.

**OREGON PINE:** *see* DOUGLAS FIR.

**OREGON TEA-TREE** (*Ceanothus sanguineus*), a name given to a large shrub of the buckthorn family (Rhamnaceae), called also buck-brush, native from northern California to British Columbia and eastward to Montana. It grows about 10 ft. high and bears reddish branchlets, thin, smooth, ovate, toothed leaves, and compound clusters, 2 to 4 in. long, of small white flowers. As in case of the New Jersey tea (*q.v.*), its leaves have been used as tea. (*See* CEANOTHUS.)

**OREGON TRAIL:** *see* OLD OREGON TRAIL.

**O'REILLY, JOHN BOYLE** (1844–1890), Irish-American politician and journalist, was born near Drogheda on June 28, 1844, the son of a schoolmaster. After some years of newspaper experience, during which he became an ardent revolutionist and joined the Fenian organization known as the Irish Republican Brotherhood, he enlisted in 1863 in a British cavalry regiment with the purpose of winning over the troops to the revolutionary cause. At this period wholesale corruption of the army, in which there was a very large percentage of Irishmen, was a strong feature in the Fenian programme, and O'Reilly was successful in disseminating disaffection in his regiment. In 1866 the extent of the sedition in the regiments in Ireland was discovered. O'Reilly was tried by court-martial and sentenced to be shot, but the sentence was commuted to 20 years' penal servitude. After confinement in various English prisons, he was transported in 1867 to Bunbury, Western Australia. In 1869 he escaped to the United States, and settled in Boston, where he became editor of *The Pilot,* a Roman Catholic newspaper. He subsequently organized the expedition which rescued all the Irish military political prisoners from the Western Australia convict establishments (1876). He was the author of several volumes of poetry, and of a novel of convict life, *Moondyne.* He died in Hull, Mass., on Aug. 10, 1890.

*See* J. J. Roche, *Life of John Boyle O'Reilly* (Boston, 1891).

**OREL** (now ORYOL), a region of the Russian S.F.S.R., surrounded by the regions of Tula, Smolensk, Mogilev, Gomel, Chernigov, Sumy, Kursk, Voronezh and Ryazan. Area 25,669 sq.mi. Pop. (1939) 3,482,388. Orel forms part of the Black Earth Area (Central), which was created in 1928. The region consists mainly of dissected plateau, drained by the Oka and its tributaries, flowing into the Volga, and the Sosna. On the water-partings between the streams, the Kurgans or artificial mounds, some containing burials and some being remains of earthworks, stand out sharply. In the Bolkhov and Dmitrov districts, the soil is podzol (*see* RUSSIA: *Soils*), but the rest of the region is covered with black earth. The forests have practically all disappeared and there is a great scarcity of wood and of fuel. For climate, the difficulties of agriculture and general social conditions *see* VORONEZH. Average January temperature 14.8°, average July 67°.

The chief crops are rye, oats, potatoes, millet and hemp. Very little wheat or sunflower seed is grown. Cattle, sheep and pigs are bred; in pre-World War I times Orel was noted for horse breeding, but their numbers diminished greatly owing to war requisitions and they are slow to recover. Livensk and Maloarchangelsk have however recovered their former position as regards horse breeding. Factory industries include the making of chemical manure from the phosphorites of the region, iron-mining and smelting in the Zinoviev district, near Dmitrovsk, and at Elets, flour-milling, distilling, leather and chalk. Koustar (peasant) industries include the making of ploughs, rope, makhorka tobacco, carpets, and, in the Elets district, lace. The region suffered much during the civil war 1917–20, and Elets changed hands several times. The chief towns are Orel and Elets.

In the 9th century a Slav tribe, the Vyatichis, was established on the Oka river and paid tribute to the Khazars. They recognized the rule of Rurik from 884 and were later absorbed in the principality of Chernigov. Their wealthy towns and villages were

devastated by the Mongols in 1239–42 and the region was reduced to poverty. The Russians erected forts and established colonies in the 16th century. In 1610 Orel then known as the Ukrayna or Ukraine (*i.e.*, "border region") was the scene of civil warfare under the false Demetrius. From 1917 to 1920 it was again the scene of civil struggles.

Orel (now Oryol), the chief town of the above region, situated at the confluence of the Orlik with the Oka river, and at the junction of roads and railways linking it with Moscow, Bryansk, Kharkov and the east, in 53° N., 36° 8′ E. Pop. (1939) 110,567.

**O'RELL, MAX,** the *nom-de-plume* of PAUL BLOUET (1848–1903), French author and journalist, was born in Brittany in 1848. He is chiefly remembered for his once famous book, *John Bull et son Île.* He died in Paris, on May 25, 1903.

**ORELLANA, FRANCISCO DE** (*c.* 1490–*c.* 1546), Spanish soldier, and first discoverer of the Amazon, was born at Truxillo about 1490. He sailed for Peru in 1535, and in 1540–41 accompanied Pizarro's expedition from Quito to Napo in the capacity of lieutenant. Early in 1541 he was sent ahead of the main party to obtain provisions, but he deserted his charge, either from necessity or choice, and continued his journey down the Rio Napo to the valley of the Amazon, whose course he explored from its source in the Andes to the Atlantic; he reached the coast in Aug. 1541. He is reported to have encountered a tribe of female warriors, of whom he had been told by the Indians, and from whom the name of the river is derived. On his return to Spain he was granted the right to conquer the newly discovered lands, but an expedition, undertaken in 1544 for this purpose, met with little success. Orellana died, probably in Venezuela, about 1546.

*See* "The Voyage of Francisco de Orellana down the River of the Amazons," trans. C. R. Markham, from A. de Herrera's *Historia general de las Indias occidentales* (Hakluyt Society *Publications,* vol. xxiv., 1859).

**ORELLI, JOHANN CASPAR VON** (1787–1849), Swiss classical scholar, was born at Zürich on Feb. 13, 1787. His cousin, JOHANN CONRAD ORELLI (1770–1826), was the author of several works in the department of later Greek literature. From 1807 to 1814 Orelli worked as preacher in the reformed community of Bergamo and published *Contributions to the History of Italian Poetry* (1810) and a biography (1812) of Vittorino da Feltre, his ideal of a teacher. In 1814 he became teacher of modern languages and history at the cantonal school at Chur (Coire); in 1819, professor of eloquence and hermeneutics at the Carolinum in Zürich, and in 1833 professor at the new university, the foundation of which was largely due to his efforts. He had already published (1814) an edition, with critical notes and commentary, of the *Antidosis* of Isocrates. The three works upon which his reputation rests are the following. (1) A complete edition of Cicero in seven volumes (1826–38). (2) The works of Horace (1837–38; 4th ed., 1886–92). (3) *Inscriptionum Latinarum Selectarum Collectio* (1828; revised edition by W. Henzen, 1856). His editions of Plato (1839–41, including the old scholia, in collaboration with A. W. Winckelmann) and Tacitus (1846–48, new ed. by various scholars, 1875–94) also deserve mention. Orelli died at Zürich on Jan. 6, 1849.

See *Life* by his younger brother Conrad in *Neujahrsblatt der Stadtbibliothek Zürich* (1851); J. Adert, *Essai sur la Vie et les Travaux de J.C.O.* (Geneva, 1849); H. Schweizer-Sidler, *Gedächtnissrede auf J.C.O.* (Zürich, 1874); C. Bursian, *Geschichte der klassischen Philologie in Deutschland* (1883).

**ORENBURG** (now CHKALOV), region of the Russian S.F.S.R. consisting of the former Orenburg and Orsk districts of the larger pre-1914 province of the same name. Area 22,085 sq.mi. Pop. (1939) 1,677,013. It is a narrow strip between Bashkiria on the north and Kazakstan on the south, widening out to the east and west. The province is hilly, except for the valleys of the Ural river and its tributaries, the Sakmara and the Or. It belongs to the region of perennial drought and dry and desert steppe: the soils are chestnut-brown clays and sands with salt efflorescences, on which crops can be raised successfully if drought is not too severe and if careful attention is paid to manuring and to the type of cultivation. Some fertile black earth occurs in the valleys. The average January temperature is 3·4° F. July 70·9° F, average rainfall 15·2 inches. Coal and rich layers of rock salt are found near Iletsk, in the south of the province and phosphorite exists. The peasants are specially skilled in the preparation of leather and the women knit the famous Orenburg goats' wool shawls.

The district lies on the border region between the territory of the Bashkirs and that of the Kirghiz; the Bashkirs were brought under Russian rule in 1557, and the fort of Ufa was built to protect them from Kirghiz raids. The frequent risings of the Bashkirs and the raids of the Kirghiz led the Russian government in the 18th century to erect a line of forts and blockhouses on the Ural and Sakmara rivers, which were afterwards extended southwestwards towards the Caspian and eastwards towards Omsk, and Chkalov became the central point of these military lines.

**ORENBURG** (now CHKALOV), the chief town of the region of the same name in the Russian S.F.S.R., on the Ural river in 51° 46′ N., 55° 7′ E. Pop. (1939) 172,925. The opening of the Orenburg-Tashkent railway in 1905 greatly increased its importance, and it has an important railway workshop for this line. Its industries include the making of metal goods and bricks, sawmilling and brewing. Trading caravans from the Central Asiatic Republics bring carpets, silk, cotton, lambskin, wool and dried fruits to Orenburg to exchange against textiles, metal goods, and other products of European Russia. Cattle, horses and sheep from the steppe lands are brought to its market, and animal products including frozen meat, hides, sheepskins, tallow and bristles are sent by rail to Samara and the west. Its population is mixed and includes Russians, Tatars, Kirghiz and Bashkirs, among others. In 1735 a fort was erected at the confluence of the Or and Ural rivers as an outpost of Russia against the Bashkirs and Kirghiz, and was called Orenburg. In 1740–43, the fortress was moved 120 mi. down the Ural river to its present position and the former Orenburg was re-named Orsk. Heavy fighting occurred here after the 1917 revolution, and in that year its population was swollen to 140,588 by refugees. During the famine of 1920–1, the town suffered severely and the population dropped proportionately.

**ORENDEL,** a Middle High German poem, of no great literary merit, dating from the close of the 12th century. The story is associated with the town of Treves (Trier), where the poem was probably written. The introduction narrates the story of the Holy Coat, which, after many adventures, is swallowed by a whale. Orendel, son of King Eivel of Treves, who had embarked with 22 ships in order to woo the lovely Brida, the mistress of the Holy Sepulchre, is wrecked, and falls into the hands of the fisherman Eise, in whose service he catches the whale and recovers the Holy Coat. The poem exists in a single ms. of the 15th century, and in one printed version dated 1512. It has been edited by von der Hagen (1844), L. Ettmüller (1858) and A. E. Berger (1888); there is a modern German translation by K. Simrock (1845).

*See* H. Harkensee, *Untersuchungen über das Spielmannsgedicht Orendel* (1879); F. Vogt, in the *Zeitschrift für deutsche Philologie,* vol. xxii. (1890); K. Müllenhoff, in *Deutsche Altertumskunde,* vol. i. (2nd ed., 1890), pp. 32 *seq.;* and R. Heinzel, *Über das Gedicht von König Orendel* (1892).

**ORENSE,** an inland province of north-western Spain, formed in 1833 of districts previously included in Galicia, and bounded on the north by Pontevedra and Lugo, east by Leon and Zamora, south by Portugal, and west by Portugal and Pontevedra. Pop. (1940) 458,272; area 2,695 sq.mi. The province is almost everywhere mountainous. Its western half is traversed in a southwesterly direction by the river Miño; the Sil, a left-hand tributary of the Miño, waters the northeastern districts; and the Limia rises in the central mountains and flows west-southwest, reaching the sea at the Portuguese port of Viana do Castello. The railway from Monforte to Vigo runs through the province. There are iron foundries. The chief towns are Orense (*q.v.*), Allariz (1,819), Carballino (2,469), Viana del Bollo (980) and Nogueira de Ramuín (7,791). The province fell to insurgent troops early in the civil war of 1936–39.

**ORENSE,** an episcopal see and the capital of the Spanish province of Orense, on the left bank of the river Miño, and on the Tuy-Monforte railway. Pop. (1940) 17,866 (mun. 28,397).

The river is here crossed by one of the most remarkable bridges in Spain. It was built by Bishop Lorenzo in 1230, but has frequently been repaired. The image of El Santo Cristo in the Gothic cathedral is celebrated throughout Galicia. The warm springs known as Las Burgas, attract many summer visitors; the waters were well known to the Romans, as their ancient names, Aquae Originis, Aquae Urentes, or perhaps Aquae Salientes, clearly indicate. They named Orense Aurium, probably from the alluvial gold found in the Miño valley. Chocolate and leather are manufactured, and there are saw-mills, flour-mills and iron-foundries.

**OREODONT,** vernacular name for any member of the extinct family Merycoidodontidae. The oreodonts were piglike in general appearance and structure, but the teeth were like those of ruminants. They were related to both pigs and ruminants, but only distantly. Extremely abundant and varied throughout most of the age of mammals (late Eocene through Pliocene) in North America, oreodonts have not been found on other continents. (G. G. Si.)

**ORESTES,** in Greek legend, son of Agamemnon and Clytaemestra. According to the Homeric story he was absent from Mycenae when his father returned from the Trojan War and was murdered by Aegisthus. Eight years later he returned from Athens and revenged his father's death by slaying his mother and her paramour (*Odyssey,* iii. 306; xi. 542). For later forms of the legend of his return, *see* ELECTRA.

In post-Homeric writers, Orestes, after the deed, is pursued by the Erinyes (*q.v.*). He takes refuge in the temple at Delhi. Apollo sends him to Athens to plead his cause before the Areopagus. The Erinyes demand their victim; he pleads the orders of Apollo; the votes of the judges are equally divided, and Athena gives her casting vote for acquittal. The Erinyes are propitiated by a new ritual, in which they are worshipped as Eumenides (the Kindly), and Orestes dedicates an altar to Athena Areia. According to Euripides, some of the Erinyes were not satisfied, so Orestes was ordered by Apollo to go to Tauris, carry off the statue of Artemis which had fallen from heaven, and bring it to Athens. He repairs to Tauris with Pylades, the son of Strophius and the intimate friend of Orestes, and the pair are at once imprisoned by the people, among whom the custom is to sacrifice all strangers to Artemis. The priestess of Artemis, whose duty it is to perform the sacrifice, is his sister Iphigeneia (*q.v.*). A recognition is brought about, and all three escape together, carrying with them the image of Artemis. After his return to Greece, Orestes took possession of his father's kingdom of Mycenae, to which were added Argos and Laconia. To gain possession of Hermione, whom Neoptolemus had married, he murdered the latter at Delphi. He is said to have died of the bite of a snake. The development of the legend is the result (*a*) of the post-Homeric horror of bloodshed (Erinyes; to Homer, Orestes does nothing which is not entirely admirable); (*b*) of the growing interest in cases of conscience (conflict of the duty of revenge and the sacredness of his mother's person); (*c*) of the development of modern ideas of ethics and jurisprudence (the Areopagus consider motive and mitigating circumstances, instead of merely regarding the act); (*d*) of the replacement of blood-feud by State intervention and formal trial.

*See* Jebb, introduction to Sophocles, *Electra;* Höfer in Roscher's *Lexikon,* art. "Orestes." (H. J. R.)

**ORFE** or **GOLDEN ORFE,** a variety, originating in Germany, of the ide (*Idus idus*), one of the Cyprinidae and allied fairly closely to the roach (*q.v.*).

**ORFILA, MATHIEU JOSEPH BONAVENTURE** (1787–1853), French toxicologist and chemist, was by birth a Spaniard, having been born at Mahon in Minorca on April 24, 1787. After studying medicine at the universities of Valencia and Barcelona, he settled in Paris to study under the chemist L. N. Vauquelin. In 1811 he graduated and immediately became a private lecturer on chemistry in the French capital. In 1819 he was appointed professor of medical jurisprudence, and four years later he succeeded Vauquelin as professor of chemistry in the faculty of medicine at Paris. In 1830 he was nominated dean of that faculty. He died in Paris on March 12, 1853. Orfila's fame rests on his *Traité des poisons,* or *Toxicologie générale* (1813).

**ORFORD, ROBERT WALPOLE,** 1ST EARL OF (1676–1745), generally known as SIR ROBERT WALPOLE, prime minister of England from 1721 to 1742, third son of Robert Walpole, M.P., of Houghton in Norfolk, was born at Houghton on Aug. 26, 1676. He was an Eton colleger from 1690 to 1695 and was admitted at King's College, Cambridge, as scholar on April 22, 1696. At this time he was destined, as a younger son, for the church, but the death of two elder brothers made him heir to an estate producing about £2,000 a year, whereupon he resigned his scholarship and was withdrawn from the university.

Walpole sat in parliament at first for the family borough of Castle Rising (1701) and then for King's Lynn, which he represented until he was raised to the peerage. In June 1705 he was appointed one of the council to Prince George of Denmark, the inactive husband of Queen Anne, and then lord high admiral of England. On Feb. 25, 1708, he succeeded Henry St. John as secretary at war, and was thus brought into immediate contact with the duke of Marlborough and the queen. With this post he held for a short time (1710) the treasurership of the navy, and was admitted to the inmost councils of the ministry. He could not dissuade Godolphin from the impeachment of Sacheverell, and when the committee was appointed in Dec. 1709 to draw up the impeachment Walpole was nominated one of the managers for the House of Commons. Walpole shared in the general wreck of the Whig party, and in spite of the flattery, followed by the threats, of Harley he took his place with his friends in opposition. Both in debate and in the pamphlet press he vindicated Godolphin from the charge of peculation, and in revenge for his zeal his political opponents brought against him an accusation of personal corruption. On these charges he was in 1712 expelled from the House and spent a short time in the Tower. His prison cell became the rendezvous of the Whigs, while his praises were sung in popular ballads. In the last parliament of Queen Anne he defended Sir Richard Steele against the attacks of the Tories.

After the accession of George, the Whigs for nearly half a century retained the control of English politics. Walpole, who had supported the Hanoverian succession, obtained the lucrative post of paymaster-general of the forces in the administration which was formed under the nominal rule of Lord Halifax, but of which Stanhope and Townshend were the guiding spirits. Walpole was chairman of the committee appointed to inquire into the acts of the late ministry, and especially into the Peace of Utrecht, with a view to the impeachment of Harley and St. John. Halifax died on May 19, 1715, and after a short interval Walpole became first lord of the treasury and chancellor of the exchequer (Oct. 11, 1715). Jealousies, however, prevailed among the Whigs, and the German favourites of the new monarch quickly showed their discontent with the heads of the ministry. Townshend was forced to resign his secretaryship of state for the viceroyalty of Ireland, but he never crossed the sea to Dublin, and the support which Sunderland and Stanhope, the new advisers of the king, received from him and from Walpole was so grudging that Townshend was dismissed from the lord-lieutenancy (April 9, 1717), and Walpole on the next morning withdrew from the ministry. They plunged into opposition with unflagging energy, and in resisting the measure by which it was proposed to limit the royal prerogative in the creation of peerages (March–Dec. 1718) Walpole exerted all his powers. This display of ability brought about a partial reconciliation of the two sections of the Whigs. To Townshend was given the presidency of the council, and Walpole re-assumed the paymastership of the forces (1720).

On the financial crash which followed the failure of the South Sea scheme, Walpole was regarded by the general public as the indispensable man. Stanhope and James Craggs, the two secretaries of state, died, John Aislabie, the chancellor of the exchequer, was committed to the Tower, and Sunderland, though acquitted of corruption, was compelled to resign. Walpole, at first lord of the treasury and chancellor of the exchequer (April 1721), became with Townshend responsible for the government (though for some years they had to contend with the influence of Carteret), the danger arising from the panic in South Sea stock was

averted by its amalgamation with Bank and East India stock, and during the rest of the reign of George I. they remained at the head of the ministry. The hopes of the Jacobites, which revived with these financial troubles, were disappointed. Atterbury, their boldest leader, was exiled in 1723; Bolingbroke sued for pardon, and was permitted to return to his own country. Peace was assured by a treaty between England, Prussia and France concluded at Hanover in 1725.

In 1727 George I. died, but the confidence which the old king had reposed in him was renewed by his successor, after a brief period of coldness, and in Queen Caroline the Whig minister found a faithful and lifelong friend. For three years he shared power with Townshend, but quarrelled with him in 1730, and Townshend retired into private life. Walpole's administration was based on two principles, sound finance at home and freedom from the intrigues and wars which raged abroad. On the continent congresses and treaties were matters of annual arrangement, and England enjoyed many years of peace. Walpole's influence received a serious blow in 1733. The enormous frauds on the excise duties forced themselves on his attention, and he proposed to check smuggling and avoid fraud by levying the full tax on tobacco and wine when they were removed from the warehouses for sale. His proposals met with violent opposition, and had to be dropped. Several of his most active antagonists were dismissed from office or deprived of their regiments, but their spirits remained unquenched, as the incessant attacks in the *Craftsman* showed, and when Walpole met a new House of Commons in 1734 his supporters were far less numerous. The Gin Act of 1736 led to disorders in the suburbs of London; and the imprisonment of two notorious smugglers in the Tolbooth at Edinburgh resulted in the Porteous riots described in the *Heart of Midlothian*. These events weakened Walpole's influence in the country, but his parliamentary supremacy remained unimpaired, and was illustrated in 1737 by his defeat of Sir John Barnard's plan for the reduction of the interest on the national debt, and by his passing of the Playhouse Act, for the regulation of the London theatres.

That year, however, heralded his fall from power. His constant friend Queen Caroline died on Nov. 20, 1737, and Frederick, prince of Wales, whose request for an increase in his official allowance had been refused, became his active opponent. The prince controlled many boroughs within the duchy of Cornwall, and he attracted Pitt, the Grenvilles and others to his cause. The leading orators of England thundered against Walpole in the House of Commons, and the press resounded with the taunts of the poet and pamphleteer, illustrious and obscure, who found abundant food for their invectives in the troubles with Spain over its exclusive pretensions to the continent of America and its claim to the right of searching English vessels. Walpole long resisted the pressure of the opposition for war, but at the close of 1739, as the king would not allow him to resign, he was forced into hostility with Spain. The Tory minority known as "the patriots" had seceded from parliament in March 1739, but at the commencement of the new session, in Nov. 1739, they returned to their places with redoubled energies. The successes of the troops brought little strength to Walpole's declining popularity, and in the new House of Commons of 1741 political parties were almost evenly balanced. Their strength was tried immediately on the opening of parliament. Walpole was defeated. On Feb. 9, 1742 he was created earl of Orford, and two days later he ceased to be prime minister. A committee of inquiry into the conduct of his ministry for the previous ten years was ultimately granted, but its deliberations came to nothing. Walpole died at Arlington Street, London, on March 18, 1745, and was buried at Houghton on March 25. With the permanent places, valued at £15,000 per annum, which he had secured for his family, and with his accumulations in office, he had rebuilt the mansion at great expense, and formed a gallery of pictures within its walls at a cost of £40,000, but the collection was sold by his grandson for a much larger sum in 1779 to the empress of Russia.

Walpole was twice married—in 1700 to Catherine Shorter (d. 1737) and in March 1738 to Maria Skerret.

Sir R. Walpole's life has been written by Archdeacon William Coxe (1798 and 1800, 3 vols.), A. C. Ewald (1878) and John Viscount Morley (1889). *See* also *Walpole, a Study in Politics*, by Edward Jenks (1894); *English Hist. Rev.* xv., 251, 479, 665, xvi., 67, 308, 439 (his foreign policy, by Basil Williams); *Bolingbroke*, by Walter Sichel (1901–02, 2 vols.); the histories, letters and reminiscences by his son, Horace Walpole; and the other lives of the chief political personages of the period.

**ORFORD,** a small town of Suffolk, England, 20 mi. E.N.E. of Ipswich. Population 818. It lies by the right bank of the river Alde, here confined by a storm beach, near the promontory of Orford Ness. The Decorated church of St. Bartholomew retains a ruined Norman chancel. Of Orford castle the keep remains; it is built of Caen stone and flintwork, and is of Norman date.

**ORGAN,** in music, the name given to the well-known wind instrument (from Gr. ὄργανον, Lat. organum, instrument).

## EARLY HISTORY

The earliest authentic records of the organ do not extend beyond the second century B.C., but the evolution of the instrument from the syrinx (*q.v.*) or Pan-pipe goes back to a remote period. The hydraulic and pneumatic organs of the ancients were practically the same instrument, differing only in the method adopted for the compression of the wind supply; and the syrinx seems to have been recognized by the ancients as the precursor of both. Thus Hero of Alexandria, in his description of the hydraulic organ, calls it a syrinx. Philo of Alexandria (*c.* 200 B.C.), mentioning the invention of the hydraulus by Ctesibius, says, "the kind of syrinx played by hand which we call hydraulus."

In the earliest organs there is no doubt that the pipes consisted of lengths of the large reed known as κάλαμος used for the syrinx, but converted into open flue-pipes. Instead of cutting off the reed immediately under the knot, as for syrinx pipes, a little extra length was left and shaped to a point to form a foot or mouthpiece, which was placed over the aperture in the wind-chest, so that it caused the stream of air to split in two as it was driven through the hole into the pipe by the action of the bellows. A narrow fissure was made through the knot near the front of the pipe, and above it a horizontal slit was cut in the reed, the two edges being bevelled inwards. When the wind was pumped into the chest it found an outlet through one of the holes in the lid, and the current, being divided by the foot of the pipe, became compressed and was forced through the fissure in the knot. It then ascended the pipe in an even stream, as yet silent, until thrown into commotion by another obstacle, the upper sharp edge or lip of the notch, which produced the regular flutterings or pulses requisite for the emission of a note.

In order to convert the syrinx into a mechanically played instrument, the addition of the actuating principle of the bag-pipe was necessary. It is probable that in the earliest attempts the leather bag was actually retained and that the supply of wind was still furnished by the mouth through an insufflation pipe. Such an instrument is described and illustrated by Father Athanasius Kircher, but his drawing should be accepted with reserve. In the instrument, which he calls the *Magraketha* or *Mashrokitha* of the Chaldees, the bag is described as being inside the wind-chest, the insufflation pipe being carried through a hole in the side of the box. Little wooden sliders manipulated by the fingers formed a means of controlling the escape of the wind through any given pipe.

Of organs in the next stage of development, namely with bellows, several examples in pottery are extant, and also a description in the Talmud. The quotation as given by Blasius Ugolinus states that the instrument known as the *Magrepha d'Aruchin* "consisted, as the Schilte Haggiborim teaches, of several rows of pipes and was blown by bellows. It had, besides, holes and small sliders answering to each pipe, which were set in motion by the pressure of the organist; the vent-holes being open, a wonderful variety of sounds was produced."

In regard to the hydraulic organ, some writers have considered that the invention of the hydraulis in the 2nd century B.C. by Ctesibius of Alexandria constituted the invention of the organ, and that the pneumatic organ followed as an improvement or variety, but such a suggestion can hardly be accepted. It is most improbable that a man busy with the theory and practice of

hydraulics would *invent* a highly complex musical instrument in which essential parts lying outside his realm, such as the flue-pipes, the balanced keyboard, the arrangements within the wind-chest for the distribution of the wind, are all in a developed state. It would be a case for which no parallel exists in the history of musical instruments, all of which have evolved slowly and surely through the ages. On the other hand, given a pneumatic organ in which the primitive unweighted bellows worked unsatisfactorily, an engineer would be prompt to see an opportunity for the advantageous application of his art. There are two detailed descriptions of the hydraulis extant, both of which presuppose the existence of a pneumatic organ. One is in Greek by Hero of Alexandria, the other in Latin by Vitruvius (*De Arch.* lib. x. cap. ii.).

The principle of the hydraulis, which long remained a mystery, is now well understood. An inverted funnel, or bell of metal, standing on short feet and immersed in water within the altar-like receptacle forming the base or pedestal, communicated, by means of a pipe, with the wind-chest, placed above it. When the air was pumped into the funnel by the alternate action of two pumps, one on each side of the organ, constructed bucket within bucket and fitted with valves, the water retreating before the compressed air, rose in the receptacle and by its weight held the air in a state of compression in the funnel, whence it travelled through the pipe into the wind-chest. For an interesting discussion of the hydraulic organ, based on a careful first-hand study of the ancient writers *see* two articles in *The Organ* for Jan. and April, 1923 by D. Batigan Verne.

The nature of the hydraulis made it possible to construct large organs of powerful tone more suitable for use in the arena than the small pneumatic instruments, but the hydraulic organ never entirely supplanted the pneumatic, which was probably not so imperfect at the beginning of our era as has been thought, and which was destined to establish its supremacy in the end.

In France and Germany the Romans must have used organs and have introduced them to the conquered tribes as they did in Spain, but the art of making them was soon lost after Roman influence and civilization were withdrawn. Pépin, when he wished to introduce the Roman ritual into the churches of France, felt the need of an organ and applied to the Byzantine emperor, Constantine Copronymus, to send him one, which arrived by special embassy in 757 and was placed in the church of St. Corneille at Compiègne. The arrival of this organ was obviously considered a great event, since it is mentioned by all the chroniclers of the time. Charlemagne received a similar present from the emperor of the East in 812, of which a description has been preserved.

Considerable activity was displayed in England in the 10th century in organ-building on a large scale for churches and monasteries, such as the monster organ for Bishop Alphege at Winchester, which had 400 bronze pipes, 26 bellows and 2 manuals of 20 keys, each governing 10 pipes.

In regard to the details of these early instruments, as represented in contemporary illustrations, it may be noted that there is no miniature on record in which the fist action on the keys is indicated, the performer during the 10th, 11th and 12th centuries being depicted in the act of drawing out the stop-like sliders—as for instance, in the 12th-century manuscript Bible of St. Etienne Harding at Dijon, where the organist is playing the notes D and F, the sliders being lettered from C to C. From the 13th century the keys are shown pressed down by means of one finger or of finger and thumb. In the beautiful Spanish ms. said to have been compiled early in the 13th century, known as the *Cantigas de Santa Maria,* a portative is shown having balanced keys, one of which is being lightly pressed by the thumb, the instrument resting on the palm—while the left hand manipulates the bellows. The keys themselves varied in shape, being either like a T; a wide rectangle, with or without the corners rounded off, or a narrow rectangle. The earliest instance of a chromatic keyboard is that of the organ at Halberstadt built in 1361 and restored in 1495.

(K. S.)

## THE MODERN ORGAN

In former centuries organs were seldom to be found outside places of worship, but at the present day they are built for use in private residences, concert and public halls, cinematograph theatres, and in many playhouses of the United States and Canada.

The sounds of an organ are produced from pipes of varying shapes and sizes, made to "speak" by means of air under pressure. The sounding of the pipes is determined by the use of the keys, some of which are played by the hands, some by the feet. The keys of the organ resemble those of the pianoforte in appearance; but whereas the pianoforte has only one keyboard or manual the organ may have four or five in addition to a keyboard of foot pedals.

**Stops.**—Each organ pipe sounds one note only and is a member of a larger unit known as a stop; each stop is a member of a still larger unit known as a sectional or divisional organ; while each sectional organ is a member of the grand organ in its totality.

To the layman the term "stop" usually denotes the knobs grouped on each side of the organist as he sits at his console or control board. In watching the organist pull out or push in these knobs with varying musical results he does not think twice about accepting the term "stop," as popularly understood. To the organ builder, however, it means one thing and one thing only, namely, a rank of pipes.

The pipes of a given stop therefore all produce sounds of similar quality, but necessarily of different pitches. No two stops are exactly similar in quality; on the contrary, they all differ, like the various instruments in an orchestra. Some stops are of high pitch, some of low; some have a thin, some a full quality of tone. The knob at the console is the only part of the stop mechanism that is visible, being merely a handle which actuates the valve admitting wind to the stop itself. Every stop has a separate knob, just as every note has a separate key. Unless one of the knobs were drawn no sound would result when the organ was played.

**Sectional Organs.**—Passing on to the next size of unit, we come to the sectional organs mentioned. Each of these organs is played from its own clavier or manual and has its own special *timbre* and utility. An organ of five manuals (where found) would commonly comprise a Great Organ, a Swell Organ, a Choir Organ, a Solo (or Orchestral) Organ, and an Echo (or else Bombarde) Organ. Moreover, save only in the tiniest instruments, there is also a Pedal Organ played by the feet of the executant.

The normal range or compass of the manuals is 61 notes, *i.e.*, 5 octaves, from CC in the bass to C'''' in the treble (though certain organ builders of the United States have adopted a manual compass of 7 octaves); that of the pedals is 32 notes, *i.e.*, 2½ octaves from CCC in the bass (lowest C on the pianoforte) to the G below middle C. In other words, a manual stop ordinarily comprises 61 pipes and a pedal stop 32 pipes.

**Organ-pipes.**—These are primarily divisible into two main genera, namely flue and reed. Flue-pipes bear a strong resemblance to the humble "penny whistle," both as to appearance and physical behaviour—except that a flue-pipe does not sound more than one note. In reed pipes the wind vibrates a curved brass tongue over the surface of a reed or shallot, so that the oscillations of the tongue cause the speech of the pipe. Associated with the reed is a metal resonator, which exercises much the same function as the "loud-speaker" horn of a radio-outfit.

Both genera have in common the properties of pitch and quality. With a flue-pipe the pitch is lower as the tube or body is longer; with a reed-pipe pitch depends on the vibrating length of tongue and on the position of the spring wire, which can be made to increase or diminish this length. The quality of a flue-pipe is affected mainly by the diameter (or scale) of the body relative to the length, the wider scale giving the fuller tone and vice versa; the quality of reeds is affected by the length of resonator, their shape and scale, the thickness of the tongues and other factors.

But the souls of organ pipes are all in the hands of the "voicer," and their ultimate character depends more on the process known as "voicing" than on anything else.

Although most of the flue-pipes in an organ are open at the ends to the atmosphere, there is also a considerable class having its bodies closed by a cap or stopper. Known as gedeckts or bourdons, these pipes are peculiar in that they speak a note nearly an octave lower than an open pipe of the same length. Another

class has the bodies pierced about midway with a small hole, the result being that they sound an octave higher than ordinary pipes of the same length. These are called harmonic pipes.

**Voicing and Tuning.**—Voicing consists for the most part in adjusting the mouth-pieces of a flue-pipe or the tongue-curvature of a reed in such a manner that the desired quality of tone or timbre is permanently obtained. The final process of voicing is

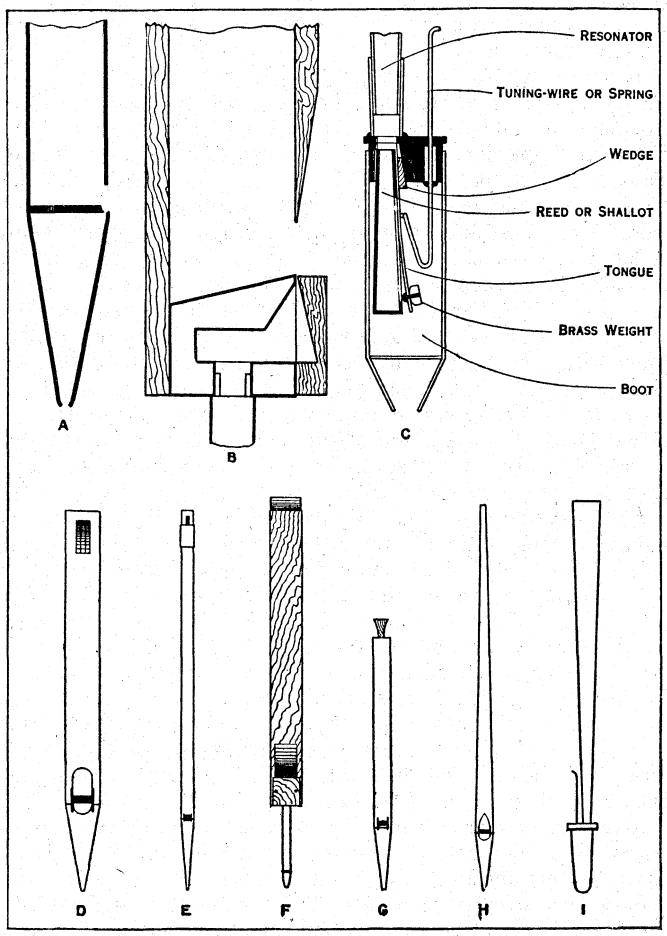



FIG. 1.—VARIOUS TYPES OF ORGAN PIPES
(a) Section of metal flue pipe; (b) section of wooden flue pipe; (c) section of reed pipe (trumpet) and its component parts; (d) open diapason; (e) Viola da gamba; (f) clarabella, or Hohl-Flöte; (g) Gedeckt; (h) Gems-Horn or Spitz-Flöte; (i) trumpet or cornopean (reed). (Not to scale)

known as "regulation" and means the making uniform in power of every pipe in a stop. This the voicer achieves by admitting a greater force of wind through the "foot" of the pipe, if he wishes to louden its tone; or by reducing the foothole and so reducing the wind, if he wishes to soften it.

For tuning various methods are employed, according to the character of the particular class of pipe being dealt with. Thus some flue-stops are tuned by moving up or down a metal sleeve which fits over the top of the pipe, the speaking length of which is in this way increased or diminished. Others—especially "upper-work" stops—have to be coned in or expanded slightly at the ends, according to whether it is intended to flatten or sharpen the pitch. Others again are tuned by pressing in or pulling out a metal piece affixed in or near the tops of the pipes. As for gedeckts the caps or stoppers afford an easy means of altering the pitch.

**Names of Stops.**—In making the acquaintance of organ stops for the first time many persons fall into the error of putting far too much faith in the names. Organ stops, it is true, resemble orchestral instruments to the extent that they bear names which are supposed to distinguish them from one another; but so far from the "orchestral" analogy holding good generally, it fails for two reasons—first, because organ builders have invented a hundred and one fancy names to denote pretty much the same kinds of stops; secondly, because they do not all agree as to what a given name is to denote.

Proceeding then on these lines, we may group flue-stops into three broad species—flute, diapason and viol. Flutes are either open or closed (*i.e.*, gedeckts), harmonic (*i.e.*, of double-length) or non-harmonic. Diapason stops on the whole have a natural and normal organ tone, familiar to everybody. Viols are of smaller scale than diapasons and so are of comparatively thin and stringy tone. Several stops stand on the borderland between two species; but the majority can be brought under one of the foregoing heads, quite apart from their loudness and intensity.

In reedwork the French horn is, roughly speaking, the equivalent of the flute, the trumpet of the diapason, the English horn (cor anglais) of the viol species. The clarinet corresponds with a gedeckts and has resonators of only half length, just as the harmonic reeds have resonators of double length. For the resonators of reeds are of about the same length on the bodies of flue-pipes giving the same pitch of note and in these two cases at least, they depart similarly from the normal. But at all times the reed stops are much less numerous than the flue, and although often blown by a wind of much heavier pressure do not compete with them on their own ground.

**Pitches of Stops.**—Organ stops which speak at the pitch indicated by the written notes are called 8ft. or "unison stops" because an open flue-pipe about so long would be needed to sound CC, the lowest note of the manual clavier. By analogy reeds and even gedeckts are 8ft. stops, if they sound at 8ft. or "unison" pitch throughout. So, too, the 16ft. stops are those which sound an octave below the "unison" pitch of the manuals. A gedeckt with a body 8ft. long would still be a 16ft. stop, because of its 16ft. pitch. Stops as grave as of 32ft. pitch appear on the pedal and in very large organs on the manuals, their name signifying a pitch two octaves below that of the manuals.

Of stops which sound higher than the 8ft. pitch of the keys the 4ft. stops give the octave, $2\frac{2}{3}$ft. stops the twelfth, 2ft. stops the fifteenth or super-octave, $1\frac{3}{5}$ft. stops the seventeenth or tierce, $1\frac{1}{3}$ft. stops the nineteenth or larigot, $1\frac{1}{7}$ft. stops the flat twenty-first or septième, 1ft. stops the twenty-second, and so (in theory at least) ad infinitum, the interval between the ranks becoming smaller as the ranks themselves are of acuter pitch, in accordance with the natural law of what is known as the *harmonic series*. Practical considerations, however, must always set arbitrary limits, and in this case they rule: (1) ranks above the fifteenth are too small and acute to be carried through the whole compass of the keyboard in an unbroken form; (2) no rank more dissonant than a minor seventh—or at most a major second—is tolerable anywhere in the tonal economy of the organ; (3) for most ordinary purposes ranks sounding octaves, thirds and fifths sufficiently represent the harmonic series. As a matter of practice all stops above the fifteenth form a part of what are called the mixtures, and except for special purposes (*see* later under *Choir Organ*, where the purpose of independent mutations is discussed) are employed collectively as "upperwork." Manual stops of 16ft., 8ft. and 4ft. pitches, being the most consonant with the unison or standard, are termed "foundation work" (Fr. *fonds*); and thus, in the upper work and in the foundation work respectively, the two complementary ideas of brilliance and gravity are fulfilled. The twelfth and fifteenth are sometimes independent ranks, sometimes part of the mixtures. As a rule, flute and viol stops are confined to the foundation pitches—reeds always. But diapasons being of a tone peculiar to the organ represent upperwork as well as foundation.

And now to consider the stops as grouped in the various sectional organs and the sections themselves as related to the organ at large, premising that letters attached to stop-names in this article indicate their genus, species or tone-quality, *i.e.*, d= diapason, f=flute, v=viol, g=gedeckt, r=reed, echo=lesser-toned.

**Great Organ.**—The Great Organ (Fr. *Grand Orgue*; Ger. *Hauptwerk*) as its name implies is the most important of these, and forms the tonal backbone of the whole instrument.

In English and American organs it is chiefly conspicuous for a diapason quality which pervades it throughout. Especially typi-

cal is the open diapason 8ft. without which scarcely an organ was ever built. To supply the requisite foundation for a large Great Organ there may be as many as three or four open diapasons, though they would not all be similarly scaled and voiced. If the first diapason is a powerful stop of full and round quality, the second is almost sure to be of a lighter and sharper tone; and sometimes in the interests of variety a geigen (dv) or gemshorn (dg) is substituted for the third or fourth.

The double open diapason, 16ft. octave or principal 4ft., twelfth $2\frac{2}{3}$ft., fifteenth 2ft., and mixtures are equally germane to the Great Organ, and may be likened to the roots, branches and twigs of the diapason trunk.

On the other hand the substratum of the French Great Organ is not so much a diapason as a flute one; for flutes are regarded as a kind of neutral canvas on which other and more positive tone colours (especially diapasons) can be laid and mixed. Again, Spanish Great Organs have no open diapasons as understood by English-speaking musicians; instead they have a foundation of hybrid flute-viol kind which is said to be particularly disagreeable. Nor does the average German Great Organ appeal to our ears much more, since its pipes are too often made of thin metal, and as a consequence sound hard and brassy. The gedeckts, *e.g.*, bourdon 16ft., stopped diapason 8ft., flute couverte 4ft., add considerable body to the diapasons besides having their own special value. In the United States a Doppelflöte (gedeckt with two mouths) is very popular. Where neither money nor space can be found for the pipes of actual 16ft. length, a bourdon 16ft. (g) frequently takes the place of a double open diapason.

Open flutes are nearly always present at 8ft. and 4ft. pitches and under a diversity of shapes and names—clarabella, wald flute, tibia, melodia, flute ouverte, etc. Viols, however, are thought to mar the sovereignty of diapason tone, and so are less common on the English Great Organ than abroad.

The usual complement of Great Organ reeds amounts to trumpets, 16ft., 8ft., and 4ft., going by the name of contra (tromba) or bombarde 16ft., tromba, trumpet or posaune, 8ft.; clarion or octave (tromba) 4ft. For a small Great Organ a single tromba or trumpet 8ft. suffices, or else the reed class may be omitted altogether from this section. To which it may be added that most builders to-day prefer to furnish all their chorus reeds with harmonic or double-length trebles which stand in better tune than the non-harmonic.

**Swell Organ.**—The Swell Organ (Fr. *Récit;* Ger. *Schwellwerk*) again almost explains itself. For inasmuch as organ pipes are naturally incapable of crescendo and diminuendo, a whole section of stops is played from a separate manual, and made expressive by artificial means. That is to say, all the pipes of the Swell Organ are enclosed in a large box which is faced on one side with a set of balanced shutters, not unlike the louvres of a venetian blind. As the shutters are opened electrically by the organist from the console, the volume of tone increases; as he closes them, it diminishes. Most people can easily recognise the sound of a full swell by the peculiar "tingling" effect it has when the shutters are nearly or completely closed. This effect indeed gives the best indication as to the basis of the Swell Organ: for it is shown to depend almost entirely on reeds and mixtures. Were all other stops omitted, a "skeleton" Swell would suffice for this effect, consisting of double trumpet 16ft., trumpet 8ft. (cornopean), clarion 4ft., plus brilliant mixtures to crown the whole.

At the same time a Swell Organ confined to a reed basis would not be practical politics; and so it comes about that other stops, both reed and flue, are required also here. The oboe, for instance (=echo horn), and the unda maris or voix celeste (a pulsating stop made up of two out-of-tune dulcianas) are almost universal. Hardly less so are narrow scale gedeckts of some kind (lieblich or rohr) in the foundation pitches. Nor is the entry of the diapason series delayed, though its stops will be of lighter calibre than those on the Great. The Swell mixtures belong properly to the diapason series, and only by design to the reed chorus, and so should not be voiced to emulate the sound of smashing glass, as sometimes happens. Then salicional (echo vd), spitz flute (dg), aeoline (echo v), wald flute (f), etc., should all be added to the list of unobtrusives, but usefuls.

In a small Swell Organ a contra-oboe or fagotto 16ft. generally appears as its first double; for a reed has the advantage over, say, a bourdon or contra-salicional 16ft. in taking up less room inside the swell-box, while contributing directly to the reed foundation.

**Choir Organ.**—The Choir Organ (Fr. *Positif;* Ger. *Oberwerk* or *Positiv*) belongs to one or other of two well defined types. It is either an Echo Great Organ in the true sense and in the old style; or else it stands in a swell-box and is less exclusive in caste.

If a miniature Great Organ, it comprises a lightly blown diapason series (16ft. to mixtures), a gedeckt or two, and perhaps even a low-pressure trumpet. In its other capacity it has an ensemble of mild flutes and viols, rather than one of pure diapason complexion, though of course there is no actual ban on diapasons. Viola da gamba, viola d'amore, fugara (v), chimney flute, cor de nuit, quintaten (g), flauto amabile, wald flute, harmonic flute (f) at 8ft., 4ft. and 2ft. pitches, the gemshorn family at all pitches—none of these are out of place so long as the key-note is gentleness and moderation in scales and wind pressures. If the Swell Organ contains a voix celeste of two salicionals (echo dv), occasion is sometimes taken to provide the Choir with a contrasting flute celeste of two gedeckts. The dulciana (echo d), or salicional 8ft., is of course indispensable and in larger instruments it may appear at 16ft., 4ft. and/or 2ft. also. Nor does a delicate mixture of dulciana or salicional pipes ever come amiss, though it is surprising how few organ-builders care about stops of so refined a tone.

An enclosed Choir Organ frequently houses the independent mutation stops, which are found to answer best in the shape of gedeckt pipes. Mutations commonly used are: nazard or twelfth ($2\frac{2}{3}$ft.), tierce or seventeenth ($1\frac{3}{5}$ft.), larigot or nineteenth ($1\frac{1}{3}$ft.), septième or flat twenty-first ($1\frac{1}{7}$ft.) and if it may be termed a mutation, the octavin or twenty-second (1ft.). With these or an even fuller muster to hand immense colouristic possibilities lie in front of the organist. Like a chemist in a laboratory he has only to mix one or two mutations with a 4ft. or 2ft. stop or even with another mutation to create new tonal compounds of rare and surprising piquancy. An excellent "orchestral oboe" can be made from this recipe—viole 8ft., nazard $2\frac{2}{3}$ft. and tierce $1\frac{3}{5}$ft.

Reeds are neither few nor insignificant on the French *Positif*, but in England the Choir is more often than not limited to a clarinet or cor anglais 8ft.

**Solo Organ.**—The Solo (or Orchestral) Organ differs from the three foregoing sections in one practical respect. Hitherto we have been dealing with units which were designed with the aim of building up a harmonious whole.

It is not perhaps overstating the case to say that the English Solo Organ is considered successful in proportion as it is anomalous in relation to the rest of the instrument. Being largely imitative of orchestral instruments, its stops, both reed and flue, represent extremes of scaling and voicing; and so have a poor blending capacity.

The Orchestral Organ may be regarded as a modern off-shoot of the Solo, which it sometimes includes on the fourth manual. So many solo stops are intended to resemble orchestral instruments, so many "orchestral" or imitative stops are distinctive enough to take a solo melody or melodic part, that the two names must largely overlap. Some builders, however, prefer to assign the Solo and Bombarde to a fifth manual, while retaining the fourth for an Orchestral pure and simple. Or, if there are only four manuals all told, the Choir and Orchestral are made to share the third, Solo and Bombarde the fourth.

Among the most prominent features of the Solo-Orchestral section is a pungent viol family. This may be more or less fully developed from the 16ft. contra-viol or violone, through the unison viol d'orchestre or violoncello to a viol mixture of 3 or more ranks, according to the size of the section.

In complete contrast stand the powerful orchestral flutes, which are invariably harmonic and appear at 8ft., 4ft. and 2ft. pitches. One name for the 4ft. rank is flauto traverso, the 2ft. nearly always being termed piccolo. Of gedeckts a large-scale tibia clausa is at once the most effective and the most vulgar.

Bassoon or fagotto 16ft., clarinet 8ft. (and sometimes 16ft.), orchestral oboe 8ft., orchestral trumpet 8ft., French horn 8ft., English horn 16ft. and 8ft., are all imitative reeds which find an appropriate home in this section. Though probably more valuable as a "timbre-creator" than an imitative stop the vox humana passes for "orchestral" and is included here.

As befits its character, the Solo-Orchestral section must be

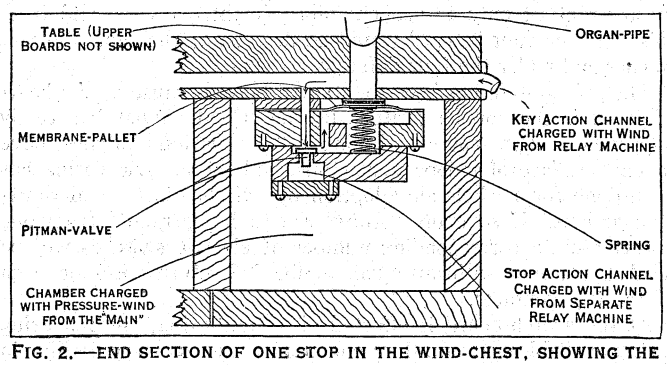



FIG. 2.—END SECTION OF ONE STOP IN THE WIND-CHEST, SHOWING THE INITIAL STAGE IN THE PROCESS OF JOINING THE PIPES WITH THE KEYS AND STOP-KNOB

enclosed in its own swell-box and voiced on a fairly heavy wind pressure, so that its stop may tell out clearly.

**Echo Organ.**—If the principle of *seniores priores* counts for anything, an enclosed Echo Organ ought to occupy the fifth manual, when one is provided: for such is its traditional place. In the churches of the United States Echo Organs are frequently met with, but without a fifth manual in the console. Modern English practice, however, seems inclined to favour the case of a Solo-Bombarde section instead of an Echo Organ for this manual, particularly if tubas are absent from the fourth manual. This would consist of heavy-pressure tubas (r) at the foundation pitches, and a chorus mixture of 6 ranks or more, the whole forming a forte-fortissimo ensemble. A stentorphone 8ft., *i.e.*, a monstrous solo diapason is often included.

**Pedal Organ.**—The Pedal Organ supplies a general bass to the whole organ, its stops therefore being pitched an octave lower than those of the manuals having the same nomenclature. Thus the "unison" stops are 16ft. instead of 8ft. A pedal double diapason would be 32ft. instead of 16ft. pitch, a pedal fifteenth 4ft. instead of 2ft., a pedal tierce $3\frac{1}{5}$ft. instead of $1\frac{3}{5}$ft., and so on.

A minimum Pedal Organ could consist of gedeckt or bourdon (16ft. closed wood) and from these the 8ft. and 4ft. pitches could be derived to form three stops in all. After which the Pedal Organ increases *pari passu* with the numerical growth of the manual stops. Soon one or more open diapasons 16ft. become imperative to balance the Great diapasons. Next a double open diapason 32ft. is the proper offset to 5 or 6 ranks of Great mixtures. From which it is but a short step to establish a diapason series from 32ft. to mixtures, thus making the Pedal Organ a complete entity on its own account. Large French Pedal Organs are especially rich in mixtures and mutation ranks, which contribute of course to reinforce the foundation. Other stops which are required as bass counterparts to manual tones include tibia (f), salicional (echo vd), geigen (vd), contrabass or violone (v), quintaten (g), etc.; and all these are amenable to extension into higher pitches.

Turning to the reeds we see the same rule of balance and expansion working itself out. As soon as an organ is large enough to contain either a tuba or Great trumpets 16ft., 8ft. and 4ft., there enters inevitably a heavy-pressure Pedal trombone, ophicleide or bombarde 16ft. Any further increase of powerful reed tone on the manuals is met by enlisting the aid of the Pedal contra (bombarde) 32ft., the clarion or octave (trombone) 8ft. and occasionally the octave clarion 4ft. A well equipped Pedal Organ would also have one or two lighter reeds such as cor anglais, clarinet, waldhorn and bassoon, "borrowed" from the manuals.

**Windchest.**—If we may regard all intermediary mechanisms which join the fingers of the organist with the sounding of the pipes as links in a chain, the first "link" claiming our attention is the windchest.

Now, a windchest has this double function: on the one hand it carries the pipes themselves; on the other it contains within it an apparatus for distributing wind to these pipes. (Each chest carries not more than nine stops.) In shape it is a box of thick pine about 8ft. long × $9\frac{1}{2}$in. deep, divided into as many longitudinal compartments as there are stops to be accommodated. Over its top surface (called the "table") are the "upperboards" on which the pipes stand. Over the upper boards and raised about $4\frac{1}{2}$″ above them are the rackboards which keep the pipes in an upright position. Fig. 2 shows a form of windchest, which has already enjoyed a wide vogue in the United States having been largely popularized by the Skinner Organ Co., of Boston, Mass. For the sake of simplicity it has been thought desirable to indicate one key action and one stop action only—*e.g.*, tenor F. and open diapason; but the reader must imagine the same mechanism multiplied to the extent of *n* stops × 61 times. The *raison d'être* of all windchests is the same—to enable the pipes to sound when the pallets below them have collapsed and have allowed the wind to flow through the orifices commanded by the pallets. This point is stressed, because it should be stated that what has been described is known as a modern "sliderless" chest (for the obsolescent "slider" windchest, *see* the Bibliography).

**Relay Machine.**—After the windchest itself comes the relay machine, which may be looked upon as the next link in our "chain." This serves to keep the key channels charged with pressure-wind, or to open the same to the atmosphere when the keys are pressed; also it is the place where the pneumatic portion of the "chain" joins the electric, and one motive force is substituted for another. Its component elements are as illustrated.

To each of the longitudinal stop channels in the windchest is attached an exactly similar apparatus; so that henceforward both key and stop "chains" continue in the form of electric wires from the magnets as shown in the illustration. These wires may be regarded as the third link in the "chain."

**Console.**—At the other end of the "chain" is the console or composite keyboard at which the organist sits. Here the "chain" terminates in the outward and visible keys, stop-knobs and other accessories, used by the player to control the organ. In the United States scarcely two builders work to the same plan of console, and as a result hardly two consoles are alike. Fig. 4 shows a typical English model of dignified and not unprogressive design. This would consist of 2–5 manuals according to the number of sectional organs, and a radiating-concave pedal clavier lying about 31 inches under the surface of the lowest manual. By English

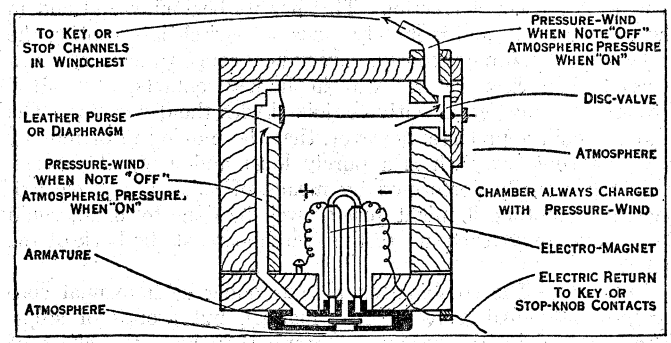



FIG. 3.—SECTION OF RELAY MACHINE (KEY OR STOP ACTION)
The second stage of process of joining the organ-pipes with keys and stop-knobs is shown, with the machine "off," the key or stop action being at rest

convention the Choir manual is the lowest, the Great the next, the Swell the third, the Solo (or Orchestral) the fourth, and the Echo (or Bombarde) the topmost. The stop-knobs are shown projecting from the jambs to right and left of the console. On the face of each knob is engraved the name of the particular stop and its approximate pitch-length in terms of feet—*e.g.*, clarinet 8ft., twelfth, $2\frac{2}{3}$ft., bourdon 16ft.—so that a moderate knowledge of technical nomenclature combined with the habit of seizing the meaning of such figures on the stop handles will be found to suffice as a key to the complexities of all consoles. The stop-knobs controlling the various sectional organs are, of course, grouped

together systematically so as to avoid any confusion, and in a 5-manual organ would be disposed thus:—

| *Left Jamb.* | *Right Jamb.* |
|---|---|
| Swell Organ. | Great Organ. |
| Solo (or Orchestral) Organ. | Pedal Organ. |
| Bombarde (or Echo) Organ. | Choir Organ. |

Over the top manual are ranged the ivory tilting-tablets, which operate the couplers. These provide for the coupling of almost any one clavier to another, at unison (8ft.) pitch, and also at

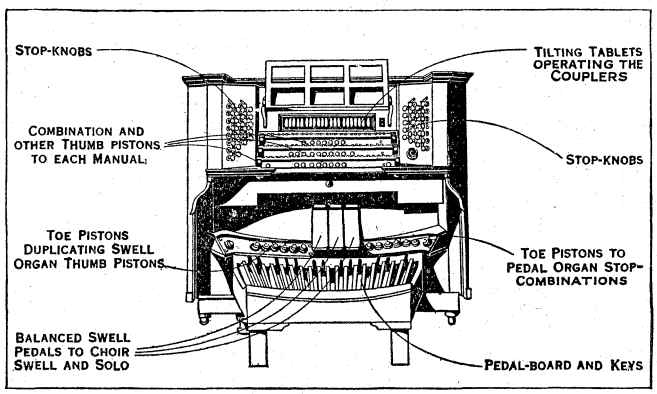



FIG. 4.—DETACHED CHURCH ORGAN CONSOLE, SHOWING THREE MANUALS AND PEDAL

sub-unison (16ft.) and octave (4ft.). Moreover, any manual except the Great may be duplicated *on itself* at sub-octave and octave pitches. Sometimes too there is a "unison silent" coupler which cuts out the 8ft. pitch of every stop drawn on the manual in question. Only the Great Organ remains constant, except as against the Pedal to which all manuals can be coupled.

Unless the action be tubular pneumatic or tracker—both older and non-electrical methods of forming our figurative "chain"—it is customary to detach the console and place it at some distance from the organ, connection being made by electric cables. For descriptions of pneumatic and purely mechanical actions, *see* G. A. Audsley's *The Art of Organ Building*.

But to revert to the key action "chain." Every manual and pedal key in the console has a thin bar of copper attached to it, so that when pressed it bridges the gap in the "return" wire and closes the circuit. The stop action "chain," operates on an identical principle and need not be further described.

Except the combination piston action, the sole remaining "chain" is the coupler action. This has its beginning and end in the console itself, and is merely a cut-out switch intercepting the 61 key circuits simultaneously. Every new coupler means an extra switch and an extra "return" wire in the key contacts, all "mains" throughout being permanently conjoined with the + terminal. The reader should appreciate, however, that the moving in or moving out of a coupler-switch is a purely local and external process. Although actually performed by means of solenoids or electro-pneumatic motors, it might just as well be done by hand, could the organist only reach out to the switchboard at the back of the console.

**Controls.**—The combination pistons under each manual control not individual stops of that manual, but groups of stops. When pressed by the organist's thumb they have the effect of throwing out whatever combination of stops he may have selected, without his having to touch the knobs. The Pedal Organ combination pistons are pressed by the right foot of the organist. On luxuriously equipped consoles it has become customary to fit also four or five general pistons, *i.e.*, having a jurisdiction over every stop and coupler in the organ. In an up-to-date console all pistons should be readily adjustable by the player, so that he may set them to operate whatever selections of stops he pleases.

**Unit System.**—Nearly all organs designed for cinematograph theatres are built on what is known as the unit or extension system; and in this respect are to be distinguished from the orthodox type which has been described. The distinction lies in the fact that whereas an orthodox organ has separate and individual stops for each manual and pedal, a unit organ employs the same rank of pipes again and again at various pitches and (rather misleadingly) under various names. By way of illustration take the case of a series of four gedeckt stops—bourdon 16ft., tibia clausa 8ft., zauberflöte 4ft., piccolo 2ft. Under the orthodox system each stop would be a separate rank consisting of 61 pipes, the total number of pipes being 244. Under the unit system there would be one master rank of only 97 gedeckt pipes (eight octaves), and from this rank the four "stops" would be derived at the four different pitches and under the four different names.

The unit system has been mentioned here, because at the heart of it all is the coupler switch just described. What has really happened is that couplers acting at the various pitches have taken the place of independent stops, and the electric wiring has been done for a wholesale adoption of switches instead of draw-stop actions. If so many "stops" are to be extracted from one parent rank, a corresponding number of electric switches will be needed, together with an equal number of return wires on each of the key contacts.

At the switch-board is effected also "duplexing," or rendering a stop available on more than one clavier—a necessary facility in the theatre organ and even in the Pedal section of an otherwise "straight" church organ.

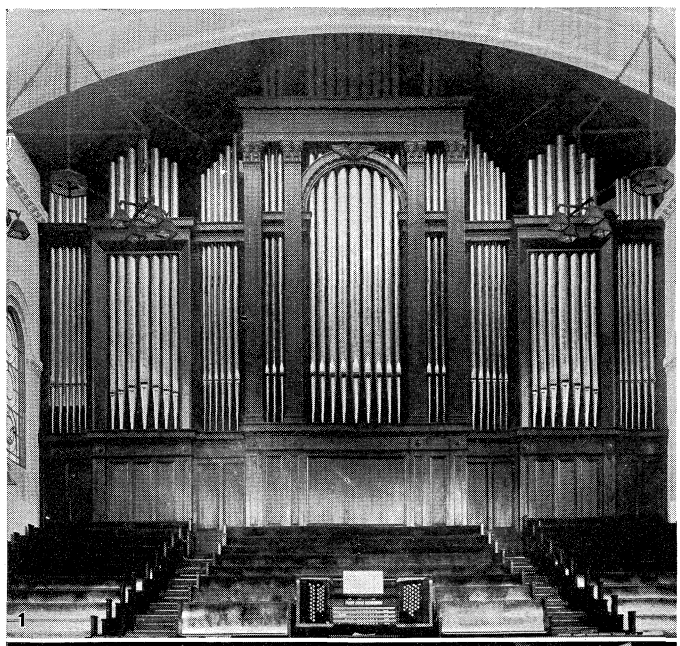
Mention may also be made of the "double-touch" device now frequently incorporated in the modern cinematograph or concert-hall organ. Its operation is quite simple and may be explained in a word. A clavier having this device is one of which the keys, when played, fall not only to the standard depth of touch, but also—on extra pressure being applied by the finger—another $\frac{1}{16}$" or so deeper. The purpose of the second touch is to enable any key to make a second electric contact at the lower level, and so to engage a second circuit when it reaches that point. As a rule this circuit brings into action a powerful solo stop, a coupler or occasionally some "percussion" (*e.g.*, cymbals); but in any case it is plain that a clavier so equipped has the potentialities of two claviers in itself.

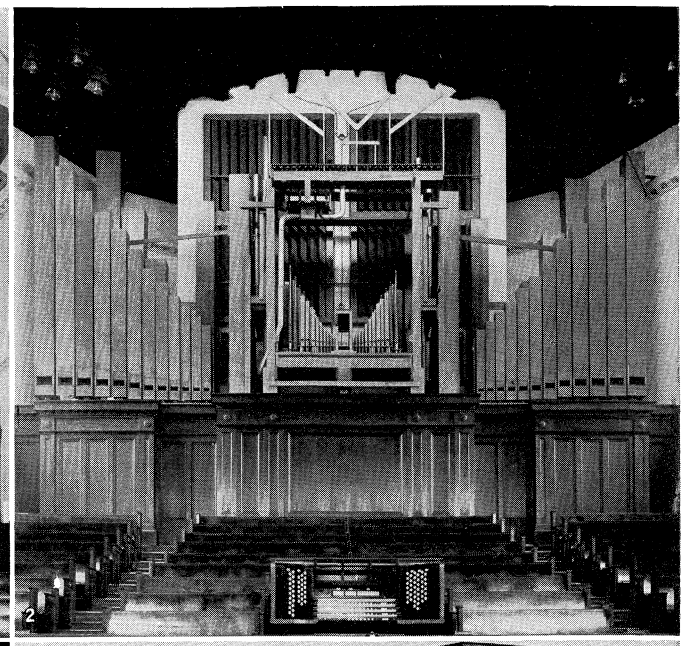
Organs designed for secular use are freely equipped with other means of making sounds than pipes. On a theatre instrument one may expect to find chimes, bird-whistle, xylophone, marimba, etc., in addition to drums, cymbal, triangle, castanets and many other "traps," as they are called, for the greater delectation of King Demos. Even in church organs of the United States 8ft. and 4ft. harps to the Choir and cathedral chimes to Great or Solo play an important part, and are by no means deemed out of place; whereas British practice, restrained by more sensitive church traditions, admits in this way nothing more fanciful than a tremulant to the enclosed sections.

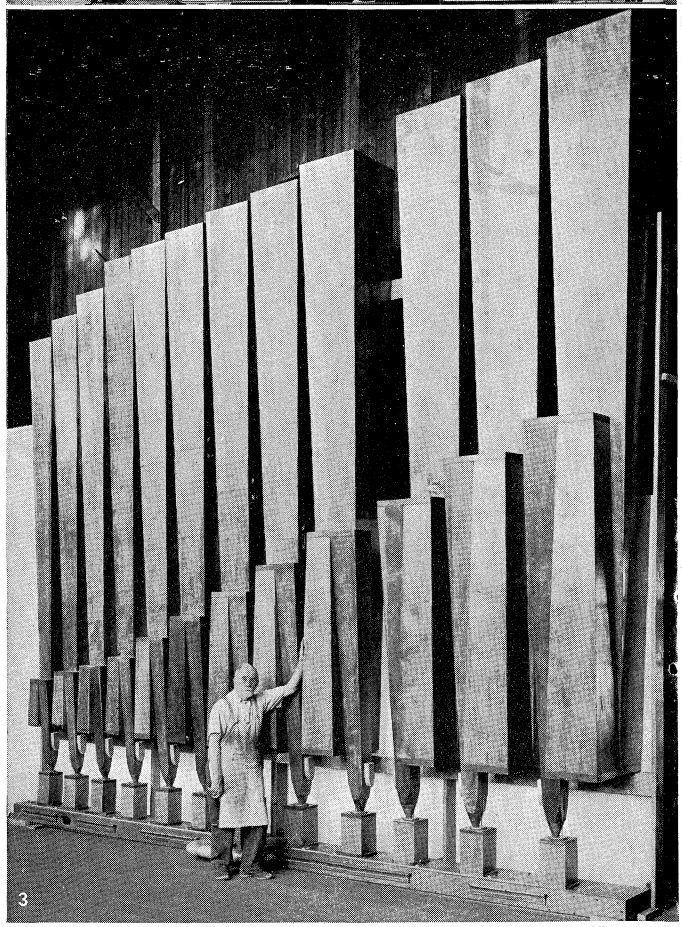
**Wind Supply.**—It but remains to add that wind is supplied to the organ by a form of rotary fan (not unlike a steam turbine), driven by an electric motor. From this fan the wind is conveyed in a zinc duct called a trunk to a junction-box, whence smaller trunks branch out to the reservoirs of each windchest. The dynamo, generating current for the action, may be driven off the main motor by a "whittle-belt" and should be properly over-compounded so as to maintain a steady voltage under varying loads. Gone are the proverbial bellows and still more proverbial "blow-boy," save in remote country districts where there is no electric power; for they have long been ousted by these all-metal machines of greater endurance and fewer vagaries.

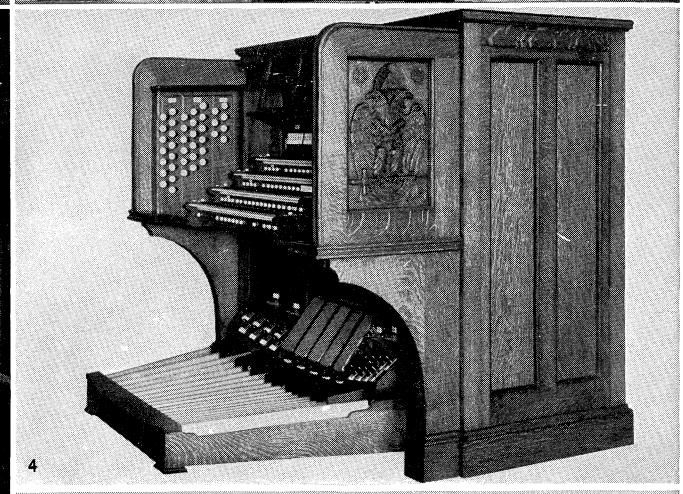
Compared to other pneumatic machines, the organ operates on a very light wind pressure. Seldom are even the most powerful reeds voiced on a wind exceeding the weight of 30 inches of water, while a large majority of stops speak on only 4–6 in. pressure.

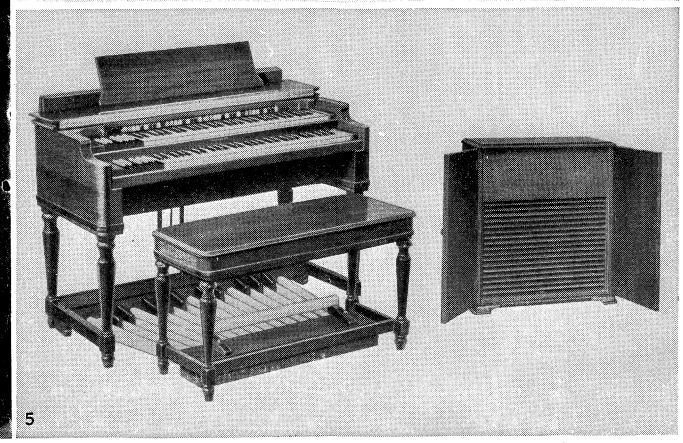
BIBLIOGRAPHY.—Dom Bédos de Celles, *L'Art du facteur d'orgues* (Paris, 1766–1778); Johann Gottlob Töpfer, *Die Orgel* (1843); Arthur G. Hill, *The Organs and Organ Cases of the Middle Ages and Renaissance* (1883); Hopkins and Rimbault, *The Organ, its History and Construction* (1877); John Wallace Goodrich, *The Organ in France* (Boston, U.S.A.); Ernest M. Skinner, *The Modern Organ* (Boston, 1917); G. A. Audsley, LL.D., *The Art of Organ Building;* F. E. Robertson, *A Practical Treatise on Organ Building;* Thomas Elliston, *Organs and Tuning* (4th ed. 1924); N. Bonavia-Hunt, *Modern Organ Stops* (1923); H. Heathcote Statham, *The Organ and its Position in Musical Art* (1909); Harvey Grace, *The Complete Organist* (1920). (D. B.-V.)











BY COURTESY OF (1-4) THE SKINNER ORGAN COMPANY, (5) THE HAMMOND ORGAN

## PARTS OF A MODERN ORGAN

1. Large organ at Finney Chapel, Oberlin College, Oberlin, Ohio, showing casework and display pipes. The console is in the foreground
2. Same organ shown in fig. 1, with casework and display pipes removed, showing interior, with manual and pedal pipes and swell boxes
3. Giant pipes known as Bombardes, set up in the factory for voicing and tuning
4. View of a standard four manual console, similar to the instrument shown in fig. 1
5. A modern electric organ, the two units of which shown are the entire instrument. The organ can be played the moment it is plugged into the ordinary household electric circuit. Its tones are created by electrical impulses instead of by air pressure. When a playing key is depressed an electrical wave, of the same shape as the sound wave for that key, is generated within the console and passed to the tone cabinet where it is amplified into audible sound. This modern electrical instrument is said to achieve the quality and rich variety of the great organs.

**ORGANIC SENSATIONS,** a term for all the bodily sensations except those derived from the skin. In addition to the four special senses, sight, hearing, taste and smell, there is the common sensibility or somaesthesia, which includes cutaneous sensations and also organic sensations. Organic sensations may be subdivided into kinaesthetic sensations, vestibular or static sensation, and visceral sensations. The deep sensibility that comes from the tissues immediately beneath the skin may also be included under this class term. Kinaesthetic sensation, so named because it mediates the perception of bodily movement as well as the perceptions of weight, resistance and posture, arises in the muscles, tendons and joints, all of which are supplied with sense organs. Its nervous mechanism has also been called the proprioceptive system, whose function it is to furnish the afferent cues necessary for precise movement. Without these kinaesthetic sensations or proprioceptive nerve impulses it is impossible to control the movements accurately. The vestibular or static sense has to do with the maintenance of balance and of bodily position and with the perception of rotation. It arises either in the vestibule or the semicircular canals of the ear. Ernst Mach's theory, to which objection has been raised, relates the perception of rotation to these canals, which seem peculiarly well-adapted by their structure to mediate this perception. The visceral sensations include the sensory bases for such experiences as hunger, nausea, appetite and sex, if indeed the last two are to be understood in terms of their sensory nature. (*See* VISCERAL SENSATIONS.)

The importance of organic sensations has been emphasized by the James-Lange theory of emotions, which asserts that an emotion differs from other consciousnesses in that it includes the perception of a violent organic reverberation. For example, a fear may be characterized by the kinaesthesis of running away and the sensations that arise from the dryness of the throat and from the viscera. Against the theory it has been argued that internal state and bodily posture are insufficient completely to account for emotion. *See* EMOTION; JAMES-LANGE THEORY OF EMOTIONS. (E. G. BOR.)

**ORGANOMETALLIC COMPOUNDS** are chemical substances containing a metal or metalloid in direct association with one or more hydrocarbon radicals. These compounds never arise by natural processes in the vegetable and animal kingdoms, being produced synthetically by the art of the chemist. They have played an important part in the development of modern chemistry, and among them are several substances of great practical utility. Lead tetraethyl (*see* p. 898), a most effective antidetonant in motor gasoline or petrol, and salvarsan, a specific remedy in syphilis, are two outstanding examples of organometallic compounds of proven worth. Included in this group of carbon compounds are the organic derivatives of magnesium known after their discoverer as Grignard reagents (*q.v.*). The application of these reagents in chemical synthesis has proved to be one of the most fruitful and far-reaching advances in practical organic chemistry since the end of the 19th century.

Brief references to organometallic compounds have been given under the headings of certain of the metals and metalloids, and the present article affords a general survey of the whole group. The arrangement adopted below follows the natural sequence of the elements according to the periodic law (*q.v.*).

**Group I.**—Although organosodium compounds were prepared as early as 1858 (J. Wanklyn), the existence and properties of these substances remained doubtful until early in the 20th century (W. Schlenk and co-workers, 1913–17). Lithium ethyl, $Li.C_2H_5$, is prepared by the action of metallic lithium on mercury diethyl; it crystallizes from benzene or high-boiling petroleum in colourless, six-sided plates melting at 95° C. Lithium methyl, $Li.CH_3$, and lithium phenyl, $Li.C_6H_5$, are crystalline powders obtained by double decomposition between lithium ethyl and mercury dimethyl and diphenyl respectively (Schlenk and J. Holtz, 1917). More recently, lithium alkyls and aryls have been prepared from lithium metal and alkyl and aryl halides (K. Ziegler, 1930; H. Gilman, 1932). Sodium triphenylmethyl, $Na.C(C_6H_5)_3$, is obtained by the action of 1% sodium amalgam on triphenylchloromethane, $(C_6H_5)_3CCl$, dissolved in dry ether in an atmosphere of oxygen-free nitrogen. The product is a brownish-red solid. The simpler sodium alkyls are prepared by the action of sodium metal on a mercury alkyl (Schlenk) or zinc alkyl (A. v. Grosse, 1926). Sodium methyl, $Na.CH_3$, is a white powder which burns in air with explosive rapidity. Sodium ethyl, $Na.C_2H_5$, sodium *n*-propyl, $Na.C_3H_7$, and sodium phenyl, $Na.C_6H_5$, are colourless solids having similar properties. Cuprous phenyl, $Cu.C_6H_5$, obtained by the interaction of cuprous iodide and magnesium phenyl bromide in ethereal solution, is a white powder decomposing at 80° C. into copper and diphenyl. Silver phenyl, $Ag.C_6H_5$, an even more unstable substance obtained from phenyl magnesium bromide and silver bromide, is a yellow solid, exploding on rubbing, on gentle warming or on treatment with acids. An ethereal solution of auric bromide and magnesium ethyl bromide yields on evaporation colourless crystalline diethylauric bromide, $(C_2H_5)_2AuBr$, melting at 58° C. and exploding at 70° C. Bromine in chloroform converts this monobromide into the ruby-red ethylauric dibromide, $C_2H_5.AuBr_2$ (W. J. Pope and C. S. Gibson, 1907).

**Group II.**—The organic derivatives of beryllium are referred to under this metal and the organomagnesium compounds are described in a special article. (*See* GRIGNARD REAGENTS.) The organozinc compounds were discovered by E. Frankland in 1849, and from his study of similar compounds he was led to the conception of chemical valency. In conjunction with D. F. Duppa (1863) he applied them in many organic syntheses which were extended by G. A. Freund (1861), A. Butlerow (1867) and others. Zinc dimethyl (b.p. 46° C.) and zinc diethyl (b.p. 118° C.) are colourless malodorous liquids, spontaneously inflammable in air. They are prepared by distilling the products of the interaction of methyl and ethyl iodides with a zinc copper couple. More recently zinc phenyl bromide, as a crystalline dietherate (E. Blaise, 1911), and zinc diphenyl (A. Job and R. Reich, 1923) have been obtained by the interaction of magnesium phenyl bromide and anhydrous zinc chloride. The cadmium dialkyls (dimethyl, diethyl, dipropyl, dibutyl, etc.) are procurable in good yields from anhydrous cadmium bromide and the appropriate magnesium alkyl bromide. Cadmium dimethyl, $Cd(CH_3)_2$ is a colourless liquid boiling at 105° C. (E. Krause, 1917). Mercury possesses a remarkable capacity for combination with the carbon of hydrocarbon groups and of organic radicals in general. Sodium amalgam acts directly on ethyl iodide and bromobenzene, giving respectively mercury diethyl, $Hg(C_2H_5)_2$ (b.p. 159° C.), and mercury diphenyl, $Hg(C_6H_5)_2$ (m.p. 120° C.). With certain reactive substances such as aromatic bases or phenols, mercury derivatives are obtained merely by boiling with mercuric acetate; aniline yields *o*- and *p*-amino-phenylmercuriacetates, whereas *m*-toluidine takes up two and even three mercuriacetate residues. Phenol gives rise to *o*- and *p*-hydroxyphenylmercuriacetates and hydroxyphenyl-2:4-dimercuriacetate. In addition to the foregoing processes, organomercury compounds are conveniently prepared through the agency of Grignard reagents. Mercury dimethyl, a colourless liquid boiling at 89–92° C., is obtained from magnesium methyl iodide and mercuric chloride, and the homologous mercury dialkyls are prepared similarly.

**Group III.**—Aluminum trialkyls and triaryls have been recorded, and the production of these substances is facilitated by the use of Grignard reagents. Magnesium ethyl bromide and anhydrous aluminum chloride interact in dry ether to produce aluminum triethyl etherate, $4Al(C_2H_5)_3,3(C_2H_5)_2O$, as a colourless mobile liquid boiling at 112° C./16mm. It fumes in air, takes fire spontaneously, and is decomposed explosively by cold water (E. Krause and B. Wendt, 1923). Aluminum diethyl iodide (b.p. 118–120° C./4 mm.) and aluminum ethyl diiodide (m.p. 35–37° C.; b.p. 158–160° C./4 mm.) were obtained by V. Grignard and R. L. Jenkins (1925) from the liquid product of the interaction of aluminum and ethyl iodide.

Organic derivatives of indium and thallium are obtainable through the Grignard reagents. Thallic bromide, but not thallous bromide, yields both dialkyl and diaryl compounds. Thallic dimethyl bromide, $(CH_3)_2TlBr$, forms silvery-white leaflets (R. J. Meyer and A. Bertheim, 1904), whereas thallic diphenyl bromide, $(C_6H_5)_2TlBr$, is obtained in colourless transparent microscopic needles (D. Goddard and A. E. Goddard, 1922).

**Group IV.**—Organic derivatives are known of silicon (*q.v.*), germanium (*q.v.*), tin and lead. The most common and stable organolead compounds are the lead tetraalkyls and tetraaryls, which are obtained by interaction of lead chloride or lead bromide with the appropriate Grignard reagent,

$$4\ RMgBr + 2\ PbBr_2 = PbR_4 + Pb + 4\ MgBr_2.$$

Lead tetramethyl, $Pb(CH_3)_4$, lead tetraethyl, $Pb(C_2H_5)_4$, and other lead tetraalkyls have been prepared in this manner, as have the tetraaryls such as lead tetraphenyl, $Pb(C_6H_5)_4$. Treatment of these compounds with acids or halogens converts them to alkyl lead salts, such as $(C_2H_5)_3PbCl$ and $(C_6H_5)_2Pb(NO_3)_2$. Lead tetraalkyls containing different alkyl groups are prepared by reaction of alkyl lead halides with a Grignard reagent containing a different alkyl group (G. Grüttner and E. Krause, 1917), or by interaction of two different lead tetraalkyls in the presence of aluminum chloride (G. Calingaert and co-workers, 1939). The lower lead tetraalkyls are relatively stable, colourless, volatile liquids, while the lead tetraaryls are colourless solids. Organolead compounds such as dilead hexamethyl, $(CH_3)_3Pb.Pb(CH_3)_3$, dilead hexaphenyl, $(C_6H_5)_3Pb.Pb(C_6H_5)_3$, and lead diphenyl, $Pb(C_6H_5)_2$ have also been prepared; on being heated these decompose to the corresponding $PbR_4$ compounds and metallic lead.

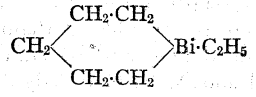
The commercially important lead tetraethyl is now manufactured (in the U.S.A. and other countries) by the action of ethyl chloride under pressure on a powdered alloy of lead and sodium contained in an autoclave. The lead tetraethyl is steam distilled from the reaction mass, leaving sodium chloride and metallic lead as the by-products. It is a colourless liquid, stable in air, soluble in gasoline, and quite volatile, although it decomposes at temperatures below its boiling point. For use as an antidetonant, it is added to gasoline in quantities not exceeding 3.0 cc. per gallon; a small quantity of ethylene dibromide, and sometimes ethylene dichloride, is added to prevent the formation of lead deposits in the engine.

The preparation and properties of organotin compounds are very much like those of organolead compounds. Stannous chloride and magnesium ethyl bromide give tin diethyl, $Sn(C_2H_5)_2$, as an oxidizable oil insoluble in water (P. Pfeiffer, 1911), whereas tin diphenyl, $Sn(C_6H_5)_2$, a bright yellow powder melting at 130° C. to a dark red liquid, is obtained from stannous chloride and magnesium phenyl bromide. When excess of Grignard reagent is used, this diaryl compound loses part of its tin and passes into ditin hexaphenyl, $3Sn(C_6H_5)_2 = Sn + (C_6H_5)_3Sn.Sn(C_6H_5)_3$, obtained in colourless plates melting at 237° C. (E. Krause and R. Becker, 1920). Tin tetramethyl, $Sn(CH_3)_4$, and tin tetraethyl $Sn(C_2H_5)_4$, boiling at 78° C. and 175° C. respectively, are prepared in good yields from stannic chloride and the appropriate Grignard reagents; in the latter case triethylstannic chloride, $(C_2H_5)_3SnCl$, is obtained as a by-product.

Magnesium benzyl chloride and stannic chloride give tribenzylstannic chloride, $(C_7H_7)_3SnCl$, (m.p. 143–145° C.) and tin tetrabenzyl (tetrabenzylstannane), $Sn(C_7H_7)_4$, (colourless needles, m.p. 42–43° C.). The former compound when acted on by chlorine furnishes dibenzylstannic chloride $(C_7H_7)_2SnCl_2$ in colourless crystals melting at 163–4° C. (T. Smith and F. S. Kipping, 1912).

**Group V.**—Certain more outstanding examples of organic derivatives of arsenic and antimony are described in the articles on these metalloids. Both trialkyl- and triaryl-bismuthines have long been known and were formerly prepared by the interaction of alkyl or aryl halides and sodium or potassium bismuthides.

The use of Grignard reagents has considerably enlarged the bismuth series of organic compounds. Diphenyl-α-naphthylbismuthine and tri-α-naphthylbismuthine (melting points 118–119° C. and 235° C.) have been prepared in this way (F. Challenger, 1914), and a cyclic bismuth compound, ethyl*cyclo*bismuthopentane has been prepared by the successive action on bismuth tribromide of magnesium ethyl bromide and the dimagnesium compound of 1:5–dibromopentane (G. Grüttner and M. Wiernik, 1915); it is a yellow viscous oil boiling at 108–112° C./18–20 mm. with an unpleasant odour and oxidizing rapidly in air.




**Group VI.**—Organic derivatives of selenium (*q.v.*) and tellurium (*q.v.*) are mentioned under these headings. A remarkable series of organic chromium compounds has been described by F. Hein (1919–24), who by the action of magnesium phenyl bromide either on chromyl chloride or on anhydrous chromic chloride obtained chromium pentaphenyl bromide, $Cr(C_6H_5)_5Br$, an orange-brown amorphous substance converted by alcoholic potash into chromium pentaphenyl hydroxide, $Cr(C_6H_5)_5OH,4H_2O$, crystallizing in golden-yellow leaflets. This basic hydroxide on treatment with acids loses a phenyl group giving rise to salts of the general type $[Cr(C_6H_5)_4]X$ (where X is the acid radical). Moreover, the mother-liquors from chromium pentaphenyl hydroxide contain chromium triphenyl hydroxide, which gives the corresponding salts $[Cr(C_6H_5)_3]X$. These organic derivatives indicate that chromium has valencies of 6, 5 and 4.

**Group VIII.**—Very few organometallic compounds of the metals of this group are known. Apart from some organoiron compounds, the only organometallic compounds isolated have been some platinum compounds. Ethyl iron chloride, $C_2H_5FeCl$, has been prepared by interaction of ethyl zinc iodide and ferrous chloride (A. Job and R. Reich, 1922). Phenyl iron iodide, $(C_6H_5)FeI$, has also been prepared from ferrous iodide and phenyl zinc iodide (G. Champetier, 1930). Trimethyl platinum iodide, $(CH_3)_3PtI$, has been obtained by interaction of platinum chloride and magnesium methyl iodide. The product, a yellow crystalline solid, is converted by silver oxide to trimethyl platinum hydroxide, $(CH_3)_3PtOH$. Solution of the latter in nitric acid gives the nitrate, $(CH_3)_3PtNO_3$. The corresponding chloride, $(CH_3)_3PtCl$, crystallizes from chloroform in colourless rhombic dodecahedra (W. J. Pope and S. J. Peachy, 1909). Platinum tetramethyl, $Pt(CH_3)_4$, has been prepared from trimethyl platinum iodide and sodium methyl, and diplatinum hexamethyl, $(CH_3)_3Pt.Pt(CH_3)_3$, has been obtained by heating trimethyl platinum iodide with powdered potassium in dry benzene (H. Gilman and M. Lichtenwalter, 1936).

BIBLIOGRAPHY.—J. N. Friend, *Text Book of Inorganic Chemistry*, Vol. XI, "Organometallic Compounds," by A. E. and D. Goddard (1929); E. Krause and A. V. Grosse, *Die Chemie der metall-organischen Verbindungen*, Gebruder Borntraeger (Berlin, 1937); H. Gilman, *Organic Chemistry, An Advanced Treatise*, Vol. I, 2nd edition (1943); F. Runge, *Organometallverbindungen*, I Teil, Wissenschaftliche Verlagsgesellschaft (Stuttgart, 1932); J. Schmidt, *Organometallverbindungen*, II Teil, Wissenschaftliche Verlagsgesellschaft (Stuttgart, 1934).

(G. T. M.; G. Cr.)

**ORGANON,** the name given to Aristotle's logical treatises (Gr. *ὄργανον*, instrument). They are so called because logic is itself neither a speculative science nor a practical art in the ordinary sense, but an aid or instrument to all scientific thought. Francis Bacon gave to his own treatise the name *Novum Organum* in the belief that he had discovered a new inductive logic.

**ORGY,** a term originally denoting the secret rites or ceremonies connected with the worship of certain deities. The word is derived from Lat. *Orgia*, Gr. *ὄργια*, a post-Homeric word used of the secret rites of Demeter (*q.v.*), at Eleusis, of the Cabeiri, Orpheus and Eumolpus (*qq.v.*), but most commonly of the rites of Dionysus-Bacchus, with their dedications and purifications. The word has been connected with **ἔργω = ἔρδω*, *ῥέζω*, in the sense of performing sacred rites; Lat. *operari*, to perform sacrifice.

The Dionysiac orgies, which were restricted to women, were celebrated in the winter among the Thracian hills or in spots remote from city life. The women met, generally at night, clad in fawn skins, with hair dishevelled, swinging the thyrsus and beating the cymbal; they danced and worked themselves up to a state of mad excitement. A bull, the representative of the god, was torn in pieces by them as Dionysus-Zagreus had been torn. The women tore the bull with their teeth, and the eating of the raw flesh was a necessary part of the ritual. The most famous festival of the kind was the *τεριετηρίς*, the triennial festival, celebrated on Parnassus by the women of Attica and Phocis. The

celebrants were called Maenads or Bacchae. The wild dances and other "orgiastic" ceremonies have given rise to the use of the word "orgy" for any wild revel or festivity. (*See* DIONYSUS and MYSTERY.)

**ORIBI** or **OUREBI,** a small South African antelope (*Oribia scoparia*), standing about 24in. at the shoulder, and characterized by a bare glandular spot below the ear, the upright horns of the bucks, which are ringed for a short distance above the face, and the tufted bushy tail. The name is extended to include the other members of the same genus.

**ORIEL,** in architecture, a projecting bay window carried by corbels or mouldings. It is usually polygonal or semicircular in plan, but at Oxford, in some of the colleges, there are examples which are rectangular and rise through two or three storeys. In Germany it forms a favourite feature, and is sometimes placed at the angle of a building, carried up through two or three floors and covered with a lofty roof. The oriel is also said to have been provided as a recess for an altar in an oratory or small chapel. In the 15th century oriels came into general use, and are frequently found over entrance gateways.

The earliest meaning of the word seems to be a gallery, portico or corridor, and the application of the term to a particular form of window apparently arose from such a window being in an "oriel." In Cornwall "orrel" is still used of a balcony or porch at the head of an outside staircase leading to an upper storey in a fisherman's cottage. The name of Oriel college, Oxford, comes from a tenement known as Seneschal Hall or La Oriole, granted to the college in 1327. (*See* BAY; WINDOW.)

**ORIENTAL COOKERY** is characterized by the use of many condiments, often making the food very "hot," and by the use of very sweet dishes. In general, the Orient prefers main dishes in which many food materials have been combined into one appetizing whole, and this means cutting into small pieces. Confucius refused to eat food that was not "chopped up properly," and also ruled that there must never be more flesh food than vegetables in the mixture. A Japanese rule calls for the five tastes of sweet, salt, sour, bitter and acrid in each meal, and another for something in each from both sea and mountain. The most widely used meat is lamb or mutton. In China pork is common. The *kebob* of Turkey and India is meat, fish or poultry cut small and strung on a skewer, often with alternating slices of vegetable. It is usually broiled. *Pilaf* or *pilau,* the national dish of Turkey and much eaten in India, is a dish of rice (usually browned in fat before cooking in stock), to which flesh foods or vegetables or both are added, either cooked with the rice or served on it, and the mixture highly seasoned. The Armenian *herissa* and the Arabian *couscous* are similar dishes made with cracked wheat instead of rice. The Turkish *dolma* is a vegetable stuffed with rice and minced meat or olive oil. Vine leaves are also used for this. Birds, domestic and wild, vary the diet. Fish and shellfish furnish more of the flesh food than does meat, being in most places abundant and cheap. All flesh foods and vegetables are preserved by drying as well as in other ways. "Bombay duck" is dried salted fish. Flesh foods eaten in the East not used in the West include buffalo, cat, dog, field rat, snake, lizard, beetle, cockroach, larvae, ant, worm, shark fin and whale, some of these being held to be great delicacies.

For fat, India uses *ghee* (clarified butter), China peanut oil, Turkey and adjacent countries olive oil, and many sesame oil. Eggs are cooked in many ways. Bread is not in as general use as in the Occident, though in Japan it is growing in popularity. The *chapati* of the Indian peasant is a thin wafer made of whole wheat flour, "pan" fried in *ghee.* The main vegetable food of the Orient is rice, which is almost everywhere served with every meal, and is generally cooked in stock. Cracked wheat, barley, buckwheat, sesame and the millets are used in some countries. Noodles are eaten, and Italian pastes, though not native, are now in Eastern markets. Milk is used in Turkey and kindred countries when curdled (*matzoun*) as a beverage and in sauces. Tea is the universal beverage of the Orient, and in some countries coffee is common. Turkish coffee is made from the following formula: For four small cups, $\frac{2}{3}$ cup water, 3 teaspoons sugar, 3 teaspoons pulverized coffee. Melt the sugar in the water over the fire, remove from fire, add coffee, stir one minute, return to fire and bring to boiling point three or four times. This is not strained, but sipped from the cup after the coffee has settled to the bottom.

Fruits are usually cooked, except that dates, the staple food of the lands of the Near East, are rarely cooked except in puddings and confections. In China pineapple is often cooked with chicken and other meats. Pastries, sweet with sugar syrup and often with nuts, or a sweet fruit compote, are the usual ending for a Turkish meal. The Chinese and Japanese use sweet cakes, confections and puddings, or cooked or preserved fruits. Salads are much eaten in the Near East, usually of a combination of vegetables and perhaps fruits. Seasonings used in the Orient not common in the Occident include cummin, saffron, coriander seed, tamarind, chilis in variety, curry powder and soy sauce. Vegetable foods form the greater part of the diet.

The most famous dish of India is the curry, in which material cooked with curry powder or in a curry sauce is served in a ring of rice. The epicure insists on curries made from spices ground fresh each day, but curry powder and essence may be made ahead in the home or may be bought bottled. A good formula for curry sauce, hot enough for the average Western taste, but not for that of India, uses 2 tablespoons minced onion, fried a little in $\frac{1}{4}$ cup butter, $1\frac{1}{2}$ tablespoons curry powder, mixed to a paste with a little of 2 cups of stock or milk, 2 teaspoons curry essence, $\frac{1}{4}$ teaspoon salt, 1 tablespoon rice flour, 1 cup cocoanut or almond milk (made by soaking an hour in 1 cup milk, $\frac{1}{2}$ cup freshly ground cocoanut or blanched almonds ground fine, and used with or without straining), 1 teaspoon scraped green ginger, 1 teaspoon currant jelly. The meat, fish, shellfish, poultry or vegetables are cooked in the sauce. With a curry is served chutney, a sauce or conserve made of sweet and sour fruits and vegetables, highly spiced.

Chinese and Japanese food are similar, though not the same. Young bamboo sprouts, bean sprouts, water chestnuts, dried mushrooms and *pe-tsai* (Chinese cabbage) are favourite vegetables. The soy bean is used not only in soy sauce, but for the delicate bean curd that adds an agreeable texture and flavour to so many dishes. The famous bird's nests of China are used in dishes with chicken and pigeon as well as for soup. They are a luxury, as are the equally famous ancient eggs. Almonds are used in many combinations.

Chop suey is a dish unknown in China. The Japanese serve many foods cooked in deep fat after being dipped in a very delicate batter.

In Japan the diner in a restaurant often cooks his own food in an iron skillet set on the dining table. (I. E. L.)

**ORIENTATION,** a term expressing the angular relation of any object to the points of the compass; in architecture, used to express the relation of the main dimensions of a building, with reference to the points of the compass, and especially with reference to the east. In Mesopotamia and Egypt, as well as in primitive Central America, orientation of buildings was common from an early date, with important features, entrances, passages and the like designed to point in the direction of the rising sun. In north Europe the same custom evidently prevailed, as Stonehenge, near Salisbury, England, is carefully orientated. Many Greek temples were also designed to face the rising sun.

In the earliest Christian basilicas at Rome, the apse was placed at the west end, so that the priest who served the altar from behind, facing the congregation, himself faced the east and the rising sun. This orientation has sometimes been traced to the influence of the churches of the Holy Sepulchre at Jerusalem and of the Nativity at Bethlehem. It is more probable, however, that this orientation was due to an underlying tradition whose roots go far back beyond the origin of Christianity.

In St. Sophia, Constantinople, and all the Byzantine churches, the apse was placed at the east end, and the same custom obtains in the early churches in Syria and the Coptic churches in Egypt. During the 6th and 7th centuries this orientation gradually came into use in Italy and the west generally. Orientation of this type, with the apse or altar toward the east, is generally carefully observed in Spain, Germany and England, and

less carefully in France and Italy. It is so common, however, that in an architectural or ecclesiastical description of a church building, the "east end" is always the end with the apse or altar. In Mohammedan mosques the mihrab or prayer niche is so placed that the worshipper looks towards Mecca.

Orientation is an important consideration in the placing of any building, as exposure to the sun, or lack of it, prevailing winds and similar facts in climate must be considered in designing a building for any purpose. Thus in the northern temperate zone, living rooms are usually arranged to get large amounts of south light; studios are arranged with north light, and, in general, buildings like schools, with rooms on both sides of a corridor, are placed, if possible, with the corridor running north and south, so that the rooms on both sides may receive the sun.

**ORIENTE** or **LA REGION ORIENTAL,** a large undefined territory of Ecuador, comprising all that part of the republic lying east of the Andes. Pop. (1941 estimate), 218,735. The territory was formed in 1884, but its boundaries with neighbouring republics have been frequently disputed. A recurrent border war was fought with Peru in 1941, involving a contested area of more than 150,000 sq.mi. At the Rio de Janeiro conference in Jan. 1942, Peru and Ecuador agreed to submit the dispute to a boundary commission comprised of representatives from their own countries and the United States.

**ORIGEN** (*c.* 185–*c.* 254), the most distinguished and most influential of all the theologians of the ancient church, with the possible exception of Augustine.

Origen was born, perhaps at Alexandria, of Christian parents in the year 185 or 186. His father Leonidas gave him an excellent education. At a very early age, about the year 200, he listened to the lectures of Pantaenus and Clement in the catechetical school. This school, of which the origin (though assigned to Athenagoras) is unknown, was the first and for a long time the only institution where Christians were instructed simultaneously in the Greek sciences and the doctrines of the holy Scriptures. Asia Minor and the West developed the strict ecclesiastical forms by means of which the church closed her lines against heathenism, and especially against heresy; in Alexandria Christian ideas were handled in a free and speculative fashion and worked out with the help of Greek philosophy. The line between heresy and orthodoxy was less rigidly drawn there than at Ephesus, Lyons, Rome or Carthage.

In the year 202 a persecution arose, in which the father of Origen perished. Origen began about the same time to earn his bread by teaching; and in 203 he was placed, with the sanction of the bishop of Demetrius, at the head of the catechetical school. He regularly attended the lectures of Ammonius Saccas, and made a thorough study of the books of Plato and Numenius, of the Stoics and the Pythagoreans. At the same time he endeavoured to acquire a knowledge of Hebrew, in order to be able to read the Old Testament in the original. His manner of life was ascetic; the sayings of the Sermon on the Mount and the practical maxims of the Stoics were his guiding stars. Four oboli a day, earned by copying manuscripts, sufficed for his bodily sustenance. A rash resolve led him to castrate himself that he might work unhindered in the instruction of women.

He commenced his great work on the textual criticism of the Scriptures; and at the instigation of his friend Ambrosius, who provided him with the necessary amanuenses, he published his commentaries on the Old Testament and his dogmatic investigations. He worked at Alexandria for 28 years (till 231–232). This period, however, was broken by many journeys to Rome, to Arabia, to Antioch, and, in 216, when the imperial executioners were ravaging Alexandria, to Palestine. There the bishops of Jerusalem and Caesarea got him to deliver public lectures in the churches. In the East, especially in Asia Minor, it was still no unusual thing for laymen, with permission of the bishop, to address the people in the church. In Alexandria, however, this custom had been given up, and Demetrius took occasion to express his disapproval and recall Origen to Alexandria.

Probably the bishop was jealous of the high reputation of the teacher; and a coolness arose between them which led, fifteen years later, to an open rupture. On his way to Greece (apparently in the year 230) Origen was ordained a presbyter in Palestine by his friends the bishops. This was undoubtedly an infringement of the rights of the Alexandrian bishop; at the same time it was simply spite on the part of the latter that had kept Origen so long without orders. Demetrius convened a synod, at which it was resolved to banish Origen from Alexandria. A second synod, composed entirely of bishops, determined that Origen must be deprived of his status as a presbyter. This decision seems to have been justified by referring to the self-mutilation of Origen and adducing objectionable doctrines which he was said to have promulgated. No formal excommunication of Origen appears to have been decreed; the sentence of deprivation was approved by most of the churches, in particular by that of Rome. At a later period Origen sought to vindicate his teaching in a letter to the Roman bishop Fabian, but, it would seem, without success.

In these circumstances Origen retired from Alexandria (231–232) to Palestine, where his condemnation had not been acknowledged by the churches. He settled in Caesarea, and established a flourishing school there. Enthusiastic pupils sat at his feet (see the *Panegyric* of Gregory Thaumaturgus), and the methodical instruction which he imparted was famous all over the East. He made frequent journeys. He was for two years together at Caesarea in Cappadocia, where he was overtaken by the Maximinian persecution; here he worked at his recension of the Bible. We find him again in Nicomedia, in Athens, and twice in Arabia. He was called there to combat the unitarian christology of Beryllus, bishop of Bostra, and to clear up certain eschatological questions. As he had formerly had dealings with the house of Alexander Severus, so now he entered into a correspondence with the emperor Philip the Arabian and his wife Severa. But through all situations of his life he preserved his equanimity, his keen interest in science, and his indefatigable zeal for the instruction of others. In the year 250 the Decian persecution broke out, Origen was arrested, imprisoned and maltreated. But he survived these troubles and lived a few years longer in active intercourse with his friends. He died, probably in the year 254 at Tyre.

**Writings.**—Origen is probably the most prolific author of the ancient church. "Which of us," asks Jerome, "can read all that he has written?" The number of his works was estimated at 6000, but that is certainly an exaggeration. Owing to the increasing unpopularity of Origen in the church, a comparatively small portion of these works have come down to us in the original. We have more in the Latin translation of Rufinus; but this translation is by no means trustworthy, since Rufinus, assuming that Origen's writings had been tampered with by the heretics, considered himself at liberty to omit or amend heterodox statements. Origen's real opinion, however, may frequently be gathered from the *Philocalia*—a sort of anthology from his works prepared by Basil the Great and Gregory Nazianzenus. The fragments in Photius and in the *Apology* of Pamphilus serve for comparison. The writings of Origen consist of letters, and of works in textual criticism, exegesis, apologetics, dogmatic and practical theology.

1. Eusebius (to whom we owe our full knowledge of his life) collected more than a hundred of Origen's letters, arranged them in books, and deposited them in the library at Caesarea (*H.E.* vi. 36). In the church library at Jerusalem (founded by the bishop Alexander) there were also numerous letters of this father (Euseb. *H.E.* vi. 20). But unfortunately they have all been lost except two—one to Julius Africanus and one to Gregory Thaumaturgus. There are, besides, a couple of fragments.

2. Origen's textual studies on the Old Testament were undertaken partly in order to improve the manuscript tradition, and partly for apologetic reasons, to clear up the relation between the LXX and the original Hebrew text. The results of more than twenty years' labour were set forth in his *Hexapla* and *Tetrapla,* in which he placed the Hebrew text side by side with the various Greek versions, examined their mutual relations in detail, and tried to find the basis for a more reliable text of the LXX. The *Hexapla* was probably never fully written out, but excerpts were made from it by various scholars at Caesarea in the 4th century; and thus large sections of it have been saved. He worked at the text of the New Testament, although he produced no recension.

3. The exegetical labours of Origen extend over the whole of the Old and New Testaments. They are divided into *Scholia* (*σημειώσεις*, short annotations, mostly grammatical), *Homilies* (edifying expositions grounded on exegesis), and *Commentaries* (*τόμοι*). In the Greek original only a very small portion has been preserved; in Latin translations, however, a good deal. The most important parts are the homilies on Jeremiah, the books of Moses, Joshua and Luke, and the commentaries on Matthew, John and Romans. With grammatical precision, antiquarian learning and critical discernment Origen combines the allegorical method of interpretation—the logical corollary of his conception of the inspiration of the Scriptures. He distinguishes a threefold sense of scripture, a grammatico-historical, a moral and a pneumatic—the last being the proper and highest sense. He thus set up a formal theory of allegorical exegesis, not quite extinct in the churches even yet, and in his own system of fundamental importance.

4. The principal apologetic work of Origen is his book *κατὰ Κέλσου* (eight books), written at Caesarea in the time of Philip the Arabian. It has been completely preserved in the original. This work is invaluable as a source for the history and situation of the church in the 2nd century; for it contains nearly the whole of the famous work of Celsus (*Λόγος ἀληθής*) against Christianity. What makes Origen's answer so instructive is that it shows how close an affinity existed between Celsus and himself in their fundamental philosophical and theological presuppositions. The real state of the case is certainly unsuspected by Origen himself; but many of his opponent's arguments he is unable to meet except by a speculative reconstruction of the church doctrine in question. Origen's apologetic is most effective when he appeals to the spirit and power of Christianity. In details his argument is not free from sophistical subterfuges and superficial reasonings.

5. Of the dogmatic writings we possess only one in its integrity, and that only in the translation of Rufinus, *Περὶ ἀρχῶν* (On the Fundamental Doctrines). This work, which was composed before 228, is the first attempt at a dogmatic at once scientific and accommodated to the needs of the church. The material is drawn from Scripture, but in such a way that the propositions of the *regula fidei* are respected. This material is then formed into a system by all the resources of the intellect and of speculation. Origen thus solved, after his own fashion, a problem which his predecessor Clement had not even ventured to grapple with. The first three books treat of God, the world, the fall of spirits, anthropology and ethics. "Each of these three books really embraces, although not in a strictly comprehensive way, the whole scheme of the Christian view of the world, from different points of view, and with different contents." The fourth book explains the divinity of the Scriptures, and deduces rules for their interpretation. It ought properly to stand as first book at the beginning. The ten books of *Stromata* (in which Origen compared the teaching of the Christians with that of the philosophers, and corroborated all the Christian dogmas from Plato, Aristotle, Numenius and Cornutus) have perished, with the exception of fragments; so have the tractates on the resurrection and freewill.

6. Of practical theological works we have still the *Προτρεπτικὸς εἰς μαρτύριον* and the *Σύνταγμα περὶ εὐχῆς*. For a knowledge of Origen's Christian estimate of life and his relation to the faith of the church these two treatises are of great importance. The first was written during the persecution of Maximinus Thrax, and was dedicated to his friends Ambrosius and Protoctetus. The other also dates from the Caesarean period; it mentions many interesting details, and concludes with a fine exposition of the Lord's Prayer.

7. In his own lifetime Origen had to complain of falsifications of his works and forgeries under his name. Many pieces still in existence are wrongly ascribed to him; yet it is doubtful whether a single one of them was composed on purpose to deceive. The most noteworthy are the *Dialogues* of a certain Adamantius "de recta in Deum fide," which seem to have been erroneously attributed to Origen so early as the 4th century.

**Outline of Origen's View of the Universe and of Life.**—The system of Origen was formulated in opposition to the Greek philosophers on the one hand, and the Christian Gnostics on the other[1]. But the science of faith, as expounded by him, bears unmistakably the stamp both of Neo-Platonism and of Gnosticism. As a theologian, in fact, Origen is not merely an orthodox traditionalist and believing exegete, but a speculative philosopher of Neo-Platonic tendencies. He is, moreover, a judicious critic. The union of these four elements gives character to his theology, and in a certain degree to all subsequent theology. It is this combination which has determined the peculiar and varying relations in which theology and the faith of the church have stood to each other since the time of Origen. That relation depends on the predominance of one or other of the four factors embraced in his theology.

As an orthodox traditionalist Origen holds that Christianity is a practical and religious saving principle, that it has unfolded itself in an historical series of revealing facts, that the church has accurately embodied the substance of her faith in the *regula fidei*, and that simple faith is sufficient for the renewal and salvation of man. As a philosophical idealist, however, he transmutes the whole contents of the faith of the church into ideas which bear the mark of Neo-Platonism, and were accordingly recognized by the later Neo-Platonists as Hellenic[2]. In Origen, however, the mystic and ecstatic element is held in abeyance. The ethico-religious ideal is the sorrowless condition, the state of superiority to all evils, the state of order and of rest. In this condition man enters into likeness to God and blessedness; and it is reached through contemplative isolation and self-knowledge, which is divine wisdom.

As a means to the realization of this ideal, Origen introduces the whole ethics of Stoicism. But the link that connects him with churchly realism, as well as with the Neo-Platonic mysticism, is the conviction that complete and certain knowledge rests wholly on divine revelation, *i.e.*, on oracles. Consequently his theology is cosmological speculation and ethical reflection based on the sacred Scriptures. The Scriptures, however, are treated by Origen on the basis of a matured theory of inspiration in such a way that all their facts appear as the vehicles of ideas, and have their highest value only in this aspect. That is to say, his gnosis neutralizes all that is empirical and historical, if not always as to its actuality, at least absolutely in respect of its value. The most convincing proof of this is that Origen (1) takes the idea of the immutability of God as the regulating idea of his system, and (2) deprives the historical "Word made flesh" of all significance for the true Gnostic. To him Christ appears simply as the Logos who is with the Father from eternity, and works from all eternity, to whom alone the instructed Christian directs his thoughts, requiring nothing more than a perfect—*i.e.*, divine—teacher. In such propositions historical Christianity is stripped off as a mere husk. The objects of religious knowledge are beyond the plane of history, or rather belong to a supra-mundane history.

On this view contact with the faith of the church could only be maintained by distinguishing an exoteric and an esoteric form of Christianity. This distinction was already current in the catechetical school of Alexandria, but Origen gave it its boldest expression, and justified it on the ground of the incapacity of the Christian masses to grasp the deeper sense of Scripture, or unravel the difficulties of exegesis. On the other hand, in dealing with the problem of bringing his heterodox system into conformity with the *regula fidei* he evinced a high degree of technical skill. An external conformity was possible, inasmuch as speculation, proceeding from the higher to the lower, could keep by the stages of the *regula fidei*, which had been developed into a history of salvation. The system itself aims in principle at being thoroughly monistic; but, since matter, although created by God out of nothing, was regarded merely as the sphere in which souls are punished and purified, the system is pervaded by a strongly dualistic element. The immutability of God requires the eternity of the Logos and of the world. At this point Origen succeeded in avoiding the heretical Gnostic idea of God by assigning to the Godhead the attributes of goodness and righteousness. The pre-

[1] The opposition to the unitarians within the church must also be kept in mind.

[2] Porphyry says of Origen, *κατὰ τὰς περὶ πραγμάτων καὶ τοῦ θείου δόξας Ἑλληνίζων* (Euseb. *H. E.* vi. 19).

existence of souls is another inference from the immutability of God, although Origen also deduced it from the nature of the soul, which as a spiritual potency must be eternal. From this follows the necessity for the created spirit, after apostasy, error and sin, to return always to its origin in God.

The actual sinfulness of all men Origen was able to explain by the theological hypothesis of pre-existence and the premundane fall of each individual soul. He holds that freedom is the inalienable prerogative of the finite spirit; and this is the second point that distinguishes his theology from the heretical Gnosticism. The system unfolds itself like a drama, of which the successive stages are as follows: the transcendental fall, the creation of the material world, inaugurating the history of punishment and redemption, the clothing of fallen souls in flesh, the dominion of sin, evil and the demons on earth, the appearing of the Logos, His union with a pure human soul, His esoteric preaching of salvation, and His death in the flesh, then the imparting of the Spirit, and the ultimate restoration of all things. The doctrine of the restoration appeared necessary because the spirit, in spite of its inherent freedom, cannot lose its true nature, and because the final purposes of God cannot be foiled. The end, however, is only relative, for spirits are continually falling, and God remains through eternity the creator of the world. Moreover the end is not conceived as a transfiguration of the world, but as a liberation of the spirit from its unnatural union with the sensual.

The old Christian eschatology is set aside; no one has dealt such deadly blows to Chiliasm and Christian apocalypticism as Origen. It need hardly be said that he spiritualized the church doctrine of the resurrection of the flesh. But, while in all these doctrines he appears in the character of a Platonic philosopher, traces of rational criticism are not wanting. Where his fundamental conception admits of it, he tries to solve historical problems by historical methods. Even in the christology, where he is treating of the historical Christ, he entertains critical considerations; hence it is not altogether without reason that in after times he was suspected of "Ebionitic" views of the Person of Christ.

Although the theology of Origen exerted a considerable influence as a whole in the two following centuries, it certainly lost nothing by the circumstance that several important propositions were capable of being torn from their original setting and placed in new connections. It is in fact one of the peculiarities of this theology, which professed to be at once churchly and philosophical, that most of its formulae could be interpreted and appreciated *in utramque partem*. By arbitrary divisions and rearrangements the doctrinal statements of this "science of faith" could be made to serve the most diverse dogmatic tendencies. This is seen especially in the doctrine of the Logos. On the basis of his idea of God Origen was obliged to insist in the strongest manner on the personality, the eternity (eternal generation) and the essential divinity of the Logos[1]. On the other hand, when he turned to consider the origin of the Logos he did not hesitate to speak of Him as a *κτίσμα*, and to include Him amongst the rest of God's spiritual creatures. A *κτίσμα*, which is at the same time *ὁμοούσιον τῷ Θεῷ*, was no contradiction to him, simply because he held the immutability, the pure knowledge and the blessedness which constituted the divine nature to be communicable attributes.

In later times both the orthodox and the Arians appealed to his teaching, both with a certain plausibility; but the inference of Arius, that an imparted divinity must be divinity in the second degree, Origen did not draw. With respect to other doctrines also, such as those of the Holy Spirit and the incarnation of Christ, etc., Origen prepared the way for the later dogmas. The technical terms round which such bitter controversies raged in the 4th and 5th centuries are often found in Origen lying peacefully side by side. But this is just where his epoch-making importance lies, that all the later parties in the church learned from him. And this is true not only of the dogmatic parties; solitary monks and ambitious priests, hard-headed critical exegetes, allegorists, mystics, all found something congenial in his writings. The only man who tried to shake off the theological influence of Origen was Marcellus of Ancyra, who produced no lasting effect on theology.

The attacks on Origen, which had begun in his lifetime, did not cease for centuries, and only subsided during the time of the fierce Arian controversy. It was not so much the relation between *pistis* and *gnosis*—faith and knowledge—as defined by Origen that gave offence, but rather isolated propositions, such as his doctrines of the pre-existence of souls, of the soul and body of Christ, of the resurrection of the flesh, of the final restoration, and of the plurality of worlds. Even in the 3rd century Origen's view of the Trinity and of the Person of Christ was called in question, and that from various points of view. It was not till the 5th century, however, that objections of this kind became frequent. In the 4th century Pamphilus, Eusebius of Caesarea, Athanasius, the Cappadocians, Didymus and Rufinus were on the side of Origen against the attacks of Methodius and many others. But, when the zeal of Epiphanius was kindled against him, when Jerome, alarmed about his own reputation, and in defiance of his past attitude, turned against his once honoured teacher, and Theophilus, patriarch of Alexandria, found it prudent, for political reasons to condemn Origen—then his authority received a shock from which it never recovered.

There were, doubtless, in the 5th century church historians and theologians who still spoke of him with reverence, but such men became fewer and fewer. In the West Vincent of Lerins held up Origen as a warning example (*Commonit.* 23), showing how even the most learned and most eminent of church teachers might become a misleading light. In the East the exegetical school of Antioch had an aversion to Origen; the Alexandrians had utterly repudiated him. Nevertheless his writings were much read, especially in Palestine. The monophysite monks appealed to his authority, but could not prevent Justinian and the fifth oecumenical council at Constantinople (553) from anathematizing his teaching.

BIBLIOGRAPHY.—Next to the works of Origen (*see* Redepenning, "Des Hieronymus wiederaufgefundenes Verzeichnis der Schriften des Origens," in *Zeit. f. d. hist. Theol.* [1851], pp. 66 *seq.*) the most important sources are: Gregory Thaumat., *Panegyricus in Orig.*; Eusebius, *H.E.* vi.; Epiphanius, *Haer.* 64; the works of Methodius, the Cappadocians, Jerome (see *De vir. ill.* 54, 61) and Rufinus; Vincent. Lerin. *Commonit.* 23; Palladius, *Hist. Laus.* 147; Justinian, *Ep. ad Mennam* (Mansi, ix. p. 487 *seq.*); Photius, *Biblioth.* 118, etc. The best of the older editions is that of Delarue (1733–59, 4 vols. fol.; pub. by Migne in *Patrol. Gr.* vols. xi.–xvii.). A critical edition is being brought out by the Preussische Akademie der Wissenschaften; it is not yet completed. Amongst the older works on Origen those of Huetius (printed in Delarue, vol. iv.) are the best; but Tillemont, Fabricius, Walch (*Historie d. Ketzereien,* vii. pp. 362–760) and Schröckh also deserve to be mentioned. In recent times the doctrine of Origen has been expounded in the great works on church history by Baur, Dorner, Böhringer, Neander, Möller (*Geschichte der Kosmologie in der griechischen Kirche*) and Kahnis (*Die Lehre vom h. Geist,* vol. i.); compare with these the works on the history of philosophy by Ritter, Erdmann, Ueberweg and Zeller. Of monographs, the best and most complete is Redepenning, *Origenes, eine Darstellung seines Lebens und seiner Lehre* (2 vols., 1841, 1846). Compare Thomasius, *Orig.* (1837); Krüger, "Über das Verhältnis des Orig. zu Ammonius Sakkas," in the *Ztschr. f. hist. Theol.* (1843), i. p. 46 *seq.*; Fischer, *Comment. de Orig. theologia et cosmologia* (1846); Ramers, *Orig. Lehre von der Auferstehung des Fleisches* (1851); Knittel, "Orig. Lehre von der Menschwerdung," in the *Theol. Quartalschr.* (1872); Schultz, "Christologie des Orig.," in the *Jahrb. f. protest. Theol.* (1875); Mehlhorn, "Die Lehre von der menschlichen Freiheit nach Orig.," in *Zeitschr. f. Kirchengesch.* vol. ii. (1878); Freppel, *Origène,* vol. i., 2nd ed. (Paris, 1875). A full list of the later bibliography will be found in Bardenhewer's *Geschichte der altkirchen litteratur* (2nd ed. 2 vols., 1914) and de Faye *Origène,* vol. i. (1923). (A. HA.)

**ORIGINAL PACKAGE,** a legal term in America, meaning the package in which goods, intended for inter-State commerce, are actually transported wholesale. The term is used chiefly in determining the boundary between Federal and State jurisdiction in the regulation of commerce, and derives special significance by reason of the conflict between the powers of Congress to regulate commerce and the police legislation of the States with respect to commodities considered injurious to public health and morals.

By the Federal Constitution Congress is vested with the power "to regulate commerce with foreign nations and among the several States, and with the Indian tribes," and each State is forbidden, without the consent of Congress, to "lay any imposts or duties on imports or exports, except what may be absolutely necessary

[1] "Communis substantiae est filio cum patre; *ἀπόρροια* enim *ὁμοούσιος* videtur, i.e., unius substantiae cum illo corpore ex quo est *ἀπόρροια*."

for executing its inspection laws," and the basis of the law on the subject of "original package" was laid when, in 1827, Chief Justice Marshall interpreted these clauses in his decision of the case of *Brown* v. *Maryland* (12 Wheaton 419), which tested the constitutionality of an act of the legislature of Maryland requiring a licence from importers of foreign goods by bale or package and from persons selling the same by wholesale, bale, package, hogshead, barrel or tierce. After pronouncing such a licence to be in effect a tax, the chief justice observed that so long as the thing imported remained "the property of the importer, in his warehouse, in the original form or package in which it was imported," a tax upon it was too plainly a duty on imports to escape the prohibition of the Constitution.

Later decisions agree that the right to import commodities or to ship them from one State to another carries with it the right to sell them, and have established the boundary line between Federal and State control of both foreign imports and inter-State shipments at a sale in the original package (*Waring* v. *Mobile,* 8 Wall. 110) or at the breaking of the original package before sale for other purposes than inspection (*May* v. *New Orleans,* 178 U.S. 498). A State or a municipality may, however, tax while in their original packages any commodities which have been shipped in from another State, provided there be no discrimination against such commodities.

The term occasioned considerable confusion prior to the adoption of the 18th (prohibition) amendment to the Constitution in 1919. The Supreme Court in Jan. 1847, in the licence cases, upheld the constitutionality of Massachusetts, New Hampshire and Rhode Island laws requiring licences for the sale of intoxicating liquors, the liquor having been shipped in the inter-State commerce (5 Howard 504). The justices based their decisions on different opinions and did not even agree that the power of Congress to regulate inter-State commerce included the power to authorize a sale after shipment. The Supreme Court held in *Leisy* v. *Hardin,* in 1889, where a keg of beer sold in Iowa, a prohibition State, had been shipped from Illinois by order of an agent of an Illinois firm, that so long as it was sold in the original package, it remained a matter for Federal regulation only (135 U.S. 100). This overruled in part the doctrine in the licence cases. Congress passed in 1890 the Wilson Act, which provided that where intoxicants were shipped into a State or Territory, they were subject to the police laws of such State or Territory. Even with this act, however, a State was not permitted to interfere with an inter-State shipment of liquor direct to the consumer. The Webb Act, passed by Congress in 1913, did prohibit the shipment of liquor into any State in violation of its police laws.

What constitutes an original package was the principal question in the case of *Schollenberger* v. *Pennsylvania* (171 U.S. 1), the court deciding that the State of Pennsylvania could not prohibit the sale of oleomargarine by retail when it had been shipped from Rhode Island in packages containing only ten pounds each, and the original package doctrine has been sharply criticized because of the difficulty in determining what constitutes an original package, as well as because of the conflict between the doctrine and the police powers of the several States.

*See* J. B. Uhle, "The Law Governing an Original Package," in *The American Law Register,* vol. xxix. (Philadelphia, 1890); Shackelford Miller, "The Latest Phase of the Original Package Doctrine," and M. M. Townley, "What is the Original Package Doctrine?" both in *The American Law Review,* vol. xxxv. (St. Louis, 1901); also F. H. Cooke, *The Commerce Clause of the Federal Constitution* (1908).

**ORIHUELA,** a town and episcopal see of eastern Spain, in the province of Alicante; 13 m. N.E. of Murcia and about 15 m. from the Mediterranean Sea, on the Murcia-Elche railway. Pop. (1940) 11,983 (mun., 43,619). It is situated in an exceedingly fertile *huerta,* on both sides of the river Segura, which divides the city into two parts, Roig and San Augusto, and is spanned by two bridges. Orihuela was captured by the Moors in 713, and retaken by James I. of Aragon, for his father-in-law Alphonso of Castile, in 1265. It was sacked during the disturbances at the beginning of the reign of Charles V. (1520), and again in the War of Succession (1706). Local annals specially mention the plague of 1648, the flood of 1651 and the earthquake of 1829. The university of Orihuela, founded in 1568 by the archbishop of Valencia, was closed in 1835. The trade in fruit, cereals, oil and wine is considerable. There are also tanneries, dye and silk works, linen and woollen fabrics, leather and starch.

**ORILLIA,** a town and port of entry of Simcoe county, Ontario, Canada, situated 84 m. N. of Toronto, on Lake Couchiching and on the Canadian National and Canadian Pacific railways. Pop. (1941) 9,798. It is a favourite summer resort, and has an extensive trade in lumber and farm produce. It contains an asylum, saw and grist mills and iron foundries.

**ORINOCO,** a river and river system of northern South America. Its basin embraces about one-half of the eastern plains of Colombia and nearly all of Venezuela south and east of the Andes; it ranks third in area among the South American river basins. The main river is about 1,500 m. long from its source in the Sierra Parima on the Venezuela-Brazil boundary to the Atlantic ocean, and, except for a stretch of about 200 m. between the mouths of the Guaviare and Meta rivers, where it forms a part of the Venezuela-Colombia boundary, it is in Venezuela. At about 150 m. from its source it bifurcates into the Casiquiare canal to the Río Negro of the Amazon system, affording a through water way to the Amazon basin. Three major rapids and numerous minor ones obstruct the upper river. At the mouth of the Apure the Orinoco is 2 m. wide in the dry season and often 7 m. wide in time of floods, and narrows to 800 ft. at the city of Ciudad Bolívar. Large steamers can navigate as far as the Cariben rapids, 700 m. from the ocean and only 6 m. from the mouth of the Meta. At the Cariben rapids the difference between high and low water averages 32 ft., while at the Angostura, at Ciudad Bolívar, the average rise is 50 ft. and has been known to reach 60.

The Orinoco enters the ocean by a delta of approximately 700 sq.m. of islands and swamps covered with dense vegetation and so little above sea-level that they are periodically flooded. The Boca Grande at the mouth of the Corosimi river (the southernmost channel of the delta) is the deepest outlet; but the Caño Macareo, one of the outlets of the Vagre river (the westernmost channel of the delta), is usually taken by steamers because it is the most direct navigable route to the Gulf of Paria.

Ordaz, whose expedition (1531–32) entered the Orinoco by the Boca de Navíos and, with much loss of life, ascended to the mouth of the Meta, was the first to explore any part of the river, although Columbus, while exploring the Gulf of Paria in 1498, noticed the freshness of its waters without investigating their source, and Ojeda, following closely the track of Columbus in 1499, probably passed in sight of one or more of the mouths of the river. There have since been many expeditions and surveys.

Except for a few outliers which form isolated hills north of the lower river, the Orinoco is the dividing-line between the *llanos* and the highlands of Venezuelan Guiana. The tributaries from the Guiana highlands are little known. They all have their sources in the divide which carries the Venezuela-Brazil boundary. The largest, the Ventuari, joins the Orinoco about 90 m. above the mouth of the Guaviare. The Caura, the next large stream to the east, is much obstructed with falls and rapids, while the lower Caroni is more or less navigable for some 400 miles. The *llanos* are divided into a broad, well-watered western section and a narrower and much drier eastern section. North of the upper Guaviare and its tributaries the western section rises gently from an elevation of about 130 ft. at the mouth of the Apure to about 700 ft. at the border of the Andes. Its principal rivers have their sources in innumerable mountain torrents that rise in the eastern ranges of the Eastern Cordillera of Colombia. From the Guaviare north to 6° 30′ N. lat. these streams are fed so abundantly by the condensation of moisture from the north-east trade winds that they have headed far back toward the high savannas of the Eastern Cordillera.

The most important tributaries of the Orinoco in this section are the Apure, Arauca, Meta and Guaviare. The Apure was, until recently, formed by the junction of the Uribante and Sarare, but the latter has now dammed its lower channel and flows to the Arauca, leaving the Uribante, an important stream with 16 large

affluents, and the Nula, formerly a tributary of the Sarare, as the chief sources of the Apure. The Apure is about 650 m. long from the Uribante-Nula junction. It is in large part navigable for large craft but is obstructed by rapids about 100 m. from its mouth. The northern tributaries drain the eastern and southern slopes of the Venezuelan Andes. Of these the Portuguesa, which the cattle route from San Fernando to Puerto Cabello follows, and a few others, are navigable for short distances. The Arauca parallels the Apure on the south. When in flood, the additional water now brought to the Arauca by the Sarare causes it to overflow and send part of its surplus water by several *caños* to the Capanaparo, a tributary which joins the Orinoco about 18 m. S. of the mouth of the Arauca.

The main stream of the Guaviare, southernmost of the great western tributaries of the Orinoco, is known as the Guayabero from its source to the mouth of the Ariari, a large tributary from the north-west. It marks in a general way the dividing line between the low savannas of the north and the higher and more varied topography of the south. The main stream and many of its tributaries after leaving the piedmont cut their way through four distinct zones: (1) a dissected sandstone plateau, the crests of which rise 1,500 ft. above the *llanos;* (2) a zone east of the escarpment of the plateau of sandstone remnants separated by clayey depressions; (3) a crystalline peneplain where the granites and gneisses are mostly covered with lateritic clays; and (4) a low plain on which stand isolated massifs of the dome-like form characteristic of crystalline mountains in wet tropical climates. The Ariari tributary is navigable for large barges for a considerable distance. About 300 m. of the Guayabero-Guaviare are said to be navigable but narrows and rapids which mark the passage of the river from one zone to another offer serious obstacles.

(R. R. P.)

**ORIOLE,** the name applied in Europe to the members of the family *Oriolidae.* The golden oriole (*Oriolus oriolus*) is an occasional spring visitor to the British Islands, but has rarely bred there. On the continent of Europe it is a well-known bird; its range in summer extends east to Irkutsk, while in winter it is found in Natal and Damaraland. In India it is replaced by an allied form, *O. kundoo,* the mango-bird, and both in Asia and Africa are several other species, some of which have a black head, or even a glowing crimson, instead of the ordinary yellow colouring, while others exhibit the dingy type of plumage seen in the female of the more normal form. Among these last are the species of the group, *Mimeta,* belonging to the Australian region, which mimic friar-birds (*see* A. R. Wallace, *Malay Archipelago;* HONEY-EATER). Another genus which has been referred to the *Oriolidae* is *Sphecotheres,* peculiar to the Australian region, and distinguishable by a bare space round the eye. Orioles are shy and restless birds, frequenting gardens and woods, and living on insects and fruit. The nest is pocket-shaped, of bark, grass, and fibres, and the eggs are white or salmon-coloured with dark spots. The name is applied in America to the *Icteridae* family.

**ORION** (or OARION), in Greek mythology, son of Hyrieus or Poseidon, a mighty hunter of great beauty and gigantic strength. He is also sometimes represented as sprung from the earth. He was beloved of Eos, the dawn-goddess, who carried him off to Delos; but Artemis slew him with her arrows (*Odyssey,* v. 121). According to other accounts which attribute Orion's death to Artemis, the goddess herself loved him and was deceived by the angry Apollo into shooting him by mistake; or he paid the penalty of offering violence to her, or of challenging her to a contest of quoit-throwing (Apollodorus i. 4; Horace, *Odes,* iii. 4, 71). In the lower world his shade is seen by Odysseus driving the wild beasts before him as he had done on earth (*Odyssey,* xi. 572). After his death he was changed into the constellation which is called by his name. It took the form of a warrior, wearing a girdle of three stars and a lion's skin, and carrying a club and a sword. When it rose early it was a sign of summer; when late, of winter and stormy weather; when it rose about midnight it heralded the season of vintage.

*See* Küentzle's article in Roscher's *Lexikon;* Preller-Robert, *Griechische Mythologie* (1894), pp. 448–454.

Orion is one of the most conspicuous constellations, containing many bright stars. Of these Betelgeuse is easily distinguished by its yellowish-red colour in contrast to all the other important stars of the constellation which are white B-type stars. Betelgeuse is an irregular variable sometimes above and sometimes below the first magnitude. It was the first star for which the apparent diameter was measured by Michelson's interferometer method (1920). Rigel at the opposite corner of the quadrilateral is rather brighter; and the third brightest star is Bellatrix. The Orion nebula can be seen with the naked eye just below the belt; faint extensions of it have been photographed filling practically the whole constellation. The multiple star $\theta$ Orionis is near the centre of the nebula. There is no doubt that the principal stars of the constellation form a single system, and are involved in the nebulosity whose luminescence is stimulated by their intense radiation rich in light of short wave-length. The distance of the nebula is estimated at 1,200 light years.

**ORION** and **ORUS,** the names of several Greek grammarians, frequently confused. The following are the most important. (1) Orion of Thebes in Egypt (5th century A.D.), the teacher of Proclus the neo-Platonist and of Eudocia, the wife of the younger Theodosius. He taught at Alexandria, Caesarea in Cappadocia and Byzantium. He was the author of a partly extant etymological Lexicon (ed. F. W. Sturz, 1820), largely used by the compilers of the *Etymologicum Magnum,* the *Etymologicum Gudianum* and other similar works; a collection of maxims in three books, addressed to Eudocia, also ascribed to him by Suidas, still exists in a Warsaw ms. (2) Orus of Miletus, who, according to Ritschl, flourished not later than the 2nd century A.D., and was a contemporary of Herodian and a little junior to Phrynichus. His chief works were treatises on orthography; on Atticisms; on the names of nations.

*See* F. Ritschl, *De Oro et Orione Commentatio* (1834); R. Reitzenstein, *Geschichte der griechischen Etymologika* (1897); and article "Orion" in Smith's *Dictionary of Greek and Roman Biography.*

**ORISKANY** (ō-rĭs′ką-nĭ), a village of Oneida county, New York, U.S.A., about 7 mi. N.W. of Utica. Pop. (1940) 1,115. Oriskany is served by the New York Central railway. In a ravine, about 2 m. west of Oriskany, was fought on Aug. 6, 1777 the battle of Oriskany, an important minor engagement of the American Revolution. On Aug. 4, Gen. Nicholas Herkimer had gathered about 800 militiamen at Ft. Dayton (on the site of the present Herkimer, N.Y.) for the relief of Ft. Schuyler (*see* ROME, N.Y.) then besieged by British and Indians under Col. Barry St. Leger and Joseph Brant. On the 6th Gen. Herkimer's force, on its march to Ft. Schuyler, was ambushed by a force of British under Sir John Johnson and Indians under Joseph Brant in the ravine above mentioned. The rear portion of Herkimer's troops escaped from the trap, but were pursued by the Indians, and many of them were overtaken and killed. Between the remainder and the British and Indians there was a desperate hand-to-hand conflict, interrupted by a violent thunderstorm, with no quarter shown by either side. On hearing the firing near Ft. Schuyler (incidental to a sortie by Lt.-Col. Marinus Willett) the British withdrew, after about 200 Americans had been killed and as many more taken prisoners, the loss of the British in killed being about the same. Gen. Herkimer, though his leg had been broken by a shot at the beginning of the action, continued to direct the fighting on the American side, but died on Aug. 16, as a result of the clumsy amputation of his leg. The battle, though indecisive, had an important influence in preventing St. Leger from affecting a junction with Gen. Burgoyne. The battlefield is marked by a monument erected in 1884. The sesquicentennial of the battle was celebrated Aug. 6, 1927. The Oneida Historical society then presented to the state the battle monument and about 5 ac. of land for a state park.

See *Orderly Book of Sir John Johnson during the Oriskany Campaign* (Albany, 1882), with notes by W. L. Stone and J. W. De Peyster; *Publications* of the Oneida Historical Society, vol. i. (Utica, N.Y., 1877); and Phoebe S. Cowen, *The Herkimers and Schuylers* (Albany, 1903); T. G. Best, *A Soldier of Oriskany* (Boonville, N.Y., 1935); T. W. Clarke, *The Bloody Mohawk* (1940).

**ORISSA,** an autonomous province and 23 states in northeastern India. The British province has an area of 32,198 sq.mi. and

a population (1941) of 8,728,544. Cuttack is the capital of the province; and Puri, with its temple of Jagannath is world-famous.

The Oriyas are an intensely patriotic people who are proud of their culture and language and trace their traditions back to the ancient kingdom of Utkal. They have always been opposed to the breaking up of Oriya-speaking tracts for political reasons. At the time of the Mogul conquest the Orissa country was broken up and race consciousness became less intense but was revived under the British regime, especially after the famine of 1866. Agitation for the unification of Oriya tracts began to receive official recognition in 1903 and was sustained by the Utkal Union conference. In 1912 the area of modern Orissa was separated from Bengal and united with Bihar to form the province of Bihar and Orissa. The status of the Oriyas was much improved by this step but they still continued their agitation for the formation of Orissa into a separate administrative unit on the basis of common language and race. In Jan. 1936, an order-in-council was issued by His Majesty's government constituting Orissa as a separate province. The new province was formed from (1) the Orissa division of the former province of Bihar and Orissa; (2) areas transferred from the Presidency of Madras including [a] the Ganjam Agency Tracts, [b] parts of the Ganjam district and [c] parts of the Vizagapatam district; and (3) areas transferred from the Central Provinces including [a] the Khariar Zamindari in the Raipur district and [b] the Padampur Tract in the Bilaspur district. The province consists of six districts, viz., Sambalpur, Koraput, Ganjam, Cuttack, Puri and Balasore, the latter three constituting the delta of the Mahanadi, Brahmani and Baitarani rivers. In 1866 Orissa suffered from famine, followed by destructive floods, during which 1,000,000 persons are estimated to have perished, largely owing to its isolation. The danger of the recurrence of such a famine was averted by the Orissa canal system and the railway, as well as by the increased prosperity of the people. The occurrence of floods still occasionally causes distress. The beds of the deltaic rivers have been raised by deposits of silt and their outlets obstructed by sand bars until flood waters are not discharged by natural channels but are liable to burst the embankments and inundate the low-lying country on either side.

Orissa is still a backward region from an industrial and agricultural standpoint. There are no big factories but there are a number of cottage industries producing handloom products and metal work. Production of jute and sugar cane as commercial crops is being steadily increased. There are forest resources of valuable timber. Mineral resources include iron ore of excellent quality, coal, limestone, manganese and mica. Orissa provides more than 60 per cent of the iron ore extracted in India.

The states of Orissa are grouped in the Orissa States Agency, one of the minor agencies of the Eastern States Agency. They are 23 in number and comprise Athgarh, Athmallik, Bamra, Baramba, Baudh, Bonai, Daspalla, Dhenkanal, Gangpur, Hindol, Keonjhar, Khandpara, Kharsawan, Narsinghpur, Nayagarh, Nilgiri, Pal Lahara, Rairakhol, Ranpur, Seraikela, Sonepur, Talcher and Tigiria. Their combined area is 18,151 sq.mi.; pop. (1941) 3,023,731. Headquarters for the Orissa States Agency is at Sambalpur.

**ORISTANO,** a town and archiepiscopal see of Sardinia, Italy, 23 ft. above sea level, 3 mi. from the eastern shore of a gulf on the west coast, to which it gives its name, and 59 mi. N.W. of Cagliari by rail. Pop. (1936) 9,454 (town), 14,662 (commune). The town has remains of the walls (1290), and two gates, the Porta Manna, with a lofty square tower (Torre S. Cristoforo) and the Porta a Mare. The houses are made of sun-dried bricks. Two miles south of Oristano is the village of S. Giusta, with a beautiful Romanesque church of the Pisan period dedicated to this saint, containing several antique columns. The lagoons on the coast are full of fish, but are a cause of malaria. In the environs garden produce is grown; good wine (*vernaccia*) is made, as well as ordinary pottery. It is also a centre of the cattle trade. A mile south of the mouth of the river Tirso is the landing place for shipping. The large orange groves of Milis lie 13 mi. N. of Oristano at the base of Monte Ferru. The inhabitants of Milis manufacture reed baskets and mats, which they sell throughout Sardinia.

Oristano occupies the site of the Roman Othoca, the point at which the inland road and the coast road from Carales to Turris Libisonis bifurcated. The mediaeval town (1070) was the seat onwards of the *giudici* (judges) of Arborea, one of the four divisions of the island. Almost the last of these judges was Eleonora (1347–1403); after her death Oristano became the seat of a marquisate, which was suppressed in 1478.

**ORIZABA** (Indian name *Ahuializ-apan,* pleasant waters), a city of Mexico in the state of Veracruz, 82 mi. by rail W.S.W. of the port of Veracruz. Pop. (1940) 47,910 including a large percentage of Indians and half-breeds. The Mexican and Mexican national railways afford frequent communication with the City of Mexico and Veracruz, and a branch line of the latter connects with the Tehuantepec National.

Orizaba stands in a fertile, well-watered, richly wooded valley of the Sierra Madre Oriental, 4,025 ft. above sea level, and about 18 mi. S. of the snow-crowned volcano that bears its name. It has a mild, humid and healthful climate. The public edifices include the parish church of San Miguel, a chamber of commerce, a handsome theatre and some hospitals. The city is the centre of a rich agricultural region which produces sugar, rum, tobacco and Indian corn. In colonial times, when tobacco was one of the crown monopolies, Orizaba was one of the districts officially licensed to produce it. It is also a manufacturing centre of importance, having good water power from the Rio Blanco and producing cotton and woollen fabrics. Its cotton factories are among the largest in the republic. The forests in the vicinity are noted for orchids and ferns. An Indian town called *Ahuializapan,* subject to Aztec rule, stood here when Cortes arrived on the coast. The Spanish town that succeeded it did not receive its charter until 1774. In 1862 it was the headquarters of the French.

**ORIZABA,** in Aztec, *Citlaltepetl,* "star mountain," an extinct or dormant volcano, on the boundary between the Mexican states of Puebla and Veracruz and very nearly on the 19th parallel. It rises from the southeastern margin of the great Mexican plateau to an elevation of 18,314 ft., according to Scovell and Bunsen's measurements in 1891–92, or 18,250 and 18,209 ft. according to other authorities, and 18,701 (5,700 metres) by the Comisión Geográfica Exploradora. It is the highest peak in Mexico, probably third highest in North America. Its upper timber line is about 13,500 ft. above sea level, and Hans Gadow found patches of apparently permanent snow at an elevation of 14,400 ft. on its southeast side in 1902. The first ascent of Orizaba was made by Reynolds and Maynard in 1848. Its last eruptive period was 1545–66, and the volcano is now considered to be extinct.

**ORJONIKIDZE** (formerly VLADIKAVKAZ), a town of the Russian S.F.S.R., in the North Ossetian A.S.S.R., in 43° 3′ N., 44° 42′ E. Pop. (1939) 127,172. The former name Vladikavkaz meant "Key of the Caucasus"; the town stands on a plateau 2,345 ft. high on both sides of the Terek river, where the latter issues from the Darial gorge. Towering above the town is the famous Kasbek peak. A small fort was established there in 1784, but the expansion of the town dates from the completion of the great Georgian military road southward through the gorge to Tiflis, which was begun in 1811 and opened in 1864. Later a railway link was made through Beslan to the Rostov-Baku line to the north. The great gorge has much historic importance for the region; through it came Persian armies and, later, Timur and his Mongol hordes, and its military road brought about the pacification of the warring Caucasian frontier tribes and gave Russia her foothold in the Caucasus. The town was renamed Orjonikidze after the famous soviet leader.

**ORKHON INSCRIPTIONS,** ancient Turkish inscriptions of the 8th century A.D., discovered near the river Orkhon to the south of Lake Baikal in 1889. They are written in an alphabet derived from an Aramaic source and recount the history of the northern branch of the Turks or Tu-kiue of Chinese historians. *See* TURKS.

**ORKNEY, EARL OF,** a Scottish title held at different periods by various families, including its present possessors the Fitzmaurices. The Orkney islands (*q.v.*) were ruled by jarls or earls under the supremacy of the kings of Norway from very early times to about 1360, many of these jarls being also earls of Caith-

ness under the supremacy of the Scottish kings. Perhaps the most prominent of them were a certain Paul (d. 1099) who assisted the Norwegian king, Harald III. Haardraada, when he invaded England in 1066; and his grandson Paul the Silent, who built, at least in part, the cathedral of St. Magnus at Kirkwall. They were related to the royal families of Scotland and Norway.

In its more modern sense the earldom dates from about 1380, and the first family to hold it was that of Sinclair, Sir Henry Sinclair (d. *c.* 1400) of Roslin, near Edinburgh, being recognized as earl by the king of Norway. He ruled the islands almost like a king, and employed in his service the Venetian travellers Nicolo and Antonio Zeno. His son Henry (d. 1418) was admiral of Scotland and was taken prisoner by the English in 1406, together with Prince James, afterwards King James I.; his grandson William, the 3rd earl (*c.* 1404–80), was chancellor of Scotland and took some part in public affairs. In 1455 William was created earl of Caithness, and in 1470 he resigned his earldom of Orkney to James III. of Scotland, who had just acquired the sovereignty of these islands through his marriage with Margaret, daughter of Christian I., king of Denmark and Norway. In 1567 Queen Mary's lover, James Hepburn, earl of Bothwell, was created duke of Orkney, and in 1581 her half-brother Robert Stewart (d. 1592), an illegitimate son of James V., was made earl of Orkney. Robert, who was abbot of Holyrood, joined the party of the reformers and was afterwards one of the principal enemies of the regent Morton. His son Patrick acted in a very arbitrary manner in the Orkneys, where he set the royal authority at defiance; in 1609 he was seized and imprisoned, and, after his bastard son Robert had suffered death for heading a rebellion, he himself was executed in Feb. 1614, when his honours and estates were forfeited.

In 1696 Lord George Hamilton was created earl of Orkney. He married Elizabeth Villiers, and was succeeded by his daughter Anne (d. 1756), the wife of William O'Brien, 4th earl of Inchiquin. Anne's daughter Mary (*c.* 1721–91) and her granddaughter Mary (1755–1831) were both countesses in their own right, the younger Mary married Thomas Fitzmaurice (1742–93), son of John Petty, earl of Shelburne, and was succeeded in the title by her grandson, Thomas John Hamilton Fitzmaurice (1803–77), whose descendants still hold the earldom.

See *Records of the Earls of Orkney, 1299–1664,* ed. by J. S. Clouston (1914).

**ORKNEY ISLANDS,** group forming a county off the north coast of Scotland. They are separated from the mainland by the Pentland firth, which is 6¼ mi. wide between Brough Ness in the island of South Ronaldshay and Duncansbay head in Caithnessshire. The group consists of 67 islands (excluding rocky islets), of which 28 were inhabited in 1931, four of them only by lighthouse attendants. They measure 50 mi. from northeast to southwest, and 29 mi. from east to west, and cover 376.3 sq.mi. Excepting on the west coasts of the larger islands, which present rugged cliff scenery, the group lies somewhat low and is of bleak aspect, owing to the absence of trees. The islands are built up wholly of Old Red Sandstone. The Old Man of Hoy is a fine stack of rock standing detached from the north-west cliffs. The only other islands containing heights of any importance are Pomona, with Ward hill (880 ft.), and Wideford (740 ft.) and Rousay. Erratics of distant origin (*e.g.,* from Moray firth) give evidence of glacial action. Nearly all of the islands possess lakes, the largest being Loch Harray and Loch Stenness in Pomona. The rivers are merely streams. Excepting on the west fronts of Pomona, Hoy and Rousay, the coast-line of the islands is deeply indented, and the islands themselves are divided from each other by straits, generally called *sounds* or *firths,* though off the northeast of Hoy is *Bring Deeps,* south of Pomona is Scapa *Flow* and to the south-west of Eday is the *Fall* of Warness. The topographical names are Norse, and the common terminal of the names of the islands, *a* or *ay,* is the Norse *ey,* meaning "island." The islets are usually called *holms* and the isolated rocks *skerries.* The tidal currents, or *roost* (as some of them are called locally, from the Icelandic), off many of the isles run very fast and whirlpools are frequent.

**History.**—The Orkneys were the *Orcades* of classical writers, and the word is probably derived from the Norse *Orkn,* seal, and *ey,* island. Evidences of prehistoric occupation include numerous weems or underground houses, chambered mounds, barrows or burial mounds, *brochs* or round towers, and stone circles and standing stones. Three of the most famous are the corbelled tomb at Maeshowe, and the circles of standing stones at Brogar and Stennis with an early village discovered in 1928. If, as seems likely, the Dalriadic Scots towards the beginning of the 6th century established a footing in the islands, their success was short-lived, and the native inhabitants regained power and kept it until dispossessed by the Norsemen in the 9th century. The Celtic missionaries, companions of St. Columba, followed about 565. As the Norse pirates made raids on Norway from the islands, as well as on Scotland, Harold Haarfager ("Fair Hair") subdued the rovers in 875 and added the Orkneys and Shetlands to Norway. They remained under the rule of Norse earls until 1231, when the line of the earls became extinct. In that year the earldom of Caithness was granted to Magnus, second son of the earl of Angus, whom the king of Norway apparently confirmed in the title. In 1468 the Orkneys and Shetlands were pledged by Christian I. of Denmark for the payment of the dowry of his daughter Margaret, betrothed to James III. of Scotland, and as the money was never paid, their connection with the crown of Scotland has been perpetual. In 1471 William, earl of Orkney, exchanged his earldom for lands in Fife, and the islands were annexed to the Scottish crown. In 1581 Lord Robert Stewart, natural son of James V., was created earl of Orkney, but in 1615 the earldom was again annexed to the crown. The islands were the *rendezvous* of Montrose's expedition in 1650 which culminated in his imprisonment and death. In 1707 the islands were granted to the earl of Morton in mortgage, but in 1766 his estates were sold to Sir Lawrence Dundas, ancestor of the marquesses of Zetland.

In early times both the archbishop of Hamburg and the archbishop of York disputed with the Norwegians ecclesiastical jurisdiction over the Orkneys; but ultimately the Norwegian bishops, the first of whom was William the Old, consecrated in 1102, continued the canonical succession. The see, left vacant on several occasions, was finally abolished in 1697, although many of the clergy refused to conform. The Norse tongue, at last extinguished by the constant influx of settlers from Scotland, lingered until the end of the 18th century. When the islands were given as security for the princess's dowry, there seems reason to believe that it was intended to redeem the pledge, because it was then stipulated that the Norse system of government and the law of St. Olaf should continue to be observed in Orkney and Shetland. Thus the *udal* succession and mode of land tenure (or, that is, absolute freehold as distinguished from feudal tenure) still obtain to some extent, and the remaining *udallers* hold their lands and pass them on without written title.

**Agriculture and Industries.**—The soil generally is a sandy loam or a strong but friable clay, and very fertile. About 45% of the total area was under cultivation in 1938 and farming is now up to the general Scottish standard. The crofters' houses have been rebuilt of stone and lime, and are superior to those in most parts of the Highlands. Of the 3,203 holdings in 1938, about 55% were between 5 and 30 ac., the average being 34 ac. The grain crops are oats and barley, while the favoured root crops are turnips and potatoes. Cattle and sheep are reared, some pigs are kept, and the horses—as a rule hardy, active and small—are numerous. The woollen, linen, straw-plaiting and kelp industries have all successively failed, though the last named has been revived. Sandstone is quarried on several islands, and distilleries are found in Pomona. About half the population is engaged in agriculture. Apart from this, the principal industry is fishing. For several centuries the Dutch practically monopolized the herring fishery, but when their supremacy was destroyed by the salt duty, the fisheries were almost totally neglected. The industry, however, is now of considerable importance, particularly the herring fishery, followed by the cod, ling and lobster fisheries. There is a regular communication by steamer between Stromness and Kirkwall, and Thurso, Wick, Aberdeen and Leith, and also between Kirkwall and Ler-

wick and other points of the Shetlands.

**Population and Administration.**—The county population was 21,799 in 1938. In 1931 there were 58 persons who spoke Gaelic and English but none who spoke Gaelic only. Orkney unites with Shetland to send one member to parliament. Kirkwall, the county town, is the only royal burgh. Kirkwall (pop. 3,673, 1938 est.) and Stromness (1,550) are the only small burghs. Orkney forms a sheriffdom with Shetland and Caithness.

**The Inhabited Islands.**—From south to north, the islands (1931 population in brackets) include Sule Skerry (lighthouse, 6), Pentland Skerries (lighthouse, 5), Swona (6), South Ronaldshay (1,312), Hoy (955). On Hoxa head is a *broch,* or round tower, and the island contains examples of Picts' houses and standing stones. The famous Dwarfie stone, an enormous block of sandstone with rooms hollowed out in it, lies in a valley near Ward hill. Flotta (282), east of Hoy, was the home for a long time of the Scandinavian compiler of the *Codex Flotticensis,* which furnished Thormodr Torfaeus (1636–1719), the Icelandic antiquary, with many of the facts for his *History of Norway.* Pharay (40) also lies east of Hoy. Burray (379) is famous for the *broch* from which the island takes its name (Borgarey, Norse, "island of the broch"). The tower stands on the northwestern shore, is 15 ft. high, has walls from 15 to 20 ft. thick, built of layers of flat stones without cement or mortar, and an interior diameter of 40 feet. Between Hoy and Pomona are Hunda (3 in 1921, nil in 1931), Cava (14) and Graemsay (114). It was around Cava that the 70 vessels of the German navy were scuttled in 1919; 32 were raised between 1924 and 1931, and salvage operations were renewed in 1934. The isle, surrounded by shoals, has two lighthouses. The cliffs of Copinsay (25) are a favourite haunt of sea-birds.

Pomona (*q.v.*) is the principal island and is known as Mainland. Shapinsay (576) was the birthplace of William Irving, father of Washington Irving. It possesses several examples of Pictish and Scandinavian antiquities and Balfour Castle, built in 1848. Gairsay (5) was the home of Sweyn Asleifson, the rover. At Lamb head is a *broch* and Pictish pier, and on Odin bay is a round pit in the rocks called the Vat of Kirbuster. Papa Stronsay (18) commemorates the Celtic *papae,* or missionaries, who preached before the arrival of the Northmen. The adjacent Wyre or Veira has a population of 44; Egilsay (85) is the island on which St. Magnus was murdered by his cousin Hacco in 1115. It derives its name (*ecclesia*) from the little church of St. Magnus, now in ruins. The round tower resembles similar ones found beside Irish churches of the 7th and 8th centuries and has walls 3 ft. thick. Eday (430) contains weems, mounds and standing stones. Carrick village was named after the earl of Carrick. It was off this island that John Gow, the pirate, was taken in 1725. Stronsay (953) and Rousay (468) are other large islands.

Sanday (1,160), one of the largest northern islands, has an area of 19 sq.mi. It produces potatoes and grain and has harbours at Otterswick and Kettletoft. The antiquities include a *broch* in Elsness. Pharay (28). Westray (1,269) has a harbour at Pier-o'-wall. Noltland castle was proposed as the refuge of Queen Mary after her flight from Loch Leven. It was at one time the property of Sir Gilbert Balfour, the master of Queen Mary's household. At the westerly point, there is the Stack of Noup. Gentleman's Cave afforded shelter to five followers of Prince Charles Edward during the winter of 1745–46.

Papa Westray (237) and North Ronaldshay (298) are the most northerly islands. The latter is reached only from Sanday over a dangerous firth 2½ mi. wide. The monumental stone with Ogham inscription, discovered in the *broch* of Burrian, must date from early Christian missionary times.

**ORLANDO, VITTORIO EMANUELE** (1860– ), Italian politician and jurist, was born at Palermo on May 19, 1860. Becoming a barrister and a law professor, he was first elected deputy for Partinico in Sicily in 1897. He was minister of education in the Giolitti cabinet of 1903–05, and of justice in the Giolitti cabinet of 1907–09, and again under Salandra in November 1914. Although a Giolittian at heart, he was in favour of Italian intervention in World War I. On the resignation of the Salandra Cabinet in June 1916 he remained in office under Boselli as minister of the interior, and when the latter resigned Orlando was entrusted with the formation of a new Cabinet. After the Armistice he went to Paris as president of the Italian peace delegation. When President Wilson launched his appeal on Fiume to the Italian people over the heads of their delegates, he returned to Rome, where he was triumphantly received, but after his return to Paris without the guarantees he was supposed to have secured, and without obtaining any satisfactory solution of the Adriatic problem, the chamber voted against him and he resigned on June 19, 1919.

On Dec. 2, 1919, he was elected president of the chamber. He at first supported Fascism and the Mussolini government, and was re-elected deputy in 1924 on the government list; but after the Matteotti affair he withdrew his support, without, however, abandoning the chamber. At the municipal elections of Palermo in August 1925 he mobilized all his adherents in favour of the anti-fascist list but upon the subsequent triumph of the fascists, obtained through a series of violences and frauds, Orlando resigned from parliament in protest.

*See* L. Hautecoeur, *L'Italie sous le ministère Orlando, 1917–19* (1919); R. Lansing, *The Big Four* (1922).

**ORLANDO,** a city of Florida, U.S.A., the county seat of Orange county; 125 mi. S. of Jacksonville, on Federal highways 92 and 441 and served by the Atlantic Coast Line and the Seaboard Air Line railways. Pop. was 30,381 in 1935 (state census); 36,736 in 1940 (by federal census). The region is devoted to citrus fruits, is dotted with lakes (1,000 in the county), and is a centre for tourists. At Winter Park, 4 mi. N.E., is Rollins college (1885), beautifully situated on Lake Virginia. Orlando, founded in 1843, was incorporated in 1875.

**ORLEANAIS,** formerly a French province, comprised the country around Orleans, the *pagus Aurelianensis;* it lay on both banks of the Loire, and for ecclesiastical purposes formed the diocese of Orleans. It had formed part of the territory possessed by the ancestors of Hugh Capet and long remained an important part of the royal demesne. In 1344 Philip VI. gave it with the title of Duke to Philip (d. 1375), one of his younger sons.

*See* A. Thomas, *Les États provinciaux de la France centrale* (1879).

**ORLEANISTS,** a French political party which arose out of the Revolution. It took its name from the Orleans branch of the house of Bourbon, the descendants of Philippe, duke of Orleans, younger brother of Louis XIV., who were its chiefs. Its aim was to reconcile the monarchical principle with the "rights of man," as proclaimed by the Constituent Assembly in 1789. The Orleans princes were traditionally marked out as the leaders in such a policy. Enormously rich, within measurable distance of the succession to the throne, but cut off by the jealousy of the crown from all share in public affairs, they had long been the centres of opposition to the encroachment of the royal power. Louis, duke of Orleans, had headed the protest of the princes against the policy of Maupeou in suppressing the *parlement* of Paris; his son later earned the style of Philippe Égalité by adopting—with ulterior objects—extreme revolutionary views (*see* ORLEANS, LOUIS PHILIPPE J., duke of); and Égalité's son, Louis Philippe (afterwards king of the French) fought, as duc de Chartres, at Jemappes, under the republican tricolour. The generation of Orleanists, the immediate supporters of Philippe Égalité, were swamped in the turmoil of the Revolution. But they came naturally to the front when another revolution overthrew the restored legitimate monarchy of Louis XVIII. and Charles X. During the Restoration, 1815–30, everything tended to identify the Liberals with the Orleanists. It is true that Louis XVIII. had been induced to grant (*octroyer*) a constitutional charter; but he and his successor claimed to rule by divine right and to confer liberties upon their subjects of their own will. The difference between the Legitimists and the Orleanists was thus fundamental. So was that between the Orleanists and the Bonapartists; for the former aimed at securing political liberty, in addition to equality before the law and in social life, while the latter aimed at subjection to a military despotism.

The revolution of 1830 brought the Orleanists into power, and

they marked the profound change made in the character of the government by styling Louis Philippe not "king of France and Navarre by the grace of God," but "king of the French by the grace of God and the will of the people." The Orleanists were led by men eminent in letters and in practical affairs—Guizot, Thiers, the Broglies, the banker Laffitte, and many others—and the 18 years of their rule were, on the whole, profitable to France. That they ended in another "general overturn" in 1848 was due mainly to the fact that the Orleanist conception of what was meant by the word "people" led the Government to offend the deeply-rooted love of the French for equality. On the model of the English constitution they instituted a *pays légal* of about a quarter of a million of voters by whom all the rest of the country was to be "virtually represented." But the nation outside of the *pays légal* soon discovered that it was being governed by a privileged class, less offensive perhaps, but also less brilliant, than the aristocracy of the old monarchy.

The revolution of 1848 swept the Orleanists from power for ever. They continued indeed throughout the Second Republic and the Empire (1848–70) to enjoy a marked prestige, due to the wealth and capacity of some of their members, their influence in the French Academy and the ability of their organs in the press. But their weakness was demonstrated when the Second Empire was swept away by the German War of 1870–71. The country, in its disgust at the Bonapartists and its fear of the Republicans, chose a great many royalists to represent it in the assembly which met in Bordeaux on Feb. 12, 1872. In this body the Orleanists again exercised a kind of leadership by virtue of individual capacity, but they were counterbalanced by the Legitimists. They defeated Thiers on May 24, 1873, as punishment for his dexterous imposition of the Republic on the unwilling majority of the assembly. Their real occupation was to endeavour to bring about a fusion between themselves and the Legitimists. As far back as 1850 Guizot had proposed, or had thought of proposing, such a fusion, but it was on the condition that the comte de Chambord would resign his divine pretentions. The fusion arranged in 1873 was on quite another footing. After much exchange of notes and many agitated conferences, the comte de Paris, the representative of the Orleanists, sought an interview with the comte de Chambord at Frohsdorff, and obtained it by giving a written engagement that he came not only to pay his respects to the head of his house, but also to "accept his principle." Orleanists have declared that the engagement was given, with mental reservations; but the country believed that the liberal royalists had been absorbed in the divine right royalists, and returned republicans at by-elections till it transformed the Assembly. The Orleanist princes had still a part to play, particularly when the death of the comte de Chambord in 1883 left them heads of the house of France, but the Orleanist party ceased to exist as an independent political organization.

BIBLIOGRAPHY.—The Orleanists are necessarily more or less dealt with in all histories of France since 1789, and in most political memoirs, but their principles can be learnt and their fortunes followed from the following: A. Sorel, *L'Europe et la révolution française* (1885–1904); F. Guizot, *Histoire parlementaire de la France* (1819–48), and *Mémoires pour servir à l'histoire de mon temps* (1858–67); P. de la Gorce, *Histoire du second empire* (1894–1904); and G. Hanotaux, *Histoire de la fondation de la 3ème République* (1925). For the attitude of the Orleans princes towards the crown under the old régime, *see* Amédée Britsch, *La Jeunesse de Philippe Égalité* (1927).

**ORLEANS, DUKES OF.** The title of duke of Orleans was first created by King Philip VI. in favour of his son Philip, who died without legitimate issue in 1375. The second duke of Orleans, created in 1392, was Louis, a younger son of Charles V., whose heir was his son, the poet Charles of Orleans. Charles's son Louis, the succeeding duke, became king of France as Louis XII. in 1498, when the duchy of Orleans was united with the royal domain. In 1626 Louis XIII. created his brother, Jean Baptiste Gaston (d. 1660), duke of Orleans, and the title was revived in 1661 by Louis XIV. in favour of his brother Philip. Descendants of this duke have retained the title until the present day, one of them becoming king of France as Louis Philippe in 1830. Two distinguished families are descended from the first house of Orleans: the counts of Angoulême, who were descended from John, a son of Duke Louis I., and who furnished France with a king in the person of Francis I.; and the counts and dukes of Longueville, whose founder was John, count of Dunois, the bastard of Orleans, a natural son of the same duke. In addition to the dukes of Orleans the most important members of this family are: Anne Marie Louise, duchess of Montpensier; Francis, prince of Joinville; Louis Philippe Albert, count of Paris; and the traveller Prince Henry of Orleans. *See* table BOURBON.

**ORLEANS, CHARLES,** DUKE OF (1391–1465), commonly called Charles d'Orléans, French poet, was the eldest son of Louis, duke of Orleans (brother of Charles VI. of France), and of Valentina Visconti, daughter of Gian Galeazzo, duke of Milan. He was born on May 26, 1391. He married (June 29, 1406), Isabella, his cousin, widow of Richard II. of England. She died three years later. He was already duke of Orleans, for Louis had been assassinated by the Burgundians two years before (1407). He was now the most important person in France, except the dukes of Burgundy and Brittany, the king being a cipher. He was, however, only nominally one of the leaders of the civil war; the real guidance of his party resting with Bernard VII., the great count of Armagnac, whose daughter, Bonne, he married, or at least formally espoused, in 1410. Five years of confused negotiations, plots and fightings passed before the English invasion and the battle of Agincourt, where Charles was joint commander-in-chief. He was taken prisoner and carried to England, where he remained for a full quarter of a century. He hunted and hawked and enjoyed society amply, though the very dignities which secured him these privileges made his ransom great, and his release difficult to arrange. Above all, he had leisure, however, for literary work which consisted of short poems in the artificial metres, then fashionable in France. Besides these a number of English poems have been attributed to him, but without certainty. For practical purposes his work consists of some hundreds of short French poems, a few in various metres, but the majority either ballades or rondels. Charles d'Orléans is the last representative of the poetry of the middle ages, in which the form was almost everything, and the personality of the poet, save in rare instances, nothing. He has the urbanity of the 18th century without its vicious and prosaic frivolity. His best-known rondels —those on Spring, on the Harbingers of Summer, and others—rank second to nothing of their kind.

The agreement for his release from captivity was concluded on July 2, 1440. He was actually released on Nov. 3, and then married Mary of Cleves, who brought him a considerable dowry to assist the payment of his ransom. After his return to France he maintained at Blois a miniature court, at which the best-known French men-of-letters at the time—Villon, Olivier de la Marche, Chastelain, Jean Meschinot and others—were residents or visitors or correspondents. His son, afterwards Louis XII., was born in 1462. Charles died on Jan. 4, 1465, at Amboise.

The best edition of Charles d'Orléans's poems, with a brief but sufficient account of his life, is that of C. d'Héricault in the *Nouvelle collection Jannet* (Paris, 1874). For the English poems *see* the edition by Watson Taylor for the Roxburghe Club (1827). *See* also C. Bruneau, *Charles d'Orléans et la poésie aristocratique* (Lyons, 1924).

**ORLEANS, FERDINAND PHILIP LOUIS CHARLES HENRY,** DUKE OF (1810–1842), born at Palermo on Sept. 3, 1810, was the son of Louis Philippe, duke of Orleans, afterwards king of France, and Marie Amélie, princess of the Two Sicilies. Under the Restoration he bore the title of duke of Chartres, and studied classics in Paris at the Collège Henri IV. At the outbreak of the Revolution, which in 1830 set his father on the throne, he was colonel of a regiment of Hussars. He assumed the title of duke of Orleans, and was sent by the king to put down the riots at Lyons (1831), and then to the siege of Antwerp (1832). He was appointed lieutenant-general, and made several campaigns in Algeria (1835, 1839, 1840). On his return to France he organized the *chasseurs d'Orléans*. He died after an accident at Neuilly, near Paris, on July 13, 1842.

The duke of Orleans had married (May 30, 1837) Helène Louise Elisabeth of Mecklenburg-Schwerin, and had by her two sons, the count of Paris and the duke of Chartres. On Feb. 24, 1848, after the abdication of Louis Philippe, the duchess of

Orleans went to the Chamber of Deputies in the Palais Bourbon in the hope of having her eldest son proclaimed and of obtaining the regency; the attitude of the populace forced her to take refuge in England, and she died at Richmond on May 18, 1858.

**ORLEANS, HENRI,** Prince of (1867–1901), eldest son of Robert, duke of Chartres, was born at Ham, near Richmond, Surrey, on Oct. 16, 1867. In 1889, at the instance of his father, he undertook, in company with MM. Bonvalot and Dedecken, a journey through Siberia to Siam. They crossed the mountain range of Tibet, and the fruits of their observations, submitted to the Geographical Society of Paris and later incorporated in *De Paris au Tonkin à travers le Tibet inconnu* (1892), brought them conjointly the gold medal of that society. In 1892 the prince made a short journey in East Africa, and shortly afterwards visited Madagascar, proceeding thence to Tongking. From there he set out for Assam, and found the sources of the Irrawaddy, which secured the medal of the Geographical Society of Paris and the cross of the Legion of Honour. In 1897 he revisited Abyssinia, and political differences arising from this trip led to a duel with the comte de Turin, in which both combatants were wounded. While on a trip to Assam he died at Saigon on Aug. 9, 1901.

**ORLEANS, HENRIETTA,** Duchess of (1644–1670), third daughter of the English king, Charles I., and his queen, Henrietta Maria, was born during the Civil War at Exeter on June 16, 1644. A few days after her birth her mother left England, and she lived at Exeter under the care of Lady Dalkeith (afterwards countess of Morton) until the surrender of the city to the parliamentarians, when she was taken to Oatlands in Surrey. In July 1646 she rejoined her mother in Paris, where her girlhood was spent and where she was educated as a Roman Catholic. Henrietta was mentioned as a possible bride for Louis XIV., but she was betrothed to his only brother Philip. After the restoration of her brother Charles II., she returned to England with her mother, but a few months later she was again in Paris, where she was married to Philip, now duke of Orleans, on March 30, 1661. The duchess was very popular at the court of Louis XIV., and was on good terms with the Grand Monarch, but she was soon estranged from her husband, and her conduct was very imprudent. In 1670, at the instigation of Louis, but without Philip's consent, she visited England and obtained the signature of Charles II.'s ministers to the treaty of Dover. Shortly after returning to France, Henrietta died at St. Cloud on June 30, 1670, and it was asserted that she had been poisoned by order of her husband. She left two daughters, Marie Louise, wife of Charles II. of Spain, and Anne Marie, wife of Victor Amadeus II. of Savoy.

**ORLEANS, JEAN BAPTISTE GASTON,** Duke of (1608–1660), third son of the French king Henry IV., and his wife Marie de Medici, was born at Fontainebleau on April 25, 1608. Known at first as the duke of Anjou, he was created duke of Orleans in 1626, and was nominally in command of the army which besieged La Rochelle in 1628. On several occasions he was obliged to leave France for conspiring against the government of his mother, of Cardinal Richelieu, and of Louis XIII. Orleans stirred up Cinq-Mars to attempt Richelieu's murder, and then deserted him. In 1643, on the death of Louis XIII., Gaston became lieutenant-general of the kingdom, and fought against Spain on the northern frontiers of France; but during the wars of the Fronde he passed from one party to the other. Exiled by Mazarin in 1652 he remained in Blois until his death on Feb. 2, 1660. Gaston's first wife was Marie (d. 1627), daughter and heiress of Henri de Bourbon, duc de Montpensier (d. 1608), and his second wife Marguerite (d. 1672), sister of Charles III., duke of Lorraine. By Marie he left a daughter, Anne Marie, duchesse de Montpensier (*q.v.*); and by Marguerite he left three daughters, Marguerite Louise (1645–1721), wife of Cosimo III., grand duke of Tuscany; Elizabeth (1646–1696), wife of Louis Joseph, duke of Guise; and Françoise Madeleine (1648–1664), wife of Charles Emmanuel II., duke of Savoy.

**ORLEANS, LOUIS,** Duke of (1372–1407), younger son of the French king, Charles V., was born on March 13, 1372. Having been made count of Valois and of Beaumont-sur-Oise, and then duke of Touraine, he received the duchy of Orleans from his brother Charles VI. in 1392. In 1389 he married Valentina (d. 1408), daughter of Gian Galeazzo Visconti, duke of Milan, who brought the county of Asti to her husband and her claim upon Milan, which she transmitted to her descendants, and which furnished Louis XII. and Francis I. with a pretext for interference in northern Italy. When Charles VI. became insane in 1392, Orleans opposed his uncle Philip II., duke of Burgundy, who was conducting the government; and this quarrel was the dominating factor in the affairs of France. Continued after Philip's death in 1404 with his son and successor, John the Fearless, it culminated in the murder of Orleans by one of John's partisans on Nov. 23, 1407. He had eight children by Valentina Visconti, including his successor, Charles of Orleans the poet, and one of his natural sons was the famous bastard of Orleans, John, count of Dunois.

*See* E. Jarry, *La Vie politique de Louis d'Orléans* (1889).

**ORLEANS, LOUIS,** Duke of (1703–1752), only son of Duke Philip II., the regent Orleans, was born at Versailles on Aug. 4, 1703. He took very little part in the politics of the time, although he was conspicuous for his hostility to Cardinal Dubois in 1723. In 1730 Cardinal Fleury secured his dismissal from the position of colonel-general of the infantry. He retired and spent his time mainly in translating the Psalms and the epistles of St. Paul. Having succeeded his father as duke of Orleans in 1723, he died in the abbey of St. Geneviève at Paris on Feb. 4, 1752. His wife Augusta (d. 1726), daughter of Louis William, margrave of Baden, bore him one son, Louis Philippe, who succeeded him.

**ORLEANS, LOUIS PHILIPPE,** Duke of (1725–1785), son of Louis, duke of Orleans, was born at Versailles on May 12, 1725, and was known as the duke of Chartres until his father's death in 1752. He served with the French armies in the campaigns of 1742, 1743 and 1744, and at the battle of Fontenoy in 1745, retiring to Bagnolet in 1757, and occupying his time with theatrical performances. He died at St. Assise on Nov. 18, 1785. The duke married Louise Henriette de Bourbon-Conti, who bore him a son Philip (Égalité), duke of Orleans, and a daughter, who married the last duke of Bourbon. His second wife, Madame de Montesson, whom he married secretly in 1773, was an authoress of some repute. He had two natural sons, the abbot of St. Far and the abbot of St. Albin.

See *L'Automne d'un prince,* a collection of letters from the duke to his second wife, ed. J. Hermand (1910).

**ORLEANS, LOUIS PHILIPPE JOSEPH,** Duke of (1747–1793), called Philippe Égalité, son of Louis Philippe, duke of Orleans, and of Louise Henriette of Bourbon-Conti, was born at St. Cloud on April 13, 1747. Having borne the title of duke of Montpensier until his grandfather's death in 1752, he became duke of Chartres, and in 1769 married Louise Marie Adelaide de Bourbon-Penthièvre, daughter and heiress of the duke of Penthièvre, grand admiral of France. Her wealth made him the richest man in France, and he determined to play a part equal to that of his great-grandfather, the regent, whom he resembled in character and debauchery. As duke of Chartres he opposed the plans of Maupeou in 1771, and was exiled to his country estate of Villers-Cotterets (Aisne). When Louis XVI. came to the throne in 1774 Chartres still found himself looked on coldly at court. In 1778 he served in the squadron of D'Orvilliers, but the Queen obtained his removal from the navy and he was given the honorary post of colonel-general of hussars. He then abandoned himself to pleasure; he often visited London, becoming an intimate friend of the prince of Wales (afterwards George IV.). He made himself very popular in Paris by his gifts to the poor in time of famine, and by throwing open the gardens of the Palais Royal to the people. Before the meeting of the notables in 1787 he had succeeded his father as duke of Orleans, and advertised his liberalism so boldly that he was believed to be aiming at becoming constitutional king of France. In November he was again exiled to Villers-Cotterets. He was elected to the States-General and led the minority of 47 noblemen who seceded from their own estate (June 1789) and joined the Tiers État. The part he played during the summer of 1789 is one of the most debated points in the history of the Revolution. The court accused him

of being at the bottom of every popular movement, and saw the "gold of Orleans" as the cause of the Reveillon riot and the taking of the Bastille. The best testimony for his behaviour during this summer is that of an English lady, Mrs. Grace Dalrymple Elliott, who shared his affections with the comtesse de Buffon; her statement shows that at the time of the riot of July 12 he was on a fishing excursion, and was rudely treated by the king on the next day when going to offer him his services. La Fayette persuaded the king to send the duke to England on a mission and he remained in England from Oct. 1789 to July 1790. On July 7, he took his seat in the Assembly, and on Oct. 2, both he and Mirabeau were declared by the Assembly entirely free of any complicity in the events of October. He now tried to avoid politics, but the court suspected him, and his friends talked about his being king. He made no attempt to get himself made king, regent or lieutenant-general of the kingdom at the time of the flight to Varennes in June 1791, but again tried in vain to make his peace with the court in Jan. 1792. In the summer of that year he was present for a short time with the army of the north, but had returned to Paris before Aug. 10. After that day he ran great risks in saving fugitives; in particular, he saved the life of the count of Champcenetz, the governor of the Tuileries, his personal enemy, at the request of Mrs. Elliott. After accepting the title of Citoyen Égalité, conferred on him by the commune of Paris, he was elected 20th and last deputy for Paris to the Convention. In that body he sat as quietly as in the National Assembly, but at the king's trial he had to speak, and then only to give his vote for the death of Louis. Nevertheless when the news of the desertion of his eldest son, the duke of Chartres with Dumouriez became known in Paris all the Bourbons remaining in France, including Égalité, were arrested April 5. He remained in prison until October, when the Reign of Terror began, and was decreed "of accusation" on Oct. 3. He was tried on Nov. 6, and guillotined on the same day. Personally Orleans possessed the charming manners of a polished grand seigneur; he was debauched and cynical, but never rude or cruel, full of gentle consideration for all about him but selfish in his pursuit of pleasure.

BIBLIOGRAPHY.—Baschet, *Histoire de Philippe Égalité; Journal* of Mrs. Grace Dalrymple Elliott (1859); A. Nettement, *Philippe-Égalité* (1842); L. C. R(ousselet), *Correspondance de Louis-Philippe Joseph d'Orléans avec Louis XVI.* (1800); Rivarol, *Portrait du duc d'Orléans et de Madame de Genlis;* Tournois, *Histoire de Louis Philippe Joseph duc d'Orléans* (1842).

**ORLEANS, LOUIS PHILIPPE ROBERT,** DUKE OF (1869–1926), eldest son of the comte de Paris, was born at York House, Twickenham, on Feb. 6, 1869. The law of exile against the French princes having been abrogated in 1871, he returned to France and was educated at Eu and at the Collège Stanislas, Paris. On the death of the comte de Chambord, the comte de Paris became head of the Bourbons; and in 1886 he and his son were exiled from France by the new law of 1886. He then passed through the Royal Military College, Sandhurst, and received a commission in the 4th battalion of the 60th Rifles, then quartered in India. In January 1888 the duke joined his regiment for a few months. On attaining his majority, he went to Paris (February 7, 1890), and, proceeding to the *mairie,* expressed his desire, as a Frenchman, to perform his military service. He was arrested in conformity with the law of 1886, tried, and sentenced to two years' imprisonment; but he was liberated by President Carnot after a few months' nominal incarceration (June 4), and conducted to the Swiss frontier. This escapade won for him the title of "Le Premier Conscrit de France." After the comte de Paris's funeral (September 12, 1894) the duke received his adherents in London, and was accepted as the head of his house. On Nov. 5, 1896, he married the archduchess Maria Dorothea Amalia of Austria; there was no issue of the marriage. The duke of Orleans was interested in exploration, and published *Une croisière au Spitzberg* (1905). He died on March 28, 1926.

**ORLEANS, PHILIP I.,** DUKE OF (1640–1701), son of the French king Louis XIII., was born at St. Germain-en-Laye on Sept. 21, 1640. In 1661 he was created duke of Orleans, and married Henrietta, sister of Charles II. of England; but the marriage was not happy, and the death of the duchess in 1670 was attributed to poison. Later he married Charlotte Elizabeth, daughter of Charles Louis, elector palatine of the Rhine. Having fought with distinction in Flanders in 1667, Orleans returned to military life in 1672, and in 1677 gained a great victory at Cassel and took St. Omer. Louis XIV., it was said, was jealous of his brother's success; Orleans never commanded an army again. He died at St. Cloud on June 8, 1701, leaving a son, Philip, the regent Orleans, and two daughters: Anne Marie (1669–1728), wife of Victor Amadeus II., duke of Savoy; and Elizabeth Charlotte (1676–1744), wife of Leopold, duke of Lorraine. His eldest daughter, Marie Louise (1662–1689), wife of Charles II. of Spain, died before her father.

**ORLEANS, PHILIP II.,** DUKE OF (1674–1723), regent of France, son of Philip I., duke of Orleans, and his second wife, the princess palatine, was born on Aug. 2, 1674, and fought at the siege of Mons in 1691. His marriage with Mlle. de Blois, the legitimized daughter of Louis XIV., won him the favour of the king. He fought at Steinkerk, Neerwinden and Namur (1692–1695). During the next few years he studied natural science. He was next given a command in Italy (1706) and in Spain (1707–1708) where he gained some important successes, but his suspected desire to succeed Philip V. on the throne of Spain gained him Louis XIV.'s disfavour. In his will, however, he appointed him president of the council of regency of the young King Louis XV. (1715). After the death of the king, Orleans had the will annulled by the parlement, and himself invested with absolute power. At first he made a good use of this, counselling economy, decreasing taxation, disbanding 25,000 soldiers and restoring liberty to the persecuted Jansenists. But the inquisitorial measures which he had begun against the financiers led to disturbances. He also countenanced the risky operations of the banker John Law (1717), whose bankruptcy led to a disastrous crisis.

A conspiracy under the inspiration of Cardinal Alberoni, first minister of Spain, to transfer the regency from Orleans to Philip V. of Spain was discovered and defeated in 1718. Dubois, formerly tutor to the duke of Orleans and now his all-powerful minister, caused war to be declared against Spain, with the support of the emperor, and of England and Holland (Quadruple Alliance). Philip V. made peace with the regent in 1720.

On the majority of the king (Feb. 15, 1723), the duke of Orleans resigned the supreme power; but he became first minister to the king, and remained in office till his death on Dec. 23, 1723. The regent had great qualities, both brilliant and solid, but his dissolute manners found only too many imitators, and the regency was one of the most corrupt periods in French history.

*See* J. B. H. R. Capefigue, *Histoire de Philippe d'Orléans, régent de* France (2 vols., 1838); A. Baudrillart, *Philippe V. et la cour de France,* vol. ii. (1890); and L. Wiesener, *Le régent, l'abbé Dubois et les Anglais* (3 vols., 1891–99).

**ORLÉANS** (ORLEANS), a city of France, the chief town of Loiret, on the Loire, 77 mi. S.S.W. of Paris by rail. Pop. (1936) 70,780. Les Aubrais, a mile to the north, is one of the chief railway junctions in the country. An early trading post among the Gauls, Orléans was known as *Genabum* by the Romans, and led the revolt against Julius Caesar in 52 B.C. In the 5th century it had taken the name *Aurelianum* from either Marcus Aurelius or Aurelian. It was vainly besieged in 451 by Attila, and by Odoacer in 471, but Clovis took it in 498 and held there in 511 the first ecclesiastical council assembled in France. It then became the capital of a separate kingdom, but was united with that of Paris in 613. In the 10th century the town was given in fief to the counts of Paris, who in 987 ousted the Carolingians. Philip, fifth son of Philip VI, was the first duke of Orléans. After the assassination of his successor Louis the people of Orléans sided with the Armagnacs, and thus brought upon themselves the attacks of the Burgundians and the English. Joan of Arc relieved the city in 1429. In 1562 it became the headquarters of Louis I of Bourbon, prince of Condé, the Protestant commander-in-chief. In 1563 Francis, duke of Guise, laid siege to it, but was assassinated. Orléans was surrendered to the king, who raised the fortifications. It was held by the Huguenots from 1567 to 1568. The St. Bartholomew massacre there in 1572 lasted a week. It

was given as a *lieu de sûreté* to the League under Henry III, but surrendered to Henry IV in person in 1594. The town is surrounded by boulevards, and is connected with the suburb of St. Marceau by an 18th century stone bridge of nine arches. The river is canalized on the right, and serves as a continuation of the Orléans canal.

In the Place du Martroi is a statue of Joan of Arc. A simple cross marks the site, on the left bank of the Loire, of the *Fort des Tourelles,* captured by Joan of Arc in 1429. The cathedral of Ste. Croix, begun in 1287, was burned by the Huguenots in 1567 before its completion. Henry IV, in 1601, laid the first stone, the building of which continued until 1829. The church of St. Aignan mutilated by the Protestants consists of a transept and choir of the second half of the 15th century; it contains in a gilded and carved wooden shrine the remains of its patron saint. St. Euverte, dedicated to one of the oldest bishops of Orléans (d. 391), is an early Gothic building dating from the 13th, completely restored in the 15th century. The church of St. Paul (15th and 16th century) has an isolated tower, and Notre-Dame de Recouvrance was rebuilt between 1517 and 1519 in the Renaissance style and dedicated to the memory of the deliverance of the city. The *hôtel de ville,* built under Francis I and Henry II and restored in the 19th century, was formerly the residence of the governors of Orléans, and was occupied by the kings and queens of France from Francis II to Henry IV. The public library comprises among its manuscripts a number dating from the 7th century. The *salle des fêtes,* formerly the corn-market, stands within a vast cloister formed by 15th-century arcades, once belonging to the old cemetery. Among old houses are that of Agnès Sorel (15th and 16th centuries), containing objects relating to Joan of Arc, that of Francis I, of the first half of the 16th century, that occupied by Joan of Arc during the siege of 1429, and that known as the house of Diane de Poitiers (16th century), which contains the historical museum. The anniversary of the raising of the siege in 1429 by Joan of Arc is celebrated yearly. Orléans is the seat of a bishopric under the archbishop of Paris, a prefect, a court of appeal, and a court of assizes and headquarters of the V army corps.

The more important industries are the manufacture of tobacco (by the state), blankets, pins, vinegar, machinery, agricultural implements, hosiery, tools and ironware, and the preparation of preserved vegetables. Wine, wool, grain and live stock are commercial staples, round which there are important nurseries.

### ORLÉANS CAMPAIGN OF 1870

Orléans was the pivot of the second phase of the Franco-German War, called the "People's War," when the new armies began their attempt to relieve Paris. After the fall of the empire, the Government of National Defense, deciding to remain in Paris, delegated three of its members, Crémieux, Glais-Bizoin and Fourichon, proceeded to the provinces to hasten the levy of troops. General de la Motte-Rouge was appointed to command the "territorial division of Tours." From many scattered units, most of them ill equipped, he formed the XV corps. The Germans, however, were only able to spare the I Bavarian corps and three cavalry divisions (2nd, 4th and 6th), the investment of Paris and Metz occupying their forces. On Oct. 5 the German 4th cavalry division was forced to retire before a French detachment under Reyau. Von der Tann, commanding the I Bavarian corps, was reinforced by the 22nd infantry and 2nd and 6th cavalry divisions. Reyau was attacked at Artenay on Oct. 10 and was thrown back in disorder, Orléans being captured in the evening of the following day, whereupon the French fell back on Sologne. Meanwhile Gambetta, minister of defense, arriving at Tours by balloon from Paris, assumed virtual control on Oct. 11, being aided by De Freycinet, the deputy minister. He forthwith appointed General d'Aurelle de Paladines in place of La Motte-Rouge. The change gave impetus to the training and reorganization of the troops and by Oct. 23 a further force was concentrated at Blois, which formed the XVI corps.

After the withdrawal of the 22nd infantry division from Von der Tann, its commander, General Wittich advanced to Châteaudun which he captured on Oct. 18. He now made for Chartres, which also fell into his hands. The resistance he had met with led the Germans to believe in the existence of a new army as the French who defended them did not belong to either the XV or XVI corps. The "Army of the West," as they called this phantom force, originated from the defenders of Châteaudun and Chartres and was never formed into a fighting unit.

The French command decided to advance against the Germans massed around Orléans whom it mistakenly estimated at 60,000 men, whereas they barely numbered 26,000. As a mystification empty trains were run to Le Mans to confirm the Germans in their belief in the existence of an army west of Paris. But the contemplated offensive was postponed owing to bad weather and the discouraging news of Bazaine's capitulation with his 150,000 troops at Metz.

Moltke directed the II army, released from the siege of Metz, towards Bourges, sending it by Chalon-sur-Saône, while he formed a new detachment under the grand duke of Mecklenburg-Schwerin consisting of the I Bavarian army corps, 17th and 22nd infantry and 2nd, 3rd and 4th cavalry divisions. This force was to concentrate between Châteaudun and Chartres.

The French advance began auspiciously, the German cavalry retiring before them on Nov. 8. The following day, moving across the country in battle formation, the French attacked Von der Tann who was drawn up at Coulmiers, forcing him to retreat unpursued. The 2,500 Germans guarding Orléans thereupon evacuated the city and joined Von der Tann at Angerville.

Meanwhile, the grand duke with his detachment had not encountered any strong hostile forces and by Nov. 19 Moltke began to believe that after all the French must still be concentrated in the neighbourhood of Orléans to the number of 150,000 men. He fully realized the gravity of the situation—the expected sortie from Paris coupled with the advance of the army of the Loire. The king of Prussia was prepared, as he said to Waldersee at Versailles, to raise the siege of Paris if the II army sustained a defeat.

The members of the government in Paris urged Trochu, the governor, to attempt a sortie toward Fontainebleau, thereby joining hands with the army of the Loire. The sortie was to begin Nov. 29, but the balloon carrying the message to Gambetta alighted in Norway, which caused a delay. D'Aurelle still remained on the defensive near Orléans though pressed by Freycinet to advance.

The battle of Beaune-la-Rolande took place on Nov. 28, General Crouzat's XX corps attacking the German X corps between Turanville and Beaune-la-Rolande, while Billot's XVIII corps pushed back the Prussian left. In the afternoon Crouzat was himself assailed in the rear from Pithiviers by a cavalry and infantry division, Billot also falling back.

After further operations in which the French sustained defeat, the Germans moved toward Orléans on Dec. 3 in a scythe-like line of battle 40 miles long. Serious resistance was only encountered at Chilleurs. Orléans was entered on Dec. 4th. (*See* further FRANCO-GERMAN WAR.)

**ORLEY, BERNARD VAN** (*c.* 1490–1540), Flemish painter, son of the painter, Valentyn van Orley, was born at Brussels about 1490. The date of his birth is estimated from his portrait by Dürer painted in 1521, now in the Dresden gallery. It represents an attractive and intelligent man of about 30. In 1515 he was employed by Margaret of Austria, then regent of the Netherlands, and three years later he was appointed her court painter. He died in 1540. His earliest important work is the altarpiece of SS. Thomas and Matthias, of which the centrepiece is at Vienna and the wings at Brussels painted about 1512. The style of the picture seems to be inspired by the school of Autrey. From 1516–22 Bernard van Orley imitated Mabuse—to this period belongs the "Madonna" in the Wied collection and the "Holy Family" in the Louvre. In the "Holy Family" in the Prado (1522) the influence of Mabuse has given way to that of Raphael. In the altarpiece representing the "Patience of Job," (1521) now in the Brussels gallery, we find the two influences combined. The artist had many opportunities to see designs by Raphael whose tapestry cartoons were in Brussels for many years. Important works of his later period are the "Hanneton

Family" altarpiece in the Brussels gallery; the "Last Judgment" (1525) at Antwerp; and the "Crucifixion" at Rotterdam. He painted several portraits; the one of Dr. Georg Zelk in the Brussels gallery is the only one which is signed and dated (1519). Van Orley was a designer of tapestries; for instance, "Hunts of Maximilian," in the Louvre, and "Victory of Pavia" at Naples.

*See* M. Friedlander, *Annual of Prussian Museums* (1908–09).

**ORLOV, ALEXIS FEDOROVICH,** PRINCE (1787–1862), Russian statesman, natural son of Count Theodore Grigorievich Orlov, took part in all the Napoleonic wars from 1805 to the capture of Paris. For his services as commander of the cavalry regiment of the Life Guards on the occasion of the rebellion of 1825 he was created a count, and in the Turkish War of 1828–29 rose to the rank of lieutenant-general. Orlov was the Russian plenipotentiary at the Peace of Adrianople, and in 1833 was appointed Russian ambassador at Constantinople, holding at the same time the post of commander-in-chief of the Black Sea Fleet. He was one of the most trusted agents of Nicholas I., whom in 1837 he accompanied on his foreign tour. In 1854 he was sent to Vienna to bring Austria over to the side of Russia, but without success. In 1856 he was one of the plenipotentiaries who concluded the Peace of Paris, and was rewarded with the dignity of prince, and the presidency of the imperial council of state and of the council of ministers. In 1857 he presided over the commission formed to consider the question of the emancipation of the serfs, to which he was altogether hostile.

**ORLOV, ALEXIS GRIGORIEVICH,** COUNT (1737–1808), brother of Gregory, Count Orlov (*q.v.*), was remarkable for his athletic strength and dexterity. In the revolution of 1762 he played an even more important part than his brother. He conveyed Peter III. to the château of Ropsha and is said to have murdered him there. In 1770 he was appointed commander-in-chief of the fleet sent against the Turks, whose far superior navy he annihilated at Cheshme (July 5, 1770), a victory which led to the conquest of the Greek archipelago. He devoted himself to horse-breeding, and produced the finest race of horses then known by crossing Arab and Frisian, and Arab and English studs. In the war with Napoleon during 1806–07 Orlov commanded the militia of the fifth district, which was placed on a war footing almost entirely at his own expense. He left an estate worth five millions of roubles and 30,000 serfs.

*See* article, "The Associates of Catherine II.," No. 2, in *Russkaya Starina* (Rus.) (St. Petersburg, 1873).

**ORLOV, GREGORY** (GRIGORII) **GRIGORIEVICH,** COUNT (1734–1783), Russian statesman, was the son of Gregory Orlov, governor of Great Novgorod. While serving in the capital as an artillery officer he caught the fancy of Catherine II., and was the leader of the conspiracy which resulted in the dethronement and death of Peter III. (1762). Catherine made him a count and adjutant-general, director-general of engineers and general-in-chief. At one time the empress thought of marrying her favourite, but the plan was frustrated by Nikita Panin. Orlov's influence became paramount after the discovery of the Khitrovo plot to murder the whole Orlov family. Gregory Orlov entered with enthusiasm, both from patriotic and from economic motives, into the question of the improvement of the condition of the serfs and their partial emancipation. He was their advocate in the great commission of 1767. One of the earliest propagandists of the Slavophil idea of the emancipation of the Christians from the Turkish yoke, he was sent as first Russian plenipotentiary to the peace-congress of Focsani (1771), but he failed in his mission, owing partly to the obstinacy of the Turks, and partly (according to Panin) to his own insolence. He was superseded in the empress's favour by Vasil'chikov.

*See* A. P. Barsukov, *Narratives from Russian History in the 18th Century* (Rus.) (St. Petersburg, 1885).

**ORLOV, NIKOLAI ALEKSYEEVICH,** PRINCE (1827–1885), entered the diplomatic service, and represented Russia successively at Brussels (1860–1870), Paris (1870–1882) and Berlin (1882–1885). As a publicist he stood in the forefront of reform. His articles on corporal punishment, which appeared in *Russkaya Starina* in 1881, brought about its abolition. He also advocated tolerance towards the dissenters. He wrote a *Sketch of Three Weeks' Campaign in 1806* (St. Petersburg, 1856).

**ORLOV, THEODORE** (FEDOR) **GRIGORIEVICH,** COUNT (1741–1790), Russian general, participated with his elder brothers, Gregory (*q.v.*) and Alexis (*q.v.*), in the *coup d'état* of 1762, after which he was appointed chief procurator of the senate. His naval exploits in the first Turkish War were commemorated by a triumphal column, crowned with naval trophies, erected at Tsarskoe Selo. He retired in 1775.

**ORM** or **ORMIN,** the author of an English book, called by himself *Ormulum* ("because Orm made it"), consisting of metrical homilies on the gospels read at mass. The unique ms., now in the Bodleian library, is certainly Orm's autograph, and contains abundant corrections by his own hand. On palaeographical grounds it is referred to about A.D. 1200, and this date is supported by the linguistic evidence. The dialect is midland, with some northern features. The orthography of the *Ormulum* is the most valuable existing source of information on the development of sound in Middle English. On the whole, the language of the *Ormulum* seems to point to north Lincolnshire as the author's native district. There are reasons for thinking that Orm and the Walter to whom it is dedicated may have been inmates of the Augustinian priory of Elsham, near the Humber, which was established about the middle of the 12th century by Walter de Amundeville.

The *Ormulum* is written in lines alternately of eight and seven syllables, without either rhyme or alliteration. The rhythm may be seen from the opening couplet:

Nu, broþerr Wallter, broþerr min
Affterr þe flæshess kinde.

The extant portion of the work, not including the dedication and introduction, consists of about 20,000 lines. But the table of contents refers to 242 homilies, of which only 31 are preserved; and as the dedication implies that the book had been completed, and that it included homilies on the gospels for nearly all the year, it would seem that the huge fragment which we possess is not much more than one-eighth of this extraordinary monument of pious industry.

The *Ormulum* was edited for the first time by R. M. White in 1852. A revised edition, by R. Holt, was published in 1878. Many important corrections of the text were given by E. Kölbing in the first volume of *Englische Studien.* With reference to the three forms of the letter *g*, *see* A. S. Napier, *Notes on the Orthography of the Ormulum,* printed with *A History of the Holy Rood Tree* (Early English Text Society, 1894).

**ORME, ROBERT** (1728–1801), English historian of India, was born at Anjengo on the Malabar coast on Dec. 25, 1728, the son of a surgeon in the Company's service. Educated at Harrow, he was appointed to a writership in Bengal in 1743. He returned to England in 1753 in the same ship with Clive, with whom he formed a close friendship. From 1754 to 1758 he was a member of council at Madras. His great work was *A History of the Military Transactions of the British Nation in Indostan from 1745* (3 vols., 1763–78). This was followed by a volume of *Historical Fragments* (1781), dealing with an earlier period. In 1769 he was appointed historiographer to the East India Company. He died at Ealing on Jan. 13, 1801. His valuable collections of mss. are in the India Office library. Not a few of the most picturesque passages in Macaulay's Essay on Clive are borrowed from Orme.

**ORMER,** the name given in the Channel Isles and on the coasts of France to *Haliotis tuberculata,* a gastropod mollusc. It has a shell with a widely open aperture, more or less resembling a human ear in outline. The animal lives beneath stones and rocks close to the low-water mark of spring tides. For a sedentary organism it can move remarkably fast, and observers have commented on its strength and agility. The ormer is an article of human food in the Channel Isles and elsewhere (*see* ABALONE). The States of Guernsey introduced legislation in 1926 for its protection.

*See* T. A. Stephenson (1924), *Journ. Marine Biol. Assocn.,* xiii. No. 2, p. 480.

**ORMEROD, ELEANOR A.** (1828–1901), English entomologist, the daughter of George Ormerod, F.R.S., author of *The History of Cheshire,* was born at Sedbury Park, Gloucestershire,

on May 11, 1828. The opportunity afforded for entomological study by the large estate upon which she grew up and the interest she took in agriculture soon made her an authority upon this subject. In 1868, she aided the Royal Horticultural Society in forming a collection of insect pests of the farm for practical purposes, and was awarded the Flora medal of the society. In 1877 she issued a pamphlet, *Notes for Observations on Injurious Insects,* which was distributed among persons interested in this line of inquiry, who readily sent in the results of their researches, and was thus the beginning of the well-known *Annual Series of Reports on Injurious Insects and Farm Pests.* In 1881 Miss Ormerod published a special report upon the "turnip-fly," and she was consulting entomologist to the Royal Agricultural Society from 1882 to 1892. For several years she was lecturer on scientific entomology at the Royal Agricultural college, Cirencester. Eleanor Ormerod died at St. Albans on July 19, 1901.

Her works include: *The Cobden Journals; Manual of Injurious Insects; Handbook of Insects Injurious to Orchard and Bush Fruits;* and her *Autobiography and Correspondence* (1904). *See* also: *Canadian Entomologist,* vol. 33, 1901; *Royal Agric. Soc. Journ.* vol. 62, 1901.

**ORMOC,** a municipality (with administrative centre and 46 *barrios* or districts), of the island and province of Leyte, Philippine Islands, on the west coast about 35 mi. S.W. of Tacloban, the provincial capital. Pop. (1939), 77,349; 32 were whites. Ormoc is the centre of an extensive abacá- (Manila hemp) producing region and has a large coastwise trade, especially with Cebu. The vernacular is Cebuano. Of the inhabitants aged 6 to 19 inclusive, 18·4% in 1939 attended school, while 32·6% of the population 10 years old and over was literate.

**ORMOLU,** an alloy of copper and zinc, sometimes with an addition of tin. The name is also used to describe gilded brass or copper. The tint of ormolu approximates closely to that of gold; it is heightened by a wash of gold lacquer, by immersion in dilute sulphuric acid or by burnishing. The principal use of ormolu is for the mountings of furniture. With it the great French *ébénistes* of the 18th century obtained results which, in the most finished examples, are almost as fine as jewellers' work. The mounts were usually cast and then chiselled with extraordinary skill and delicacy. (*See* also SILVERSMITHS' AND GOLDSMITHS' WORK.)

**ORMOND,** a town of Volusia county, Florida, U.S.A., on the Halifax river (an arm of the Atlantic ocean extending along the east coast for 25 mi.) just N. of Daytona Beach. It is on federal highway 1 and is served by the Florida East Coast railway. The resident population was 1,517 in 1930; 1,914 in 1940, federal census. It is a winter resort with large hotels and beautiful residences. The hard, compact Ormond-Daytona beach (200 ft. wide and 20 mi. long), formerly the scene of automobile speed tests, is used by tourists, winter and summer, for bathing and motoring. Ormond was incorporated in 1880. Until his death in 1937, it was the winter home of John D. Rockefeller.

**ORMONDE, EARL AND MARQUESS OF,** titles still held by the famous Irish family of Butler (*q.v.*), the name being taken from a district now part of co. Tipperary. In 1328 James Butler (*c.* 1305–37), a son of Edmund Butler, was created earl of Ormonde, one reason for his elevation being that his wife Eleanor Bohun was a granddaughter of Edward I. His son James, the 2nd earl (1331–82), was four times governor of Ireland; the latter's grandson James, the 4th earl (d. 1452), held the same position several times, and won repute not only as a soldier, but as a scholar. His son, James, the 5th earl (1420–*c.* 1461), was created an English peer as earl of Wiltshire in 1449. He was lord high treasurer of England in 1455 and again in 1459, and was taken prisoner by the Yorkists after the battle of Towton in 1461. He and his two brothers were then attainted, and he died without issue, the exact date of his death being unknown. The attainder was repealed in the Irish parliament in 1476, when his brother Sir John Butler (*c.* 1422–78), who had been pardoned by Edward IV. a few years previously, became 6th earl of Ormonde. John, who was a fine linguist, served Edward IV. as ambassador to many European princes. His brother Thomas, the 7th earl (*c.* 1424–1515), a courtier and an English baron under Richard III. and Henry VII., was ambassador to France and to Burgundy; he left no sons, and on his death in August 1515 his earldom reverted to the crown.

Margaret, a daughter of this earl, married Sir William Boleyn of Blickling, and their son Sir Thomas Boleyn (1477–1539) was created earl of Ormonde and of Wiltshire in 1529. He arranged the preliminaries for the Field of the Cloth of Gold; he was lord privy seal from 1530 to 1536, and served the king in many other ways. He was the father of Anne Boleyn.

Meanwhile in 1515 the title of earl of Ormonde had been assumed by Sir Piers Butler (*c.* 1467–1539), a cousin of the 7th earl. He was lord deputy, and later lord treasurer of Ireland, and in 1528 he surrendered his claim to the earldom of Ormonde and was created earl of Ossory. Then in 1538 he was made earl of Ormonde, this being a new creation; however, he counts as the 8th earl of the Butler family. In 1550 his second son Richard (d. 1571) was created Viscount Mountgarret, a title still held by the Butlers. The 8th earl's son, James, the 9th earl (*c.* 1490–1546), lord high treasurer of Ireland, was created Viscount Thurles in 1536. In 1544 an act of parliament confirmed him in the possession of his earldom, which, for practical purposes, was declared to be the creation of 1328, and not of 1538.

Thomas, the 10th earl (1532–1614), a son of the 9th earl, was lord high treasurer of Ireland. He was a Protestant, and threw his great influence on the side of the English queen and her ministers in their efforts to crush the Irish rebels, but he was perhaps more anxious to prosecute a fierce feud with his hereditary foe, the earl of Desmond, this struggle between the two factions desolating Munster for many years. His successor was his nephew Walter (1569–1633), who was imprisoned from 1617 to 1625 for refusing to surrender the Ormonde estates to his cousin Elizabeth, the wife of Sir R. Preston and the only daughter of the 10th earl. He was deprived of the palatine rights in the county of Tipperary, which had belonged to his ancestors for 400 years, but he recovered many of the family estates after his release from prison in 1625.

Walter's grandson, James, the 12th earl, was created marquess of Ormonde in 1642 and duke of Ormonde in 1661 (*see* below); his son was Thomas Butler, earl of Ossory, and his grandson was James Butler, 2nd duke of Ormonde (*see* below).

When Charles Butler, earl of Arran (1671–1758), the brother and successor of the 2nd duke, died in December 1758, the dukedom and marquessate became extinct, but the earldom was claimed by a kinsman, John Butler (d. 1766). John's cousin, Walter (1703–83), inherited this claim, and Walter's son, John (1740–95), obtained a confirmation of it from the Irish House of Lords in 1791. He is reckoned as the 17th earl. His son Walter, the 18th earl (1770–1820), was created marquess of Ormonde in 1816, a title which became extinct on his death, but was revived in favour of his brother James (1774–1838) in 1825, and was retained by his descendants.

*See* J. H. Round on "The Earldoms of Ormonde" in Joseph Foster's *Collectanea Genealogica* (1881–83).

**ORMONDE, JAMES BUTLER,** 1ST DUKE OF (1610–1688), Irish statesman and soldier, eldest son of Thomas Butler, Viscount Thurles, and of Elizabeth, daughter of Sir John Poyntz, and grandson of Walter, 11th earl of Ormonde (*see* above), was born in London on Oct. 19, 1610. On the death of his father by drowning in 1619, the boy was made a royal ward by James I., removed from his Roman Catholic tutor, and placed in the household of Abbot, archbishop of Canterbury, with whom he stayed until 1625, residing afterwards in Ireland with his grandfather. In 1629, by his marriage with his cousin, the Lady Elizabeth Preston, daughter and heiress of Richard, earl of Desmond, he put an end to the long-standing quarrel between the families and united their estates. He succeeded his grandfather in 1632.

His active career began in 1633 with the arrival of Strafford, whom he supported consistently. In 1640 during Strafford's absence he was made commander-in-chief of the forces, and in August he was appointed lieutenant-general. On the outbreak of the rebellion in 1641 he rendered great service in the expedition to Naas, and in the march into the Pale in 1642, though much hampered by the lords justices, who were jealous of his power and

recalled him after he had succeeded in relieving Drogheda. On April 15, 1642, he gained the battle of Kilrush against Lord Mountgarret. He was created a marquess, and lieutenant-general with a commission direct from the king. He won the battle of New Ross (March 18, 1643) against Thomas Preston, afterwards Viscount Tara. In September, the civil war in England having meanwhile broken out, Ormonde, in view of the successes of the rebels and the uncertain loyalty of the Scots in Ulster, concluded (Sept. 15) with the latter, in opposition to the lords justices, the "cessation" by which the greater part of Ireland was given up into the hands of the Catholic Confederation, leaving only small districts on the east coast and round Cork, together with certain fortresses in the north and west then actually in their possession, to the English commanders. He subsequently, by the king's orders, despatched a body of troops into England (shortly afterwards routed by Fairfax at Nantwich) and was appointed in January 1644 lord lieutenant, with orders to keep the Scotch army occupied.

In the midst of all the plots and struggles of Scots, Old Irish, Catholic Irish of English race, and Protestants, and in spite of the intrigues of the pope's nuncio, as well as of attempts by the parliament's commissioners to ruin his power, Ormonde showed the greatest firmness and ability. He assisted Antrim in his unsuccessful expedition into Scotland. On March 28, 1646, he concluded a treaty with the Irish which granted religious concessions and removed various grievances. Meanwhile the difficulties of his position had been greatly increased by Glamorgan's treaty (Aug. 25, 1645) with the Roman Catholics, and it became clear that he could not long hope to hold Dublin against the Irish rebels. He thereupon applied to the English parliament, signed a treaty on June 19, 1647, gave Dublin into their hands upon terms, and sailed for England at the beginning of August. He attended Charles during August and October at Hampton Court, but subsequently, in March 1648, in order to avoid arrest by the parliament, he joined the queen and prince of Wales at Paris. In September of the same year, he returned to Ireland to endeavour to unite all parties for the king. On Jan. 17, 1649 he concluded a peace with the rebels on the basis of the free exercise of their religion; on the execution of the king he proclaimed Charles II. and was created a knight of the Garter in September. On the conquest of the island by Cromwell he returned to France in December 1650.

Ormonde accompanied Charles to Aix and Cologne when expelled from France by Mazarin's treaty with Cromwell in 1655. In 1658 he went disguised, and at great risk, upon a secret mission into England. He attended the king at Fuenterrabia in 1659 and had an interview with Mazarin; and was actively engaged in the secret transactions immediately preceding the Restoration. On the return of the king he was at once appointed a commissioner for the treasury and the navy, and received other important places, together with an English peerage, and (1661) the dukedom of Ormonde in the Irish peerage. On Nov. 4, 1661 he once more received the lord lieutenantship of Ireland. The act of Explanation (on land settlement) was passed through the Irish parliament by Ormonde in 1665. His heart was in his government, and he vehemently opposed the bill prohibiting the importation of Irish cattle which struck so fatal a blow at Irish trade; and retaliated by prohibiting the import into Ireland of Scottish commodities, and obtained leave to trade with foreign countries. He encouraged Irish manufactures and learning to the utmost, and it was to his efforts that the Irish college of Physicians owes its incorporation.

Faced by the loss of royal favour, Ormonde declared "However ill I may stand at court I am resolved to lye well in the chronicle." His irresponsible government was no doubt open to criticism. He had billeted soldiers on civilians, and had executed martial law. The impeachment, however, threatened by Buckingham in 1667 and 1668 fell through. Nevertheless by 1669 constant importunity had had its usual effect upon Charles, and in March Ormonde was dismissed. That year, he was however, elected chancellor of Oxford university. On Dec. 6, 1670 an attempt was made to assassinate the duke by Thomas Blood. He was dragged out of his coach, and taken on horseback along Piccadilly with the intention of hanging him at Tyburn. Ormonde, however, succeeded in overcoming the horseman to whom he was bound, and his servants coming up, he escaped. The king pardoned Blood, and even treated him with favour after his apprehension while endeavouring to steal the crown jewels.

In 1671 Ormonde successfully opposed Richard Talbot's attempt to upset the act of Settlement. In 1677 he was restored to favour and reappointed to the lord lieutenancy. On his arrival in Ireland he placed the revenue and the army upon a proper footing. In 1682 Charles summoned Ormonde to court. On Nov. 9, 1683 an English dukedom was conferred upon him, and in June 1684 he returned to Ireland; but he was recalled in October in consequence of fresh intrigues. Before, however, he could give up his government to Rochester, Charles II. died; and Ormonde's last act as lord lieutenant was to proclaim James II. in Dublin. Subsequently he lived at Cornbury in Oxfordshire. He refused the king his support over the Indulgence but James held him in respect. He died on July 21, 1688, and was buried in Westminster abbey.

BIBLIOGRAPHY.—Thomas Carte, *Life of the Duke of Ormonde;* the same author's *Collection of Original Letters, found among the Duke of Ormonde's Papers* (1739), and the Carte mss. in the Bodleian library at Oxford; Sir Robert Southwell, *Life of Ormonde,* printed in the *History of the Irish Parliament,* by Lord Mountmorres (1792), vol. i.; *Correspondence between Archbishop Williams and the Marquess of Ormonde,* ed. by B. H. Beedham (reprinted from *Archaeologia Cambrensis,* 1869); *Observations on the Articles of Peace between James, Earl of Ormonde, and the Irish Rebels,* by John Milton; *Hist. mss. Comm.* Reps. ii.–iv. and vi.–x., esp. Rep. viii., appendix p. 499, and Rep. xiv. App.: pt. vii., *Mss. of Marquis of Ormonde,* together with new series; *Notes and Queries,* vi. ser. v., pp. 343, 431; Gardiner, *Hist. of the Civil War; Calendar of State Papers* (*Domestic*) and *Irish, 1633–1662,* with introductions; *Biographia Britannica* (Kippis); *Scottish Hist. Soc. Publications: Letters and Papers of 1650,* ed. by S. R. Gardiner, vol. xvii. (1894); and G. Coffey, *O'Neill and Ormonde, a Chapter in Irish History* (1914).

**ORMONDE, JAMES BUTLER,** 2ND DUKE OF (1665–1745), Irish statesman and soldier, son of Thomas, earl of Ossory, and grandson of the 1st duke, was born in Dublin on April 29, 1665, and was educated in France and afterwards at Christ Church, Oxford. He commanded a regiment of horse in William's army at the battle of the Boyne. In 1691 he served on the continent under William, and after the accession of Anne he was placed in command of the land forces co-operating with Sir George Rooke in Spain. He succeeded Rochester as viceroy of Ireland in 1703, a post which he held till 1707.

On the dismissal of the duke of Marlborough in 1711, Ormonde was appointed captain-general in his place, and allowed himself to be made the tool of the Tory ministry, whose policy was to carry on the war in the Netherlands while giving secret orders to Ormonde to take no active part in supporting their allies under Prince Eugene. Though he had supported the revolution of 1688, Ormonde was traditionally a Tory, and Lord Bolingbroke was his political leader. During the last years of Queen Anne he almost certainly had Jacobite leanings, and corresponded with the duke of Berwick. He joined Bolingbroke and Oxford, however, in signing the proclamation of King George I., by whom he was nevertheless deprived of the captain-generalship. In June 1715 he was impeached, and fled to France, where he for some time resided with Bolingbroke, and in 1716 his immense estates were confiscated to the crown by act of parliament, though by a subsequent act his brother, Charles Butler, earl of Arran, was enabled to repurchase them. After taking part in the Jacobite invasion in 1715, Ormonde settled in Spain, where he was in favour at court and enjoyed a pension from the crown. He died on Nov. 16, 1745, and was buried in Westminster abbey.

*See* Thomas Carte, *Hist. of the Life of James, Duke of Ormonde* (6 vols., Oxford, 1851), which contains much information respecting the life of the second duke; Earl Stanhope, *Hist. of England, comprising the Reign of Queen Anne until the Peace of Utrecht* (1870); F. W. Wyon, *Hist. of Great Britain during the Reign of Queen Anne* (2 vols., 1876); William Coxe, *Memoirs of Marlborough* (3 vols., new edition, 1847).

**ORMSKIRK,** a market town, urban district, Ormskirk parliamentary division, Lancashire, England, 11 mi. N.E. of Liverpool by the L.M.S.R. Pop. (1938) 18,400. Area, 24.4 sq.mi. The name and church existed in the time of Richard I, when the priory of Burscough was founded. Edward I granted the prior a char-

ter for a market at the manor of Ormskirk. On the dissolution of the monasteries the manor was granted to the earl of Derby.

The church of SS. Peter and Paul is a spacious building in various styles, principally Perpendicular. It possesses two western towers, the one square and embattled, the other octagonal and bearing a short spire. There are various Norman fragments, including a fine early window in the chancel. To the south-east of the church, is the Derby chapel, the property of the earls of Derby, whose vault is contained within. A grammar school was founded about 1614. Rope and twine making, iron-founding and brewing are carried on. The town has long been famous for its gingerbread, and is the centre of an important potato-growing district.

**ORNAMENT, ARCHITECTURAL.** In decorative art ornament is that element which supplies beauty in detail by the addition of anything which gives an aesthetic pleasure.

In all beginnings of primitive culture man shows a marked tendency to decorate his utensils, fabrics and ceramics with some sort of ornament. These early designs, consisting largely of overlapping stitches, lines, triangles, dots, zigzags, spirals and crosses, are purely linear even when colour is used to heighten the effectiveness of the designs. All have very similar motifs, and crude as this early ornament is, it still persists as a basis for much of the so-called abstract ornament in use to-day. These forms may be due to a lack of handicraft ability. For whether or not these early designs in the cultural growth of a people are representative of natural objects—the scales of fishes, the feather patterns of birds, plants and things of common everyday experience—the technical difficulties in the way of making free designs in the art of basketry, weaving or pottery tend to make the designs geometric in character. It is also possible that such designs may have lost their pure form through the tendency to standardize that comes of the endless copying by craftsmen of different degrees of skill. It is evident to the casual observer that more culture is necessary to produce free designs than is the case with the use and development of geometric art, because of the greater technical difficulties, and that naturalistic ornament while deriving its sources from nature tends to become abstract owing to the conventionalization of the motifs employed. At the same time, the abstract ornament tends to revert back to the natural as it takes on complexity.

The theory of the evolution of the natural to the geometric, while not accepted by all the authorities on primitive art, has, if the psychology of the designer or artist is taken into consideration, much to commend it. A conventionalization of design takes place without fail in any art due to the very great difficulty in inventing new motifs and to the natural inclination of the average craftsman to be content with imitation, and finally the design motifs conventionalize in primitive art because of a special symbolic meaning associated with the religion and customs of the tribe and so become difficult to change. In fact, it is this very conventionalization of ornament for all uses, for whatever reason, that formalizes into the standards which we call styles. Historically, these styles mark the evolution of ornamental design and are definitely related to the customs and civilization of the people who produced them. Furthermore, a style is known not by its beginnings but by its decadence, and is named not by its creator but by historians.

**Influences.**—All ornament is affected very strongly by the philosophy and thought of the time in which it is designed. It is interesting in that respect that primitive art fundamentally shows a clear desire on the part of the group design to express a complete and definite sense of fulfilment, a straightforward expression of a thing or things of the present only. Each unit or repeat in primitive design is wholly complete in itself and only establishes its relation as part of the whole through a very simple rhythm of the necessary repetition. And while it is true that primitive design may be very elaborate it is rarely complex but rather indicates a desire for richness. The slight degree of complexity that is gained is by the use of different primary colours added to the same linear motif or by increasing the number of rows of different patterns, each simple in itself.

Historically, all ornament has passed through this primitive stage to a period of larger viewpoint, when the artist becomes more interested in a sense of a lack of completeness and the design motifs gather or lose a quality of freshness and time appreciation in ratio to the existence or lack of that sense. For example, architectural ornament of the nature of the chevron, the dentil, the egg and dart, and the bead and reel, are primitive forms, each complete in itself, in which as a repetition the timebeat, the interval and the rhythm are uniform and are therefore rigid and mechanical, easily comprehended, and lacking in time appreciation; whereas such motifs as the arabesque, the vine and flamboyant tracery are without that limited sense of completeness, and in so far as the rhythm interacts with the interval and against the timebeat, they lose the quality of the mechanical and become more enduring in interest. (*See* GREEK ARCHITECTURE and ROMAN ARCHITECTURE.)

Appreciation of any art presupposes sufficient leisure for its enjoyment, so that in designing ornament it would seem necessary to consider a time element as well as whether or not it is proper both as to position and technical fitness. This time element engenders space elements by means of which appreciation must be led from one detail to another, and as all ornament is static in nature it should include, therefore, within the design a stimulus toward, and an opportunity for, fresh viewpoints, and so encourage a more continuous period of appreciation. It is the thought or emotion behind the ornament that lives, while its surface aspects, because of the always evident desire to change, must become out-moded in time.

As all ornament is designed to form a pattern, whether it is composed of repeat units or as a general composition, the rhythms and interrelations of the structural background on which the ornamental detail is composed are as important as the primary functions of the design itself. It is this structure which gives coherence, unity and the sense of space and time to the ornamental design. In the consideration that all ornament must bear the repetition of being seen not only once but many times, the longer the element of time appreciation that is consciously set up within the design the more enduring in interest it will become. Yet it must not be so extended and involved as to be incomprehensible upon close inspection. It seems evident that a design whose rhythmic quality is purely mechanical, even though colour is used to superimpose an additional rhythm, must fail in possessing a sustained interest. The design motif fulfills its sole purpose when it creates a longer time interest in the object ornamented through its added beauty. This growth in time interest in appreciation of ornament is closely allied with the same growth in the complexity of the manners and philosophy of the people who are creating or modifying the ornamental design. A very clear conception of this interrelation of thought and design can be obtained from the study of the differences in growth of oriental and occidental ornamental motifs; the differences remain even when there are signs of influence of one thought upon the other, or through the gradual change from simplicity to complexity which is evident in the difference between the early ornament and thought of the Gothic period (*see* GOTHIC ARCHITECTURE) and its later development. And while it is evident that the technical ability of the craftsman has contributed a great deal as to whether the design motifs are simple or complex—for instance, compare the wood carving of the Jacobean craftsmen with the work of Grinling Gibbons and the later English wood carvers—it would seem that the technical skill had but kept pace with the civilization with which it is associated, for as a civilization advances it is apparent that ornamental design becomes more complex rather than less, that the design motifs become fuller in nature, richer in detail and more nearly perfect in technique.

**Materials.**—It is generally thought that the treatment of ornament is definitely limited by and related to processes and materials, although throughout the history of ornament motifs and technique have been freely translated from one material to another without loss of harmony. The architectural motifs, for example, both structural and ornamental have always been used as pure ornament in the furniture and accessories of the same style. Ornamental design in which the design is not inherently manufactured

can be considered apart from the material it embellishes. The material of which the structure is built limits only the coarseness or fineness of the technique of the detail employed, although, for example, most stones or woods may be carved crudely or delicately according to the effect desired by the designer, the scale desired, or the technical ability of the craftsman. This being so, the actual design motif may be thought of for its effect as such and is only limited in its possibilities by the thought and ability of the creator who might use it to obtain a difference in texture as a help in making a transition between two materials, or to create the pattern interest that comes from employing detail. In its relations to the material employed, it may be either structurally inherent or applied. Structural ornament is either integral, that is part of the structure as in weaving or where a structural member is changed for added grace, or as in veneers where the inherent pattern of wood or marble is used; whereas applied ornament may have little or no relation to the structure other than being placed upon it, and as its name implies is added later for pure embellishment.

**Modern Tendency.**—The ornament of the present, because of the almost immediate world-wide communication of ideas, is breaking away from the local or national boundaries and is becoming more universal in its characteristics. This will not necessarily lead to a tighter standardization because the means by which design is produced has undergone a great change. Since ornament has always had a very definite relation to the tools and technical ability of the period in which it is produced, it would seem natural that ornament, which is becoming more and more dependent upon the machine for its production and upon designers of greater perceptibility, will become less standardized because of the ease with which the tools are changed and improved, and as the self-consciousness of the designer in designing for the machine becomes less as the communities become more completely industrialized. This loss in standardization will tend to give a sense of greater freshness and creativeness in design and will give, because of the freedom in execution, a maximum individuality to the work of the designer.

For a complete list of the various architectural subjects treated in this work *see* ARCHITECTURAL ARTICLES.

BIBLIOGRAPHY.—*L'Art pour Tous* (1860–92); O. Jones, *The Grammar of Ornament* (1868); C. Daly, *Motifs historiques d'architecture et de sculpture d'ornement* (1869–80); C. Boito, *Arte Italiana* (1890–1901); *Decorative Work of Robert and James Adam,* reproduction of plates from their "Works in Architecture (1778–1812)" (1900); E. Male, *Religious Art in France* (1913); J. D. Crace, *The Art of Colour Decoration* (1913); A. Speltz, *Coloured Ornament of all Historical Styles* (1915); *Arte y Decoracion en España,* ed. V. Casellas Moncanus (1917–27); R. Grandjean, *Ceramique Orientale* (1922); D. Baud-Bovy, *Peasant Art in Switzerland* (1924); L. Sullivan, *A System of Architectural Ornament* (1924); H. T. Bossert, *Peasant Art in Europe* (1926); F. Boas, *Primitive Art* (1927). (R. T. WA.)

**ORNAMENTS, PRIMITIVE.** The term "ornament" is strictly applied to objects worn from a sense of aesthetic value and intrinsic beauty either in gratification of the personal taste of the wearer, or in accord with fashion. But it can also be applied to objects which are worn for other reasons, such as the various objects worn for magico-religious reasons, as indications of social distinction and status, for the purpose of protection, as amulets and charms, or even as curatives. As Professor Radcliffe Brown pointed out, the desire for protection and the desire for display "are very intimately related and are really both involved in every kind of ornament. All ornament in some way marks the relation of the individual to the society." (*Andaman Islanders,* p. 319.) Classes of ornaments in primitive society mark distinctions of sex and social status, the unmarried having ornaments peculiar to their status which differ conspicuously from those allowed to or required of married people. Articles worn as dress, that is, either for protection against climatic conditions, or from modesty may become ornaments if an element of aesthetic appreciation helps to determine individual choice or fashionable vogue. Decorations may be worked on or fashioned to plain materials to make the whole ornamental. In communities of a more permanent order, ornament and embellishment, external and internal, is applied to architecture in personal rivalry or in token of social status. To religious zeal is due the wealth of ornament often found in the Men's House—the centre of the communal life, the repository of the cult objects of the community, the origin of the temple.

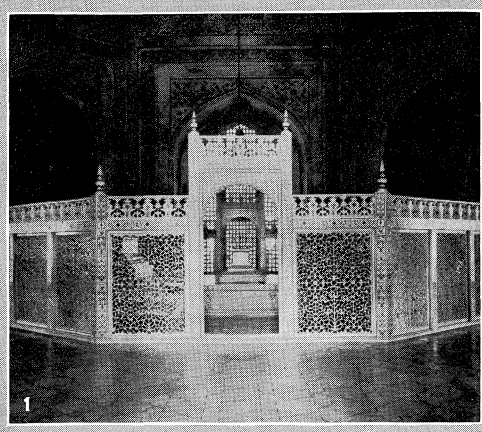
The objects worn as ornaments are sometimes of a considerable degree of elaboration. Wings of butterflies, gorgeous tropical beetles, seeds, berries, flowers, variegated leaves, bright stones, all sorts of natural products are employed. The manufacture of ornaments as prescribed by the social order is an occupation of importance. Thus, "The Akamba wear a great number of ornaments (*mapa*) of various kinds, especially metal ones, but they never overload their bodies with them on ordinary occasions. On account of the composition and choice of colours these ornaments are attractive even to European ideas of beauty, and the fine execution of the work must arouse admiration." (G. Lindblom, *Akamba,* 1920, p. 375.) Nature provides the materials and the models. The sense of colour is expressed by using different coloured earths, the quest for which is a stimulus towards economic development. Conventionalization, vulgarization, degradation and imperfect, unintelligent, imitations are notable in primitive art but at one and the same time in one community there may be artists of very different capacities.

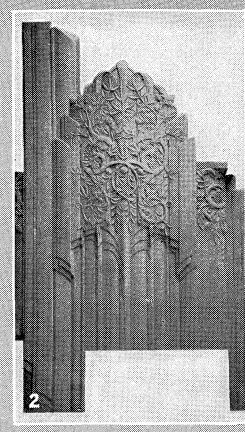
**ORNE,** a department of the north-west of France, about half of which formerly belonged to the province of Normandy and the rest to the duchy of Alençon and to Perche. Pop. (1936) 269,331. Area, 2,372 sq.mi. West of the Orne and the railway from Argentan to Alençon lie primitive rocks connected with those of Brittany; to the east begin the Jurassic and Cretaceous formations of Normandy. The district of the newer rocks is rich agriculturally, that of the older rocks poor, but the whole department is relatively high land, by far the greater portion being over the 600 ft. contour (highest point, forest of Écouves, 1,368 ft.). It forms a centre whence rivers diverge in all directions, traversing deeply-cut and picturesque valleys, in many cases well-wooded with fine oaks.

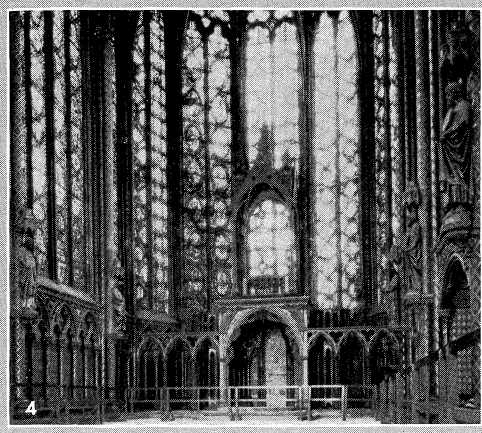
Horse-breeding is very important in the rural districts; there are three breeds—those of Perche, Le Merlerault and Brittany. The great government stud of Le Pin (which was established in 1714), with its school of horse-breeding, is situated between Le Merlerault and Argentan. A large number of lean cattle are bought in the neighbouring departments to be fattened; the farms near Vimoutiers, on the borders of Calvados, produce the famous Camembert cheese, and others excellent butter. The bee industry is very flourishing. Oats, wheat, barley and buckwheat are the chief cereals, and fodder in great quantity and variety, potatoes and some hemp are grown. The variety of production is due to the great natural diversity of the soils. Small farms are the rule, and the fields are surrounded by hedges relieved by pollarded trees. Along the roads or in the enclosures are numerous pear and apple trees, the latter yielding cider, part of which is manufactured into brandy. Orne has iron mines and freestone quarries; a kind of smoky quartz known as Alençon diamond is found. The hot springs of Bagnoles, which contain salt, sulphur and arsenic, are famous. In the forest of Bellême is the chalybeate spring of La Hesse, which was used by the Romans.

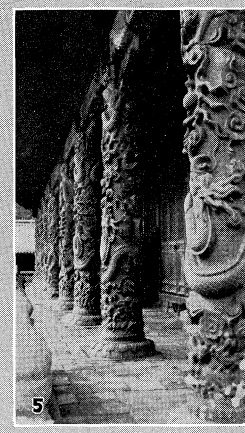
Cotton and linen weaving, notably at Flers (*q.v.*) and La Ferté-Macé (pop. [1936] 3,704), forms the staple industry of Orne. Alençon and Vimoutiers make linen and canvas. Vimoutiers has bleacheries, which, with dye-works, are found in the textile centres. At Alençon only a little of the lace which takes its name from the town is still made. There are foundries and wire-works in the department, and articles in copper, zinc and lead are manufactured. Pins, needles, wire and hardware are produced at Laigle (pop. 5,145), and hardware also at Tinchebray. There are glass-works, paper-mills, tanneries (the waters of the Orne being reputed to give a special quality to the leather), and glove-works. Coal, raw cotton, metals and machinery are imported. The exports include woven and metal manufacture, livestock, farm produce.

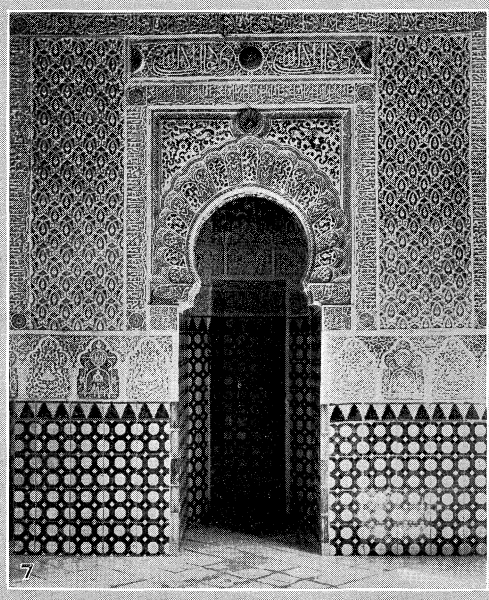
The department is served by the Ouest-Etat railway. There are two arrondissements, with Alençon, the capital, and Argentan, as their chief towns, 36 cantons and 513 communes. The department forms the diocese of Sées (province of Rouen) and part of







BY COURTESY OF (2) VOORHEES, GMELIN AND WALKER, ARCHITECTS; PHOTOGRAPHS, (1, 6, 7) EWING GALLOWAY, (3, 9) ALINARI, (4) DE COU, FROM EWING GALLOWAY, (5) ORIENT AND OCCIDENT, (8) PUBLISHERS PHOTO SERVICE

## ORNAMENTAL DETAIL IN ARCHITECTURE

1. Taj Mahal, Agra, India; alabaster screen inlaid with precious stones enclosing the tombs of Shah Jahan and his empress, Mumtaz Mahal, for whom Shah Jahan built (*c.* A.D. 1631) the Taj Mahal. 2. Models of ornament for the Telephone Building, Washington, D.C., an illustration of modern vertical design. 3. Sarcophagus from the tomb of Caecilia Metella, Augustan era; now in the court of the Farnese Palace, Rome. 4. Interior of *La Sainte-Chapelle,* Paris, built 1246–58 by Louis IX. (Saint Louis). (See *Gothic Architecture,* Plate I.) 5. Pillars of the Confucius Temple at Chü Fu, Shantung Province (Yüan dynasty, 1280–1368), with the Chinese dragon and other forms in high relief. 6. Entrance to the Transportation Building, Chicago World's Fair, 1893. Louis Sullivan, architect. 7. The Alhambra, Granada, Spain, 13th and 14th centuries; *mihrab* or prayer niche in the private mosque, adorned with lace-like carvings in stone of Arabic inscriptions, delicate arabesques, and geometric designs; and with horseshoe and lobar arch forms and coloured tiles, characteristic of Moorish art in Spain. 8. St. Mark's, Venice. Two isolated marble columns, near the arcades of the south side, brought in the 18th century, from St. Jean d'Acre, Palestine, by Tiepolo. 5th century, Hellenistic style. 9. Detail of a marble altar, by Benedetto da Rovezzano (1476–1556), in the Church of the Holy Trinity (Santa Trinità), Florence

the *académie* (educational division) of Caen, and the region of the IV. army corps; its court of appeal is at Caen.

**ORNITHOLOGY** is the science of birds. We begin with the records of birds made by Aurignacian man during the last glacial epoch of the Ice age in France and Spain—paintings on the walls of caves, or figures or incisions carved on bits of horn, bone or stone. The birds that have been identified thus far from this remote Palaeolithic art include the crane, duck, goose, grouse, owl, partridge and swan. In the more recent Neolithic period, outlines of birds are more common, so that in the cave at Tajo Segura, in the province of Cadiz, southern Spain, Col. Willoughby Verner has found figures of 12 species of birds, the great bustard, crane, duck, goose, raven, spoonbill, flamingo, purple gallinule, glossy ibis, stork, eagle and marsh harrier. To these archaeologists assign an antiquity of 6–8,000 years. The Palaeolithic designs are much older.

From a painting and a statuette of the common fowl from Egypt, made about 4400 B.C., it is believed that this bird was even then kept in captivity, while knowledge of the domesticated pigeon in the same country, according to Canon Tristram, goes back to the 5th dynasty, about 3500 B.C. Record of the use of pigeons as carriers of messages is found a little later. In a tomb of the 4th dynasty of about 3700 B.C., at Meidoum, in Egypt, Mariette discovered a fresco showing red-breasted and white-fronted geese, whose painted colours are said to be exactly like those seen in the two species to-day.

**Early Writings.**—There are many incidental references to birds in the Bible, those in the Old Testament being of considerable antiquity. The writings of Aristotle (384–322 B.C.), though they do not attempt to give a connected account, include statements (according to Sundevall) that concern about 170 species of birds. He obtained part of his information from still earlier writers whose works are lost. Pliny the elder (d. A.D. 79), in his *Historia Naturalis,* devoted Book X. to birds, taking much from Aristotle. Aelian (d. about A.D. 140) made various notes on birds, compiled in part from older authors.

Early Saxon poets mention the gannet and several other birds of uncertain identity in songs current during the 6th and 7th centuries, and during the latter came the first records of falconry, apparently introduced by the Saxons into Britain. About the middle of the 8th century the *Epistolae Sancti Bonifacie* informs us that Boniface, archbishop of Mons in Belgium, presented to Ethelbert, king of Kent, a hawk and two falcons. In the laws of Howel, king of Cambria, supposedly in the 10th century, there is statement of the hunting of the pheasant, and allusion to hawking. Incidental references to hunting with hawks are found in accounts of the activities of Athelstan, and of Edward the Confessor. Aelfric's *Vocabulary,* a list of words prepared in the 10th century, possibly for educational use, and another of somewhat later date, contain names of more than 100 birds, while in the *Colloquy of Aelfric,* a series of dialogues between a master and his pupils, are references to hunting with and training of hawks. In the writings and manuscripts of the 12th and 13th centuries are many references to hawking, descriptions of decoys in which ducks were captured alive, records of heronries, and an account of a great flight of crossbills into England in the year 1251.

Following the invention of printing, William Turner published in 1544 a commentary on the birds of Aristotle and Pliny, prepared in accordance with treatment that was the forerunner of modern methods. This was followed in 1555 by Conrad Gesner's *Historia Animalium,* whose third book dealt with birds and contained many original observations, as the author travelled extensively and recorded his impressions first-hand. Pierre Belon, whose *Histoire de la Nature des Oyseaux* appeared also in 1555, had considerable knowledge of the anatomy of birds, and seems to have been the first to correlate the various parts of the avian skeleton with those of man's.

In the joint observations of Francis Willughby and John Ray, published by the latter in 1676, after the death of Willughby, there is found a division of all known birds into two great groups of "land-fowl" and "water-fowl," an arbitrary classification that has been current to the present generation, though now superseded by a more modern grouping based on structural characters.

Linnaeus, the founder of the modern system of scientific names used in systematic zoology, began publication of his *Systema Naturae* in 1735. His attempt was to be terse and concise, and in 1758, in the 10th edition of his work, he proposed that each species be designated by two names, the first of generic significance applying in most cases to a number of somewhat similar allied forms, and the second specific in nature and used in connection with the genus name for the species in question alone. (*See* ZOOLOGICAL NOMENCLATURE.) In recent years, sub-species, or geographic races, are designated by a third Latin term or subspecific name.

Natural history collections made in connection with the many exploring expeditions of the late 18th and early 19th centuries brought to Europe, particularly to England and France, many specimens of birds that greatly broadened knowledge of the ornithology of the world. In early explorations paintings or drawings were made of birds, or specimens were preserved in spirits, or sometimes dried as mummies. At the beginning of the 19th century, as travellers increased and interest in natural objects expanded, methods of preparing skins of birds were evolved that led finally to the making of what are known as scientific specimens, where the skin, with the feathers intact, is removed from the bird, leaving only the bones of the skull, wings, feet and base of the tail. The inner surface of the skin is poisoned, usually with arsenic, filled with cotton, tow or other light vegetable substance, and dried after being wrapped or otherwise arranged so that it resembles a dead bird. By means of such preparations it is possible to assemble collections of birds that may be preserved indefinitely for continued study and examination. The growth of such collections and their expansion into museums, where birds were mounted in natural positions, changed completely the style and method of published treatises dealing with ornithology. To this time these had been mainly accounts and descriptions written from hearsay or memory, and involving constant repetition of the writings of previous authors. Such accounts were now in large measure supplanted by detailed statements regarding specimens secured during voyages, or monographs that brought together all available knowledge concerning genera, families, or larger groups of birds. The art of illustration was amplified, and many works contained series of coloured representations that delineated the bird under discussion more definitely than words. Among early writers of such illustrated works or monographs may be mentioned Daubenton, whose *Planches Enluminées* contained 1,008 plates mainly on birds, Le Vaillant who published on hornbills, cotingas, birds of paradise, and many others; Vieillot, who produced an array of volumes that dealt with the majority of the known birds of the world; and Temminck, who wrote on the pigeons and gallinaceous birds.

Audubon's *Birds of America,* in 4 vols. of elephant folio size, containing 435 plates, was published in London between 1827 and 1838, and was followed by his *Ornithological Biography,* in which, with the aid of William MacGillivray, he gave accounts of the habits of North American birds. The writings of John Gould, which began in 1832, covered descriptions and beautiful paintings in colour of birds of all parts of the world and included in all more than 40 folio volumes illustrated by upwards of 3,000 plates.

**Modern Contributions.**—After the middle of the 19th century ornithological publications increased to a point where it is impossible in brief space to enumerate them. In 1874 there appeared the first of the great series of volumes comprising the *Catalogue of Birds in the British Museum,* begun by R. Bowdler Sharpe, and completed in 27 vols. in 1898 with the assistance of a number of other writers. This, with Sharpe's *Handlist of the Birds of the World,* in 5 vols. (1899 to 1909), has had profound influence.

In America increase of knowledge in ornithology subsequent to Audubon and Wilson (who was a contemporary of Audubon in the study of American birds and published an excellent and painstaking account of them) came rapidly with the appointment of Spencer Fullerton Baird as assistant-secretary of the Smithsonian institution. Baird's early years in this new position

were coincident with the initiation of the great exploratory surveys, including the Hayden surveys and the survey of the 40th parallel of latitude, undertaken by the Government to develop the western part of the United States. Baird established the U.S. National Museum as a depository for specimens of all kinds belonging to the American Government, and arranged to send naturalists with the different survey parties, with the result that large collections, particularly of birds and mammals, came to Washington, furnishing the material for many important reports.

At the same time Baird initiated the preparation of a complete review of the birds of America, a project that he had perforce to turn over finally to Robert Ridgway because of increasing administrative duties. The final result has been the publication by the U.S. National Museum since 1901 of 8 vols. under the title, *Birds of North and Middle America.* Two more volumes are expected to bring this work to completion.

**Ornithological Societies.**—As ornithologists increased in number desire for discussion of their problems grew, to take shape finally in serials devoted to birds alone. Among the early periodicals that continue to-day there may be mentioned especially the *Journal für Ornithologie* begun in 1853, the *Ibis,* founded by the British Ornithologists' Union in 1859, and the *Auk,* originated by the American Ornithologists' Union in 1883. The last mentioned is a direct continuation of the *Bulletin* of the Nuttall Ornithological Club, established by that organization in April 1876. The Zoological Society of London, especially in its earlier years, has had a profound influence on the development of ornithology through the labours of its prosectors, particularly A. H. Garrod, W. A. Forbes and Frank E. Beddard, and through its publications, especially the *Proceedings* of the Zoological Society of London, and its precursor the *Proceedings* of the Committee of Science and Correspondence of the Zoological Society (1830, etc.).

Today, there is an ornithological or similar society in most of the principal countries of the world. At the present time there are more than 30 periodicals devoted to various phases of bird study alone. Of these the most important to the ornithologist has been the *Zoological Record,* published annually since 1864 by the Zoological Society of London. The section devoted to *Aves* now annually contains reference to more than 1,000 separate papers.

**Bird Protection.**—Another phase of ornithological interest that has obtained extended popular support in the past two decades is that of the protection of useful or harmless birds. (*See* BIRDS, PROTECTION OF; BIRD SANCTUARIES.) Legislation intended to restrict the killing of ducks, grouse and other birds considered as game, began in very early times, indication of recognition of the propriety of such action being found in the Old Testament (Deuteronomy, xxii., 6–7) where there is a prohibition against the killing of a bird on the nest.

In the laws of the Welsh king, Howel of Cambria, about the 10th century A.D., there are definitions of the various kinds of hunts, including the hunting of the pheasant. Such penalties as the loss of both eyes were provided by William, duke of Normandy, for peasants who had the temerity to kill game reserved for the nobility. Game protection was thus one of the early tenets of Anglo-Saxon law, and so came early to the New World, particularly to the United States, though, unfortunately, it has not been possible to show clearly the need for rigid protective measures until the destruction of game had greatly reduced valuable species of birds. In America protective measures to conserve valuable birds antedate the coming of the Caucasian, however, since the Inca rulers recognizing the value of the sea birds of the coasts of Peru as producers of fertilizers, forbade anyone under penalty of death to enter or disturb their rookeries during the breeding season. For many years in America legislation for the protection of game-birds was considered a local matter and was applied by States or territories individually. It has become recognized recently that this procedure, through lack of uniformity, did not give proper protection to ducks, geese and other migratory game-birds, which has led finally to assumption by the Federal Government of control over non-sedentary species, and a covenant with Canada known as the Migratory Bird treaty, arranged in 1916, which provides uniform regulations for the two countries concerned. The success of this measure has been so pronounced that it has attracted wide attention and will lead to similar measures between other nations.

As human interest in birds spread, there has arisen considerable feeling against the killing of small birds for food or game. It was realized that insectivorous birds were of benefit to man through their assistance in keeping down the abundance of insects injurious to agriculture, to which was coupled the aesthetic appeal of birds in general, through their beauty of form, colour and note, to the sympathetic and understanding mind. Use of the feathers of birds in decorative dress has been the custom from remote times, a custom that at the close of the last century culminated in a fashion that required the placing of stuffed skins or parts of skins of birds in more or less grotesque attitudes upon women's hats. The resultant demand for feathers led to the destruction of birds by the hundred thousand. Plume-hunting became a lucrative business, and led to search for strange and beautiful feathers throughout the world. Terns, gulls, herons, birds of paradise, hummingbirds, to say nothing of countless familiar song-birds, were slaughtered to supply an unthinking and somewhat senseless desire for decoration, a course that led to great diminution in numbers in many species of birds. The destruction wrought was especially rapid in species that breed in colonies. Herons, terns and grebes, brought together by the paramount instinct for reproduction, were held by their eggs or young to a limited area, and so were easy to kill in large numbers. As this killing entailed the loss of eggs and the starvation of young, these species suffered to such an extent that some almost disappeared as living forms. As understanding of the results of such brutal methods arose, there resulted a revulsion against this fashion which led to the formation of such bird-protective organizations as the Audubon Society that have brought forcibly to public attention the evils of plume-hunting. This has resulted in a partial change in fashion, and in legislation against plume importation and traffic. It is now generally recognized in England and the United States that bird protection is meritorious, a sentiment spreading rapidly to other countries so that international conventions have been held to promote it.

In connection with protective measures it is realized that the Caucasian race in its present civilization has modified natural environments to such an extent that many avian inhabitants of our earth are being crowded out of existence. To procure the continuance of interesting forms, some for their economic worth and some for their aesthetic interest, reservations or sanctuaries have been formed which birds may frequent without molestation. In Europe such preserves were made primarily to protect upland game birds, and are thrown open to hunting at the proper season. In the United States reservations have been established to cover areas where herons, terns, or similar birds nest and consist of low coastal islands, or swamp and marsh lands of little monetary value. Both types of sanctuary are now found in many countries.

The result of such protection, enforced in most instances by paid wardens, has been to increase the numbers of many birds. The egret and snowy heron, at one time reduced from a vast multitude whose breeding colonies were so populous that, from a distance, they appeared like vast white blankets, to a condition where it was unusual to see a single individual, have become again common in extensive areas. Terns have returned to colonies that were deserted for years, and the pelican maintains its numbers in spite of much unthinking persecution.

In the United States there are at the present time 76 bird reservations under jurisdiction of the Department of Agriculture, ranging in size from a few acres to several hundred square miles, while light-house reservations, national parks, and similar tracts under supervision of other governmental departments have also been designated as bird preserves. In addition, various States are now developing the idea of game sanctuaries which are also refuges for birds. Pennsylvania, at the present time, has 88 sanctuaries of this kind, including nearly 73,000 acres. Private sanctuaries also are multiplying and afford much protection; many have been established as local enterprises by cities, towns, or by groups of private individuals.

**Economic Studies.**—Early information on the economic value of birds was based largely on field observation of living birds and many of the data obtained were erroneous. The method should be checked by the stomach examination, as developed largely by the Bureau of Biological Survey, of the U.S. Department of Agriculture. In this a series of stomachs of any given species of bird is secured, so far as practicable, at intervals throughout the year, under as many varying conditions of life as possible. These contents are examined under a microscope with low magnification, and the different kinds of insects, seeds, bones or other materials sorted. There is thus afforded a picture of the actual food preferences of the species concerned and the status of the bird is decided on this basis as useful or harmful. These data have been of great use in arranging protection for species that assist in the war on insects injurious to crops, or that are proved to be harmless, since such information offers a certain check against observations on living birds in the field. (*See* publications of the Biological Survey [*q.v.*] of the U.S. Department of Agriculture.) With few exceptions, the destruction of birds as a means of protecting crops, has been found to be an unsound policy.

**Aviculture.**—Aviculture (*see* AVIARY), or the keeping of birds alive, goes back to a remote period, of unknown date, when primitive man brought young birds of various kinds to his rude domicile, partly through curiosity and partly to use as food. Parrots are mentioned by Ctesias, a Greek writer, a century before the time of Aristotle, as birds that spoke the language of man, and that a little later the Romans are known to have kept them in ornate, silver-wired cages of tortoise-shell and ivory.

The domestication of falcons for hunting is recorded in Persia as early as 1700 B.C., and is said to have antedated that period in China. Falconry (*q.v.*) is believed to have spread to Europe as early as three centuries before the Christian era. In America the Pueblo Indians of New Mexico and Arizona held the turkey (*Meleagris gallopavo*) in captivity at least 1,000 years ago, and probably at a much earlier period, not for use as food, but for the feathers, which were plucked from the living bird and burned in prayer offerings to propitiate Deity. The accumulations of turkey bones in a number of pueblo ruins indicate the numbers maintained.

The original canary (*Serinus serinus canarius*) is believed to have come from the Canary islands, but in its original grey, olive-green and yellowish plumage, with sides and flanks streaked with dusky, is so similar to the serin finch (*Serinus serinus serinus*) of southern Europe that it is probable that both these closely-related geographic races have furnished the stock from which have come our modern birds. Canaries were known in a domesticated state at the close of the 14th century, though they seem at that time to have been rare, as Gesner, in 1555, mentions that he had never seen one. Variation in colour among them began early, as partly yellow canaries were known at Nuremberg in 1614, and in 1677 pure yellow canaries as well as white ones were recorded at Augsburg. There are now at least 14 distinct strains and numerous varieties. Modern interest in canaries is shown by the fact that from 1905 to 1914 more than 3,250,000 were imported into the United States, mainly from Germany and England. There are many societies of canary breeders and several journals that deal their needs.

The keeping in captivity of exotic birds of all kinds originally was the field of zoological gardens, but has engaged the attention of many individuals, and in the past 25 years has gained greatly in vogue, particularly in western Europe and in the United States. Aviaries have been brought to a high state of perfection, and the requirements of many delicate species of birds studied with the utmost care to permit success in their breeding and rearing in confinement, the highest goal of achievement of the bird fancier. Among journals dealing with the pursuit is the *Avicultural Magazine*.

### TYPES OF LIVING BIRDS

Mammals have specialised for life on land (as the deer and mouse), in water (as the whale), in the air (as the bat), for night life (as the lemur), and in the earth (as the mole). But birds specialise for existence or progression through the air. Though it is common for birds to nest in holes or tunnels in the earth, which, in many cases, are excavated specially for this purpose, no bird has been able to adapt itself to continuous life underground, probably because its covering of feathers is not designed to withstand the constant abrasion that would take place in burrowing. Also, though many birds frequent the water, none are so wholly adapted to life beneath the surface as the whales. The bird thus has failed to utilize completely the ecological environments that have been available for it—a manifestation of its inferior adaptability compared to the mammal.

Birds adapted to a terrestrial existence are found in many widely separated groups, as for example ostriches, bustards, plovers, larks and pipits. Most of these adopt a terrestrial habit to secure food and safety from enemies. They run about on the earth, and though the greater number retain power for flight, often trust to their legs to avoid or escape ordinary pursuit. Most of them show greatest variety in regions of extensive plains, prairies or broad, open downs. The wholly terrestrial forms that have entirely lost the power of flight are comparatively few, and (so far as Continental areas are concerned) are birds of considerable size and strength. Among living forms they include the ostriches of Africa, which extend into Eurasia as far as southern Persia, the cassowaries of New Guinea and adjacent areas, the emus of Australia, the kiwis of New Zealand and the rheas of South America. These birds, though united by certain peculiarities, differ widely from one another, and seem to represent ancient types of bird that were formerly more abundant, as a number of fossil forms are known. It will be noted that large flightless birds exist in modern times in all of the continents except North America, where they have not been represented since the Eocene.

The kiwis (*Apteryx*) of New Zealand, the queerest and most unbirdlike of living birds, are nocturnal and have different habits from the other species mentioned. They have long bills with the nostrils at the extreme tip, and move about by using the bill to test the ground before them as a blind man uses a cane, noting their surroundings partly by touch and partly by smell. On casual examination they seem to have no wings, but on investigation the wing is found concealed beneath the feathers, a tiny structure, a little more than 3 in. long when fully extended, and entirely without flying function, as the bird is heavier than an ordinary fowl. The cassowaries, like the kiwis, inhabit forest areas, but are far less peculiar. The wings are small, with heavy, naked quills nearly concealed beneath the long, hair-like feathers, and there is a curious casque on the head. It is said that the bird uses both casque and wing-quills to fend off entangling vines in travelling through the jungle.

Ostriches and rheas have larger wings and may extend them while running, but are wholly without power of flight. In all these birds the body is heavy and the legs are large and strong. With those fleetest in running there is a tendency to reduction in the number of toes, so that the rhea has three and the ostrich only two. That these birds have come from flying ancestors is apparently indicated by the wing, which, while small and weak, has the bones formed as in flying species. All the species discussed have the external surface of the breast bone smooth without the great keel so characteristic of the flying birds, there being no necessity for such attachment, as in flightless birds the muscles usually concerned in flying have little development.

There is another type of terrestrial bird that has developed more recently than those just discussed, found mainly on oceanic islands. This includes various species of flightless rails, and some other birds that have lived under conditions in which they had no enemies from whom it has been necessary to escape by flying, so that through disuse the power of flight has been lessened until, finally, the birds are not able to rise from the ground, though the wing retains the same form encountered in flying birds and the breast bone still has a keel, though this may be greatly reduced in size. The weka rails of New Zealand are the most striking living examples of this group; they are nearly as large as a fowl, and run with great ease and rapidity. Some other flightless rails are much smaller, for example the Laysan

rail (*Porzanula palmeri*), of Laysan island in the Hawaiian islands, which is not much larger than a newly-hatched chicken. In running fast this bird extends its wings and flaps them rapidly, but is unable to rise from the ground. Many other insular birds show a tendency to degeneration of the wing but can still fly.

Among birds adapted to life in the water the penguins are pre-eminent. These include about 17 species found in southern seas, ranging in size from the great emperor penguin (*Aptenodytes forsteri*), which is 48 in. long and weighs up to 78 lb., to the little blue penguin (*Eudyptula minor*) of New Zealand and the Chatham islands, which is only 16 in. in length. Penguins have thick, heavy bodies, more or less elongated, and are covered uniformly with dense, short feathers, without the bare spaces or apteria that in other birds divide the feather-growths into distinct tracts. The wing is a short, broad paddle, without developed quills, the feathers being close-set and stiff, almost like the scales of a reptile. In the water the penguin rests comparatively low. Beneath the surface it progresses literally by flying, the flattened wings driving the bird through its aquatic medium swiftly and gracefully, while the feet are extended behind and serve as a rudder. Penguins have possessed their present type of body since early Tertiary times; but they came originally from a flying stock.

Other types of birds developed for life in the water include loons or divers and grebes, whose progress beneath the surface is accomplished, usually, by the use of the broad feet alone, the wings being held close to the sides, except when the birds are frightened or under other unusual circumstances. The downy young dive, by use of both wings and feet, indicating that flying under water is a primitive method. The many species of auks and guillemots use the wings beneath the surface as in the air above. The cormorant and the snake-bird progress by use of feet alone. Mergansers, scaups, redheads, pochards and golden-eyes among ducks dive regularly with the feet alone, while in the same group old squaws, scoters and eiders as regularly use both wings and feet beneath the surface. The curious diving petrels (*Pelecanoides*) of the southern hemisphere fly swiftly beneath the water, and may burst out through the surface in full flight.

Birds adapted for life at night are fairly numerous, and are typified especially by members of the nightjar and owl families, though specialized forms occur among a number of other families. Most nocturnal birds have large eyes that usually reflect light with a prominent reddish colour so that the eyes of many nightjars glow like dull coals of fire by the reflected light of an electric torch, and may be seen for a considerable distance. One of the American night-hawks (*Chordeiles acutipennis*) is an exception, as the eye is said to shine with a pale green hue. Most nocturnal birds actually see at night by a specialized eye adapted to collect the faintest rays of light. Only the kiwis (*Apteryx*) among habitually nocturnal species appear wholly blind.

## GEOGRAPHIC DISTRIBUTION

The laws governing geographic distribution (*see* DISTRIBUTION OF ANIMALS), through which each faunal area has its own peculiar forms, apply to birds as to all other animals, in spite of the easy method of travel possible for the bird. Very few birds are cosmopolitan. As an example may be mentioned the sanderling (*Crocethia alba*) that at some season may be found along water almost anywhere on the earth, but that nests only in the Arctic regions, passing southward in migration throughout the world, to return in spring to its breeding area. The barn owl (*Tyto*), resident through wide areas in the temperate and tropical regions of the earth so that it reaches all the continents, has reacted to its environment in such a way that 25 geographic forms, some sufficiently distinct to be called species, are now recognized. In contrast to this, many species are confined within very narrow limits, as the very distinct Laysan teal (*Anas laysanensis*), found only about the shores of one small lagoon in Laysan islands in the Hawaiian Bird Reservation, where it has a range of only about 1 sq. mile.

Every continent has its peculiar forms of life, so that the earth's surface has been divided into great regions, each characterized by certain groups or by the lack of some found elsewhere. According to a usually accepted classification, these are given the following names: Nearctic region, for North America south to include the Mexican tableland; Neotropical region, for southern Mexico, Central and South America, and the West Indies; Palaearctic region for Europe, Algeria and Morocco, and Asia north of the Himalayas and the Gobi desert; Ethiopian region, for the remainder of Africa; Oriental region, for India, Indo-China, China, the Philippine islands, and the East Indian islands to, and including, Bali; Australian region, for Australia, and the Pacific islands south of the Tropic of Cancer; and New Zealand region, for New Zealand. The life of the northern hemisphere is so evidently allied that what are here designated Nearctic and Palaearctic regions are frequently united under the term Holarctic, a vast area that extends throughout the entire north temperate and Arctic area.

These great regions, which cover continents, are divided into life-zones, where temperature and certain other general conditions control the distribution of species within narrower limits. The life-zones are more sharply delimited in temperate regions than in tropical and sub-tropical areas, and to some extent are more easily distinguished in the northern hemisphere than in the southern. They change with difference in altitude on the slopes of mountains, as they do with difference in latitude in travelling north or south, and are most easily perceived on the slopes of steep mountains, where the successive zonal bands may be compared without great difficulty. Life-zones to the present time have been most intensively studied in North America. By the student the life-zone is further divided into faunas, where conditions imposed by rainfall, geological formation and similar factors produce sections characterized by aggregations of species or sub-species.

Birds, in general, have attained a vast distribution over the surface of the globe because of their ability in flight and their specialization for life on both land and water. As a result of this versatility and adaptability some form of bird is found at some season everywhere over the world, except perhaps in the centre of the great unexplored Antarctic continent. Broad areas of the sea, away from the great ocean currents that flow like rivers through this aquatic medium, may appear birdless for days and weeks, but are crossed at certain seasons by some of the petrels in their wanderings. The seas and lands within the Arctic Circle are visited by many birds, some of which, as the raven and snow bunting, nest far north in Greenland, and some, as ducks and gulls, in summer traverse the solitudes of the north polar sea.

As individuals, birds may be tremendously abundant in temperate regions, but it is within the Tropics that the greatest variety of forms occur within small limits. The largest aggregations are found in regions of diversified topography, where the life-zones change within a comparatively few miles from tropical to alpine. The greatest number of forms at present recorded from a limited area is that reported by Dr. Frank M. Chapman from Ecuador, where within approximately 75,000 sq.m., an area less in extent than Great Britain, there are at present known 1,508 forms of birds, and it is said that this list is far from complete.

## THE AVIAN LIFE-CYCLE

The circle of annual activities of any bird, in general, includes a period for nesting, the rearing of the young to maturity, and a subsequent resting time when a moult occurs to renew the covering of feathers. With many birds there is included in this programme a migration or journey to some other region, and a subsequent return to the native area at the coming of a new breeding period. The cycle of activities thus corresponds to the seasonal round of the year, as the necessities of the bird are influenced by climatic conditions, which change from month to month, except in limited areas in the Tropics, and even there the life of birds is influenced to a greater extent than might be imagined through the incidence of wet or dry seasons.

## REPRODUCTION

With the approach of the breeding season there is instituted at once a conflict, active or passive, as the case may be, between males of the same kind for a breeding area in which, later, the

nest will be located. (*See* also BIRD, *Reproductive Habits.*) Each male selects some section suited to nesting needs and remains within or near it until a mate appears, if he is not already mated, and protects this tract against encroachment by others that may be considered rivals. In the case of gregarious species, like the sooty tern (*Sterna fuscata*) that nests in great colonies on islands in the sea, the nesting territory for each pair may be only a yard square, or even less, being a space in which the egg may be located, so that the incubating bird and her mate, on guard beside her, cannot quite reach the adjacent pair with whom, and with any others that intrude, they spar and fight on the slightest provocation. The male red-winged blackbird (*Agelaius phoeniceus*) of North America, also gregarious, selects an area of marsh or swamp, with his neighbours situated at a distance of a few feet or a few yards, and remains on guard, forbidding entrance of another male in that limited space. Solitary species hold larger areas, so that a red-eyed vireo (*Vireo virescens*) may hold a clump of three or four trees, or a blackbird (*Turdus merula*) may preempt a small section, including thickets, trees and open ground. Possession of such a breeding ground at the beginning of the nesting season is a paramount passion with each male, and to retain possession he will battle fiercely, even until death, with any others of his kind that may attempt definitely to locate within what have been selected as his limits. Under this urge, sanguinary combats are not unusual among species whose individuals live for the rest of the year wholly at peace with their kind.

**Mating.**—At the mating season the male bird resorts to a variety of artifices to attract attention on the part of the female, and to arouse her interest to the end that a nest be established. (*See* also COURTSHIP OF ANIMALS; SELECTION, SEXUAL; BIRD, *Reproductive Habits.*) Among perching birds this is first indicated by song (*q.v.*), by which the male not only gives expression to the pleasant sensations of merely living, but also, when established on his breeding ground, gives notice to rivals of his presence as a guard over his territory and notice to females that he is in search of a mate. The song may range from the polished effort of an expert, like many thrushes, the nightingale, or the mocking-bird, to sounds that, to some human ears, may be merely disagreeable noise, as the chatter of the house sparrow, or the strange music of the plant-cutter of South America (*Phytotoma rutila*), whose song is a curious squeaking that resembles exactly the rubbing produced by tree-limbs touching in the wind. The rhea booms, the hawk screams and the owl hoots, each producing music in the estimation of others of its kind.

Actual mating may be accompanied by a great variety of strange and unusual actions which the male alone, both sexes, or more rarely the female alone, may undertake (*see* COURTSHIP OF ANIMALS). The male ruffed grouse (*Bonasa umbellus*), of North America, selects a stand on some sheltered log or stump, to which he resorts each day to "drum," a resonant love-call for which he draws himself fully erect and begins a steady beat of his short, stiffly-feathered wings. The action of these against the air between wing and body is so strong and abrupt that a dull thumping sound is produced, at first slowly, and then with increasing rapidity, until the sound comes as a steady, pulsating roar. The display of the peacock, in which the long, ornamented upper tail-coverts (mistaken by many for the tail, which is short, stiff and dull in colour, entirely concealed beneath the longer feathers) are erected and fully spread, to be shaken finally with a dry rattle as the male faces the apparently indifferent female, is another well-known example of activity on the part of the male alone.

The great crested grebe has been found by Julian Huxley to have a complicated courtship-display in which both sexes participate. A pair approach, facing one another with head wagging from side to side, then raise one wing and preen the feathers beneath, an action varied in many ways to culminate finally in a weird "dance" in which the pair rise erect, treading water, and remain bolt upright with breasts nearly touching for a brief space. In some species of albatross mutual courtship-displays have progressed to a point where they have far exceeded mere mating antics, and have become social customs that continue through a period of months, beginning with the arrival of the birds on the breeding grounds, and continuing until the young are grown. In the Laysan albatross (*Diomedea immutabilis*) of the Leeward islands of Hawaii, the display begins with two birds approaching with quick bows, shaking their heads rapidly from side to side, raising the wing to preen the feathers beneath, and finally throwing the head and neck fully erect, with the bill pointing perpendicularly to the sky, while both birds emit a hollow groan. This action is of daily occurrence when the birds are on land, from October to May, and is participated in by mates or neighbours. It has thus developed into an interesting racial custom.

As an example of the third type of display there may be mentioned the courtship of the phalaropes, in which the female has brighter plumage than the male, and takes much of the initiative. In Wilson's phalarope (*Phalaropus tricolor*) both birds bow and nod, but in the culmination of this action the male flees with one, or sometimes two, females in close pursuit.

The site for the nest that is to contain the eggs is sometimes chosen by the female, sometimes indicated by the male, though the female may exhibit certain supposed prerogatives of her sex in such matters by modifying considerably the original plans proposed by her mate. The male house sparrow (*Passer domesticus*) selects some hollow suitable for a nest, and rests beside the entrance, calling and chattering until a female comes to inspect the premises. If these appear suitable, nest-construction may proceed. With birds that nest in trees or bushes, or on the ground, where there is greater latitude of site, various locations may be examined before definite selection is made, both male and female apparently exhibiting directive impulse in choice. When suitable sites are numerous it is probable that final selection comes frequently through the chance that directs the placing of the first nesting-material when the courtship shall have proceeded to the point of actual nest construction. In some instances, where numerous sites all exactly alike are available, as where barn swallows (*Hirundo*) make their nests of mud on the rafters of a building, there is often confusion, so that birds may carry pellets of mud to a dozen rafters until, finally, one of the several foundations assumes more importance in their eyes than the others and a nest is brought to completion. In such species as the ruby-throated hummingbird (*Archilochus colubris*) and prairie-hen (*Tympanuchus americanus*), where mating takes place at a point away from the nest and the male does not visit the nest-site, selection of a suitable spot rests entirely with the female.

With most birds mating is temporary, and may be for the period of a single brood, or, where two or more families are reared, for one nesting season. Some interesting information has been secured recently on this subject through marking birds with numbered bands which serve to distinguish such individuals from others of their kind. Experiments made by S. P. Baldwin on the house wren (*Troglodytes aëdon*) in Ohio have been particularly instructive. In these studies one male house wren was found mated with three different birds in three successive years, and this same individual mated with two different mates for first and second broods during one season. Another wren mated with one companion for one brood, and in the following year took a new mate, with which it was found in the year succeeding. This shifting in the mating relation is not due to the death of one of the birds.

Though the majority of birds associate in pairs only during the nesting season there are some exceptions to this. The white-breasted nuthatch (*Sitta carolinensis*) of North America is found so invariably in pairs that when one appears alone the assumption is that something has killed its mate. Cardinal grosbeaks (*Cardinalis cardinalis*) also are usually found in pairs throughout the year. It is commonly stated that some birds, as eagles, mate for life, but this remains to be definitely proven.

Polygamy is practised by numbers of birds, particularly among the pheasant-like species. The males of the capercaillie (*Tetrao urogallus*), black grouse (*Lyrurus tetrix*) and wild turkey (*Meleagris gallopavo*) regularly take several mates, though the bobwhite (*Colinus virginianus*), a related species, is monogamous. Polyandry has been alleged for a number of species but needs verification as to regular occurrence since one of the forms concerned, the cowbird (*Molothrus ater*), where the female has been said to

mate with several males, has recently been found to pair as regularly as is normal in small birds.

**Nests.**—The nests of birds (*see* NEST) exhibit a wide range in form and many have wonderful features.

The skimmer (*Rynchops nigra*) and the least tern (*Sterna antillarum*) excavate a slight hollow in sand or gravel to contain the eggs. The American avocet (*Recurvirostra americana*) may line a slight depression near the water's edge with a few bits of weed stem, and there deposit its four eggs. Subsequently, should the waters increase in freshet the avocet hustles about gathering grass, bits of wood, feathers, small bones and weeds to raise its treasures above the flood, so that where necessity arose, these birds have been known to erect piles of rubbish a foot in height. If the waters subsequently subside these elevated nests become conspicuous structures, but are not removed.

Some ground-nesting birds regularly conceal their eggs in holes. The Manx shearwater (*Puffinus puffinus*) digs burrows in loose soil, and makes its nest at the end of the tunnel. There may be variation in method in one species, however, as the wedge-tailed shearwater (*Puffinus pacificus*) of the Pacific islands ordinarily excavates a hole for nesting, but on rocky islands, where there is little soil, may deposit its egg on the ground, under bushes, or even in the open. The little auk or dovekie (*Alle alle*) searches out a crevice or shelter beneath boulders, often on talus slopes where rock fragments are piled in great confusion. The belted kingfisher (*Streptoceryle alcyon*) digs a tunnel on the face of a steep bank and lays its eggs at the end, gradually building up a mass of fish bones from regurgitated pellets for a nest.

Concealment is sought also by some tree-nesting birds. The scops owl (*Otus scops*) of Europe, and the screech owl (*Otus asio*) of North America, seek hollows in trees, where the eggs are placed without nest lining of any kind. Woodpeckers excavate special chambers in the trunks of trees, placing their eggs on an accumulation of chips at the bottom. Though dead trunks are usually chosen, the yellow-bellied woodpecker (*Sphyrapicus varius*) frequently drills its home in a living hardwood tree, and the Porto Rican woodpecker (*Melanerpes portoricensis*) may nest in a living palm trunk.

Nests of many herons, *e.g.*, the night-heron (*Nycticorax nycticorax*), are placed in trees, and are flat structures of twigs and sticks that form a mere platform, so loosely built that the eggs may often be seen from below. Among larger nests there is every variation from this type to that of the osprey (*Pandion haliaëtus*) to which material may be added year after year until the mass is 8 or 10 ft. in diameter and makes a cartload in bulk.

Among smaller birds, the tree nest is usually a simple cup that has a foundation of rough material on which the nest proper of finer material rests; the lining is made of soft substances, as rootlets or plant downs. The blackbird (*Turdus merula*) and the American robin (*Turdus migratorius*) line their nests with cups of mud, within which are placed soft grasses. Many birds place nests of grasses and rootlets under herbage or in thickets on the ground. For protection, many tree-nesting birds build homes with arched tops that wholly conceal the eggs. There is a great group of birds in South America, the so-called tracheophones, many of whose species have this habit. Conspicuous among them in the Argentine is the leñatero, or firewood-gatherer (*Anumbius annumbi*), that gathers a quantity of thorny twigs to form a spherical mass, within which is placed the nest proper, reached by a runway, the whole so firmly constructed that the eggs inside may be reached only with difficulty. These nests are durable and last for several years, until the materials composing them decay. The oven-birds (*Furnarius*) in this group construct rounded masses of mud, with an entrance at one side, the walls being an inch or more in thickness, and so built that they will withstand the beating of heavy rains without damage.

Many of the troupial family (*Icteridae*) make purse-like nests that are suspended in the tops of trees. The nest of the oropendola (*Gymnostinops montezuma*) of Central America may be 5 ft. in length, suspended by the upper end, below which is located the entrance which leads through a long, constricted neck to the expanded lower part, where the nest proper is placed. The oropendola nests in colonies, but nests of the orioles, as the Baltimore oriole (*Icterus galbula*) which also constructs a purse-shaped nest from 8 to 10 in. in length, are found alone. The nests of the social weaver-finches of southern Africa are among the most remarkable structures known in the bird world. These birds are gregarious and, in company, accumulate masses of grass in trees to form a roof, under which each pair of birds has its separate cubicle, lined warmly with feathers. From 20 to 300 pairs may inhabit a single structure, which grows in size as it is inhabited year after year, until it may contain several wagon-loads of material.

Among other curious nests there may be mentioned those of the edible-nest swiftlets of the Indian, Australian, and South Pacific areas, that are cupped platforms, composed of a coagulated mucus secreted by the mouth-glands of the birds, placed on the walls of caves. These are gathered commercially and form the basis for a soup highly prized by the Chinese. The American chimney swift (*Chaetura pelagica*) makes a nest of twigs, cemented together by mucus from the mouth, to make a tiny basket. In early times these nests were placed on the inside of hollow tree-trunks, but with the advent of the Caucasian race and the building of houses, hollow trees have been forsaken for chimneys.

Nest-building with most birds seems to be usually the duty of the female. The male may assist by bringing material and may lay it on the nest, but it is mainly arranged by the female. In many species the entire work devolves upon the female.

## EGGS

In birds, as in all other vertebrates, the gonads are paired organs on the dorsal wall of the body-cavity. In most birds the right ovary disappears early in life, leaving only the left to grow and mature. This rule, though usual, is not invariable, since in many hawks, particularly the harriers (*Circus*), and the small bird-eating forms (*Accipiter*) usually, but not invariably, we find both ovaries present and functional. The ovum, or yolk, in birds is a relatively enormous cell which passes from the ovary into the mouth of a convoluted tube, the oviduct. As the yolk moves down the oviduct it receives first a deposit of gelatinous albumen, the "white," next a membranous sheath, and then is enclosed in a hard, calcareous shell, and is deposited as an egg (*q.v.*).

Eggs are ordinarily oval in shape, though this is not invariable, as the eggs of swifts are usually elliptical, and those of owls are nearly round. Eggs of birds that breed on rock ledges without constructing nests are much pointed, which allows them to roll about in a relatively small circle and so lessens the danger of a fall over the edge. Eggs of many shore-birds, which are relatively large in relation to the size of the birds, are also strongly pointed, which permits them to pack closely with the pointed ends toward the centre, thus bringing the whole into a compass that permits the parent to cover them.

Eggs of owls, kingfishers and woodpeckers, which are laid usually in holes or cavities (though some owls occupy open nests) are white, and whitish eggs are found in grebes, albatrosses and petrels. Most eggs have, however, a coloured shell, or spots and blotches of colour spread over a lighter background. Where there is a pattern of markings present there is usually a wreath of heavy colour about the large end of the eggs. Herons' eggs are pale blue or bluish-green, and plain green or blue eggs are found in various perching birds. The tinamous of the New World, a primitive group, have very striking eggs, with smooth and highly polished shells, varying from green or pink to deep brown, their lustre suggesting porcelain.

The egg-shells are penetrated by pores which usually cannot be seen, except under a lens, but that in some eggs, as those of the ostrich, are easily visible to the unaided eye. Evaporation takes place through these openings, so that the egg loses steadily in weight during the incubation period.

The number of eggs produced annually varies widely in different groups, being adjusted to the requirements of each species, to enable maintenance of its normal numbers. The migratory species that covers a considerable range encounters more dangers than one that is sedentary and, therefore, must produce more of its kind.

This statement, however, has many exceptions. Migratory wild ducks lay from five to 12 eggs, while the bobwhite, which is sedentary, may have as many as 21, though usually not more than a dozen. Among small birds, on the average more eggs are deposited annually by the migratory species of the temperate zones than by the sedentary forms of the Tropics. On the other hand, the non-migratory titmice and wrens lay many more eggs than the migratory warblers (*Sylviidae*). Most perching birds of temperate regions have from three to five eggs, rarely six, in a setting, but may nest two or three times each season. Most sandpipers deposit four eggs, though in some the number is reduced to three. Many gulls, hummingbirds, loons, and some species of pigeons have two eggs regularly. Other kinds of pigeons, with auks, petrels and albatrosses, lay but one egg. Boobies lay two eggs, but never seem to rear more than one young.

Adjustment of birds to their environment as regards the number of eggs deposited, to ensure continuance of each species, was made before the rise of man, who has been an active factor in the life of the earth for a relatively brief period compared to other animals. In some cases, where man has kept in check enemies of birds, these species have increased. In other instances, where man has been an active enemy, he has brought about reduction in numbers or actual extermination, because the birds concerned had become adjusted to a certain annual drain on their numbers from natural enemies and were unable to change to counteract added destruction by man. The great auk laid only one egg, and as it nested in colonies was quickly exterminated. The passenger pigeon of North America, which existed in colonial days in innumerable hosts, also produced but one young each season, which did not enable it to withstand the drain of hunting, so that it has become extinct. Usually, only those birds which rear a number of young each year can be maintained as game, and these must have protective regulation to enable them to hold their own.

**Incubation.**—After the egg is deposited it requires a certain definite temperature to develop to the point of hatching. This is normally accomplished by incubation on the part of one of the parents, usually the female, a period during which the bird remains closely on the nest, except for brief intervals required for a hasty search for food. The eggs are warmed by being brought into close contact with the breast and abdomen of the brooding bird, there being usually a sloughing of down and other feathers over a part of this area, to permit close contact between the skin and the eggs, and at the same time an increase in the blood supply to the skin, to bring a more even heat to bear. The actual degree of heat required to develop the embryo in the egg is known for only a few forms of birds. In the case of the domestic fowl the average incubation temperature is about 103° F. In charts published by Baldwin and Kendeigh, showing by use of a thermo-couple fluctuating temperature in the nest of a house-wren (*Troglodytes aëdon*), the incubating temperature is shown to vary from 39° to 41° C, or 102° to 106° F, the average being about 104° F.

Though, ordinarily, care of the eggs involves their being heated from the body of the incubating bird, in species that nest in the open, in warm climates, where the sun is torrid, brooding may be required to shade the eggs from too powerful sun-rays. The body of the bird here acts as a shelter and an equalizer of heat.

Though incubation falls ordinarily to the lot of the female, there are many species in which both sexes alternate in this duty. This is true in the ostrich, various auklets, herons, grebes, petrels, etc. The male rose-breasted grosbeak (*Zamelodia ludoviciana*) broods devotedly, though in this case his action would seem disadvantageous, as his plumage is strikingly variegated with black and white, and the rose-red spot on his breast often shows above the rim of the nest, while his mate is inconspicuous in a brown, streaked dress. In the phalaropes, the bustard-quails (*Turnix*), the emu and the rhea the male alone incubates, the female taking no part in this duty. It is believed that this also obtains in other shore-birds.

The megapodes or mound-builders (*Megapodidae*), found from the Nicobars and Philippine islands to Australia, carry on no incubation whatever. For example, the scrub-fowl (*Megapodius duperryi*), of Northern Territory and Queensland in Australia, scrapes together a mound of sand and earth, to which a small amount of vegetation is added, during the wet season. The mound may be used for a number of consecutive seasons; and mounds 14 ft. in height and 35 ft. in diameter have been discovered. The eggs of one pair of birds are buried in the top of such a mound, and, through heat generated by decomposition of the included vegetation, are maintained at an even temperature of 95° F. The Mallee fowl (*Leipoa ocellata*) of Australia constructs a much smaller nest by scraping out a hole in the ground 2 ft. wide and 1 ft. deep, with the excavated earth piled up around the opening, so that the whole resembles the crater of a volcano in miniature. The cavity is filled with leaves, twigs and vegetable debris, scraped up by use of wings and feet for yards around. This is left uncovered for four or five months until it is soaked by rains, when decomposition changes it into a hot-bed. A central chamber is excavated in the top at the proper time, and the debris taken out, mixed with sand and returned. In a few days another excavation is made, and an egg placed within it, so that it stands with the small end down. On warm days when the sun shines the birds make a cavity in the top of the mound to catch the rays of warmth. In damp, rainy weather the conical peak of the mound is covered with sticks and rubbish that assist in turning water that might penetrate to the eggs. The temperature about the eggs is maintained from 90° to 97° F until they are hatched. During dry seasons, when there is no moisture to promote the necessary decomposition of vegetable material to produce heat, the birds are said not to breed. On the other hand recent researches show that in some species at least there is no generation of heat by decomposition within the nests, and the comparatively low temperature necessary for development is maintained by oxidations within the egg itself. The nesting activities of these curious birds are strongly reminiscent of the breeding-habits of the reptilian group, from which the class of birds as a whole is descended.

The period of incubation varies greatly in different groups, in general, being longer in large birds. The period may be shortened slightly by slight increase in incubation temperature or prolonged somewhat by irregular attention on the part of the parent. The incubation period of the emu is said to range from 56 to 63 days, that of the ostrich is reported as 42 days, the domestic mallard requires four weeks, and the domestic fowl three weeks. Most small perching birds require from 12 to 14 days, with magpies and jays running from 16 to 18 days. The shortest incubation period known is that of the American cowbird (*Molothrus ater*), whose eggs hatch after 10½ days' incubation.

In the gallinaceous birds, *e.g.*, the domestic fowl, and many other species, the nest is used merely to house and incubate the eggs and the young, which are born covered with down, and follow the mother in search of food as soon as their plumage is dry. In some mound birds the young are hatched with developed wing-quills, so that they are able to fly within half-an-hour of hatching. In most tree-nesting species the young undergo a shorter period of development in the egg, and consequently must remain in the nest under close parental care for a period after hatching. The nest is thus a home during early juvenile development. Food is sought by the parents and brought to the young, and what guard may be possible is maintained against destructive enemies. In hole-nesting species like the hoopoes and woodpeckers there is indifference to nest sanitation, as immunity against dangerous bacteria that multiply actively when heat and moisture are available has apparently been developed. Such nests become extremely foul as the period of occupancy progresses. Hawks, herons and numerous others, even when very young, instinctively void their excrement beyond the nest, so that such unsanitary condition is obviated. In most of the smaller perching birds the excrement of the young is of such a consistency that it maintains a globular form and is removed from the nest by the parent. In a few finches, as the American goldfinch and crossbills, the excreta are voided by the young about the margin of the nest and are not removed.

In most birds the young remain with the parents for a time after leaving the nest, and gradually become self-reliant, so that they procure their own food. At this stage family parties usually

separate as the young drift away from their parents, or the adults tire of importunate begging for food on the part of progeny able to procure their own sustenance, and so either drive the young away or themselves leave. When the young learn early to search for food they may remain in bands with their parents.

**Parasitism.**—Breeding parasitism is found in several groups of birds in which no nest is built, the eggs being deposited with those of other birds and left entirely to the foster-parent for care. The European cuckoo (*Cuculus canorus*) has long been known to have such habits. The female places a single egg in the nest of some bird, usually a species of small size, ordinarily choosing a nest in which the eggs are fresh, and removing one of the rightful set when leaving her own (*see* CUCKOO.) Although about 100 species of birds have been recorded as parasitized, ordinarily each female cuckoo places her eggs in the nests of one particular species of bird. Each female cuckoo is supposed to lay from five to 16 eggs during the season. There is argument as to whether the cuckoo deposits her egg directly in the nest of the fosterer or whether she extrudes the egg elsewhere and carries it in her throat to the nest chosen. The former is certainly the more usual. An egg of the foster-parent is almost invariably removed and eaten by the cuckoo after she has deposited her own. The process of placing the egg requires only a few seconds, and then the bird leaves at once, which renders definite observation difficult. The young cuckoo's back is hypersensitive to touch, has a spasmodic reaction when it comes in contact with objects other than the nest; aided by a curious depression on the back, the parasite casts out the rightful young, or the eggs until finally it occupies the nest alone.

Similar parasitic habits are known for a number of other cuckoos in other parts of the world. Stuart Baker, in discussing parasitism in Indian cuckoos, shows that a number are parasitic on one species or group of species of birds, and that the cuckoo's egg is specialized to resemble the foster-parent's rather closely. In some cases one cuckoo may have widely different eggs in different parts of its range, as the hawk-cuckoo (*Hierococcyx sparveroides*), which, when it parasitizes the streaked spider-hunter (*Arachnothera magna*), lays a dark olive-brown egg like that of the bird parasitized, but that elsewhere foists on the laughing thrushes or allied species a bright blue egg like that of its dupes.

Some of the American cowbirds are also parasitic. The common North American cowbird (*Molothrus ater*) has developed no particular resemblance in egg colour to the egg of the fosterer, except that many of its dupes lay spotted eggs like its own. In South America the bay-winged cowbird (*Molothrus badius*) cares for its own eggs in a normal manner, but is parasitized by a related species, the screaming cowbird (*Molothrus rufo-axillaris*), which uses this species alone as foster parent. Parasitism is also known in the rice-grackles (*Cassidix orizivora*) which lay in the nests of related oriole-like birds. Certain species of weaver-birds (*Ploceidae*) and the honey-guides (*Indicatoridae*) of Africa also parasitize other birds. The origin of such habits is obscure.

### POST-BREEDING LIFE

The period of reproduction is the most active part of the annual life-cycle of the bird, from a biological standpoint, as it brings in play-instincts and activities different and more complex than those apparent during the remainder of the year. Reproductive activity reaches its climax with the maturity of the young. With these on the wing the individual pair have done their utmost in the perpetuation of their kind, and there ensue a number of months of more restful life, with search for food and escape from enemies as the principal activities. For many species there is immediately a period of moult to renew the feathers, a period during which birds are quiet and sluggish, often seeking haunts where they will be disturbed as little as possible. With the drain on vitality brought by feather-production at an end, there comes a time of greater activity, when old and young seem to attain greater vitality.

**Moult.**—The close of the breeding season finds adult birds with worn feathers, so that most species immediately undergo a moult, during which the old feathers are dropped and new ones are grown. The process is one that, in totality, requires more than a month to complete and progresses in regular routine, varying in sequence over the body in the different orders. In most species the feathers of the wing are shed and renewed one or two at a time, so that the bird still retains the power of flight. Ducks, geese, flamingos, cranes, rails and grebes drop all the wing- and tail-feathers in a very short time, so that they become flightless for several weeks until new feathers are grown. Penguins shed their feathers in patches, almost as a lizard drops its old skin. The epidermis of the tarsus and feet is sloughed during the moult, and any ornamental coverings of the beak are dropped at the same time.

Young birds have a first plumage, grown during their period of development, that is replaced by a post-juvenile dress of feathers that comes when they are fully grown and able to care for themselves. In most, the flight-feathers remain until the following year, but in some, as the house sparrow (*Passer domesticus*), the wing- and tail-quills are also completely renewed at this first moult.

In most adult birds the moult comes immediately after the close of the breeding season, and in temperate regions occurs in late summer. The birds are thus again in full dress when the time for migration arrives, or, if resident, by the approach of cold weather. Swallows, many shorebirds, and hawks moult during the winter, the two former groups undergoing this process in the winter home after migration.

Most birds have one complete moult annually, which takes place as indicated, at the close of the breeding season. In many, particularly among the perching birds there is another moult, partial or complete, through which the bird acquires nuptial plumes. In the bobolink (*Dolichonyx orizivorus*) and the whinchat (*Saxicola rubetra*), for example, the body plumage is completely changed in late winter and early spring. Many of the sparrow family, as the cirl bunting (*Emberiza cirlus*) and the Harris's sparrow (*Zonotrichia querula*), have a partial moult of the feathers about the head that produces bright plumes for the breeding dress.

Change in colour is not necessarily accompanied by moult, as often the tip of a feather may be one colour and the middle portion another. In the throat of the male house sparrow, for example, in autumn and early winter the black throat is obscured by greyish feather tips. As spring arrives the grey tips wear away, so that the black is fully revealed. The most striking change of this type is found in the snow bunting (*Plectrophenax nivalis*), which is white or light brown above in autumn and winter, but through sloughing of the feather tips becomes entirely black on the back in spring.

### MIGRATION

Aristotle (384–322 B.C.), the first to discourse connectedly on migration (*q.v.*), tells in his writings that the crane flies from the steppes of Scythia to the marshlands at the source of the Nile, south of Egypt. He noted migration also in the swan, land-rail, lesser goose, quail, rock-dove and turtle-dove, though he reports that of the last three a few may linger through the winter in protected localities. The cuckoo disappeared with the rising of the dog-star in July. Pliny, in his *Natural History*, repeats much that had been said by Aristotle, adding that the European blackbird, starlings and thrushes pass to neighbouring countries, while storks and cranes travel to a great distance. There are scattered references to migration in the writings of the middle ages, Olaus Magnus, in 1555, speaking of the migrations of swallows, and Francis Willughby, in 1768, mentioning various migratory birds. In the succeeding century Gilbert White, Thomas Pennant and George Edwards kept regular records of the arrival and departure of birds. Interest in the subject was considerable by the opening of the 19th century, and from that time forward the number of observers and the mass of published information on migration has increased yearly.

**Superstitious Beliefs.**—Though the migrations of larger birds were understood, as these travelled openly across the spring and autumn skies, the movement of smaller species, that appeared or disappeared under cover of night, so that they were present one day and gone the next, or vice versa, were present suddenly after an absence of several months, was the basis of considerable superstitious belief. It was thought that the smaller species were too weak to travel far, so that, in 1740, J. G. Gmelin was told by

the Tatars of Krasnojarsk that each crane carried a corn-crake on its back in its journeys. In southern Europe the peasantry believe to-day that small birds congregate on the shores of the Mediterranean, and as opportunity offers flutter on the backs of storks and cranes who carry them across to Africa.

Somewhat more unusual is a belief promulgated in an anonymous tract published in London in 1703 "By a person of Learning and Piety," entitled in part "An Essay Towards the Probable Solution of this Question. Whence come the Stork and the Turtle, the Crane, and the Swallow, when they Know and Observe the Appointed Time of their Coming." The author announces a belief that migratory birds travel to the moon, where they pass the winter, the journey in either direction requiring 60 days to compass, during which the author (who, according to Hugh Gladstone, was Charles Moreton, a minister who in late life removed to New England), informs us that they required no food, as they travelled in a rarefied ether.

Another superstition centring around migration has been the supposed hibernation on the part of some birds, a belief that dates back to early times and has been prevalent both in Europe and America. Aristotle attributed hibernation to the swallow and various other birds, saying that some individuals became torpid, and so passed the winter in the shelter of caves or hollow trees in a state of suspended animation. In later years hibernation was used mainly to explain the disappearance of swifts, swallows and the sora rail. Many and detailed have been the arguments over this matter, and over 200 papers have been written dealing with supposed cases of hibernation. It was related that the sora rail abounded in its favourite marshes, until, overnight, the birds turned into frogs, or sank in the mud, to remain until the following spring. Naturalists with great detail described how swallows gathered on reeds growing in water until their combined weights bent down these slender supports and the birds were submerged in the water. Those to whom this theory did not appeal stated that swallows and swifts hibernated in hollow trees and clefts in rocks, and the finding of birds in such situations in winter was described in great detail in a number of instances, all, however, under some misunderstanding of the circumstances. In short, though hibernation, or its correlate aestivation, is common among mammals, reptiles, amphibians, and even in fishes, it has never been proved among birds. The frequent coupling of this superstition with swallows may be explained, perhaps, by the fact that these birds in autumn regularly roost at night in marshes, and that during storms many perish to fall into the water and sink into the mud, never, however, to revive.

Among other superstitious beliefs mention may be made also of a transmutation theory prevalent among early writers, who supposed that at the approach of winter a bird might be transformed into another species, to remain thus until spring, when it resumed its proper form. Apparently this was first suggested by Aristotle, who held that the redbreast or robin (of Europe) changed to the redstart. The confusion resulted, apparently, from similarity of form and difference of plumage in two related species, where one disappeared in southward migration about the time that another arrived from northern regions, thus lending colour to a transmutation argument.

**Theories of Origin.**—An explanation of migrational movement has been that of seasonal change in food supply. According to this belief, with the approach of winter in areas remote from the Equator, there is failure of the food supply that causes birds to travel, and as the food supplies remain more constant toward the Tropics, birds move in that direction. When, with the approach of spring, the instinct for reproduction becomes paramount, as the food supplies of the broad equatorial area are not sufficient to support the great host of young birds that will appear, the adults move out again to their summer homes in temperate or boreal regions, where they rear their families. It may be argued against this that the tropical belt supports the migratory hosts when they have become grown, so that it would seem that these same individuals might obtain sustenance there while in younger stages.

An allied theory contends that migration is controlled by cold, from which birds retreat in autumn. Under this hypothesis some have held that birds originated in the north, were driven south by the advance of ice in the Pleistocene, and have returned to the north with the coming of milder climate. Each year now they retreat before the breath of approaching winter, while each spring a love of birthplace calls them to their natal homes. It must be noted that many birds retreat south early in the season, long before there is climatic necessity for their movement. This, with similar facts, has given rise to the theory that all species of birds have had their origin in the south, and through a natural struggle among individuals have spread to the north, especially for the period when each pair must be bound to a restricted territory for its breeding ground.

A somewhat different theory is that of phototropism, which holds that birds move toward the region of greatest light, this bringing a natural ebb and flow of bird life with the changing seasons as the sun moves north and south across the Equator. It is true that the course of migration, in general, follows the advance and retreat of the sun, but it would seem that it is the changing season and not the change in intensity in light itself that affects our bird-life. Through phototropism we may not, for example, explain the migrations of nightjars, which are nocturnal, and which, therefore, find in darkness the period of their activity. Such birds should find their optimum conditions of life in the equatorial regions, where the hours of the day are divided between daylight and darkness. The nightjar and whippoorwill, to give two well known examples, travel north to breed, and in June in their northern ranges have their hours of activity greatly curtailed through the lengthened period of daylight. A recent theory, supported by some experimental evidence, asserts that the onset of migration is physiologically controlled by the relative length of day and night, as is known to be the case with the flowering of plants.

The main difficulty with these and a number of other theories that have been promulgated in connection with migration is that they attempt to explain this great and impelling semi-annual movement by some single factor. When we consider that the known history of the bird in its evolutionary development, from present knowledge goes back through an enormous stretch of time, so vast that it may be noted in figures but is beyond human comprehension, to the fossil species known as *Archaeopteryx* and *Archaeornis* of the Jurassic period, it must be recognized that our present day species have had their instincts and habits moulded by many factors, so that it seems reasonable to consider that such a widespread phenomenon as migration may be due to a complex association of a number of powerful causes, some of which may have affected one species and some another, but no one of which may serve to explain the entire phenomenon as it exists at present.

We may believe, therefore, that the underlying basis of migration is founded on a combination of a number of causes, and we may look upon the present migratory instinct as an outgrowth of all the complex circumstances that have affected birds during their entire evolution, though it seems evident that the actual routes followed by migratory birds, at least in the northern hemisphere, have been shaped during the climatic changes of the Pleistocene.

During breeding-period the bird is restricted closely to the region in which the nest is located, and though some young are free to move about when recently hatched, the parents are, as a rule, confined to one neighbourhood until their offspring may be old enough to require no further care. This close confinement is seen easily in the smaller perching birds that are held within a very limited range until the young are finally on the wing. When the young are grown the adults may linger to rear other broods, but the young, driven often by antagonism of erstwhile attentive parents, wander away, borne by their newly-developed wings, and though they may not go far, do not usually remain for long in the immediate vicinity of the nest. This is one type of wandering in its simplest form. Somewhat more complex is the condition found in some parts of Australia, where prolonged droughts occur during which water evaporates, vegetation is not developed and the majority of birds disappear. With the incidence of rains the country again becomes green and birds return. Though both kinds of movement that have been described may appear as vagrancy, yet such impulses need only to become synchronized with seasonal

climatic change to become true migration.

Tropical regions offer interesting data in this connection, as though hundreds of birds found in these areas are strictly sedentary, yet there are some that shift about with changing conditions. Climatic variation within the Tropics is confined mainly to a cycle, in which periods of relatively little precipitation alternate with those of heavy rains. There is thus a seasonal shift that is influenced by changes in the vegetation. Some species of tree or vine come into flower or fruit and immediately there appear tanagers, honey-eaters and other birds hitherto absent to live upon the newly-available food.

It is idle to suppose all birds have arisen within either tropical or temperate areas. Birds, as a group, have been in existence for many million years, and during all that period there has been constant unceasing competition between individuals. In virile species individuals have been produced in abundance, and many have necessarily been forced out into new range. Some have reacted to new conditions, or have become modified through some inherent quality, so that they have been changed so greatly that they have finally become species apart from the parent stock, and have thus set up their own *loci* for subsequent radiation. The complexity of overlapping ranges under such conditions is easily apparent.

## HOW MIGRATION PROCEEDS

Some students have indicated that the spring and fall migrations correspond to advance to the breeding station and subsequent retreat therefrom, and indicate correctly that the stimulus for this may be a hormone arising from physiological change in the gonads. This, however, is merely an activating principle for migration as it exists at the moment, and may not be considered the cause through which migration itself has originated.

Briefly, migration may be defined as advance and retreat, with fluctuation in conditions favourable to each species separately, which, as each form has its own reaction to its environment, has originated from varying causes. The origin of the present day regular, seasonal movements is thus complex.

**Methods of Migration.**—Migration may take place by day or by night, according to the species. Geese, ducks, cranes and pelicans crossing the sky, flying abreast or in angular formation, are accepted as portents of changing season throughout the world. Though seen regularly by day, these birds may also migrate by night, as we frequently hear the calls of geese and swans coming from darkened skies during the height of their movements. The smaller birds travel mainly by night, and descend on us in hordes, so that frequently we go out in early morning to find fields and hedgerows crowded with songsters that were absent the previous evening. During the proper season, when a full moon rides the sky in evening, it is possible to detect the forms of these nocturnal travellers silhouetted against the illuminated disk of light as they pass far above the earth, and occasionally to recognize a feathered friend by some peculiarity of form or wing movement. Many such observations have been made through large telescopes, and birds may be seen occasionally against the moon through ordinary field-glasses. It is probable that timid wrens, warblers and sparrows, that live ordinarily under shelter, feel greater safety in prolonged flights under the protecting cover of darkness. Kingbirds, robins, bluebirds, bluejays and many others however regularly fly by day.

The matter of procurement of food is probably a greater factor than timidity in inducing nocturnal flight. Digestion in birds is rapid, so that food must be obtained at regular intervals to maintain the activity especially characteristic of smaller species, whose tiny bodies have necessarily smaller reserves of energy than their larger brethren. Stomachs of small birds killed at night by striking lights or other obstructions are nearly always entirely empty, which, though an entirely natural thing, in some cases has given rise to belief that the individuals in question were in the throes of starvation. If tiny migrants flew long distances by day they would arrive at some distant destination with empty stomachs and depleted energies, perhaps almost exhausted, and because of darkness would not be able to procure food until the following morning. Such circumstances would lead to delay in further flights through need for recuperation or, if accompanied by cold or storm, might prove fatal because of the lowered vitality. By arrival at daybreak it is possible for migrants to rest for a time and then search for food, and so to recuperate that they may continue the following evening if desired. At the same time there is often detected among these smaller species an indication of continuation of migratory flight by day, as in feeding they often tend to move in the general direction towards which the seasonal flight trends.

It was thought formerly that migrants flew at great altitudes above the earth, there being a somewhat hazy notion that rarefied atmosphere in some uncertain way facilitated flight. Modern observations from aeroplanes show, however, that this belief is unfounded, and that the bulk of migrant birds travel at less than 3,000 ft. above the earth. It is unusual to meet with birds above 5,000 ft., though exceptionally aviators have recorded shore-birds at 10,000 and 12,000 feet. In many instances birds pass at very moderate altitudes, particularly above the sea, where they may barely clear the waves. At night, the calls of migrants may be often heard, apparently only short distances above the trees.

There has been much discussion of the method by which birds direct their courses in flights to distant lands, without arrival at definite explanation. Memory of routes previously travelled, some magnetic sense, courses laid by the positions of the heavenly bodies, as a mariner directs his navigation, the direction of regular winds, telepathy, television and hereditary memory have all had their champions. It may be said that there appears great probability that young birds of the season, on occasion, migrate southward without the guidance of others that have previously made the journey, that sea-birds return across apparently trackless oceans to remote islands where they nest, and that birds have returned to their breeding stations when removed forcibly to waters that they do not ordinarily frequent. This may, perhaps, be explained in the somewhat general terms, by supposition, that the birds are directed by some special sense of direction, but must be regarded at present as something of which there is no definite explanation.

One of the most interesting facts connected with migration is the almost unfailing regularity that accompanies the movements of birds in the temperate regions. Through records kept over a long period of years, the average dates of arrival in spring of the common birds are now known, and it is found that they appear with almost uncanny regularity, often on the average day and always within a range of a few days earlier or later. Among small birds the seed-eaters generally migrate earlier in spring and later in autumn than insect-eaters, as they find their food with greater readiness. The first arrivals in spring or fall are usually few, and it may be days or weeks before the mass of individuals appear.

The length of the journeys made by individual birds varies greatly. Inhabitants of high mountains, in a flight of a mile or two, descend to some warm valley, where they may spend the winter in comfort, or the migration flight may entail a movement to a great distance, as from central Europe to southern Africa. The Arctic tern is supposed to have the longest migration route known, as it nests in the far north and spends the northern winter near the shores of the Antarctic continent, with 11,000 m. in an air-line separating its northern and southern homes. Incidentally, this tern probably enjoys longer hours of daylight than any other living creature, since it lives under the midnight sun in both northern and southern hemispheres, and only in its travels through the equatorial belt does it meet extended periods of darkness. There are numerous shore-birds, such as the American golden plover, that nest in the Arctic and spend the northern winter on the plains of Argentina. Many birds nest in Canada or in the northern United States and winter in the Gulf States, Mexico, Central America, the West Indies, or northern South America. Likewise, many pass from northern Europe to Africa, some going as far as Cape Colony.

There is almost infinite variety in the migration routes and travels of the many forms of birds, yet in each continent it is found that there is a tendency to converge in great lanes of migration that carry the bulk of individuals, though random birds may cross anywhere in the intervening area. The flight-lines often fol-

low river valleys or coast-lines, which seem to afford assistance in directing the flight. The observer interested in bird life who is located on one of these great air-roads is fortunate.

Through prolonged journeys birds encounter constant perils and dangers, so that many are destroyed. Storms, unfamiliar coverts, with consequent exposure to the attacks of enemies, and wandering from the direct course in crossing broad reaches of water annually exact a toll of unknown thousands of individuals, as has been indicated in a previous section. To enable maintenance of their proper number migratory species, therefore, are required to produce a sufficient number of young to permit this toll, and at the same time leave a pair to continue the species at the next breeding season. On the average, the migratory species of the north and south temperate zones produce from three to six eggs in each nesting, four or five being the rule, with from one to three families each season, while the more strictly resident form of the Tropics may produce only two or three eggs and have only one nesting annually. In spite of apparent prolificness the more northern species do not increase inordinately. The song sparrow family, in August, at the close of the breeding season, if there has been no mortality, may have ten or 14 individuals, depending upon whether two or three broods have been reared, yet by next spring does not show any appreciable increase in abundance; so that there has been a tremendous wastage in individual life during the migrations and the intervening winter.

In final consideration, it may be said that residents in Europe and North America are often prone to consider migration as something peculiar to birds breeding in the northern hemisphere. It must be noted, however, that in South America, southern Africa, and Australia there are native species that, at the approach of the southern winter, travel north toward the Equator, to return at the proper season to their breeding-grounds.

## BIRD BANDING

Until the beginning of the present century the study of migration was carried on by mass-observation, under which records were kept of the first appearance for each species and of its subsequent fluctuations in abundance, the value of the records depending to a certain degree upon the skill and experience of the observer. Much valuable data has thus been assembled, and this method of study is still highly useful. In recent years there have been developed methods in marking individual birds with numbered bands that have added greatly to knowledge of migration, since by this means it is possible to single out the individual bird from the great army of his fellows, and to learn something of the separate flights that make up this mass movement.

Sporadic attempts to mark wild birds so that they might be identified began more than 125 years ago, and have ranged from little bells, bits of coloured yarn, marks made with indelible inks or paints on some of the feathers, plain rings of wire or other material, or strips of metal on which were marked scriptural quotations, to the modern scheme of bands of aluminium marked with a serial number and the name and address of the person or organization responsible for them.

The earliest definite record for a banded bird, according to F. C. Lincoln, is that of a heron (*Ardea cinerea*), captured in Germany in 1710, with metal rings on the leg, one of which had been placed on the bird in Turkey several years before. Sporadic efforts to mark birds have been made at irregular intervals, but nothing of real importance was attempted until 1899, when C. C. Mortensen, of Viborg, Denmark, began systematically to band storks, ducks, starlings and birds of prey. The results obtained were so valuable that soon others took up this study, with the result that at the beginning of the World War approximately 20 distinct banding projects had been initiated in Europe.

In America the first birds ringed seemed to have been some common phoebes (*Sayornis phoebe*), marked by Audubon, when in the nest, with silver wires around the leg, some of them returning the following year to breed in the locality where they had been born. After several persons in America had arranged schemes for the marking of birds the American Bird Banding Association was organized, in 1909, through the efforts of Dr. L. J. Cole, and continued until 1920, when its activities were taken over as part of the work of the Bureau of Biological Survey, U.S. Department of Agriculture. Under Government auspices the work has been expanded through a co-operative scheme until now more than 1,500 persons are engaged in banding birds in the United States and Canada, and to 1928 approximately 350,000 birds had been banded. Early work was concerned with the marking of young birds before they were able to fly, or the casual capture of adult individuals. In recent years this has changed to the banding, principally, of adults captured by a variety of ingenious traps, and then marked and released. Banding in the United States has progressed to a point where there have been organized four regional societies concerned with it. Though hundreds of birds that have been marked are not subsequently detected, enough are recovered to render the work profitable to a high degree. Among ordinary birds from one to four in every hundred banded are later retaken, while among ducks, which are hunted as game, the recovery runs from 12 to 20 in each hundred, a remarkable number. Through the trapping method it often happens that banded birds are retaken and released uninjured, sometimes on several occasions.

Through banding, it has been found that some birds have winter homes as definitely defined as those inhabited in summer. As a case in point, there may be mentioned the white-throated sparrow (*Zonotrichia albicollis*), which nests in the northern section of eastern North America, from Massachusetts and Wyoming north to Labrador and Great Bear lake, and winters in the central and southern States. A bird of this species banded by S. P. Baldwin, near Thomasville, Georgia, on March 5, 1916, was retaken within a few yards of the original spot on March 7 and 19, 1917, on several occasions between February 25 and March 22, 1920, and on March 27, 1921, indicating a remarkable regularity in return to one spot. Wild ducks banded by the writer at the northern end of Great Salt lake, in Utah, were killed subsequently in California, Mexico, Texas, Oklahoma, Missouri, Nebraska and Saskatchewan, revealing a tremendous spread in flight, and, with other similar data, giving information of great importance in game conservation. A black-headed gull (*Larus ridibundus*), banded at Rossitten, Germany, was taken subsequently at Bridgetown, Barbados, and another from the same point crossed to Vera Cruz, Mexico. A common tern, marked at Eastern Egg Rock, on the coast of Maine, was found dead four years later at the mouth of the Niger. A lapwing (*Vanellus vanellus*) banded in Cumberland, England, was taken in Newfoundland. Such examples of trans-oceanic migration will increase as the work progresses.

## SONGS AND CALLS

The voice in mammals, including man, is produced in the voice-box, or larynx, in the upper part of the throat. The bird possesses a similar larynx; but its sounds and notes are formed in another voice-box, the syrinx, at the lower end of the windpipe, where it divides to send a bronchial tube to either lung. The syrinx is composed of firm walls derived from the rings of the trachea, or in part from the bronchi, and has within delicate membranes whose tension is controlled by slender muscles. Air expelled forcibly over these membranes produces sound which may be of many kinds, according to the species concerned. The adult turkey vulture (*Cathartes aura*), and the brown pelican (*Pelecanus occidentalis*), have as their only note a sighing aspiration made by expelling the air unmodulated, though their young utter harsh calls in some variety, either in begging for food or in attempting to repel possible enemies. The voiceless condition in the adult is unusual. The rhea sends forth a booming call, ventriloquial in effect, that carries for long distances, the wedge-tailed shearwater utters a series of indescribable groans and shrieks, which combine with those of thousands of its kind to produce a vast volume of sound, the gull or tern calls in constant iteration with a note of harshest sound. In the highest order of birds, among the oscines or song-birds, song has reached high development, and in many follows lines of human music sufficiently to give deep aesthetic pleasure. The male mockingbird (*Mimus polyglottos*) of America, is stirred by spring to a period of vocal utterance that includes a varied repertoire of utterances peculiar to his

own expression, as well as notes borrowed from tuneful neighbours. In the height of the breeding season his efforts continue day and night in apparently ceaseless expression of virile energy. The nightingale (*Luscinia megarhyncha*) of Europe, a dweller of tangled copses, would be overlooked by many were it not for his impassioned outburst of song (which, contrary to popular belief, may be heard at all hours of day and night). The two just mentioned, with the addition of the hermit thrush and the skylark, are the songsters of greatest renown among English-speaking peoples.

A number of bird-songs, even where they have variety of note, are frequently unpleasant to some human ears. Many complain of the doleful cadence of the cooing of mourning doves (*Zenaidura macroura*), or are unpleasantly affected by the harsh chatter of the house sparrow. The song of the plant-cutter (*Phytotoma rutila*) of Argentina exactly resembles the creaking of two tree-limbs rubbing against one another in the wind. The song of the Henslow's sparrow (*Passerherbulus henslowii*) is a low double note barely audible at a hundred yards.

The song impulse is so predominant at the height of its period that it is given expression on the slightest disturbance. Birds awakened at night frequently sing for an instant as clearly as during the day, and song also may be used to express emotions of fear and anger.

Though modulated speech for the expression of abstract ideas may be peculiar to man, there is no question but that birds possess a rudimentary language in the sense that they use their calls to communicate with one another. A low call on the part of a parrot or paroquet at detection of a sound or sight that may denote danger will instantly cause the entire group of its companions to become motionless, or send them in screaming confusion into the air. The mother pheasant warns her young, who immediately hide and cannot be found. The rooster, by rapid repetition of a certain note, calls the members of his harem to some supply of food. There are also cries of anger, and others that may be interpreted as conversational, that enable species of social habit to keep in touch with one another. Bird-calls are often intelligible to other creatures, as the alarm-call of a jay or plover will often startle deer or other game.

There are a number of birds that possess a strong imitative faculty which, in domesticated individuals, may be adapted to the mimicry of human sounds. Canaries and other finches may be taught to whistle a few notes of musical airs. The Amazon parrots are particularly adept at mimicry of the human voice, and similar ability is found in some macaws, paroquets and other parrots. Crows, jays and magpies also may learn to repeat a few words, as may starlings and mynahs. According to a widely current superstition the tongues of the latter birds must be split to enable them to articulate human speech, a belief for which there is no valid basis, whatever, and which, when practised, imposes a needless cruelty. This curious belief may be based on the fact that the tongue of crows and jays is naturally somewhat split.

## FLIGHT

The wing-membranes of the ancient reptilian pterosaur (*see* PTERODACTYL) were supported by elongated finger-bones, as are the wings of bats (though differently), but birds have developed another mechanism for flying, as the fore-limb, including the hand, has long feathers projecting from its posterior margin that are extended to form a supporting surface, by which flight is accomplished (*see* also BIRD). The hand is stiffened, being flexible only at the wrist, the number of hand and finger-bones is reduced, and those that remain are partly fused together. The wing thus developed folds against the sides, so that it causes no embarrassment when the bird is at rest or is walking or climbing, but at the same time may be extended instantly should need or desire for flight arise. It appears thus perfectly adapted for its purpose and in utility (though not in speed) eclipses the aeroplanes of man.

**Methods in Flight.**—Avian flight is accomplished, except when soaring, by strokes of the wings, which may be slow or fast according to circumstances or the custom of the bird. A certain momentum must be acquired before the bird actually moves through the air. From a level surface this is ordinarily accomplished by an initial spring, through which the flexed legs throw the body as though from a catapult. From an elevation, as from a cliff or the limb of a tree, a fall of a few inches or a few feet may occur before the bird is under way. Albatross take off from land facing the wind, running a few steps forward with beating wings and then spreading their pinions, to rise and sail gracefully away. Some aquatic birds with small wings and heavy bodies, as coots, diving ducks, grebes and loons rush across the water surface with beating wings and alternately striking feet until they acquire sufficient momentum to carry them into the air. Surface-feeding ducks, on the contrary, spring directly into the air with one tremendous impulse that gives such impetus that they fly without appreciable pause. Grebes rise with difficulty except from the water. From a smooth, hard surface they can sometimes take off in flight, but in herbage they are unable to rise, as the slightest obstructions break their momentum.

There is a considerable group of birds that in their active moments are so constantly in the air that they may almost be termed aerial creatures. The swallows are an excellent example of these as they secure their entire supply of food in the air, and for hours on end circle and swing with tirelessly moving wings, only perching when their appetite is satisfied, for the purpose of rest at night, or at their nests.

Aerial existence of a stronger, more placid type, is exemplified by the great vultures and the larger hawks that circle and turn on broadly extended wings above the earth, frequently at great heights. Such birds may soar for hours with only an occasional stroke of the wings, as they use the force of rising or laterally moving air-currents to maintain themselves, the only motion being a constant slight adjustment of the angle of the wings, particularly at the tips, and of the tail to secure the proper amount of upward thrust to enable them to maintain the desired altitude and at the same time move ahead. The turkey vulture (*Cathartes aura*), which uses a soaring flight constantly for its progress through the air, is seldom abroad on foggy days when the air is still, but on such occasions remains quietly in its roosts. Many other birds soar merely for the pleasure that this occasions. Pelicans, cormorants, storks, and screamers, to mention only a few, are seen wheeling for hours so high above the earth that they appear as mere specks in the sky, though these birds search for food near, or on the surface of, water or the ground. Soaring flight of a different kind is seen where gulls glide beside or over a vessel, holding steady position in one place for minutes at a time without movement of the wings. This again is occasioned by steady air-currents that are deflected from the surfaces of the boat at a constant angle.

Hawks and the other soaring birds that have been mentioned that perform their flights relatively high in the air have wings wide in proportion to their length. Albatrosses and other seabirds that travel habitually near the surface of the water have long, narrow wings that when fully extended are more or less of equal width throughout their length, and so are somewhat similar in shape to the wings of a monoplane. These birds progress by utilization of air-currents induced by wind, and are most common in pelagic regions where there are regular winds, and are rare in regions of calm. Their flight is quick and subject to sudden turns, so that the method of progression differs somewhat from the smooth, spiraling turns that mark the soaring of hawks and vultures. As the larger petrel-like birds follow in the wake of ships they bank and turn rapidly with stiffly-extended wings, frequently swinging so that the plane of the wings for a brief space is at right angles to the line of the horizon. It is common to see shearwaters caught in the trough of a wave fly rapidly to the crest and then scale with set wings down the succeeding moving slope of water.

Birds like magpies and ducks, that habitually fly long distances, travel with a steady beat of the wings that carries them in a smooth, direct line. Inhabitants of thickets and hedgerows, as sparrows and wrens, progress with a tilting flight in which the short, rounded wings move rapidly for a few quick strokes, and

then pause for a very brief instant, so that the flight is rapidly tilting, or irregular in a vertical plane. Another group of birds, as many woodpeckers, fly in long undulations with a regular rise, during which the wings are stroked rapidly, and a slow descent, during which they are closed and the bird progresses through a combination of its previous momentum and the pull of gravity.

Such ground-haunting birds as the grouse and quails regularly walk or run, and use their wings extensively only to carry them from danger. In these the wings move rapidly, so that flight is swift and is accompanied by a roaring sound. The rapid movement is maintained for a comparatively short distance when the bird drops to the ground to hide in cover. Flight at high speed is thus maintained for only a brief space. The tinamous (*Tinamidae*) of South America, birds of grouse-like appearance related to the rheas, like grouse, fly only when pressed. They rise violently and drive rapidly away for fair distances, but are reluctant to rise again, and when forced to fly a second or third time do so with some difficulty. They are so seldom in the air that in violent winds they cannot easily control their direction, and often alight so clumsily that they fall.

Ground-inhabiting birds that reside on islands where they have no regular persistent enemies, have little incentive to flight, with the result that wings become shortened and their movement weakened. In many instances, particularly among rails, this has resulted in species in which the power of flight is completely lost, and the wings, though they may beat rapidly as the bird runs, cannot raise it from the ground. In some species now living loss of power of flight is now taking place. The Laysan teal (*Anas laysanensis*) is now in this process, so that, though an initial flight of about 100 yd. may be made, the birds are then exhausted and may sometimes be caught by hand.

**Speed of Flight.**—The speed that birds attain in flight, until comparatively recent years, has been a matter of uncertainty, in many cases subject to gross exaggeration. Most of these may be traced to Gätke, who in his otherwise admirable studies of migration on the island of Heligoland became seized with the hypothesis that birds perform most of their migration-flight during the course of a single night. On this theory, he placed the migratory speed of the northern blue-throat at 180 to 240 m. per hour, the hooded crow at 108 m., and plovers and related species at 240 m. per hour, or 4 m. per minute. He believed that these tremendous speeds were possible through flight at great altitudes, even to 40,000 ft. above the earth, where he supposed that the thin air offered little resistance. These statements, which have been widely quoted, are wholly erroneous.

Reliable data on the rate of flight have accumulated slowly during the past 15 years. The writer has secured some information on the subject by timing birds flying parallel to roads by means of the speedometer of an automobile, and in such diverse forms as herons, hawks, horned larks, ravens and shrikes has found the usual flight to vary from 22 to 28 m. per hour. Another observer has found the Arkansas kingbird and scissor-tailed flycatcher flying at only 10 to 17 m. per hour. Gladstone gives similar records for the willow warbler as 23½ m. per hour, the pied wagtail as 25, the European blackbird as over 22, the missel thrush as 23, and the cuckoo as 23 m. per hour.

Meinertzhagen has recently given very definite data on the speed of flight in birds from observations made by theodolites designed to estimate the speed of aeroplanes at anti-aircraft stations, by stop watches along measured courses, and by observations from travelling aeroplanes. From his records it appears that members of the crow family may travel from 31 to 45 m. per hour, the smaller perching birds, as larks, pipits and buntings from 20 to 37 m. per hour, starlings from 38 to 49 m., geese from 42 to 55 m., ducks 44 to 59 m., falcons 40 to 48 m. and sand grouse 43 to 47. The fastest flying birds known are found in the family of swifts (*Micropodidae*). One species (apparently the common swift of Eurasia), observed from an aeroplane in Mesopotamia, circled easily about a plane when this was flying at 68 m. per hour. From this and other observations it appears that ordinary swifts fly regularly at 70 m., and may accelerate this to 100 m. per hour for necessity or pleasure.

## FOOD

During their long period of evolution, birds have become adapted to all foods available to their methods of feeding. Geese graze on tender herbage as readily as cattle, rheas and ostriches select a miscellaneous vegetable diet, the plant-cutter (*Phytotoma*) eats buds, berries and other vegetable matter, the palm-chat of Haiti (*Dulus dominicus*) frequently consumes blossoms, the sage-hen (*Centrocercus urophasianus*) delights in the bitter twigs and leaves of sage (*Artemisia*), ducks are fond of succulent roots, tubers and leaves of aquatic plants, and many other birds have similar propensities for plant-stems or leaves. Fruits are taken by many birds, while the number of birds that depend upon starchy seeds for the major part of their diet is myriad, and includes a great variety of species. The finches with their strong bills crack off the investing hulls of large seeds and consume only the starchy interior. Small hard seeds, as those of lambs-quarter (*Chenopodium*), are swallowed entire and are ground up by sand and bits of gravel swallowed for the purpose. Grackles (*Quiscalus*) by means of a keeled process on the palate, cut around the shells of acorns until they crack in two and the meat is exposed. Jays hold nuts between the toes and break them open by strong blows of the beak. Some woodpeckers force acorns into crevices in trees, where they are held until they may be broken open. The mallard and wood-duck swallow acorns and even entire nuts of the hickory, which have a shell so thick that it requires a strong blow of a hammer to break them, and grind them up in their gizzards. Seeds form a standard autumn and winter food when other sustenance is lacking, and are produced in tremendous quantity. From the stomach and gullet of one mallard duck there have been taken 102,400 seeds of the water primrose (*Jussieua leptocarpa*).

Birds that feed on insect-life abound, and include a large proportion of the smaller species. Vireos, warblers and kinglets search actively for insects among leaves and twigs, picking off their prey at rest or flying out a few inches after some escaping titbit. Flycatchers (*Tyrannidae*) watch from commanding perches and fly out to snap up passing insects on the wing, or occasionally to pick them from the ground. Nuthatches and creepers search over the bark of trees for insects, spiders or eggs hidden in the crevices, and woodpeckers chisel out coleopterous grubs from their hidden tunnels in wood. Usually these are found in decaying trunks, but occasionally some of the stronger woodpeckers will cut in through 1 in. of hard wood to secure a grub. The flicker (*Colaptes*) feeds much on the ground on ants, which it secures by its long tongue as the insects run about their hills. More than 6,000 ants have been taken from the stomach of one flicker. Swifts, swallows and nightjars feed exclusively on the wing, securing flying insects in their capacious mouths. In the stomach of one nighthawk there have been found 50 species of flying insects comprising several thousand individuals. Cuckoos consume large numbers of hairy caterpillars, from which the stomach becomes so filled with hairs stuck in the lining that its inner surface appears covered with short, stiff fur. Hummingbirds live on the nectar of flowers and tiny flies, Hymenoptera, beetles and spiders that find a home in blossoms or in the bark of trees.

Grebes, divers, herons, mergansers, cormorants and pelicans feed on fish of various kinds, most often on species not especially desirable from a human standpoint. Albatrosses and shearwaters take quantities of squid, and the smaller petrels seem to secure the miscellaneous array of smaller marine creatures known collectively as plankton (*q.v.*). Hawks and owls feed extensively on small mammals and other birds. Some eat frogs, snakes and large insects, as well as crayfish. Larger owls may capture and consume smaller ones, and partly-grown brown pelicans, when ravenous with hunger, may seize and swallow a small member of the colony, that has just been fed. The flesh of dead animals, even in the form of putrid carrion, is sought by vultures that eat with impunity where death from poison from bacillary action would be the fate of another creature.

Though most birds seek their food day by day and so live an existence that involves continual search for sustenance, a few species form food-stores against a time of scarcity. Most

remarkable among these is a group of North American woodpeckers (*Balanosphyra formicivora*), that drill holes in the trunks of trees, in which they fit acorns, and so preserve a part of the acorn harvest for subsequent consumption. The birds work assiduously, as 13,200 acorns have been estimated as the store on one large tree-trunk, with an average density of 60 to the square foot. That the instinct for storage sometimes goes astray is shown when the carefully-drilled holes are filled with pebbles instead of nuts. The red-headed woodpecker (*Melanerpes erythrocephalus*) fills cavities with quantities of acorns or other small nuts, over which it piles bits of bark to conceal them. Many shrikes (*Lanius*), when food is abundant, frequently impale the bodies of grasshoppers, birds, mice or other prey on thorns, to return to them later if needed.

Hawks and owls swallow their prey entire or in large fragments, digest out all nutritive matter and form the bones, fur, scales, feathers or chitin into pellets, which are subsequently regurgitated, leaving the stomach empty to receive another meal. Albatrosses eject pellets composed of the beaks of squids, flycatchers masses of insect chitin, and even hummingbirds may throw up tiny pellets made up of the indigestible portions of their insect food. Birds with strong, muscular gizzards, that feed on seeds, swallow sand or gravel that serves as millstones to triturate into digestible starch meal the seeds they have eaten.

The Brahmans maintain towers where food for birds is placed, and where birds may nest. In Japanese temples shelves are built where swallows may erect their homes. Indians in the eastern United States placed hollow gourds on bare stubs of trees to provide nesting cavities for the purple martin (*Progne subis*), a species of swallow, a practice that was adopted by early colonists from Europe, and that is followed to-day in country districts in the southern States. From these somewhat rude foundations there have developed complicated procedures for the attraction of birds about human homes. The martin-gourd has been transformed into ornate martin-houses containing many compartments, each of a size to house a pair of birds, and boxes or houses have been designed for many other hole-nesting birds. Though in use in many places, particularly in Germany, at an earlier date, it is since the beginning of the present century that methods for the attraction of birds have received widespread attention. In the United States and Europe single-compartment houses (nesting-boxes) are set up for wrens, bluebirds, tits, woodpeckers and similar birds, and where favourably located are occupied without the slightest hesitation. These bird-houses are of many types, and so many are used that commercial companies have been formed for their manufacture.

Large pieces of suet tied to the trunks or limbs of trees, where birds may feed without fear of capture from cats, draw woodpeckers, nuthatches and titmice. A shelf built on an outside window ledge will draw many birds where they may be seen to the best advantage. Sunflower and canary seed, wheat, chick-feed, moderately fine-ground corn, nut meats and crumbs of bread are all relished by feathered neighbours. A mixture of suet and nut meats, preferably peanuts, ground medium fine in a food grinder, is especially relished by titmice and jays. Birds come to such feeding stands throughout the year.

## ORIGIN AND EVOLUTION

Bizarre as the idea may seem at first, birds are more closely allied to reptiles (*q.v.*) than to any other living group of vertebrates. The bird, while similar to the reptile in much of its structure, in its superior mental capacity, and concomitant adaptations that this has permitted, has far outstripped its lowly cousins, and so has flourished and multiplied while its cold-blooded relatives with decreasing numbers have fallen behind in the race of life. From one viewpoint we may look upon the bird as the attempt of the reptilian groups to retain the dominance of the earth that was theirs during the Mesozoic era, a design that was frustrated by the development of mammals.

The earliest birds known were contemporaneous with dinosaurs (*q.v.*), to which, structurally, they seem to have close affinity, particularly to the hollow-boned, agile, bird-like groups. As these creatures existed at a time when primitive birds were also known search must be carried farther into the ages for a generalized reptilian group from which both birds and dinosaurs may have sprung. This, apparently, is found in the fossil reptiles known as the Pseudosuchians, of early Triassic times; though according to some the original ancestor of the bird-like creatures should be sought in still older ages in the Permian.

**Fossil Birds.**—The bones of birds are so poorly preserved in the fossil state that there is record now of only about 750 fossil forms, including some of questionable identity. The earliest fossils known are *Archaeopteryx* (*q.v.*) and *Archaeornis* of the Jurassic beds of Bavaria, creatures with toothed jaws, very long, bony tails with feathers projecting along the sides, and free fingers, that in spite of their reptilian form, were birds, as they were covered with feathers and were able to fly. In the Cretaceous period two types of birds, both possessing teeth, are known from nearly complete skeletons, *Hesperornis* and its allies, diver-like species that lived in water and seemed to have had no wings, and *Ichthyornis* which was aerial and may have had the habits of a gull (*see* ODONTORNITHES). These four are the most peculiar fossil birds known at present, since others, while often strange, are allied more or less closely to modern families.

At the beginning of the Tertiary period the types of birds found were suggestive, in form, of existing birds, though in the Eocene some were highly peculiar, and most seem to pertain to extinct families. In the Miocene there occur a number of birds very closely similar to those existing to-day, and in the Pleistocene are found bones of numerous birds still in existence, in addition to many that differed from modern forms.

The progress of the avian group since the coming of the Pleistocene ice seems to have been one of extermination rather than of consistent evolutionary progress, as peculiar types seem to have been exterminated in numbers during the Pleistocene, and there is no indication that others have developed to take their places except for the minor characters that distinguish sub-species or poorly-marked species. The story of fossil birds is far from complete, and much work remains to be done on many of those at present discovered, to establish their relationship.

## SYSTEMATIC CLASSIFICATION

It is difficult to arrive at an exact figure for the number of kinds of birds now known, but at a conservative estimate it is believed this may reach 25,000 distinct forms.

The primary group or class, Aves, is one of the great divisions of the vertebrates and is equal in rank to the fishes, amphibians, reptiles and mammals. This class is divided into two sub-classes, the first, the Archaeornithes, containing the most primitive birds which are very close to reptiles, and the second, the Neornithes, all other known birds. The Neornithes are divided again into three major divisions or super-orders, the Odontognathae, containing forms with teeth, the Palaeognathae, for the ostrich-like birds and their allies, which have a primitive arrangement of the bones of the palate, and the Neognathae, including the remaining species with a more specialized modern type of palatal structure. These super-orders are divided again into orders, sub-orders, super-families and families. An arrangement embodying modern ideas of classification follows:

*Class Aves.*
- Sub-class ARCHAEORNITHES
  - Order Archaeopterygiformes
    - Family Archaeopterygidae, *Archaeopteryx, Archaeornis* (fossil)
- Sub-class NEORNITHES
  - Super-order Odontognathae, toothed bird
    - Order Hesperornithiformes
      - Family Hesperornithidae, *Hesperornis, Hargeria* (fossil)
      - „ Enaliornithidae, *Enaliornis* (fossil) [position provisional]
    - Order Ichthyornithiformes
      - Family Ichthyornithidae, *Ichthyornis* (fossil)
  - Super-order Palaeognathae
    - Order Struthioniformes
      - Family Struthionidae, Ostriches (Old World)
    - Order Rheiformes
      - Family Rheidae, Rheas (South America)

Order Casuariiformes
Family Casuariidae, Cassowaries (Australian region)
„ Dromiceidae, Emus (Australian region)
„ Dromornithidae, *Dromornis* (fossil)
Order Dinornithiformes
Family Dinornithidae, Moas (extinct, New Zealand)
Order Aepyornithiformes
Family Aepyornithidae, *Aepyornis* (extinct, Madagascar)
Order Apterygiformes
Family Apterygidae, Kiwis (New Zealand)
Order Tinamiformes
Family Tinamidae, Tinamous (S. Central America)
Super-order Neognathae
Order Sphenisciformes
Family Spheniscidae, Penguins (Southern hemisphere)
„ Cladornithidae, *Cladornis* (fossil)
Order Gaviiformes
Family Gaviidae, Loons and divers (Arctic & North temperate)
Order Colymbiformes
Family Colymbidae, Grebes (Cosmopolitan)
Order Procellariiformes
Family Diomedeidae, Albatrosses (Tropics, sub-Tropics & Antarctic)
Family Procellariidae, Shearwaters, Fulmars (Cosmopolitan)
Family Hydrobatidae, Small Petrels (Cosmopolitan)
„ Pelecanoididae, Diving Petrels (Cosmopolitan)
Order Pelecaniformes
Sub-order Phaëthontes
Family Phaëthontidae, Tropic-birds (tropical)
Sub-order Pelecani
Super-family Pelecanides
Family Pelecanidae, Pelicans (Tropics, sub-Tropics and warm temperate)
Family Cyphornithidae, *Cyphornis, Palaeochenoides* (fossil)
Super-family Sulides
Family Pelagornithidae, *Pelagornis* (fossil)
„ Sulidae, Boobies, Gannets (Cosmopolitan)
„ Phalacrocoracidae, Cormorants (Cosmopolitan)
„ Anhingidae, Snake-Birds or darters (Tropics and sub-Tropics)
Sub-order Fregates
Family Fregatidae, Man-o'war Birds (Tropics and sub-Tropics)
Sub-order Odontopteryges
Family Odontopterygidae, *Odontopteryx* (fossil)
Order Ciconiiformes
Sub-order Ardeae
Family Ardeidae, Herons, Bitterns (Cosmopolitan)
„ Cochleariidae, Boat-billed Herons (S. America)
Sub-order Balaenicipites
Family Balaenicipitidae, Shoe-bills (Africa)
Sub-order Ciconiae
Super-family Scopides
Family Scopidae, Hammerheads (Africa)
Super-family Ciconiides
Family Ciconiidae, Storks, Jabirus (Cosmopolitan)
Super-family Threskiornithides
Family Threskiornithidae, Ibises, Spoonbills (Cosmopolitan)
Sub-order Phoenicopteri
Family Phoenicopteridae, Flamingos (temperate & tropical regions)
Order Anseriformes
Sub-order Anhimae
Family Anhimidae, Screamers (South America)
Sub-order Anseres
Family Anatidae, Ducks, Geese, Swans (Cosmopolitan)
Order Falconiformes
Sub-order Cathartae
Family Cathartidae, New World Vultures (America)
„ Teratornithidae, *Teratornis* (fossil)
Sub-order Falcones
Family Sagittariidae, Secretary-birds (Africa)
„ Accipitridae, Hawks, Old World Vultures, Harriers, Ospreys (Cosmopolitan)
Family Falconidae, Falcons, Caracaras (Cosmopolitan)
Order Galliformes
Sub-order Galli
Super-family Cracides
Family Megapodidae, Megapodes (Australian region)
„ Cracidae, Curassows, Guans, Chachalacas (Central & South America)
Super-family Phasianides
Family Tetraonidae, Grouse (Cosmopolitan)
Family Perdicidae, Quails (Old World)
„ Phasianidae, Pheasants, Peacocks, Common Fowl (Old World)
Family Numididae, Guinea-fowl (Africa)
„ Meleagridae, Turkeys (America)
Sub-order Opisthocomi
Family Opisthocomidae, Hoatzins (South America)
Order Gruiformes
Sub-order Mesoenatides
Family Mesoenatidae, Roatelos, Monias (Madagascar)
Sub-order Turnices
Family Turnicidae, Bustard-Quails (Old World)
„ Pedionomidae, Collared Hemipodes (Old World)
Sub-order Grues
Super-family Gruides
Family Gruidae, Cranes (Cosmopolitan except South America)
Family Aramidae, Limpkins (America)
„ Psophiidae, Trumpeters (South America)
Super-family Rallides
Family Rallidae, Rails, Coots, Gallinules (Cosmopolitan)
Sub-order Heliornithes
Family Heliornithidae, Sun-Grebes or fin-foots (Old World and South America)
Sub-order Rhynocheti
Family Rhynochetidae, Kagus (New Caledonia)
Sub-order Eurypygae
Family Eurypygidae, Sun-Bitterns (Central and South America)
Sub-order Phororhaci
Family Phororhacidae, *Phororhacos* (fossil)
Sub-order Cariamae
Family Hermosiornidae, *Hermosiornis* (fossil)
„ Cariamidae, Cariamas (South America)
Sub-order Otides
Family Otididae, Bustards (Old World)
Order Diatrymiformes
Family Diatrymidae, *Diatryma* (fossil)
Order Charadriiformes
Sub-order Charadrii
Super-family Jacanides
Family Jacanidae, Jaçanas (Tropics)
Super-family Charadriides
Family Haematopodidae, Oyster-catchers (Cosmopolitan)
Family Charadriidae, Plovers, Lapwings, Turnstones, Surf-birds (Cosmopolitan)
Family Scolopacidae, Snipe, Woodcock, Sandpipers (Cosmopolitan)
Family Recurvirostridae, Avocets, Stilts (Cosmopolitan)
Family Presbyornithidae, *Presbyornis* (fossil)
„ Phalaropodidae, Phalaropes (Northern hemisphere)
Super-family Dromades
Family Dromadidae, Crab-plovers (India, Arabia and East Africa)
Super-family Oedicnemides
Family Oedicnemidae, Thick-knees (Cosmopolitan)
Super-family Glareolides
Family Glareolidae, Pratincoles, Coursers (Old World)
Super-family Thinocorides
Family Thinocoridae, Seed-snipe (Tropics)
Super-family Chionides
Family Chionidae, Sheath-bills (Southern hemisphere)
Sub-order Lari
Family Stercorariidae, Skuas, Jaegers (Cosmopolitan)
„ Laridae, Gulls, Terns (Cosmopolitan)
„ Rynchopidae, Skimmers (America, Africa and South Asia)
Sub-order Alcae
Family Alcidae, Auks, Auklets, Murres, Guillemots (North temperate and Arctic)
Order Columbiformes
Sub-order Pterocletes
Family Pteroclidae, Sand-Grouse (Old World)
Sub-order Columbae
Family Raphidae, Dodo, Solitaire (Mauritius, Réunion, Rodriguez)
Family Columbidae, Pigeons, Doves (Cosmopolitan)
Order Cuculiformes
Sub-order Musophagi
Family Musophagidae, Plantain-eaters (Africa)
Sub-order Cuculi
Family Cuculidae, Cuckoos, Road-runners, Anis (Cosmopolitan)

Order Psittaciformes
- Family Loriidae, Lories (Australian region)
- „ Psittacidae, Parrots, Macaws (Tropics & sub-Tropics)

Order Strigiformes
- Family Tytonidae, Barn-owls (Cosmopolitan)
- „ Strigidae, Owls (Cosmopolitan)

Order Caprimulgiformes
- Sub-order Steatornithes
  - Family Steatornithidae, Oil-birds (South America)
- Sub-order Caprimulgi
  - Family Podargidae, Frogmouths (India and Australia)
  - „ Nyctibiidae, Potoos (Old World Tropics)
  - „ Aegothelidae, Owlet-Frogmouths (Old World Tropics)
  - Family Caprimulgidae, Nightjars, Night-hawks, Whip-poorwills (Cosmopolitan, except east Pacific)

Order Micropodiformes
- Sub-order Micropodii
  - Family Micropodidae, Swifts (Cosmopolitan)
  - „ Macropterygidae, Crested Swifts (Asia)
- Sub-order Trochili
  - Family Trochilidae, Hummingbirds (America)

Order Coliiformes
- Family Coliidae, Colies (Africa)

Order Trogoniformes
- Family Trogonidae, Trogons (Tropics)

Order Coraciiformes
- Sub-order Alcedines
  - Super-family Alcedinides
    - Family Alcedinidae, Kingfishers (Cosmopolitan)
  - Super-family Todides
    - Family Todidae, Todies (West Indies)
  - Super-family Momotides
    - Family Momotidae, Motmots (Central and South America)
- Sub-order Meropes
  - Family Meropidae, Bee-eaters (Old World)
- Sub-order Coracii
  - Family Coraciidae, Rollers (Old World)
  - „ Leptosomatidae, Ground-rollers (Madagascar)
  - „ Upupidae, Hoopoes (Old World)
  - „ Phoeniculidae, Wood-hoopoes (Africa)
- Sub-order Bucerotes
  - Family Bucerotidae, Hornbills (Old World Tropics)

Order Piciformes
- Sub-order Galbulae
  - Super-family Galbulides
    - Family Galbulidae, Jacamars (Central and South America)
    - Family Bucconidae, Puff-birds (Central & South America)
  - Super-family Capitonides
    - Family Capitonidae, Barbets (Tropics)
    - „ Indicatoridae, Honey-guides (Old World)
  - Super-family Rhamphastides
    - Family Rhamphastidae, Toucans (Central and South America)
- Sub-order Pici
  - Family Picidae, Woodpeckers, Piculets (Cosmopolitan, except Madagascar and Australia)

Order Passeriformes
- Sub-order Eurylaimi
  - Family Eurylaimidae, Broadbills (Indo-Malaya)
- Sub-order Tyranni
  - Super-family Furnariides
    - Family Dendrocolaptidae, Wood-hewers (South America)
    - Family Furnariidae, Ovenbirds (America)
    - „ Formicariidae, Ant-thrushes (Central and South America)
    - Family Conopophagidae, Ant-pipits (South America)
    - „ Rhinocryptidae, Tapaculos (Central and South America)
  - Super-family Tyrannides
    - Family Cotingidae, Cotingas (America)
    - „ Pipridae, Manakins (Central and South America)
    - Family Tyrannidae, New World Flycatchers (America)
    - „ Oxyruncidae, Sharp-bills (Central and South America)
    - Family Phytotomidae, Plant-cutters (South America)
    - „ Pittidae, Pittas (Old World Tropics)
    - „ Xenicidae, New Zealand Wrens (New Zealand)
    - „ Philepittidae, Asities or Wattled Ant-thrushes (Madagascar)
- Sub-order Menurae
  - Family Menuridae, Lyre-birds (Australia)
  - „ Atrichornithidae, Scrub-birds (Australia)
- Sub-order Oscines
  - Family Alaudidae, Larks (Cosmopolitan, one genus in America)
  - Family Palaeospizidae, *Palaeospiza* (fossil)
  - „ Hirundinidae, Swallows, Martins (Cosmopolitan)
  - Family Campephagidae, Cuckoo-shrikes (Old World)
  - „ Dicruridae, Drongos (Old World Tropics)
  - „ Oriolidae, Old World Orioles (Old World)
  - „ Corvidae, Crows, Magpies, Jays (Cosmopolitan)
  - Family Ptilinorhynchidae, Bower-birds (Australian region)
  - Family Paradiseidae, Birds of Paradise (Australian region)
  - Family Paridae, Titmice (Europe, Asia, Africa, North America)
  - Family Sittidae, Nuthatches (Northern hemisphere, Australia, Madagascar)
  - Family Hypositttidae, Coral-billed Nuthatches (Madagascar)
  - Family Certhiidae, Creepers (Europe, Asia, North America, Australia)
  - Family Chamaeidae, Wren-tits (Oregon and California)
  - „ Timeliidae, Babbling Thrushes (Old World)
  - „ Pycnonotidae, Bulbuls (Old World)
  - „ Cinclidae, Dippers (Northern hemisphere)
  - „ Troglodytidae, Wrens (Cosmopolitan, except Africa and Australia)
  - Family Mimidae, Thrashers, Mockingbirds (America)
  - „ Turdidae, Thrushes (Cosmopolitan)
  - „ Zeledoniidae, Wren-thrushes (Central America)
  - „ Paramythiidae, *Paramythia* (New Guinea)
  - „ Sylviidae, Old World Warblers (Old World)
  - „ Regulidae, Kinglets, Gold-crests (Northern hemisphere)
  - Family Muscicapidae, Old World Flycatchers (Old World)
  - Family Motacillidae, Wagtails, Pipits (Cosmopolitan)
  - „ Enicuridae, Fork-tails (Indo-Malaya)
  - „ Bombycillidae, Waxwings (mainly northern hemisphere)
  - Family Ptilogonatidae, Silky Flycatchers (Tropical America)
  - Family Dulidae, Palm-chats (West Indies)
  - „ Artamidae, Wood-swallows (Africa, India, Australia)
  - Family Vangidae, Vanga Shrikes (Madagascar)
  - „ Laniidae, Shrikes (Cosmopolitan except South America)
  - Family Prionopidae, Wood-shrikes (Old World Tropics)
  - Family Aërocharidae, Helmet-birds (Madagascar)
  - „ Cyclarhidae, Pepper-shrikes (Central and South America)
  - Family Vireolaniidae, Shrike-vireos (Central and Northern South America)
  - Family Sturnidae, Starlings (Old World)
  - „ Graculidae, Glossy Starlings (Old World)
  - „ Meliphagidae, Honey-eaters (Australian region)
  - „ Nectariniidae, Sun-birds (Africa, Asia, Australia)
  - Family Dicaeidae, Flower-peckers (West Africa, Indo-Malaya, Australia)
  - Family Zosteropidae, White-eyes (Africa, Asia, Australasia)
  - Family Vireonidae, Vireos (America)
  - „ Coerebidae, Honey-creepers (Tropical America)
  - Family Drepanididae, Hawaiian Honey-creepers (Hawaiian Islands)
  - Family Mniotiltidae, Wood Warblers (America)
  - „ Ploceidae, Weaver-finches (Africa, South Asia, Australia)
  - Family Icteridae, New World Blackbirds, Troupials (America)
  - Family Procniatidae, Swallow-Tanagers (America)
  - „ Thraupidae, Tanagers (America)
  - Family Catamblyrhynchidae, Plush-capped Finches (Northern Andes)
  - Family Fringillidae, Grosbeaks, Finches, Buntings (Cosmopolitan)

[Fossil Families of uncertain Systematic position]
- Enaliornithidae, *Enaliornis*
- Gastornithidae, *Gastornis*
- Opisthodactylidae, *Opisthodactylus*

*See* BIRD, BIRD SANCTUARIES, PROTECTION OF BIRDS, NATURE RESERVES, VERTEBRATE EMBRYOLOGY, VERTEBRATA, REPTILES.

BIBLIOGRAPHY.—The literature of ornithology is extensive and important, and works on birds appear in increasing numbers annually. The following list of books is intended merely to indicate a few useful works for consultation from which general information may be obtained, and which will assist the student by references to other works. The titles are grouped for convenience under several headings.

General: G. M. Allen, *Birds and their Attributes* (Boston, Mass., 1925), a readable and accurate general account of birds as a group; G. Heilmann, *The Origin of Birds* (London, 1926), a discussion of fossil birds and their relations to reptiles; F. H. Knowlton, *Birds of the World* (New York, 1909), a popular and authentic account of the principal species; A. Newton, *A Dictionary of Birds* (London, 1893–96), a vast amount of information arranged in encyclopaedic form; W. P. Pycraft, *A History of Birds* (London, 1910), a general account of the biology and evolution of birds; J. A. Thomson, *The Biology of Birds* (London and New York, 1923), a modern account that considers broadly the entire subject.

Migration: A. L. Thomson, *Problems of Bird Migration* (London, 1926), a detailed discussion of migration; A. Wetmore, *The Migrations of Birds* (Cambridge, Mass., 1926), a summary of modern knowledge of migration in its broader aspects.

Manuals and Check Lists: Florence M. Bailey, *Handbook of Birds of the Western United States* (Boston, 1921), a manual for the identification and study of the birds of its region; E. C. Stuart Baker, *The Fauna of British India—Birds* (London, 1922, 4 vols. at present issued), a systematic account; F. M. Chapman, *Birds of Eastern North America* (New York, 1912), a manual for the identification and study of the birds of its region; E. Hartert, *Die Vögel der palaarktischen Fauna* (Berlin, 1903), an authoritative manual of the birds of Europe and North Asia; F. W. Hutton and J. Drummond, *The Animals of New Zealand* (Christchurch, N.Z., 1905), includes an account of the bird life of the Dominion; K. Lambrecht, *Fossilium Catalogus, I., Animalia, Aves* (Berlin, 1921), a list of known fossil birds; G. M. Mathews, *Systema Avium Australasianum* (London, 1927, one part issued, another in preparation), a list of names, with ranges of the birds of the South Pacific islands, including Australia; C. A. Reed, *Land Birds East of the Rockies; Water Birds East of the Rockies; Land Birds West of the Rockies* (Nat. Assoc. of Audubon Soc., New York), three booklets for easy identification of birds in the field by coloured illustrations; W. L. Sclater, *Systema Avium Ethiopicarum* (London, 1924, one part issued, another in preparation), a list of names, with ranges of the birds of Africa; H. F. Witherby (editor), *A Practical Handbook of British Birds* (London, 1920–24), a complete manual for its region; American Ornithologists Union, *Check-list of North American Birds* (Philadelphia, 19– ) the official list for America north of Mexico; British Ornithological Union, *List of British Birds* (London, 1915), the official list for the British Isles; Royal Australasian Ornithologists' Union, *Official Check-list of the Birds of Australia* (Melbourne, 1912, and thence quarterly), a list of names with ranges of Australian birds.

Economic Papers: Walter E. Collinge, *The Food of some British Wild Birds* (2nd ed. 1929), studies of the food of certain British birds; J. Henderson, *The Practical Value of Birds* (New York, 1927), general review of economic status, with extended bibliography; Biological Survey, U.S. Dept. of Agriculture, many *Bulletins* by Judd, Beal, McAtee, Fisher, Kalmbach, Wetmore and others, beginning in 1892 and forming the most comprehensive series of reports on this subject.

Periodicals: American Ornithologists' Union, *The Auk* (Washington, D.C.), published quarterly, with articles of current, general and scientific interest, particularly relating to the New World, and with a *résumé* of current literature; British Ornithologists' Union, *The Ibis* (London), quarterly, articles of general and scientific interest, particularly of the Old World, review of current literature; Avicultural Society, *The Avicultural Magazine* (London), monthly, deals with problems of aviculture; American Museum of Natural History, *Bird Lore* (New York), bi-monthly, devoted to popular ornithology and bird protection; H. F. and G. Witherby, *British Birds* (London), monthly, a popular magazine on current ornithology in the British Isles; Cooper Ornithological Club, *The Condor* (Berkeley, Calif.), bi-monthly, devoted particularly to birds of western North America; Royal Australasian Ornithologists' Union, *The Emu* (Melbourne), to promote the interest of ornithology in Australia and adjacent regions; Sociedad Ornithologica del Plata, *El Hornera* (Buenos Aires), deals with current ornithological studies in the Argentine and adjacent countries; Deutsche Ornithologische Gesellschaft, *Journal für Ornithologie* (Berlin), for general and technical ornithological articles. (A. WT.)

## ECONOMIC ORNITHOLOGY

Economic ornithology deals with the study of birds in their relation to man and his various activities, such as agriculture, forestry, trade, sport, etc., or in other words "it is the practical application of the knowledge of birds to the affairs of everyday life." It is a difficult and intricate study and of the greatest importance to mankind.

The scientific study of wild birds from an economic standpoint may be said to date from the publication of a paper by Prevost in 1858, and one by Jenks in 1859. Since then, thanks largely to the workers in the United States Department of Agriculture (Bureau of Biological Survey), great progress has been made and numerous intensive studies undertaken. As a result it is now almost universally admitted, with very few exceptions, that the wholesale destruction of wild birds as a means of protecting crops, etc., is, economically, an unsound policy. A bird which does a considerable amount of harm at a particular season of the year may more than compensate for it by the nature of the food consumed at another season, and in a like manner a bird which is injurious in one district may be beneficial in another. It must ever be borne in mind that, as a rule, insect-eating birds feed upon those species of insects that are the easiest to obtain, and that the variation in a bird's diet depends to a very large extent upon the abundance of the supply and the ease with which it may be obtained. Moreover, where destructive irruptions of insect life occur and wild birds concentrate on one particular species of insect, no especial chance is given for the rise of new fluctuations amongst the commoner species eaten, for the species which is unusually numerous is so widely distributed amongst the ordinary food elements. The more numerous insectivorous birds are, both in species and numbers, the fewer and shorter the insect oscillations are likely to be.

**The Amount of Food Consumed by Birds.**—As a class birds are distinctly beneficial, and experience shows that it is possible to learn with very considerable precision the exact amounts of the different kinds of food that each species requires in a year. This precision is attained by measuring the percentage volumes of the different items of food found in the stomach, crop, etc., during the various months of the year, from a large series of specimens obtained from different localities. This volumetric method, or the expression of the contents in terms of bulk, is much more exact than any numerical count of the different food items, and enables the investigator not only to express himself in exact quantities, but to compare one bird's diet with another; further, it admits of the stating of the definite ratios each element bears to the other. Every bird requires a certain bulk of food per day, not a certain number of insects, seeds, etc., and to estimate correctly the importance of any item in its diet it is necessary to know what proportion the insects, seeds, etc., bear to the standard requirements, and to do so it is necessary to use some method of measurement. Take the case of the skylark. This bird requires about 6 lb. of food per year; in other words 10,000 larks would require about 27 tons of food in a year. Knowing the percentages of food eaten by this species, it is possible to analyse this figure. Of the total bulk of food consumed in a year 35·5% consists of injurious insects, 3·5% of neutral insects, 2·5% of beneficial insects, 9·5% of grain, 1% of leaves, 2% of earthworms, 1% of slugs, 1·5% of miscellaneous animal matter, and 43·5% of weed seeds. In other words, the lark benefits the farmer in regard to 36·5% of its food eaten, is neutral in respect of 50·5%, and injurious only in respect of 13%. If the debit and credit account is further examined it shows on the former side a loss of 2½ tons of cereals, and on the latter something like 30,000,000 injurious insects and 30,000 slugs. Such a plague of insects left to themselves would have destroyed many more tons of cereals, root crops, etc. Thus the farmer is undoubtedly the gainer from the activities of this bird by an enormous tonnage of produce.

**The Effects of Fluctuations in the Number of Birds.**—It is now fully recognized that wherever the insect-feeding birds of a district or of districts are destroyed, either wantonly or through climatic and other causes, there is an accompanying insect oscillation which is not reduced until the balance of bird life is restored. In the case of many insects whose numbers remain relatively constant, the controlling influence is largely, if not entirely, due to the uniformity of the bird life which prevails from year to year. Any factor, therefore, that tends to modify or upset the restraining influences of wild birds in their relationship to injurious insects is distinctly detrimental. In a like manner, where raptorial birds and owls are destroyed, farm vermin, such as rats, voles and mice, rapidly increase in numbers.

Some species of wild birds are injurious because they are too numerous, and as a result there are too many birds feeding upon

the same kind of food in a given area, in consequence of which certain species supplement their diet by feeding upon cultivated crops. No better instance of this can be found than the European house sparrow. It has been estimated that in Great Britain alone the losses due to this species reach the incredible figure of £8,000,000 per annum. Wherever it has been introduced it has increased and spread with startling rapidity, and proved an enemy to the cultivator. Injury to crops invariably proceeds from an excessive number of individuals rather than from the natural habits of the species. Once any species exceeds what may be described as its high-water mark of abundance, its food habits change and it becomes a source of danger to mankind. The failure of a normal source of food supply occasionally leads birds to injure crops which under ordinary conditions they seldom attack. Many fluctuations in number are either only local or temporary, and if not interfered with will adjust themselves.

The contention that insectivorous birds do more harm than good by attacking beneficial insects and parasitized caterpillars does not appear to be well founded. Similarly those species which feed largely upon the seeds of weeds have been regarded as beneficial, but it is now known that many of these species act as distributors of the seeds. In any economic consideration of such birds it is perhaps best to regard such activities as neutral, but on this point considerable diversity of opinion exists.

**The Food of Nestlings.**—No consideration of the economic status of wild birds can be complete without a reference to the food of the young birds in the nest. During the first few days of life nestlings consume daily considerably more than their own weight of food and add 20 to 50% to their weight. From sunrise to sunset feeding continues, 200 to 300 visits being paid to the nest by the parent birds. With the exception of doves and pigeons, and aquatic and raptorial species, the food brought to the young consists of caterpillars, soft-bodied insects, spiders, worms and slugs. Moreover, during the whole of the nesting period the parent birds are feeding upon food similar to that fed to the young. "Few people," states H. C. Bryant, "have any realization of the great quantities consumed by birds. For instance, if we consider that there is an average of one meadow lark to every two acres of available land for cultivation (11,000,000ac.) in the Sacramento and San Joaquin valleys, and that each pair of birds raises an average of four young, each one of which averages one ounce in weight while in the nest, and consumes half of its own weight of food each day, it takes over 343½ tons of insect food each day to feed the young birds in the great valleys alone."

It is difficult to bring home to the mind by an expression of figures the millions of caterpillars, grubs, flies, beetles, etc., that birds consume. Careful investigations have shown that the British song thrush during the breeding season, April to June, consumes on an average 10,080 caterpillars, flies, grubs, etc., per month; assuming that there are 100,000 of these birds in the British Isles, they would account for 3,024,000,000 insects, etc., weighing upwards of 520 tons. Such a number are capable of destroying in three months upwards of 65,000 tons of produce, and assuming that this was worth £5 per ton, the activities of the thrushes would result in a saving of £325,000. Other species are equally beneficial, so that these figures might be multiplied by 20 or 30, thus showing a saving of produce every spring approaching ten millions sterling.

To summarize:—"A careful examination of the circumstances in which birds have done harm leads to the belief that the damage is usually caused by an abnormal abundance of a species within a limited territory. In such cases so great is the demand for food that the natural supply is exhausted and the birds attack some of the products of garden or orchard.

"Economically considered, birds are simply natural forces, and it should be our purpose to ascertain how they may be turned to our greatest advantage. The best economic conditions are probably fulfilled when birds are numerous as species and moderately abundant as individuals. Under such conditions there will be a demand for food of many kinds, without excessive demand for any one kind. The most desirable status would seem to be such a relation of numbers and species between birds and insects that the birds would find plenty of food without preying on useful products, while the insects would be held in such check that they would neither increase to a harmful extent nor be completely exterminated. The proper course to pursue, apparently, is to study the food habits of both birds and insects, to favour the increase of species which seem best adapted to preserve the proper balance, and to reduce the numbers of those that prey too greatly on the products of orchard or farm."—(F. E. L. Beal.)

## COMMERCIAL USES

**Game.**—Commercially, birds are utilized in various ways. Some are used as food, others are valued for their plumage and others for their guano.

Most game-birds are beneficial to agriculture. While accurate statistics are difficult to obtain, there is a larger consumption of such birds to-day than ever, and most nations have enacted special laws for their preservation. When and where such laws do not exist the danger of extermination is very great. In practically all cases the preservation of game-birds has, economically, proved of great value.

**Eggs.**—The eggs of various species of wild birds are highly esteemed as food, and large quantities are annually gathered, but here again there is the same tendency toward extermination unless the gatherings are limited, or close seasons instituted.

**Feathers.**—The feathers of birds are commercially of considerable value apart altogether from the demand of the millinery trade. There is a large trade carried on for upholstery purposes in which the feathers of gulls, guillemots, puffins, ducks and the domestic fowl are utilized. The soft feathers or down of the eider-duck are preferred to all others owing to their superior warmth, lightness and elasticity. Large quantities are imported from Iceland, Greenland and the Faeroe islands. The great mercantile value of the plumes of the ostrich has led to the establishment of ostrich farms, which yield considerable profits.

What is known as the plumage trade, *i.e.*, the trade in birds' feathers for millinery purposes, has, quite apart from many very repulsive aspects, led to more wanton destruction of certain species of birds than all other causes combined. The almost complete extinction of the egrets in the United States and the appalling destruction of birds of paradise, gulls, terns, grebes, tanagers, orioles, bluebirds and numerous other small birds was a blot on present-day civilization. Restrictive measures have been, or are being, taken in many countries.

**Guano.**—Prior to the introduction of artificial manures, guano from the various islands of the Pacific ocean was greatly sought after. Although utilized by the Peruvians over three centuries ago, it was not until the middle of the 19th century that it assumed any importance as an article of commerce. So great was the demand that the better qualities were soon exhausted, and the poorer ones proved unprofitable when compared with the better artificial fertilizers. Small quantities are still collected. Schemes for protection and conservation of the birds and their product have, however, now been introduced.

**Legislation.**—In the absence, until recent years, of really comprehensive and reliable statistics with reference to the precise economic status of the different species of wild birds, it is not surprising that the various acts and orders relating to the preservation or destruction of wild birds have proved largely abortive. Many of these have been ill-considered and often hastily prepared, others have been largely selfish in nature, while the advocates of uniform protection have indirectly contributed to the wanton destruction of many useful birds. What would be the probable ultimate effect of such legislation was never seriously considered at the time.

In some countries the principles on which legislation has been based are, that all wild birds are the property of the State, hence that without permission no one has a right to destroy them; the State has the right to impose restrictions and birds may be captured, killed, possessed, etc., only under such conditions as the State enacts; in a like manner landowners can only kill or capture as a privilege and according as the law specifically grants.

International co-operation in Europe as regards the protection

of wild birds has proved difficult, so many and diverse are the interests of the different countries. Valuable work has, however, been done by the International Ornithological Congresses and other organizations. An international committee was founded in London in 1922, and the International Treaty of 1916 between Great Britain and the United States of America for the protection of migratory birds constitutes one of the most important and far-reaching measures in the history of wild bird protection.

The immediate need of the present is for (1) wide and comprehensive measures that will ensure protection to all non-injurious and beneficial wild birds, and provide adequate repressive measures for those species which have, or do, become too numerous and destructive: (2) the establishment of an ornithological bureau, which would have full control of all matters relating to wild birds, including game-birds. Such an organization should be the sole authority for framing new laws or making special local orders, and for granting licences to persons to collect birds or their eggs for scientific or other purposes, or to destroy birds which the bureau considers to be injurious. Such a bureau would of course be in close touch with other similar bodies, so that international action could be taken where desirable. (*See* EGG; FEATHER.)

BIBLIOGRAPHY.—S. A. Forbes, Papers in *Trans. Ill. State Hort. Soc.* and *Ill. State Laboratory* (1879–1908); W. B. Barrows, A. K. Fisher, H. W. Henshaw, S. D. Judd, E. R. Kalmbach, W. L. McAtee, H. C. Oberholser T. S. Palmer, etc., *Publications of U.S. Dept. of Agric., Bulletins of Biol. Bureau, Farmers' Bulletins,* Year Books, etc.(1887 *et seq.*); E. D. Forbush, *Useful Birds and their Protection* (Mass. State Board of Agric., Boston, 3rd ed., 1908); C. M. Weed and N. Dearborn, *Birds in their Relations to Man* (3rd ed., London and Philadelphia, 1924), a popular manual for U.S. and Canada; W. E. Collinge, *The Food of Some British Wild Birds* (2nd ed., York, 1924–27), a comprehensive manual in nine parts, for Great Britain, with full bibl. containing detailed references to U.S. publications mentioned above. (W. E. C.)

**ORNITHOPTER,** a flying machine with flapping wings operated either mechanically or manually. The type is of historic interest only, and represents man's attempt to imitate the flight of birds. (*See* FLIGHT.)

**ORODES,** the name of two Parthian kings. Orodes I. reigned about 57–37 B.C., succeeding his father, Phraates III. whom, in conjunction with his brother, Mithradates III., he had murdered. He was in turn murdered by his son and successor, Phraates IV. Orodes II. succeeded Phraates V. about A.D. 5 and within two years was murdered on account of his cruelty. (Joseph. Ant., xviii., 2, 4.) *See* PARTHIA: PHRAATES.

**ORONTES,** the ancient name of the chief river of Syria, also called Draco, Typhon, Axius, the last name being probably the name whence has sprung the modern name El-'Āsī (rebel). Taking its rise on the east side of the Beka', it flows northwards expanding into the lake of Homs, and in the plain of Antioch, it is joined by two tributaries, the Afrīn and Kara-su. It reaches the sea near the small port of Suedia (Seleucia Pieriae). In its 170m. course it is mainly unnavigable and of small value for irrigation. Its valley, however, has served as a highway for armies and trade between Egypt and Palestine, and Asia Minor.

**OROPUS,** an ancient Greek seaport on the Euripus which, falling finally to Athens, remained an Attic town under the Roman empire. The oracle of Amphiarus was here. *See* ALTAR.

**OROSIUS, PAULUS** (*fl.* 415), historian and theologian, was born in Spain (possibly at Braga in Galicia) towards the close of the 4th century. Having entered the Christian priesthood, he naturally took an interest in the Priscillianist controversy then going on in his native country, and it may have been in connection with this that he went to consult Augustine at Hippo in 413 or 414. After staying for some time in Africa as the disciple of Augustine, he was sent by him in 415 to Palestine with a letter of introduction to Jerome, then at Bethlehem, the result of his arrival being that John, bishop of Jerusalem, was induced to summon at his capital in June 415 a synod at which Orosius communicated the decisions of Carthage and read such of Augustine's writings against Pelagius as had at that time appeared.

Success, however, was scarcely to be hoped for amongst Orientals who did not understand Latin, and whose sense of reverence was unshocked by the question of Pelagius, *et quis est mihi Augustinus?* All that Orosius succeeded in obtaining was John's consent to send letters and deputies to Innocent of Rome; and, after having waited long enough to learn the unfavorable decision of the synod of Diospolis or Lydda in December of the same year, he returned to north Africa, where he is believed to have died.

The earliest work of Orosius, *Consultatio sive commonitorium ad Augustinum de errore Priscillianistarum et Origenistarum,* explains its object by its title; it was written soon after his arrival in Africa, and is usually printed in the works of Augustine along with the reply of the latter, *Contra Priscillianistas et Origenistas liber ad Orosium.* His next treatise, *Liber apologeticus de arbitrii libertate,* was written during his stay in Palestine, and in connection with the controversy which engaged him there. It is a keen but not always fair criticism of the Pelagian position from that of Augustine. The *Historiae adversum Paganos* was undertaken at the suggestion of Augustine, to whom it is dedicated.

Nearly two hundred mss. of the Historiae have survived. A free abridged translation by King Alfred is still extant. The *editio princeps* of the original appeared at Augsburg (1471), and has been superseded by C. Zangemeister, who has edited the *Hist.* and also the *Lib. apol.* Besides the Old and New Testaments, Orosius appears to have consulted Caesar, Livy, Justin, Tacitus, Suetonius, Florus and a cosmography, attaching also great value to Jerome's translation of the *Chronicles* of Eusebius.

**ORPEN, SIR WILLIAM NEWENHAM MONTAGUE** (1878–1931), British painter, was born at Stillorgan, co. Dublin, on Nov. 27, 1878, and studied at the Dublin Metropolitan school of Art and at the Slade school, London. He was elected A.R.A. in 1910 and R.A. in 1919. He first exhibited at the New English Art club, of which he became a member in 1900, his early work being marked by preoccupation with spacing and silhouette and the use of quiet harmonies of grey and brown, with a note of vivid red or blue. He soon turned to the use of bright colour and the study of light, seen in a series of brilliant portrait interiors such as the "Hon. Percy Wyndham" (1907), "Myself and Venus" (1910, now in Pittsburgh gallery, U.S.A.). About this time he became well known for his vigorously characterised portraits. During the World War Orpen received an appointment as official artist and in 1918 an exhibition of his war pictures was held in London. Many of these are now in the Imperial War Museum. He was created K.B.E. in 1918. He wrote *An Onlooker in France* (1921) and *Stories of Old Ireland and Myself* (1924).

**ORPHEUS.** The legendary founder of the cult known as Orphism, ὁ Ὀρφικὸς βίος. The derivation of the name is uncertain, possibly from the same root as ὄρφνη, signifying darkness. What original figure, human or divine, lies behind the legend, is unknown; it seems possible, however, that Orpheus is the name or title of Thraco-Phrygian priest-kings, who may have been regarded as incarnating the god Dionysus (*q.v.*) or some similar deity, and were perhaps killed by the worshippers of the god after a period of years (*see* Frazer, *Golden Bough,* 3rd ed. vi. 99).

**Legend.**—Orpheus was the son, in most accounts, of the Thracian king Oeagrus (sometimes of Apollo), and a Muse, generally Calliope, sometimes Polyhymnia. He took part in the Argonautic expedition (*see* ARGONAUTS), and there was an Orphic version of that exploit, preserved in a late form in the Orphic *Argonautica.* The best-known episode of his career is that of his marriage. His wife Eurydice was bitten by a serpent (while fleeing from Aristaeus, according to Virgil, *Georg.,* iv., 457; this detail is not found earlier, but the story itself is old and widespread; *see* Rose in *Aberystwyth Studies,* iv. p. 21). Orpheus, inconsolable at her death, went down to Hades to get her back. The infernal deities, softened by his music, allowed her to return, on condition that she should walk behind Orpheus and he should not look back. He broke this condition, and she became a ghost once more (Plato, *Sympos,* 179 D., seems to allude to a slightly different account). He now refused to have anything more to do with women, and consequently the Thracian women, during a Dionysiac orgy, set upon him and tore him to pieces. His head floated down the Hebrus and finally came ashore on Lesbos, where there was apparently an oracular shrine of Orpheus. The legend

may be founded on the practice of the *omophagia* (*see* DIONYSUS).

Orpheus is represented as a musician so marvellous that the wild beasts, and even trees and rivers, came to listen to him. He is also represented as a seer, a founder of mystic rites, particularly Dionysiac, a magician, and later as an astrologer also. Sometimes his adventures tend to be assimilated to the stock incidents in the career of a philosopher, for he is represented as travelling in search of knowledge (as Plato, for example, is said to have visited Egypt). Several writers speak of him as a sort of missionary of civilization (*e.g.*, Aristophanes, *Frogs*, 1032, Horace *A.P.*, 391). He is also the reputed author of a number of books, some dating from the time of Peisistratus of Athens (*cf.* ONOMACRITUS).

**The Orphic Doctrines and "Life".**—There was no Orphic Church but there existed a number of *thiasoi* (conventicles) of initiates into the Orphic mysteries, all having a similar doctrine and rules of life, but lacking any sort of central organization and probably having no common standard of orthodoxy. Orphic initiators (ὀρφεοτελεσταί) were numerous, and are spoken of with the utmost contempt by Plato and others. We hear of Orphism from about the 6th century on, and the doctrine, which seems to have grown out of a combination of the Thraco-Phrygian worship of Dionysus with certain religious speculations characteristic of that age, and probably resulting from the contact of Greece with the East, was in outline as follows. When Zagreus was devoured by the Titans (*see* DIONYSUS) and they were consumed by the thunderbolt, man sprung from their ashes. Hence man is partly divine (Zagreus), partly desperately wicked (the Titans). It is his chief end to get rid of the latter element, which is accomplished by a life of ritual and moral purity during the soul's incarnation in a series of bodies. When completely purified, it will be freed from the "circle of birth or becoming" (κύκλος τῆς γενέσεως) and be made fully divine. The rules of purity included abstinence from animal food of all kinds, avoidance of polluting actions, such as contact with death or birth, wearing of white garments and other ascetic practices. There were mysteries of some kind, at which we may conjecture that the death of Zagreus was enacted (*see* MYSTERY), also various Dionysiac practices, such as the *omophagia*. In some cases, at least, the Orphic dead were provided with extracts from the sacred writings of their sect, inscribed on gold tablets, containing directions for their conduct in the underworld. Several of these have been recovered (*see* next paragraph). The influence of Orphism on Pythagoreanism was very great, so much so that it is often impossible to separate the two, although one was primarily a religion, the other a system of philosophy.

**Orphic Literature.**—A great number of books existing in antiquity were ascribed to Orpheus, or his son Musaeus. This literature was well known to Pindar and Euripides, and exercised great influence, directly or through Pythagoreanism, on Plato, and probably on Socrates also (*see* A. E. Taylor, *Varia Socratica*). It is now lost save for (1) the gold tablets already mentioned, which clearly contain extracts from a poem dealing with the underworld, (2) a collection of hymns of late date, (3) *Lithica* (on the virtues of minerals) and the *Argonautica*, also late. There are, however, numerous quotations in writers of various dates, which together make up a large collection of fragments, some early and undoubtedly genuine Orphic, others much later, including palpable forgeries, showing Jewish and other foreign influence. A principal source for these is the controversialists, Christian and pagan, of the 3rd and 4th centuries A.D. Among editions may be mentioned E. Abel, *Orphica* (1885); O. Kern, *Orphicorum fragmenta* (1922). The former contains the hymns, *Lithica* and *Argonautica*.

BIBLIOGRAPHY.—C. A. Lobeck, *Aglaophamus* (1829); E. Rohde, *Psyche* (Eng. trans. W. B. Hillis, 1925), vol. ii.; E. W. Maas, *Orpheus* (1895); T. Gomperz, *Greek Thinkers* (Eng. trans. 1901), vol. i.; A. Dieterich, *Nekyia* (1913) (since reprinted with some additional notes). *See* also the larger works on mythology, as O. Gruppe, *Griechische Mythologie*, ii. (1906), and the relevant articles in Roscher's *Lexikon der Mythologie* and Daremberg-Saglio's *Dictionnaire des antiquités*.

On the representations of Orpheus in heathen and Christian art (in which he is finally transformed into the Good Shepherd with his sheep), *see* A. Baumeister, *Denkmäler des classischen Altertums*, ii. p. 1,120; P. Knapp, *Über Orpheusdarstellungen* (Tübingen, 1895); F. X. Kraus, *Realencyklopädie des christlichen Alterthums*, ii., (1886); J. A. Martigny, *Dictionnaire des antiquités chrétiennes* (1889); A. Heussner, *Die altchristlichen Orpheusdarstellungen* (Leipzig, 1893); R. Eisler, *Vorträge der Bibliothek Warburg 1922–23 ii. Teil*, (1925); and the articles in Roscher's and Daremberg and Saglio's Lexicons.

The story of Orpheus, as was to be expected of a legend told both by Ovid and Boethius, retained its popularity throughout the middle ages and was transformed into the likeness of a northern fairy tale. In English mediaeval literature it appears in three somewhat different versions: *Sir Orpheo*, a "lay of Brittany" printed from the Harleian ms. in J. Ritson's *Ancient English Metrical Romances*, vol. ii. (1802); *Orpheo and Heurodis* from the Auchinleck ms. in David Laing's *Select Remains of the Ancient Popular Poetry of Scotland* (new ed. 1885); and *Kyng Orfew* from the Ashmolean ms. in J. O. Halliwell's *Illustrations of Fairy Mythology* (Shakespeare Soc., 1842). The poems show traces of French influence.

**ORPIMENT,** an arsenic trisulphide. *See* ARSENIC.

**ORPINGTON,** a residential urban district (after 1934) of Kent, England, 13¾ mi. S.E. of London, on the S.R. Pop. (est. 1938) 46,320. Area 32.6 sq.mi. The church is Early English.

**ORRERY, CHARLES BOYLE,** 4th EARL OF (1676–1731), British author, soldier and statesman, the second son of Roger, 2nd earl, born at Chelsea, was educated at Christ Church, Oxford. He translated Plutarch's life of Lysander, and published an edition of the epistles of Phalaris, which engaged him in the famous controversy with Bentley. Orrery was imprisoned for a short time in 1721 on suspicion of being concerned in Layer's Jacobite plot. He died on Aug. 28, 1731. Among the works of Roger, earl of Orrery, will be found a comedy, entitled *As you find it*, written by Charles Boyle.

**ORRERY, ROGER BOYLE,** 1ST EARL OF (1621–79), British soldier, statesman and dramatist, 3rd surviving son of Richard Boyle, 1st earl of Cork, was born on April 25, 1621, created baron of Broghill on Feb. 28, 1627, and educated at Trinity college, Dublin, and, according to Wood, also at Oxford. He travelled in France and Italy, and coming home took part in the expedition against the Scots. He returned to Ireland on the outbreak of the rebellion in 1641 and fought with his brothers at the battle of Liscarrol in September 1642. On the resignation of the marquis of Ormonde, Lord Broghill consented to serve under the parliamentary commissioners till the execution of the king, when he retired from public life. He was engaged in royalist schemes, however, when Cromwell visited him, and, explaining that he knew all about his activities, offered him a chance of clearing himself by serving the Commonwealth in Ireland. He accepted, and served Cromwell faithfully throughout the Irish campaign.

Orrery was returned to Cromwell's parliaments of 1654 and 1656 as member for the county of Cork, and also in the latter assembly for Edinburgh, for which he elected to sit. He served that year as lord president of the council in Scotland; and when he returned to England he was included in the inner cabinet of Cromwell's council, and was nominated in 1657 a member of the new House of Lords. On Cromwell's death he gave his support to Richard; but as he saw no possibility of maintaining the government he left for Ireland, where by resuming his command in Munster he secured the island for Charles and anticipated Monk's overtures by inviting him to land at Cork. He sat for Arundel in the Convention and in the parliament of 1661, and at the Restoration was taken into great favour. On Sept. 5, 1660, he was created earl of Orrery. The same year he was appointed a lord justice of Ireland and drew up the act of Settlement. He continued to exercise his office as lord-president of Munster till 1668, when he resigned it on account of disputes with the duke of Ormonde, the lord-lieutenant. On Nov. 25 he was impeached by the House of Commons for "raising of money by his own authority upon his majesty's subjects," but the proceedings were interrupted by the prorogation of parliament and were not afterwards renewed. He died on Oct. 26, 1679.

In addition to Lord Orrery's achievements as a statesman and admin-

istrator, he gained some reputation as a writer and a dramatist. He was the author of *An Answer to a Scandalous Letter . . . A Full Discovery of the Treachery of the Irish Rebels* (1662), printed with the letter itself in his *State Letters* (1742), another answer to the same letter entitled *Irish Colours Displayed . . .* being also ascribed to him; *Parthenissa,* a novel (1654); *English Adventures by a Person of Honour* (1676), whence Otway drew his tragedy of the *Orphan; Treatise of the Art of War* (1677), a work of considerable historical value; poems, of little interest, including verses *On His Majesty's Happy Restoration* (unprinted), *On the Death of Abraham Cowley* (1677), *The Dream* (unprinted), *Poems on most of the Festivals of the Church* (1681); plays in verse, of some literary but no dramatic merit, of which *Henry V.* (1664), *Mustapha* (1665), *Tryphon* (acted 1668), *The Black Prince* (1669), *Herod the Great* (published 1694), and *Altemira* (1702) were tragedies, and *Guzman* (1669) and *Mr. Anthony* comedies. A collected edition was published in 1737, to which was added the comedy *As you find it. The General* is also attributed to him.

AUTHORITIES.—*State Letters of Roger Boyle, 1st Earl of Orrery,* ed. with his life by Th. Morrice (1742); *Add. mss.* (Brit. Mus.) 25,287 (letter-book when governor of Munster), and 32,095 *sqq.* 109–188 (letters); article in the *Dict. of Nat. Biog.* and authorities there collected; Wood's *Athenae Oxonienses,* iii. 1200; *Biographia Britannica* (Kippis); *Orrery Papers,* ed. by Lady Cork and Orrery (1903) (Preface); *Contemporary Hist. of Affairs in Ireland,* ed. by John T. Gilbert (1879–80); *Cal. of State Pap., Irish and Domestic.*

**ORRIS-ROOT** (apparently a corruption of "iris root"), the rhizomes or underground stems of three species of *Iris, I. germanica, I. florentina* and *I. pallida,* closely allied plants growing in subtropical and temperate latitudes, but principally identified with north Italy.

The three plants are indiscriminately cultivated in the neighbourhood of Florence as an agricultural product under the name of "ghiaggiuolo."

The rhizomes are in August dug up and freed of the rootlets and brown outer bark; they are then dried and packed in casks for sale. In drying they acquire a delicate but distinct odour of violets. It is principally powdered for use in dentifrices and other scented dry preparations.

**ORSHA** (Polish, Orsza), a town of the White Russian S.S.R., in 54° 34′ N., 30° 20′ E., on the Dnieper river, and at a junction on the Moscow-Warsaw railway. Pop. (1933) 32,200. It is an entrepôt for grain and timber and has iron works and a brewery. An electric plant was under construction in 1928. It is mentioned in the annals in 1067 as Rsha and was captured by the Lithuanians in the 13th century.

A Polish Jesuit college was founded here in 1604. During the 16th and 17th centuries it was several times besieged by the Russians, and finally annexed 1772.

**ORSINI,** the name of a Roman princely family of great antiquity. According to tradition the popes Paul I. (757) and Eugenius II. (824) were of the Orsini family, but the probable founder of the house was a certain Ursus (the Bear), about whom very little is known, and the first authentic Orsini pope was Giacinto Orsini, son of Petrus Bobo, who assumed the name of Celestin III. (1191). The latter endowed his nephews with church lands and founded the fortunes of the family, which alone of the Guelph houses was able to confront the Ghibelline Colonna. "Orsini for the church" was their war-cry in opposition to "Colonna for the people." In the 13th century the "Sons of the Bear" were already powerful and rich, and under Innocent III. they waged incessant war against other families, including that of the pope himself (Conti). In 1241 Matteo Orsini was elected senator of Rome, and sided with Pope Gregory IX. against the Colonna and the Emperor Frederick II., saving Rome for the Guelphic cause. In 1266 the family acquired Marino, and in 1277 Giovanni Orsini was elected pope as Nicholas III.

When Boniface VIII. proclaimed a crusade against the Colonna in 1297, the Orsini played a conspicuous part in the expedition and captured Nepi, which the pope granted them as a fief. On the death of Benedict XI. (1304) fierce civil warfare broke out in Rome and the Campagna for the election of his successor, and Cardinal Napoleone Orsini appears as the leader of the French faction at the conclave. The Campagna was laid waste by the feuds of the Orsini, the Colonna and the Caetani. At this time the Orsini held the castle of S. Angelo, and a number of palaces on the Monte Giordano, which formed a fortified and walled quarter. In 1332, during the absence of the popes at Avignon, the feuds between Orsini and Colonna, in which even Giovanni Orsini, although cardinal legate, took part, reduced Rome to a state of complete anarchy. The Orsini were again at war with the Colonna at the time of Rienzi. In 1435 Francesco Orsini was appointed prefect of Rome, and created duke of Gravina by Pope Eugenius IV. In 1484 war between the Orsini and the Colonna broke out once more, the former supporting the pope (Sixtus IV.). Virginio Orsini led his faction against the rival house's strongholds, which were stormed, the Colonna being defeated.

The Orsini fortunes waxed and waned many times, and their property was often confiscated, but they always remained a powerful family and gave many soldiers, statesmen and prelates to the church. The title of prince of Solofra was conferred on them in 1620, and that of prince of the Holy Roman empire in 1629. In 1724 Vincenzo Maria Orsini was elected pope (Benedict XIII.) and gave his family the title of Roman princes.

*See* F. Sansovino, *Storia di casa Orsina* (Venice, 1565); F. Gregorovius, *Geschichte der Stadt Rom* (Stuttgart, 1872); A. von Reumont, *Geschichte der Stadt Rom* (1868); *Almanach de Gotha.*

**ORSINI, FELICE** (1819–1858), Italian revolutionist, was born at Meldola in Romagna. He joined the Giovane Italia, a society founded by Giuseppe Mazzini. Implicated together with his father in revolutionary plots, he was arrested in 1844 and condemned to imprisonment for life. The new pope, Pius IX., released him, and he led a company of young Romagnols in the first war of Italian independence (1848). He was elected member of the Roman constituent assembly in 1849, and after the fall of the republic he conspired against the papal autocracy once more in the interest of the Mazzinian party. Mazzini sent him on a secret mission to Hungary, but he was arrested in 1854 and imprisoned at Mantua, escaping a few months later. His account of his prison experiences, *Austrian Dungeons in Italy* (1857), led to a rupture between him and Mazzini.

He then formed a plot to assassinate Napoleon III., whom he regarded as the principal obstacle to Italian independence. On the evening of Jan. 14, 1858, while the emperor and empress were on their way to the theatre, Orsini and his accomplices threw three bombs at the imperial carriage. The intended victims were unhurt, but several other persons were killed or wounded. Orsini was arrested; on Feb. 11, he wrote a letter to Napoleon, exhorting him to take up the cause of Italian freedom. He addressed another letter to the youth of Italy, stigmatizing political assassination. He was executed on March 13, 1858. Of his accomplices Pieri also was executed, Rudio was condemned to death but obtained a commutation of sentence, and Gomez was condemned to hard labour for life. Orsini's attempt terrified Napoleon, who may have been so induced to take up Italy's cause.

BIBLIOGRAPHY.—*Memoirs and Adventures of Felice Orsini written by himself* (Edinburgh, 1857, 2nd ed., edited by Ausonio Franchi, Turin, 1858); *Lettere edite e inedite di F. O.* (Milan, 1861); Enrico Montazio, *I contemporanei Italiani-Felice Orsini* (Turin, 1862); *La vérité sur Orsini, par un ancien proscrit* (1879); Angelo Arboit, *Tofin e la fuga di Felice Orsini* (Cagliari, 1893).

**ORTA, LAKE OF,** in north Italy, west of Lago Maggiore. Its southern end is about 22 m. by rail N.W. of Novara on the main Turin-Milan line, while its north end is about 4 m. by rail S. of the Gravellona-Toce railway station. It has an area of about 6¼ sq.m., it is about 8 m. in length, its greatest depth is 469 ft., and the surface is 951 ft. above sea-level, while its width varies from ½ to 1¼ m. The island of San Giulio (just west of the village of Orta) has a picturesque church. The chief place is Orta, on a peninsula projecting from the east shore of the lake, while Omegna is at its northern extremity. The lake is the remnant of a larger sheet of water by which the waters of the Toce flowed south towards Novara. As the glaciers retreated the waters flowing from them sank, and were gradually diverted into Lago Maggiore. This explains why no considerable stream feeds the Lake of Orta, while at its north end the Nigoglia torrent flows out of it, ultimately joining Lago Maggiore.

**ORTELIUS** (WORTELS), **ABRAHAM** (1527–1598), next to Mercator the greatest geographer of his age, was born at Antwerp on April 14, 1527, and died in the same city on July 4, 1598. He

was of German origin, his family coming from Augsburg. He travelled extensively in western Europe. Beginning as a map-engraver, he became a merchant, and most of his journeys before 1560 were for commercial purposes. In 1560, however, when travelling with Gerhard Kremer (*see* MERCATOR, GERARDUS), he became interested in scientific geography and began to prepare that atlas or *Theatre of the World* by which he became famous. In 1564 he completed a *mappemonde,* which afterwards appeared in the *Theatrum.* In 1570 (May 20) was issued, by Gilles Coppens de Diest at Antwerp, Ortelius' *Theatrum Orbis Terrarum,* the "first modern atlas" (of 53 maps). Many editions, Flemish, Latin and German, appeared in his lifetime. Most of the maps were admittedly reproductions (a list of 87 authors is given by Ortelius himself), and many discrepancies of delineation or nomenclature occur; but, taken as a whole, this atlas with its accompanying text was a monument of rare erudition and industry. In 1573 Ortelius published 17 supplementary maps under the title of *Additamentum Theatri Orbis Terrarum.*

In 1575 Ortelius was appointed geographer to the king of Spain, Philip II., on the recommendation of Arius Montanus, who vouched for his orthodoxy (his family, as early as 1535, had fallen under suspicion of Protestantism). Other important works are: *Synonymia geographica* (1578); *Nomenclator Ptolemaicus* (1584); his *Parergon* (a series of maps illustrating ancient history, sacred and secular), and his *Itinerarium per nonnullas Galliae Belgicae partes,* a record of a journey in Belgium and the Rhineland made in 1575; an edition of Caesar (*C. I. Caesaris omnia quae extant,* Leyden, Raphelingen, 1593), and the *Aurei saeculi imago, sive Germanorum veterum vita* (Philippe Galle, Antwerp, 1596). He also aided Welser in his edition of the Peutinger Table in 1598. His death and burial (in St. Michael's Abbey church) in 1598 were marked by public mourning.

*See* Emmanuel van Meteren, *Historia Belgica* (Amsterdam, 1670); General Wauwermans, *Histoire de l'école cartographique belge et anversoise* (Antwerp, 1895), and article "Ortelius" in *Biographie nationale* (Belgian), vol. xvi. (Brussels, 1901); J. H. Hessels, *Abrahami Ortelii epistulae* (Cambridge, England, 1887); Max Rooses, *Ortelius et Plantin* (1880); Génard, "Généalogie d'Ortelius," in the *Bulletin de la Soc. roy. de Géog. d'Anvers* (1880 and 1881).

**ORTHEZ,** a town of S.W. France, department of Basses-Pyrénées, 25 mi. N.W. of Pau on the Southern railway. Pop. (1936) 4,578.

At the end of the 12th century Orthez passed from the viscounts of Dax to the viscounts of Béarn, who resided there in the 13th century. Jeanne d'Albret founded a Calvinist university in the town and Theodore Beza taught there for some time. An envoy sent in 1569 by Charles IX. to revive the Catholic faith was besieged in Orthez which was taken by the Protestant captain, Gabriel, count of Montgomery. In 1684 Nicholas Foucault, intendant under Louis XIV., was more successful, as the inhabitants, ostensibly at least, renounced Protestantism, which however is still strong there. It stands on the right bank of the Gave de Pau here crossed by a 14th century bridge with four arches and surmounted by a central tower. The Tour de Moncade, a pentagonal tower of the 13th century, was once the keep of a castle of the viscounts of Béarn, and is now used as a meteorological observatory. The work of spinning and weaving cotton, especially of the fabric called *toile de Béarn,* the manufacture of paper and of leather, and the preparation of hams known as *jambons de Bayonne* and of other delicacies are carried on.

**ORTHOCLASE,** an important rock-forming mineral belonging to the felspar group (*see* FELSPAR). (Gr. *ὀρθός,* "right," and *κλᾶν,* "to break.") The mineral, so named by A. Breithaupt in 1823 in allusion to the right-angled intercleavage angle, has the composition $KAlSi_3O_8$ but commonly contains significant proportions of the corresponding $NaAlSi_3O_8$ compound in solid solution.

Included under orthoclase are the varieties known as adularia and sanidine, the former occurring in druses in granites and crystalline schists, the latter as glassy crystals enclosed in lavas and dike rocks. The apparent symmetry of orthoclase is that of a monoclinic crystal with the two prominent cleavages 001 and 010 at right angles. The crystals show considerable variety of habit, prismatic, as in adularia, elongated along the edge 001 : 010 as in crystals from the Baveno granite quarries, and tabular on the clinopinacoid as in sanidine. The simple Carlsbad type of twinning is exceedingly common.

Orthoclase melts incongruently at 1,170° C with formation of leucite (*q.v.*). As a primary mineral it is an essential constituent of many acidic igneous rocks, in granites, porphyries, syenites and trachytes, while the variety sanidine is practically wholly limited to surface lavas and associated dike rocks. It is common as a constituent of thermally altered argillaceous sediments but its place in the crystalline schists is usually taken by microcline (*q.v.*).

(C. E. T.)

**ORTHODONTIA,** a special department of dentistry concerned with the prevention and correction of irregular and of malposed teeth. Orthodontic treatment is usually effected by means of the spring force of delicate wires attached to the teeth. The earliest attempt in the literature at systematic treatment of orthodontia was by Fauchard in 1728. In 1836 Kneisel published a special work on the subject. Between these two it was variously treated by several writers in the field of mechanical dentistry (Bunon 1743; Bourdet 1757; Fox 1803; Delabarre 1819). At the beginning of the 20th century in America orthodontia emerged from the general field of mechanical dentistry as a recognized specialty. Its advent was heralded by the appearance of many "systems of regulating." These "systems" were marketable combinations of mechanical appliances designed to effect various movements of the teeth, and were identified by the names of their inventors (Angle, Case, Jackson *et al*). While this period of the exploitation of apparatus undoubtedly was a great stimulus to the development of technique, the literature which it evoked took the form of personal opinion rather than the presentation of scientific evidence. Expert technicians soon demonstrated the limitations of the mechanical conception of the subject whereupon interest centred in its biological aspect. Since then the results of treatment have been more satisfactory. Great advances have been made in America where specialization is more common while the conservative influence of the dental profession in Great Britain and European countries has acted as a stabilizing force in its growth. The condition of irregular and malposed teeth, *i.e.,* malocclusion, may be caused by bad diet in both its chemical and physical aspects (Howe, McCollum, Mellanby). Habits of infancy and childhood as thumb-sucking, tongue-biting and mouth-breathing, and mutilations from trauma and disease are also important causes. In fact any abnormal function in or about the mouth when persisted in may result in irregular and malposed teeth.

(A. L. J.)

**ORTHODOX EASTERN CHURCH** (frequently spoken of as "the Greek Church," and described officially as "The Holy Orthodox Catholic Apostolic Eastern Church"), the historical representative of the churches of the ancient East. It consists of (*a*) those churches which accepted all the decrees of the first seven general councils, and have remained in full communion with one another, (*b*) such churches as derived their origin from these by missionary activity, or by abscission without loss of communion.

**Origins of the Greek or Eastern Church.**—Christianity arose in the East, and Greek was the language of the Scriptures and early services of the church, but when Latin Christianity established itself in Europe and Africa, and when the old Roman empire fell in two, and the eastern half became separate in government, interests and ideas from the western, the term Greek or Eastern Church acquired gradually a fixed meaning. It denoted the church which included the patriarchates of Antioch, Alexandria, Jerusalem and Constantinople, and their dependencies. The ecclesiastical division of the early church, at least within the empire, was based upon the civil. Constantine introduced a new partition of the empire into dioceses, and the church adopted a similar division. The bishop of the chief city in each diocese naturally rose to a pre-eminence, and was commonly called *exarch* —a title borrowed from the civil jurisdiction. In process of time the common title *patriarch* was restricted to the most eminent of these exarchs, and councils decided who were worthy of the dignity. The council of Nicaea recognized three patriarchs—the bishops of Rome, Alexandria and Antioch. To these were after-

wards added the bishops of Constantinople and Jerusalem.

When the empire was divided, there was one patriarch in the West, the bishop of Rome, while in the East there were at first two, then four and latterly five. This geographical fact has had a great deal to do in determining the character of the Eastern Church. It is not a despotic monarchy governed from one centre and by a monarch in whom plenitude of power resides. It is an oligarchy of patriarchs. It is based, of course, on the great body of bishops; but episcopal rule, through the various grades of metropolitan, primate, exarch, attains to sovereignty only in the five patriarchal thrones. Each patriarch is, within his diocese, what the Gallican theory makes the pope in the universal church. He is supreme, and not amenable to any of his brother patriarchs, but is within the jurisdiction of an oecumenical synod. The schismatic churches of the East have always reproduced the ecclesiastical polity of the church from which they seceded.

The Greek Church, like the Roman, soon spread far beyond the imperial dioceses which at first fixed its boundaries, but it was far less successful than the Roman in preserving its conquests for Christianity. This was due in the main to the differing quality of the forces by which the area covered by the two churches was respectively invaded. Greek Christianity became the religion of the Slavs as Latin Christianity became that of the Germans; but the Orthodox Church never conquered her conquerors.

The great dogmatic work of the Eastern Church was the definition of that portion of the creed of Christendom which concerns *theology proper*—the doctrines of the essential nature of the Godhead, and the doctrine of the Godhead in relation with manhood in the incarnation, while it fell to the Western Church to define *anthropology*, or the doctrine of man's nature and needs.

All the churches of the East, schismatic as well as orthodox, accept unreservedly the decrees of the first two councils. The schismatic churches protest against the additions made to the creeds of Nicaea and Constantinople by succeeding councils. The Niceao-Constantinopolitan creed declared that Christ was *consubstantial* (ὁμοούσιος) with the Father, and that He *had become man* (ἐνανθρωπήσας). Disputes arose when theologians tried to explain the latter phrase. These differences took two separate and extreme types, the one of which forcibly separated the two natures so as to deny anything like a real union, while the other insisted upon a mixture of the two, or an absorption of the human in the divine. The former was the creed of Chaldaea and the latter the creed of Egypt; Chaldaea was the home of Nestorianism, Egypt the land of Monophysitism. The Nestorians accept the decisions of the first two councils, and reject the decrees of all the rest as unwarranted alterations of the creed of Nicaea. The Monophysites accept the first three councils, but reject the decree of Chalcedon and all that come after it. They gave rise to numerous sects and to at least three separate national churches,—the Jacobites of Syria, the Copts of Egypt, and the Abyssinian church, which are treated under separate headings. (*See* also NICAEA, COUNCIL OF; CHALCEDON, COUNCIL OF; NESTORIUS; NESTORIANS; MONOPHYSITES.)

### CONFLICT WITH ROME

The relation of the Byzantine Church to the Roman may be described as one of growing estrangement from the 5th to the 11th century, and a series of abortive attempts at reconciliation since the latter date. The estrangement and final rupture may be traced to the increasing claims of the Roman bishops and to Western innovations in practice and in the doctrine of the Holy Spirit, accompanied by an alteration of creed. In the early church three bishops stood forth prominently, principally from the political eminence of the cities in which they ruled —the bishops of Rome, Alexandria and Antioch. The transfer of the seat of empire from Rome to Constantinople gave the bishops of Rome a possible rival in the patriarch of Constantinople, but the absence of an overawing court and of meddling statesmen did more than recoup the loss to the head of the Roman Church. The theological calmness of the West, amid the violent theological disputes which troubled the Eastern patriarchates, and the statesmanlike wisdom of Rome's greater bishops, combined to give a unique position to the pope, which councils in vain strove to shake, and which in time of difficulty the Eastern patriarchs were fain to acknowledge and make use of, however they might protest against it and the conclusions deduced from it.

But this pre-eminence, or rather the Roman idea of what was involved in it, was never acknowledged in the East; to press it upon the Eastern patriarchs was to prepare the way for separation, to insist upon it in times of irritation was to cause a schism. The theological genius of the East was different from that of the West. The Eastern theology had its roots in Greek philosophy, while a great deal of Western theology was based on Roman law. (*See* Stanley's *Eastern Church*, ch. i.) This gave rise to misunderstandings, and at last led to two widely separate ways of regarding and defining one important doctrine—the procession of the Holy Spirit from the Father or from the Father and the Son. Political jealousies and interests intensified the disputes, and at last, after many premonitory symptoms, the final break came in 1054, when Pope Leo IX. smote Michael Cerularius and the whole of the Eastern Church with an excommunication. There had been mutual excommunications before, but they had not resulted in permanent schisms. Now, however, the separation was final, and the ostensible cause of its finality was the introduction by the Latins of two words *Filioque* into the creed. (After the words "and in the Holy Ghost" of the Apostles' Creed the Constantinopolitan creed added "who proceedeth from the Father." The Roman Church, without the sanction of an oecumenical council and without consulting the Easterns, added "and the Son." The addition was first made at Toledo [589] in opposition to Arianism. The Easterns also resented the Roman enforcement of clerical celibacy, the limitation of the right of confirmation to the bishop and the use of unleavened bread in the Eucharist.) It is this addition which was and which still remains the permanent cause of separation.

**Doctrines and Creeds.**—The Eastern Church has no creeds in the modern Western use of the word, no *normative* summaries of what must be believed. It has preserved the older idea that a creed is an adoring confession of the church engaged in worship; and, when occasion called for more, the belief of the church was expressed more by way of public testimony than in symbolical books. Still the doctrines of the church can be gathered from these confessions of faith. The Eastern creeds may thus be roughly placed in two classes—the oecumenical creeds of the early undivided church, and later testimonies defining the position of the Orthodox Church of the East with regard to the belief of the Roman Catholic and of Protestant Churches. These testimonies were called forth mainly by the protest of Greek theologians against Jesuitism on the one hand, and against the reforming tendencies of the patriarch Cyril Lucaris (*q.v.*) on the other. The Orthodox Greek Church adopts the doctrinal decisions of the seven oecumenical councils, together with the canons of the Concilium Quinisextum or second Trullan council (692); and they further hold that all these definitions and canons are simply explanations and enforcements of the Nicaeo-Constantinopolitan creed and the decrees of the first council of Nicaea. The first four councils settled the orthodox faith on the doctrines of the Trinity and of the Incarnation; the fifth supplemented the decisions of the first four. The sixth declared against Monothelitism; the seventh sanctioned the worship (δουλεία, not ἀληθινὴ λατρεία) of images; the council held in the Trullus ( a saloon in the palace at Constantinople) supplemented by canons of discipline the doctrinal decrees of the fifth and sixth councils.

The most important doctrinal testimonies of the Eastern church are (1) the Orthodox confession of catechism of Peter Mogilas, confirmed by the Eastern patriarchs and by the synod of Jerusalem (1643), and (2) the decree of the synod of Jerusalem or the confession of Dositheus (1672). Besides these, the catechisms of the Russian Church should be consulted, especially the catechism of Philaret, which since 1839 has been used in all the churches and schools in Russia.

The Church of Christ is the fellowship of ALL THOSE WHO ACCEPT AND PROFESS ALL THE ARTICLES TRANSMITTED BY THE APOSTLES AND APPROVED BY GENERAL SYNODS. *Without this visible Church there is no salvation.* It is under the abiding influence of

the Holy Ghost, and *therefore cannot err in matters of faith.* Specially appointed persons are necessary in the service of the Church, *and they form a threefold order, distinct jure divino from other Christians, of Bishops, Priests and Deacons.* THE FOUR PATRIARCHS, OF EQUAL DIGNITY, HAVE THE HIGHEST RANK AMONG THE BISHOPS, AND THE BISHOPS *united in a General Council represent the Church and infallibly decide,* under the guidance of the Holy Ghost, all matters of faith and ecclesiastical life. All ministers of Christ must be regularly called and appointed to their office, and are consecrated *by the sacrament of orders. Bishops must be unmarried,* and PRIESTS AND DEACONS MUST NOT CONTRACT A SECOND MARRIAGE. To all priests in common belongs, besides the preaching of the word, the administration of the SIX SACRAMENTS—BAPTISM, CONFIRMATION, PENANCE, EUCHARIST, MATRIMONY, UNCTION OF THE SICK. The *bishops* alone can administer the *sacrament* of orders.

*Ecclesiastical ceremonies are part of the divine service; most of them have apostolic origin; and those connected with the sacrament must not be omitted by priests under pain of mortal sin.* (This summary has been taken with Corrections from G. B. Winer, *Comparative Darstellung des Lehrbegriffs der verschiedenen Kirchenparteien,* Eng. trans. 1873. Small capitals denote differences from Roman Catholic, italics differences from Protestant doctrine.)

**Liturgy and Worship.**—The ancient liturgies of the Eastern Church were very numerous but a strong desire for uniformity led to the almost exclusive use of the liturgy of Jerusalem or of St. James in the East. It is used in two forms, a shorter revised by Chrysostom, and a longer called the liturgy of St. Basil. This liturgy and the service generally are either in Old Greek or in Old Slavonic, and frequent disputes have arisen in particular districts about the language to be employed. Both sacred languages differ from the language of the people, but it cannot be said that in the Eastern Church worship is conducted in an unknown tongue—"the actual difference," says Neale, "may be about that between Chaucer's English and our own." There are eleven chief service books, and no such compendium as the Roman breviary. Fasting is frequent and severe. Besides Wednesdays and Fridays, there are four fasting seasons, Lent, Pentecost to SS. Peter and Paul, August 1–15 preceding the Feast of the Sleep of the Theotokos, and the six weeks before Christmas. Indulgences are not recognized; an intermediate and purificatory state of the dead is held but not systematized into a doctrine of purgatory. The Virgin receives homage, but the dogma of her Immaculate Conception is not admitted. While ikons are found in the churches, there is no "graven image" apart from the crucifix.

Monasticism is, as it has always been, an important feature in the Eastern Church. An Orthodox monastery is perhaps the most perfect extant relic of the 4th century. The simple idea that possesses the monks is that of fleeing the world; they have no distinctions of orders, and though they follow the rule of St. Basil object to being called Basilians. A few monasteries (Mt. Sinai and some on Lebanon) follow the rule of St. Anthony. K. Lake in *Early Days of Monasticism on Mount Athos* (1909) traces the development through three well-defined stages in the 9th and 10th centuries—(*a*) the hermit period, (*b*) the loose organization of hermits in lauras, (*c*) the stricter rule of the monastery, with definite buildings and fixed rules under an *ἡγούμενος* or abbot. (*See* ABBEY, MONASTICISM, and related articles.)

**The Branches of the Church.**—In addition to the ancient churches which have separated themselves from the Orthodox faith, many have ceased to have an independent existence, owing either to the conquests of Islam or to their absorption by other churches. In the early years of the present century the Orthodox Eastern Church consisted of 12 mutually independent churches (or 13 if we reckon the Bulgarian Church), using their own language in divine service (or some ancient form of it, as in Russia) and varying not a little in points of detail, but standing in full communion with one another, and united as equals in what has been described as one great ecclesiastical federation. However, in using such language it must be remembered that we are not dealing with bodies which were originally separated from one another and have now entered into fellowship, but with bodies which have grown naturally from a single origin and have not become estranged. The most ancient of these divisions depend on the jurisdiction of the four patriarchates. (1) The ancient *Patriarchate of Constantinople* included the imperial dioceses of Pontus, Asia, Thrace and Eastern Illyricum—*i.e.,* speaking roughly, the greater part of Asia Minor, European Turkey, and Greece, with a small portion of Austria. The Oecumenical Patriarch, as he has been called since early in the 6th century, is the most exalted ecclesiastic of the Eastern churches, and his influence reaches far outside the lands of the patriarchate. His jurisdiction extends over the dominions of the Sultan in Turkey, together with Asia Minor and the Turkish islands of the Aegean; there are 82 metropolitans under him, and the "monastic republic" of Mount Athos. He has great privileges and responsibilities as the recognized head of the Greek community in Turkey, and enjoys also many personal honours which have survived from the days of the Eastern emperors. In ecclesiastical affairs the patriarch acts with two governing bodies—(*a*) a permanent Holy Synod (Ἱερὰ Σύνοδος τῆς Ἐκκλησίας Κωνσταντινουπόλεως) consisting of 12 metropolitans, six of whom are re-elected every year from the whole number of metropolitans, arranged in three classes according to a fixed cycle; (*b*) the Permanent National Mixed Council (Διαρκὲς Ἐθνικὸν Μικτὸν Συμβούλιον), a remarkable assembly, which is at once the source of great power by introducing a strong lay element into the administration, and of a certain amount of weakness by its liability to sudden changes of popular feeling. Its members are chosen by an electoral body appointed for the purpose. The election of the patriarch himself is to a considerable extent popular. (2) The *Patriarchate of Alexandria,* consisting of Egypt and its dependencies, was at one time the most powerful, as it was the most centralized, of all; but the secession of the greater part of his church to Monophysitism (COPTIC CHURCH), and the Mohammedan conquest of Egypt, have left him but the shadow of his former greatness. (3) The *Patriarchate of Antioch* has undergone most changes in extent of jurisdiction, arising from the transfer of sees to Jerusalem, from the progress of the schismatic churches of the East and from the conquests of the Mohammedans. The patriarch retains little of his old importance. His jurisdiction includes Cilicia, Syria (except Palestine) and Mesopotamia. (4) The *Patriarchate of Jerusalem* was constituted at the council of Chalcedon in 451, with jurisdiction over Palestine. The inroads of the Saracens reduced its importance, which afterwards depended chiefly on the position and associations of Jerusalem.

In addition to the four patriarchates, the Orthodox Eastern Church, until 1914, consisted of nine national branches or divisions: the ancient Church of Cyprus (*see* CYPRUS, CHURCH OF); the Church of Mount Sinai, consisting of little more than the famous monastery of St. Catherine; the Eastern Orthodox Church in Austria-Hungary, which consisted of the Serbs of Hungary and Croatia, the Rumanians of Transylvania, the Ruthenians of Bukovina, and the Serbs of Bosnia-Herzegovina; and the respective national churches of Russia, Greece, Bulgaria, Rumania, Serbia, and Montenegro.

### POSITION AT THE OUTBREAK OF WORLD WAR

Russia, with Georgia, is reckoned to have had nearly 100,000,000 Slavonic Orthodox. Georgia, an exarchate once independent, was gradually being Russianised; the exarch was a Russian and an *ex officio* member of the Russian Holy Synod since 1801, while his suffragan bishops were Georgians. The effects of Tsarism on the Russian Church have been described by a learned observer as not good (Agéyev, *The Christian East,* 1920). "Under the guise of protecting the Church, the state in reality had enslaved it." The Church was in a state of paralysis, and the Russian educated classes were estranged from it.

The Orthodox Church in Turkey (Greek), under the Ecumenical Patriarch, Archbishop of Constantinople—often erroneously in the West called the Patriarch of Constantinople—is believed to have numbered 2,500,000 in Europe—counting in those transferred to the kingdom of Hellas in 1912—and 2,000,000

in Asia Minor and the islands. In Greece proper, where the autocephalous position of the Church was recognised by the Ecumenical Patriarch in 1850, there were about 2,000,000 orthodox (*ib.*).

In the Austro-Hungarian Empire there were several orthodox Churches, chiefly Slavonic, with some 3,000,000 souls: the Karlowitz Serbian Church; those of Dalmatia and Cattaro, joined to the Ruthenian Bukowina, though far distant from it; of Bosnia and Hercegovina; of Transylvania; and a certain number of orthodox scattered in various districts. The Bulgarian Church was made autocephalous by the Sultan in 1876, when the Bulgarian exarch resided in Constantinople; but the Ecumenical Patriarch did not recognise its independence. It numbered about 4,000,000.

In Rumania the old Church of Okhrida was suppressed in 1767 and the Orthodox then became subject to the Ecumenical Patriarch till recent times. They numbered about 4,500,000. The same state of things obtained in Serbia (1,500,000), where the old Church of Ipek was suppressed in 1766.

The little Church of Montenegro (about 200,000 souls) was made independent in 1766 and governed by a metropolitan who had one suffragan bishop. (Note that in some of the separated Churches of the East the metropolitans have no suffragans.) In addition there were the Orthodox in the patriarchate of Antioch, that of Jerusalem, that of Alexandria, Cyprus, autocephalous since 431, and the monastery of Mount Sinai, autocephalous since 1575, the archbishop of which usually resides in Egypt.

### POSITION AFTER THE WAR

The alterations in the boundaries of the various states have necessarily had a great effect on the Church. But a much greater effect has been produced by the internal convulsions in Russia and Turkey.

Russia has lost Poland and the Baltic provinces; but this has not affected the Orthodox Church to a very great extent, as the bulk of the population was of other faiths. Poland has still 3 million Orthodox; Lithuania has 23,000 Orthodox and 35,000 "Old Believers"; Czechoslovakia has very few Orthodox, most of the population being Roman Catholics or Uniats.

In Russia proper and in Georgia the effect has been most disastrous. At first the revolution promised well for the Orthodox. A Holy Synod of 12 bishops and a council of bishops, priests and laymen were established in 1917; the office of Chief Procurator—a layman who had represented the Tsar, and who wielded very great powers—was abolished; the patriarchate, discontinued by Peter the Great since 1700, was revived (Nov. 1, 1917) in the person of Tikhon, Patriarch of Moscow and all Russia, who was enthroned on Dec. 4, 1917. But the Bolshevist régime dashed all the hopes of the Church. The new rulers set themselves to oppose Christianity in all its forms.

All teaching of religion in public schools was forbidden; parents were not allowed to teach their children religion; only candidates for the priesthood, if over 18 years of age, might learn theology. No minister of religion could enjoy full civil rights. No religious association could hold property, and all property of existing religious associations was confiscated to the State, which might at its pleasure lend buildings for religious worship. Monasteries were to be converted to useful purposes. Most of the bishops who have not escaped from Russia and have not been put to death have been interned in or about Moscow, or in monasteries in the far north. And the only organization that has been found possible is a synod of 15 Russian bishops which holds its sessions outside Russia, at Belgrade. The patriarch Tikhon died in 1925, and a makeshift for the patriarchate has been devised in the shape of a locum tenens. The passive resistance of the Russian peasantry has been the great obstacle to the Government's endeavour to suppress Christianity, and the so-called reformed Russian Church, a body encouraged by the Soviet power, has so far been a failure for the same reason. In Georgia, the Church is in as great confusion as in Russia; since the first revolution the tendency has been towards independence in ecclesiastical matters. (The translation of an official summary of Soviet legislation against religion is given in the *Church Times*, Oct. 30, 1925; *see* also Nov. 20, 1925.)

Post-War Turkey, with its curtailed frontiers, has as its aim the creation of an entirely Muslim State; and among other things the Turkish Government desires the abolition of the Oecumenical Patriarchate. But the European Powers, while restoring Constantinople to Turkey, prevented this, and at Lausanne the Turkish delegates made a formal declaration of their Government that the Patriarchate would be allowed to continue. Yet, as far as Turkey is concerned, the Patriarchate is little more than "the shadow of a shade." By the Treaty of Lausanne all Greek Orthodox residents in Constantinople before Oct. 30, 1918, are exempt from expulsion. All other Greeks in Turkey, however, are liable to expulsion, and those in Asia Minor have been settled in the new Greece and elsewhere, in many cases in change for Muslims. Only Turkish subjects can be metropolitans in Turkey, and therefore the episcopate has to be recruited from the comparatively few Greek residents in Constantinople. Outside modern Turkey the Oecumenical Patriarch, not the Metropolitan of Athens, has jurisdiction in Macedonia, Western Thrace, Epirus, Crete and the Aegean Islands, and this is an exception to the rule about ecclesiastical independence mentioned above. (*See* an informative series of four articles on *The Orthodox Churches*, by Dr. Greig, Bishop of Gibraltar in *Theology*, 10–11, March, April, July, Aug., 1925.)

**Yugoslavia,** called in the Treaties the Serb-Croat-Slovene State, is now re-organizing its Church, which includes the former Serbian Church, the Karlowitz Serbian Church, that of Dalmatia and Cattaro, that of Bosnia and Hercegovina (these three formerly in Austro-Hungary) and Montenegro. During the World War many Serbians were in England; over 600 refugees, young ordinands, were there instructed and prepared for the Orthodox priesthood under Serbian priests. (*The Christian East*, 48 f, 51 f, 54.) Many others were in France, engaged in secular pursuits, and in other countries. This will be a convenient place to remark on the changed ecclesiastical conditions in both Yugoslavia and Rumania. Before the War Rumania and Serbia were inhabited practically by Orthodox alone. But the enlarged boundaries have brought in many Roman Catholics and Lutherans, and this has complicated the problem of national religions. The former idea of one country, one church, has to be given up, and religion and politics cannot have the same close connection that they had before. Moreover, the greatest hindrance to the reorganization of the Orthodox Church in the Balkans and in Rumania is the exaggerated national feeling and jealousy of each country against the others. This jealousy is much more felt between the different branches of Orthodoxy than between them and the Roman Catholics or Lutherans. (Greig in *Theology*, ii., 8, 66.)

To the former Rumanian Church, with its two metropolitans, is now added the Transylvanian Church (formerly in Hungary), with its metropolitan at Hermannstadt, and suffragan bishops at Arad and Kazansebes; and also the Churches of Bukowina and Bessarabia.

The old metropolitanate of Athens has not been greatly affected. For Macedonia, etc., *see* above; but it is hard to see how the Oecumenical Patriarch in Constantinople can under the changed conditions exercise an effective supervision over these districts. Salonika has now become once more a Christian city, and the mosques which had originally been Christian churches have now been restored to Orthodox worship.

Bulgaria has lost the Aegean coast to Greece, and part of the Dobruja to Rumania. Otherwise the Church has not been much affected. It has, by the official census of 1920, about 4,000,000 members, almost all of Bulgarian nationality, out of a total population of nearly 5,000,000, of whom about 700,000 are Muslims, chiefly Turks.

Among the smaller communities in Asia and Africa which were once under Turkish rule, the Orthodox patriarchate of Jerusalem, now under British mandate, consists of about 30,000 Arab and Greek Christians and a few Russians: the chief obstacles to progress are the jealousies between Arabs and Greeks, and the financial difficulties of the monasteries. The Orthodox patriarchate of Antioch, now under French mandate, suffers from the same difficulties as that of Jerusalem. It has some 300,000 members The

Orthodox ("Melkite") Patriarch of Alexandria has only a small following of about 100,000, as has been the case since the Monophysite schism in the 5th century. Under him is the Archbishop of Nubia. The autocephalous Churches of Cyprus (with about 200,000 Orthodox) and Mount Sinai have not been greatly affected by the War.

BIBLIOGRAPHY.—For the origins of the Eastern Church and the early controversies *see* the authorities cited in the article CHURCH HISTORY. The following are devoted specially to the history and condition of the Eastern Church: M. le Quien, *Oriens Christianus* (1740); J. S. Assemani, *Bibliotheca Orientalis* (1719–28); A. P. Stanley's *Eastern Church* (1861); J. M. Neale, *The Holy Eastern Church* (*General Introduction*, 2 vols.; *Patriarchate of Alexandria*, 2 vols.; and, published posthumously in 1873, *Patriarchate of Antioch*); W. F. Adeney, *The Greek and Eastern Churches* (1908); A. Fortescue, *The Orthodox Eastern Church* (1907, with valuable bibliography); also references in Hastings' *Encyclopaedia of Religion and Ethics*, articles "Greek Orthodox Church" and "Russian Church" by S. V. Troitsky. For liturgy, *see* H. A. Daniel, *Codex Liturgicus Eccl. Univ. in epitomen redactus* (4 vols., 1847–55); F. E. Brightman, *Eastern Liturgies* (Oxford, 1896). For hymnology *see* Daniel, *Thesaurus Hymnologicus* (4 vols.); Neale's translations of *Eastern Hymns;* B. Pick, *Hymns and Poetry of the Eastern Church* (New York, 1908). On the question of Reunion, *see* Fortescue, as above; and art. REUNION, CHURCH.

**ORTHOGENESIS,** a zoological term introduced by Eimer to express the view that the variations from the normal form of an animal species, on the occurrence of which evolution depends, do not arise at hazard but have a definite direction in all closely allied species; and that these variations may be repeated over a long series of generations, always in the same direction. The cause of these definite variations is left uncertain but is supposed to lie within the animal and not in its environment. Thus evolution would follow a direct course, which need have no positive adaptive significance. This view was founded on a study of the patterns of butterfly wings.

The phylogenies built up by palaeontologists, as E. D. Cope was the first to observe, do show that evolution has generally proceeded in definite directions, each member of a series differing from its predecessor in the same ways as its successor differs from it. In most cases the changes take place in such a way that greater mechanical efficiency is secured, and they can thus, theoretically, be accounted for by natural selection, exercised by a constant or auto-orthogenetic environment. In some cases however the changes may proceed in a definite direction despite very great changes in habits and habitat amongst the animals.

The essential point, that variation is not indefinite in direction, has been established for those heritable variations known as mutations by the observation that definite mutants appear time after time at a definite rate amongst the members of a species bred under controlled conditions; and that identical mutants occur in allied species and genera. The implication of these facts is that the mechanism which determines the course of development of the fertilized egg, and is hence responsible for heredity, is capable of modification only in certain definite ways, and that this mechanism is of essentially the same structure in allied animals. This view is in harmony with the fact, observed by palaeontologists, that closely allied stocks (phyla or lineages) exposed to similar conditions pursue parallel evolutionary courses. It is not inconsistent with the view that the evolution, at least of certain structures, may follow a definite trend independently of its environment. *See* EVOLUTION. (D. M. S. W.)

**ORTHOPAEDIC SURGERY.** In this branch of surgery, which deals with the rectification of congenital and acquired deformities, particularly those of the limbs, great advances have been achieved during recent years as a consequence of the exceptional opportunities of study and practice afforded during the Great War. Thus the treatment of fractures during the early part of the War was attended not only by unnecessary deformity, but also by a high mortality, and remained unsatisfactory until special hospitals were started, manned by teams of expert surgeons. In compound fractures of the femur an initial mortality of 80% was ultimately reduced to 25%. This dramatic change was accomplished by immediate reduction and fixation of the fracture, by segregation and by continuity of treatment. Knowledge thus gained has formed the basis of the efforts to place the organisation and teaching of fractures upon a different basis with a view to minimising the disabilities of industrial accidents. Reform lies in the simplification of apparatus, and in an intensive education in their application, in segregation of fractures in special wards and in appointing surgeons with special qualifications to teach the student.

**Improved Technique.**—Among certain reconstructive operations in the case of which a greatly improved technique has resulted may be mentioned repair of injuries to the peripheral nerves, tendon transplantations, bone grafting and bone infections. The enormous number of complete nerve lacerations enabled a finished operative technique to be built up, which was largely wanting previously. Many misconceptions were also corrected, such as the worthlessness of complete transplants of nervous or other tissue to bridge gaps in peripheral nerves, and the doubtful value of lateral nerve anastomosis. In cases of irreparable destruction to nerves, healthy muscles were transposed to take the place of paralysed ones. These operations proved singularly successful where large tracts of the musculospiral nerve were irreparably damaged.

Certain flexor muscles of the forearm were attached in such a way that extension of the wrist and fingers became assured. Bone graft surgery likewise received a great impetus and has since been extended. This has led to considerable research on the viability of transplanted tissue, and in the case of the bone it is held that the transplant is a scaffold along which the fresh bonelaying cells creep from the embracing bone and deposit new bone, the scaffolding itself being ultimately removed by absorption. The treatment of virulent infections has been similarly developed. The Carrel-Dakin method has permanently established itself as well as the procedure of laying open infected bone cavities so that the soft tissues fall in easily to obliterate the gap when the infection is at an end.

**Care of Cripples.**—The most notable recent advance in orthopaedic surgery in Great Britain has been in the organization for the care and cure of cripples. This has consisted in the establishment of well-equipped open-air hospitals in various parts of the country, known as hospital schools, fully staffed by surgeons specially trained to deal with deformities of every kind. These schools provide treatment and education for the cripple, and are associated with what are known as after-care clinics situated in small towns covering an area of from 40 to 50 m. distant from the hospital in every direction. These after-care clinics are visited by the hospital staff at stated times, and are attended by out-patients who have been inmates of the hospital school, and by cases from the district, who are often seen at a sufficiently early date to prevent deformities from arising. These hospitals and clinics are run in close association and agreement with the local practitioners, the education authorities and the Ministry of Health. This scheme, in association with preventive measures, promises practically to eliminate the cripple. Its aims are to secure the potential cripple at the earliest moment, to give him expert institutional treatment in fresh air and sunlight and to secure continuity of treatment until recovery is complete. (*See* CRIPPLES.)

**Artificial Light.**—Of other recent advances in knowledge, the evolution of the artificial light treatment as an auxiliary form of therapeutics for tuberculosis of bones and joints and of rickets may be instanced. The work of Rollier, Leonard Hill and others has given prominence to the therapeutic value of sunlight (*see* HELIOTHERAPY), and in the absence of sun extended observation favours the conclusion that we have in various forms of artificial light a promising substitute. This treatment, as in the case of heliotherapy, must be looked upon merely as an accessory measure in surgical tuberculosis. It is most effective when used in combination with other surgical procedures. It should be pointed out that there is grave danger in spreading a belief that other forms of treatment are unnecessary and subsidiary.

**Infantile Paralysis.**—The further study of infantile paralysis has resulted in a more widespread knowledge of the early symptomatology and important work has been done, especially by the late Prof. Lovett of Harvard from 1916 onwards. It has

now been proved that complete rest and immobilisation and the elimination of meddlesome therapeutics during the acute and convalescent stages have resulted in lessening the severity of symptoms by limiting the paralysis. The mass of material rendered available during late years by epidemics has thrown new light on the actual treatment of deformity. Tendon transplantations for various deformities of the feet have given place to operative stabilisation of the flail foot, and transplantations when practised are now associated with reconstructive operations upon bone. This combination has resulted in more satisfactory function.

**Rickets.**—Rickets and allied nutritional diseases have likewise received within recent years close investigation by many observers abroad and at home with valuable results. Considerable work on the aetiology, particularly with reference to diet, exercise and sunlight, has been carried out at Johns Hopkins Hospital, the Lister Institute and by Findlay of Glasgow, Mellanby and Chick. Much has been discovered regarding "vitamines" or "accessory food factors" (*see* VITAMINES). The report of the Research Committee provisionally dealt with only two varieties; one known as vitamine A, or fat soluble A, and the other as anti-rachitic vitamine. Both are essential to the diet of growing animals. Defect in the one leads to arrest of growth and loss of weight; in the other a deficiency in the deposit of lime salts. The committee conclude that an anti-rachitic vitamine is a central factor in the prevention of rickets; and that a deficiency of calcium and phosphorus, in conjunction with a deficiency of anti-rachitic vitamine, hastens rickets. The greater the discrepancy in the calcium phosphorus intake the greater need for an appropriate anti-rachitic intake. It has now been proved that sunlight and ultra-violet rays act as an antidote to a deficiency diet, and can ward off the on-coming of rickets. This work has added considerably to the knowledge of orthopaedic surgeons, and has rendered unnecessary a good deal of the operative treatment for rachitic deformities.

**Spinal Treatment and Other Operations.**—The writings of Albee, Hibbs, Calvé, Girdlestone and Waldenstrom have enabled us to place in accurate perspective the bony fixation of the vertebral column in tubercular disease of the spine. Forcible correction and fixation of the spine in lateral curvature is being abandoned in favour of less drastic measures, and bony fixation of the flail spine in paralytic cases is being performed with promising results.

Operative treatment in osteoarthritis, especially in the non-articular type, is being more widely practised. This consists in stabilising the joint by exercising the joint surfaces and in the complete removal of diseased synovial membrane in the knee joints. The so-called operations of arthroplasty, or mobilisation in ankylosis of joints is becoming more common, and the results more encouraging. They mainly consist of the loosening and reconstruction of the bone ends, and the introduction of transplanted or living tissue between the bone ends to secure movement.

The treatment of fractures of the neck of the femur by wide abduction of the limb with internal rotation have been still further perfected by Royal Whitman of New York, and a large percentage of recoveries in this obstinate type of fracture occurring in old age is reported. The pathology of the rarer bone diseases such as "cysts of bone," "myeloid sarcoma," "Paget's disease" have been closely studied by many observers, resulting in valuable information in relation to operative procedure.

BIBLIOGRAPHY.—P. B. Roth, *Orthopaedics for Practitioners*, An Introduction to the Practical Treatment of the Commoner Deformities (Arnold 1920); Sir R. Jones (ed.), *Orthopaedic Surgery of Injuries* (by various authors), 2 vol. (Oxford University Press 1921); Sir R. Jones and R. W. Lovett, *Orthopaedic Surgery* (Oxford University Press 1923) (bibl.); R. Whitman, *Treatise on Orthopaedic Surgery*, 8th ed. London 1927 (bibl.); W. A. Cochrane, *Orthopaedic Surgery*, Edinburgh 1926; G. Potel, *Traité pratique d'orthopédie*, Paris 1925; F. Calot, *L'orthopédie indispensable aux praticiens*, 8th ed. Paris 1923; F. H. Albee, *Orthopaedic and Reconstruction Surgery*, Philadelphia 1919 (bibl.). (R. J.)

**Developments in the United States.**—The World War taught the *rehabilitation* of human beings, the first step of which is reconstruction surgery. Instead of accepting a functional handicap as inevitable, and fitting out the patient with braces, canes, or crutches, reconstruction operations are performed which in many instances accomplish normal, or nearly normal return of function. Plastic operative work, tendon transplantation, skin and bone grafting have finally been placed in their proper correlation with the old methods of braces, straps and buckles, plaster of Paris casts, etc., so that the specialty now has rounded out into one in which operative work and the mechanical means of treatment as well as heliotherapy and physiotherapy have been co-ordinated.

At least 65 per cent of all the injuries sustained in the late war and coming to definitive treatment involved bones, joints, ligaments, muscles, tendons or nerves, thus throwing orthopedic surgery into sharp relief. The technique of reconstruction operations to meet the unusual demands was rapidly developed and perfected, and the scope of this branch of surgery widened appreciably as the best orthopaedic surgeons combined their skill at the front.

The war over, the demand for rehabilitation surgery has increased rather than decreased. The high-powered machines of industry, the speeding automobile, the aeroplane, and our great railway systems and construction projects take a terrific annual toll in bones, joints, muscles, tendons, etc., which, without reconstruction surgery, would mean a tremendous number of cripples, unhappy themselves, and a great economic burden upon society.

The introduction of automatic machine tools into orthopaedic surgery was an important event in the technical world as it has made possible the cutting and moulding of bone with as much variety as the machinist shapes metal, and these power-driven instruments have been an important factor in the development of reconstruction surgery. In 1909 Dr. Fred H. Albee of New York city conceived the technique of bone graft of the spine to arrest tuberculous destruction and prevent hunchback; but found it impossible of accurate execution with the hand tools then comprising the surgeon's armamentarium. Realizing further the great possibilities of repair and reconstruction in cases of extensive loss of bone and damage to joints which adequate machine tools (such as circular twin saw, dowel and screw cutter) would make possible in transplanting bone from one portion of the body to another, he designed a set of miniature automatic machine tools, carefully adapted from those used by a cabinet maker and mechanic, to the various surgical problems encountered in cutting and shaping bone. This has become known as the Albee bone mill. As other grafting plastic bone operations were devised, notably for hip, knee and jaw, new instruments have been added to the "mill," which by their great accuracy and rapidity tremendously reduce the shock attendant upon cutting bone with the old hand instruments, shorten the time of anaesthesia, and permit intricate bone operations.

As a result of the benefits of the X-ray in determining diagnosis and showing the exact condition of bone, and the use of the automatic machine tools and orthopaedic appliances introduced within the last 25 years, the human bony system can to-day be made over in a truly remarkable way.

The increased understanding of shock, as a result of the researches of Crile and Cannon, and the increased means of combating or eliminating it by employing electrically driven tools, as well as outstanding advances in technique, have made complicated and exacting operative problems that were formerly hopeless now possible.

The Carrel-Dakin treatment of lacerated or infected wounds before operation is attempted has greatly lessened the chances of sepsis. By this method, which was devised during the war by Carrel of the Rockefeller Foundation and Dakin, the English chemist, the wound is kept constantly bathed in a solution containing free chlorine gas with elements which dissolve away the discharges of the wound.

In fractures of the hip, conditions are such that union does not occur in a large percentage of cases, even when conservative treatment is applied in the most ideal way. Cases of persistent non-union have been salvaged by means of automatic machinery and the bone graft, dowel or peg union being secured in from 75% to 90% of cases according to the degree of erosion between the fragments.

The conception that arthritis is a metastatic infection from some focus, often remote from the joint or joints affected, has led to the prevention of many cases and relief of others by elimination of sources of toxic absorption.

One of the most striking developments has been the technique which enables the surgeon to manufacture or make joints when they have been destroyed, that will function in a nearly normal manner without pain.

If a case is not controlled wisely from the psychologic standpoint while the patient is receiving treatment physically, the compensation law may react to his detriment rather than his benefit. The best sympathy that can be given a crippled man is to see that he is receiving adequate treatment and to encourage him to return to work as soon as it is safe. Follow-up work is most important; this lies with the surgeon and social worker co-operating with the surgeon.

Rehabilitation, of which the orthopaedic treatment is an important part, to-day represents three distinct yet overlapping problems: (1) the problem of treatment, preventive or corrective; (2) the sociological problem—relationship of the injured labourer to the rest of society; and (3) the medico-legal problem of properly applying the Workmen's Compensation Act. The first concerns chiefly the patient, his relatives and immediate friends, but the second and third affect all society. The rehabilitation movement in the United States has gone forward with the same strides since the war as have the hospital schools for cripples in Great Britain, the difference being that in the United States through wise legislation, state and national, it has been possible to a large extent to correlate the efforts of various agencies and to avoid duplication of effort.

The first compensation law, passed by the State of New Jersey in 1911, grew out of the sympathy of society for those crippled or physically handicapped in our great industrial plants. Since then thirty-six States have passed compensation or rehabilitation laws.

(F. H. A.)

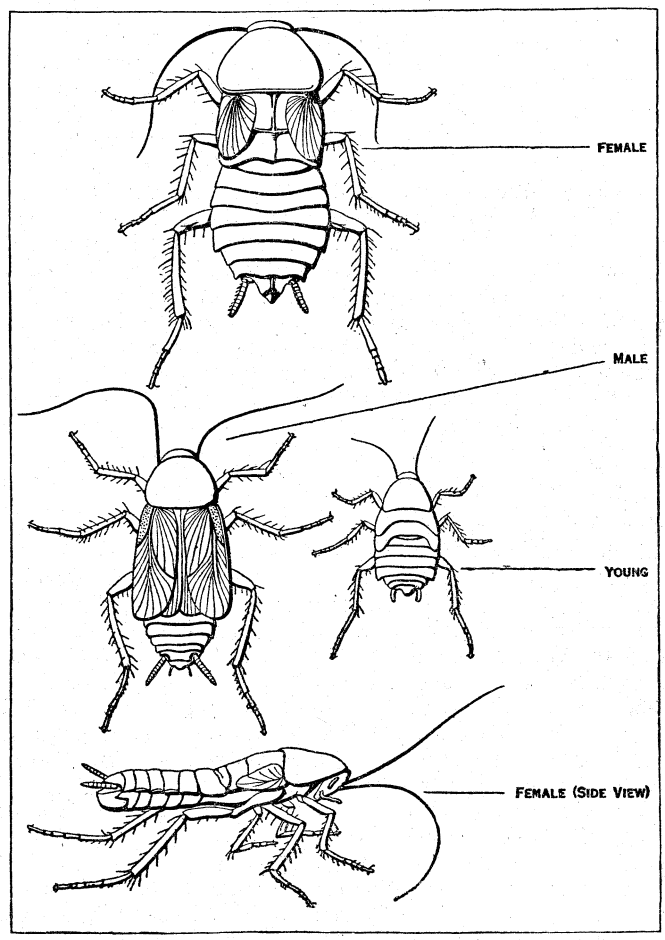
**ORTHOPTERA,** the term used in zoological classification for that order of insects which includes the cockroaches, mantids, grasshoppers, locusts, crickets and their allies. The earwigs are included here by some authorities but they are now more often relegated to a separate order of their own—the *Dermaptera* (*see* EARWIG). The Orthoptera are essentially terrestrial insects and many possess greatly developed powers of running or leaping. Excepting in the *Acridiidae,* flight is not one of their striking characteristics and wings are often reduced or entirely lost. They are mostly insects of comparatively large size, some being among the giants of their class; many possess well-developed sound-producing organs and are notorious stridulators. The wings, when present, are net-veined, the anterior pair being more or less hardened to form tegmina which are narrower than the membranous hind wings; the latter have a well developed posterior lobe capable of being folded up fanwise. The antennae are most often long and threadlike, the mouth parts are of the biting type and have a 4-lobed ligula. The prothorax is generally large and the abdomen is terminated by a pair of cerci. Metamorphosis is incomplete and in the wingless forms it is very little evident. Over 13,000 species of Orthoptera are known and of these about 500 inhabit Europe. In Britain there are 31 indigenous forms, while some others are naturalized alien species; there are also a number of casual immigrants which have not become established.

Orthoptera may be conveniently divided into forms which run or walk (Cursoria) and into those which leap (Saltatoria) as given below.

### DIVISION I.—CURSORIA

*Legs of approximately equal size, hind pair not adapted for leaping. Tarsi 5-jointed, stridulatory organs absent, ovipositor almost always concealed.*

Included in this division are four families. The *Grylloblattidae* are confined to western North America and Japan; they are wingless insects with long ovipositor and cerci and exhibit close affinities with the Saltatoria also. The *Blattidae* or cockroaches (*q.v.*), have a large shieldlike prothorax, very broad coxae and short, jointed cerci (fig. 1). The *Mantidae* (*see* MANTIS) have the fore legs adapted for seizing prey; the eyes are large and the cerci are several-jointed. The *Phasmidae* comprise the Stick Insects (*q.v.*)




BY COURTESY OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

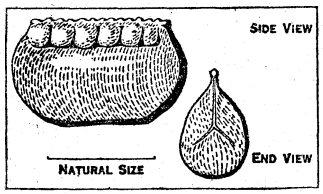
FIG. 1.—THE COMMON COCKROACH (BLATTA ORIENTALIS), NATURAL SIZE

and the Leaf Insects (*q.v.*); the fore legs are normal, the eyes are small and the cerci are single-jointed (fig. 3).

### DIVISION II.—SALTATORIA

*Legs of unequal size, the hind pair with enlarged femora and adapted for leaping. Tarsi with fewer than five joints, stridulatory organs usually present, ovipositor well developed and evident.*

Three families belong here and included in the *Acridiidae* are the short-horned grasshoppers (*see* GRASSHOPPER) and the true locusts (*q.v.*). The antennae are shorter than the body, the tarsi are 3-jointed and the ovipositor short. Stridulation takes place by the insect rubbing the inner side of its hind femur, which bears a row of minute pegs, against a hardened area of the tegmen of the same side. Auditory organs are represented by a pair of drums at the base of the abdomen. The *Tettigoniidae* (*Locustidae*) include the long-horned grasshoppers (*see* GRASSHOPPER) which have the antennae usually longer than the body, 4-jointed tarsi and a long broad ovipositor. Stridulation is effected by the insect rubbing its right tegmen against a filelike area of the left tegmen and auditory organs are present on the fore tibiae. The *Gryllidae* include the crickets (*q.v.*) and their allies. The antennae are generally long and threadlike, the tarsi are usually 3-jointed and the ovipositor is commonly long and slender (fig. 4). Stridulation takes place by rubbing the tegmina together and the auditory organs are on the fore tibiae, but unlike the *Tettigoniidae* the outer organ is larger




BY COURTESY OF THE U.S. DEPT. OF AGRICULTURE

FIG. 2.—EGG CAPSULE OF AMERICAN COCKROACH (PERIPLANETA AMERICANA)

than the inner one of the same side. The tegmina differ from those of other Saltatoria in that they are bent downwards along the sides of the body when in repose.

The eggs of Orthoptera are more or less cylindrical and in cockroaches (fig. 2) and mantids they are laid in protective capsules or oothecae, each containing 16 or more eggs. On hatching the young nymphs bear a close miniature resemblance to the adults except for the absence of wings. After a period of gradual growth, accompanied by a very variable number of moults, the adult condition is assumed. As previously mentioned, the saltatory forms are capable of stridulation, a feature that is almost confined to the males; auditory organs, on the other hand, are present in both sexes. Some of the most notorious stridulators are the katydids (*see* GRASSHOPPER) and the crickets, and in some cases the strident notes can be heard nearly a mile away. Many Orthoptera are wingless (fig. 3), while among the stridulating forms the wings are sometimes reduced to the sound-producing portions of the tegmina only. The majority of the Orthoptera are herbivorous, and many of the grasshoppers and all the locusts are highly injurious insects—voracious devourers of all kinds of vegetation. Some of the cockroaches are omnivorous, the domestic species injuring or fouling a great variety of materials, while the mantids are predators devouring various insects and other creatures. Although Orthoptera are predominantly terrestrial in habit, a few species are aquatic, the curious cricket *Hydropedeticus*, for example, skates actively over streams in Fiji. Many of the *Tettigoniidae* frequent trees and bushes, while some of the *Gryllidae*, notably the mole crickets and their allies, are subterranean. The curious small wingless crickets of the genus *Myrmecophila* live in close association with ants.

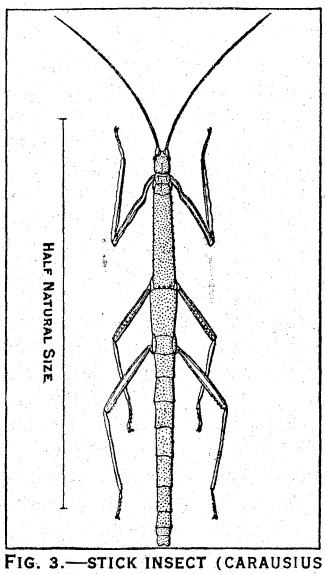
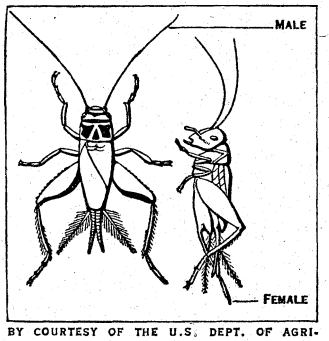



FIG. 3.—STICK INSECT (CARAUSIUS MOROSUS)

Geographically the largest families are world-wide in range. The leaf insects, however, are restricted to the oriental region and the *Gryllo*blattidae are confined to North America and Japan. The *Mantidae* and *Phasmidae* are common in the warmer regions of the world, but are absent from more northern latitudes. Among individual species the oriental cockroach (*Blatta orientalis*) and some of its allies have become practically cosmopolitan. In the fossil condition cockroaches are abundant, and form the greater part of the insect remains in certain of the Upper Carboniferous rocks of western Europe. They persisted until Permian times, after which their pre-eminence gradually declined until at the present day they form an insignificant part of the world's insects.



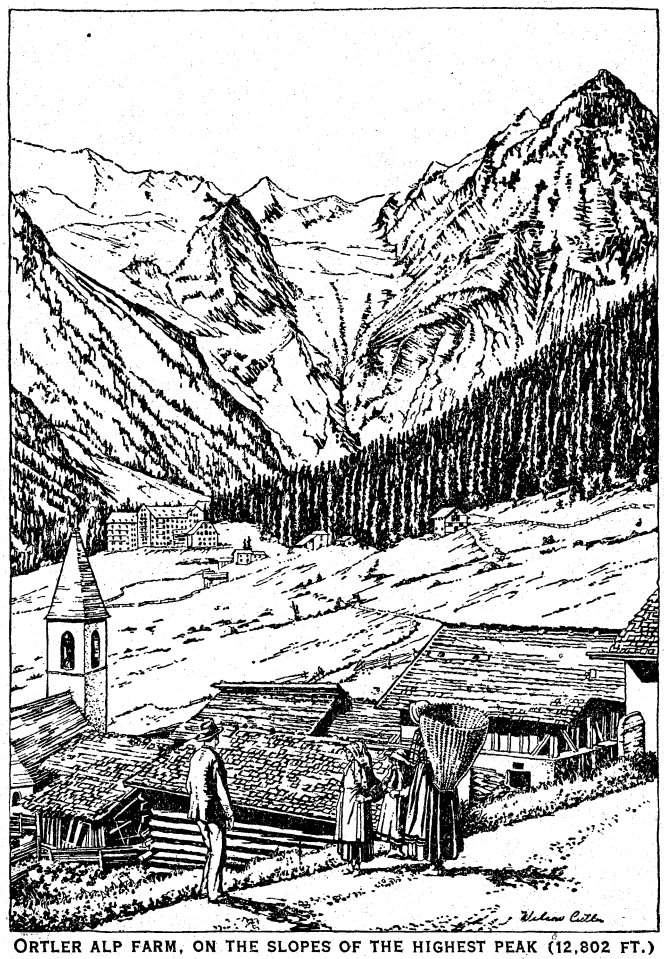

BY COURTESY OF THE U.S. DEPT. OF AGRICULTURE

FIG. 4.—HOUSE CRICKET (GRYLLUS DOMESTICUS)

BIBLIOGRAPHY.—For the British Orthoptera *see* W. J. Lucas, *British Orthoptera* (1920), while for the European species *see* R. Tümpel, *Die Geradflügler Mitteleuropas* (1907–08), M. Burr, *Synopsis of the Orthoptera of Western Europe* (1910) and the handy work of C. Houlbert which forms two volumes in the *Encyclopédie Scientifique* (Paris, 1924–1927). For the North American species consult W. S. Blatchley, *Orthoptera of North-Eastern America* (1920). (A. D. I.)

**ORTIGUEIRA,** a seaport of north-western Spain, in the province of Corunna; on the northern slope of the Sierra de la Faladoira, on the river Nera and on the eastern shore of the Ría de Santa Marta—a winding, rock-bound and much indented inlet of the Bay of Biscay, between Capes Ortegal and Vares. Pop. (1940) 1,479 (mun., 22,152). The population is scattered. The industries are fishing and farming. There is an important coasting trade, despite the dangerous coast-line and the fogs and gales.

**ORTLER,** the highest point (12,802 ft.) in Tirol, and in the whole of the Eastern Alps. It is a great snow-clad mass, which rises east of the Stelvio Pass, and a little south of the upper valley of the Adige between the valleys of Trafoi (north-west) and of Sulden (north-east). It was long considered inaccessible, but was conquered in 1804 by three Tirolese peasants. The first traveller to make the climb was Herr Gebhard in 1805 (sixth ascent). Many routes to the summit are now known.



ORTLER ALP FARM, ON THE SLOPES OF THE HIGHEST PEAK (12,802 FT.) IN THE EASTERN ALPS, BETWEEN THE VALLEYS OF TRAFOI AND SULDEN

**ORTNIT** or **OTNIT,** German hero of romance, was originally Hertnit or Hartnit, the elder of two brothers known as the Hartungs, who correspond in German mythology to the Dioscuri. His seat was at Holmgard (Novgorod), according to the *Thidrekssaga* (chapter 45), and he was related to the Russian saga heroes. Later on his city of Holmgard became Garda, and in ordinary German legend he ruled in Lombardy. Hartnit won his bride, a Valkyrie, by hard fighting against the giant Isungs, but was killed in a later fight by a dragon. His younger brother, Hardheri (replaced in later German legend by Wolfdietrich), avenged Ortnit by killing the dragon, and then married his brother's widow. Ortnit's wooing was corrupted by the popular interest in the crusades to an Oriental *Brautfahrtsaga,* bearing a resemblance to the French romance of Huon of Bordeaux (*q.v.*).

*See* editions of the *Heldenbuch* and one of *Ortnit* and *Wolfdietrich* by Dr. J. L. Edlen von Lindhausen (Tübingen, 1906).

**ORTOLAN,** *Emberiza hortulana,* a bunting (*q.v.*) celebrated for the delicate flavour of its flesh. A native of most European countries—the British islands excepted—as well as of western Asia, it migrates southwards in autumn and returns about the end of April. Its distribution throughout its breeding range seems to

be very local. In habits it much resembles the yellow-hammer, but it wants the bright colouring of that species. The monotonous song of the cock is also much of the same kind. The nest is placed on or near the ground, but the eggs seldom show the hair-like markings which characterize those of most buntings. Its natural food consists of beetles, other insects and seeds. Ortolans are netted in great numbers, kept alive in a darkened room, and fed with oats and millet. In a very short time they become enormously fat and are then killed for the table.

**ORTONA A MARE,** seaport and episcopal see, Abruzzi, Italy, province of Chieti, 12 mi. directly E. of that town, 105 mi. by rail S.S.E. of Ancona. Pop. (1936) 9,215 (town); 20,210 (commune). It is on a promontory 230 ft. above sea-level, and connected with the port below by a funicular railway. The ruined castle has magnificent views. The cathedral (1127) has a fine portal by a local artist, Nicolo Mancini (1311). The town occupies the site of the ancient Ortona, a seaport of the Frentani.

**ORURO,** a department and town of Bolivia. The department is bounded north by La Paz, east by Cochabamba and Potosí, south by Potosí and west by Chile; it occupies part of an ancient lacustrine basin lying between the eastern and western ranges of the Andes, and has an area of 20,386 sq.mi., the greater part of which is semi-arid and covered with extensive saline deposits. The Desaguadero river, the outlet of Lake Titicaca, flows southward into Lake Pampa-Aullagas, or Poopó, on the eastern side of the department near the Cordillera de los Frailes. Lake Poopó is 12,106 ft. above sea-level, or 400 ft. lower than Titicaca, and its waters discharge through a small outlet, called the Lacahahuira, into the lagoon and saline morasses of Coipasa (12,073 ft. elevation) in the south-west corner of the department. Oruro is almost exclusively a mining department, the country being too arid and too cold for agriculture. With the exception of a narrow strip along the foot-hills of the Cordillera de los Frailes, where a few cattle, mules, llamas and sheep are reared, little of the area is suitable even for grazing. In the vicinity of the capital, in the north-east part of the department, there are large deposits of tin, silver, tungsten and copper; Oruro is the second largest producer of tin in the republic. Population (1942 est.), 174,500.

The capital of the department is Oruro, 125 mi. south-south-east (direct) of La Paz; it is an old mining town dating from the 17th century, when it is said to have had a population of 70,000. The estimate of 1942 gave it a population of 60,000, the greater part of whom are Indians and mestizos. A considerable number of foreigners are interested in the neighbouring mines. The elevation of Oruro is 12,158 ft. above sea-level, and its climate is characterized by a cool summer with light rainfall and a cooler but sunny winter, with nightly frosts and an occasional snow-storm. The mean temperature of the warmest month, December, is 51° F. and that of the coolest month, June, is 31° F. There is a much greater difference than this between day and night temperatures, both in summer and winter. Oruro is connected by rail with La Paz and Cochabamba, with Antofagasta, 578 mi. away, and with Arica (via Viacha) 380 mi. distant. (G. M. McB.)

**ORVIETO** (anc. *Volsinii* [*q.v.*], later *Urbs Vetus*, whence the modern name), town and episcopal see, province of Terni, Italy, on the Paglia, a tributary of the Tiber, 78 mi. by rail N. by W. of Rome. Pop. (1936) 8,883 (town); 21,469 (commune). It crowns an isolated rock, 1,033 ft. above sea-level, 640 ft. above the plain, commanding splendid views, and is approached by a funicular railway. The town has a large number of fine 13th-century houses and palaces. The splendid cathedral dedicated to the Virgin was begun at least as soon as 1288 on the site of two older churches erected to commemorate the miracle of Bolsena (*q.v.*), and was decorated by many mediaeval painters and sculptors. The exterior is black and white marble; the interior is grey limestone with bands of dark basaltic stone. There is a large rectangular nave, with semicircular recesses for altars, opening out of the aisles, north and south, two transeptal chapels and a short choir. The finest polychrome monument in existence is the west façade, of richly-sculptured marble from the designs of Lorenzo Maitani of Siena, divided into three gables with intervening pinnacles; it is a reproduction of the façade of Siena cathedral. The mosaics are modern. The four wall-surfaces that flank the three western doorways are decorated with beautiful sculpture in relief, executed under Maitani's direction until his death in 1330. In the interior, the Cappella del Corporale possesses a large silver shrine, resembling the cathedral façade, enriched with countless figures in relief and subjects in translucent coloured enamels—one of the most important specimens of early silversmith's work. It was begun by Ugolino Vieri of Siena in 1337, and was made to contain the Holy Corporal from Bolsena (*q.v.*). On the south side is the chapel of S. Brizio, separated from the nave by a fine 14th-century wrought-iron screen. The walls and vault are covered with fine and well preserved frescoes—among the noblest works of Fra Angelico and Luca Signorelli, painted 1499 to 1504—the latter being of especial importance in the history of art owing to their great influence on Michelangelo in his early days. The choir stalls are fine and elaborate specimens of *tarsia* and rich wood-carving—the work of Pietro del Minella (1430–41). In 16th-century sculpture the cathedral is especially rich, containing many statues, groups and altar-reliefs by Simone Mosca and Ippolito Scalza. Close by are two Gothic buildings, the bishop's palace (1264) and the Palazzo dei Papi (1264–1302), the latter with a huge hall now containing the Museo Civico, with various mediaeval works of art, and also objects from the Etruscan necropolis of the ancient Volsinii (*q.v.*). The Palazzo Faina has another interesting Etruscan collection. The Palazzo del Comune is Romanesque (12th cent.). S. Andrea and S. Giovenale are also Romanesque churches of the 11th century; both contain later frescoes. To the 11th–12th century belongs the ruined abbey of SS. Severo and Martirio, 1 m. south of the town. The church of S. Domenico contains one of the finest works in sculpture by Arnolfo di Cambio, the tomb with recumbent effigy of the Cardinal de Braye (1282), with much beautiful sculpture and mosaic. There are a few buildings by Sammicheli of Verona, architect of the cathedral from 1509–28. The fortress built in 1364 by Cardinal Albornoz has been converted into a public garden. The well, now disused, called Il pozzo di S. Patrizio, is one of the chief curiosities of Orvieto. It is 200 ft. deep to the water-level and 42 ft. in diameter, cut in the rock, with a double winding inclined plane, so that asses could ascend and descend to carry the water from the bottom. It was begun by the architect Antonio da San Gallo the younger in 1527 for Clement VII. and was finished by Simone Mosca under Paul III. (*See* UMBRIA.)

*See* L. Fumi, *Il Duomo d' Orvieto e i suoi restauri* (1891); *Orvieto, note storiche e biografiche* (1891), and other works; P. Perali, *Orvieto* (*ibid.* 1919). (T. A.)

**ORYX,** the scientific name of a group of African antelopes of large size with long horns, which are present in both sexes, and long tufted tails. They are desert animals. The true oryx is the East and North-east African beisa oryx (*Oryx beisa*), which is replaced in South Africa by the gemsbok (*q.v.*). In northern Africa the group is represented by *O. algazel,* and in Arabia by *O. leucoryx. See* ANTELOPE.

**ORZESZKOWA** (*née* Pawlowska), **ELIZA** (1842–1910), Polish novelist, born near Grodno, of the noble family of Pawlowski. In her 16th year she married Piotr Orzeszko, a Polish nobleman, who was exiled to Siberia after the insurrection of 1863. She wrote a series of powerful novels and sketches, dealing with the social conditions of her country. *Eli Makower* (1875) describes the relations between the Jews and the Polish nobility, and *Meir Ezofowicz* (1878) the conflict between Jewish orthodoxy and modern liberalism. *On the Niemen* (1888), perhaps her best work, deals with the Polish aristocracy, and *Lost Souls* (1886) and *Cham* (1888) are on rural life in White Russia. She died at Grodno on May 18, 1910.

**OSAGE,** a tribe of American Indians formerly on Osage and Arkansas rivers in Missouri and Arkansas. Their speech is Siouan; their culture that of the plains. The original population is estimated at 5,000; in 1921 there were 2,200 in Oklahoma. Oil royalties, land leases and interest on trust funds held for them by the Government, make them one of the richest populations in the world.

*See* F. La Flesche, *Bur. Am. Ethn. Rep.* xxxvi, 1921; xxxix, 1925.

**OSAGEORANGE** (*Maclura pomifera*), a thorny tree with large, yellow, somewhat orange-like fruit. The tree, which is the only species of its genus, belongs to the mulberry family (Moraceae). It is native to rich soils in the south-central United States from Missouri and Kansas to Texas, but has been planted extensively in the Mississippi valley and occasionally in the eastern states, being hardy in New England. The very hard, strong, flexible, yellow wood, formerly used for bows and war-clubs by the Osage and other Indians west of the Mississippi, is utilized for railway ties and fence posts. Osageorange is also known as bowwood and as Bois d'Arc. The wood yields a yellow dye principle.

**OSAKA,** the chief industrial city of Japan (*q.v.*). Pop. (1940) 3,252,340. It lies in a plain bounded, except westward, where it opens on Osaka bay, by hills of considerable height, on both sides of the Yodogawa, or rather its headwater the Aji (the outlet of Lake Biwa), and is so intersected by river-branches and canals as to suggest a comparison with a Dutch town. Steamers ply between Osaka and Kobe-Hiogo or Kobe, and Osaka is an important railway centre. The opening of the railway (1873) drew foreign trade to Kobe, but a harbour for ocean-steamers has been constructed at Osaka. Shin-sai Bashi Suji, the principal thoroughfare, leads from Kitahama, the district lying on the south side of the Tosabori, to the iron suspension bridge (Shin-sai Bashi) over the Dotombori. The former foreign settlement is at Kawaguchi at the junction of the Shirinashi and the Aji. It is the seat of a number of European mission stations. Buddhist and Shinto temples are numerous. The principal secular buildings are the castle, the mint and the arsenal. The castle was founded in 1583 by Hideyoshi; the enclosed palace, probably the finest building in Japan, survived the capture of the castle by Iyeyasu (1615), and in 1867 and 1868 witnessed the reception of the foreign legations by the Tokugawa shoguns; but in the latter year it was fired by the Tokugawa party. It now provides military headquarters, containing a garrison and an arsenal. The whole castle is protected by high and massive walls and broad moats. The mint, erected and organized by Europeans, was opened in 1871. Osaka possesses iron-works, sugar refineries, cotton spinning mills, shipyards and a great variety of other manufactures.

Osaka owes its origin to Rennio Shonin, eighth head of the Shin-Shu sect, who in 1495–1496 built, on the site now occupied by the castle, a temple which became the principal residence of his successors. In 1580, after ten years' successful defence of his position, Kenryo, the eleventh "abbot," was obliged to surrender; and in 1583 the victorious Hideyoshi made Osaka his capital. The city brought several suburban districts within its boundaries in 1925, becoming temporarily the most populous city in Japan. In 1909 one-third of the city was destroyed by fire and though it was rebuilt with wider streets and better buildings, there are still many wooden houses and bridges, dangerous in case of fire, and its factories and warehouses compared less favourably with European and American standards than those of Tokyo until after World War I, when a number of fine buildings were erected and a program of city planning was carried a long way, though it is still incomplete. Osaka boasts of its advanced municipal government. Trade has grown rapidly in the last two decades, and a number of foreign-going ships now load and unload in Osaka harbour, which is being continuously extended and improved. The city was enlarged in 1926 by the absorption of outlying districts, to form Greater Osaka. Osaka, like Tokyo and Kyoto, as well as being a municipal administrative unit is an urban prefecture (Fu). The budget of Osaka city for 1938 was balanced at $69,705,000 (U.S.). Municipal indebtedness, $151,075,000 (U.S.).

**OSAWATOMIE,** a city of Miami county, Kansas, U.S.A., 45 mi. S. by W. of Kansas City, on the Missouri Pacific railroad. Pop. (1940) 4,145. It is near oil and gas fields, in a farming and grazing region, and has railroad shops. A state hospital for the insane is 1 mi. N.E. Osawatomie was settled about 1854 by colonists sent out by the Emigrant Aid company. The name was derived from Osage and Pottawattomie. It was the scene of many clashes between the pro-slavery and the free-soil factions of Kansas and Missouri, notably on Aug. 30, 1856, when Capt. John Brown (who had come to Osawatomie in 1855) and 40 followers attempted to repulse an attack by Gen. John W. Reid, at the head of 400 Missourians. They were quickly overpowered and the town was looted and practically destroyed.

**OSBORN, HENRY FAIRFIELD** (1857–1935), palaeontologist, was born at Fairfield (Conn.), Aug. 8, 1857. He graduated from Princeton university (1877) and continued his studies under Balfour and Huxley. His professorships included natural history and anatomy at Princeton (1881–91); biology and zoology until 1910, and the deanship of the faculty of pure science (1892–1895) at Columbia university. From 1910 to 1935 he held the research professorship in zoology at Columbia university. His connection with the American Museum of Natural History began as curator of the department of vertebrate palaeontology (1891–1910), and was followed by a number of offices till 1908, when he became president. After 1900 he was connected with the United States Geological **survey,** first as vertebrate palaeontologist and after 1924 as senior geologist. Among offices too numerous to mention, he had important connections with the Canadian Geological survey, the New York Zoological society, and the Carnegie institute. He declined the proffered secretaryship of the Smithsonian institution.

The American Museum of Natural History extension school service, its unique exhibition halls, and the organization of a complete survey of the geological succession of the higher vertebrates of North America are due to President Osborn's efforts. His extensive researches chiefly concerned the palaeontology of the vertebrates. His publications dealt with almost all groups of animals and reptiles, but made especially important contributions to the knowledge of the rhinoceroses, horses, titanotheres, and dinosaurs. He founded a flourishing school of vertebrate palaeontology which already included the names of numerous brilliant younger men of science. He did much towards the determination of relative ages of extinct mammals in North America, and performed important services in working out a correlation between the Tertiary and mammal horizons of Europe and America. He also studied and wrote on the philosophical bearings of his work. He was called, by the Royal Society of London at the time of his election to membership, "one of the most distinguished palaeontologists of our time."

His scientific writings (1877–1928) in geology, palaeontology, anthropology and biology comprise 755 titles, including memoirs on extinct reptiles and mammals. Dr. Osborn died Nov. 6, 1935.

His books combine literary art and scientific information. Among the most important are: *From the Greeks to Darwin* (1894); *Evolution of Mammalian Molar Teeth* (1907); *The Age of Mammals* (1910); *Huxley and Education* (1910); *Men of the Old Stone Age* (1915); *Origin and Evolution of Life* (1917); *The Earth Speaks to Bryan* (1925); *Evolution and Religion in Education* (1926); *Creative Education* and *Man Rises to Parnassus* (1927).

*See* "Eminent Living Geologists," *Geological Magazine,* London (1917), vol. 4, pp. 193–196, new Series, Decade 6.

**OSBORNE,** a former royal residence in the Isle of Wight, England, south-east of East Cowes. The name of the manor in early times is quoted as Austerborne or Oysterborne. In 1845, it was purchased by Queen Victoria, who died there in 1901. King Edward VII. presented the property to the nation. A part of the house was transformed into a convalescent home for officers of the navy and army, opened in 1904. In 1903 there was opened on the Osborne estate a Royal Naval college, which in 1921 was closed down, and the cadets thenceforward joined Dartmouth college.

**OSCAN** was the name given by the Romans to that dialect (*lingua Osca*) which they found spoken by the *Osci* of Campania. But inscriptional and other records, *i.e.,* local and personal names and glosses in ancient authors, manifestly of the same dialect, have been found not only in Campania, where the dialect was, according to the most probable interpretation of the evidence, not original, but seems to have been imposed upon the Oscans by Samnite invaders in the 5th century B.C., but also further south, namely in northern Apulia, Lucania, in the country of the Brutii (the "toe" of Italy), and even in the north-east angle of Sicily at Messana (the modern Messina), which was captured by the

Campanian Mamertines *c.* 289 B.C.; in Samnium proper, including the territory of the Frentani and Hirpini; and finally, further north, in the country of the Paeligni, Marrucini and Vestini. Thus there are distinguished, geographically, and dialectally, three main groups of Oscan: (1) Central Oscan of Campania and the Samnite tribes, (2) Southern Oscan, and (3) Northern Oscan. These are all closely related to one another as compared with the dialect of the Volsci and of the Umbrian townships (Iguvium, the modern Gubbio; Tuder, modern Todi; and one or two others); while Oscan, Volscian and Umbrian, taken together, make one of the two great divisions—the other being Latin (*q.v.*) with Faliscan—into which the Italic branch of the Indo-European family of languages falls. Since the Samnitic tribes, whose expansion by successive migrations—"sacred springs" as they were called—diffused the Oscan speakers from their home in central Italy, knew their land (in Latin, Samnium) by the name *Safinim,* it has been proposed to describe their dialects as "Safine," a title at once more comprehensive and historically truer than "Oscan." The stock to which the Samnites belonged used commonly a suffix *-no-* (*e.g.,* in *Sabi-ni*) to form their tribal names, as distinguished from the suffixes *-co-* and *-(a)ti-* of an earlier stratum of population (*e.g.,* in *Vols-ci, Tea-te*). In names like *Marru-ci-ni, Ardea-ti-ni,* the superimposed *-no-* suffix bears witness to a conquest or overlordship of the earlier by the later stock.

Until the Roman advance gradually replaced it by Latin—important stages of this advance are marked not so much by the three Samnite wars as by the destruction of Capua in 211 B.C. and the Social War of 91–89 B.C.—Oscan held its place as a language in recognized official and educated usage side by side with, or instead of, Latin or Greek. The poet Ennius is said to have spoken all three tongues (Gellius 17,17,1), and if Strabo (5, p.233 C) may be trusted, the rude farces or puppet-shows introduced from the Oscan town Atella (*fabulae Atellanae, ludi Osci*) were actually performed at Rome in Oscan. The latest Oscan inscriptions, scratched on the walls of houses at Pompeii, were written shortly before the eruption of Vesuvius which overwhelmed that city in A.D. 79, and it is probable that the dialect, which has left its mark on modern south Italian dialects, survived in remote country districts as a local patois for some time longer. None of the Oscan inscriptions, on the other hand, is older than the 5th century B.C.

Many of the inscriptions are carefully, indeed almost with phonetic accuracy, written in a native alphabet which was itself derived, with certain necessary modifications, from the Etruscan alphabet; but a few belonging to the southern group, and including all those from Sicily, are in the Greek, and some from Lucania and elsewhere in the rustic or Colonial Latin alphabets. Over 250 in number, the majority are quite short; nevertheless, they furnish materials adequate to give us a fairly complete conspectus of the dialect. About two-thirds of the whole come from Campania, and most of those from Capua and Pompeii.

In character they fall mostly into the following classes: (1) official documents—municipal regulations (Bantia), a treaty (Nola and Abella), inscriptions relating to public works (Pompeii and elsewhere); (2) religious—an inventory of statues and altars in a sacred grove at Agnone (Samnium), the interesting group of heraldic *iovilae* (*q.v.*) from Capua, recording or prescribing special ceremonies connected with family cults, numerous simple votive and dedicatory inscriptions; (3) military and election announcements (from Pompeii); (4) private documents—epitaphs, bricks inscribed with names, and (from Campania) a few belonging to the interesting group of curses, inscribed on lead and deposited in tombs; (5) coin legends, including those of the Social War reading *vítelliú, i.e.,* "Italia."

Oscan has many peculiarities which distinguish it from Latin in sound changes, word forms and vocabulary; in syntax the differences are much less marked. But it also possesses certain features which distinguish it amongst the Italic dialects themselves. Their nature and extent may be indicated roughly by a specimen text (on a sundial found at Pompeii):

mr atiniís mr kvaísstur eítiuvad
múltasíkad kúmbennieís tangi(nud)
aamanaffed

This in Latin would be:

M(a)r(a) Atinius M(a)r(ae) (filius) quaestor pecunia multaticia conventus scitu
fieri iussit

(Mara Atinius, son of Mara, quaestor, in accordance with a decree of the assembly, had this set up from fine-money.)

BIBLIOGRAPHY.—R. S. Conway, *The Italic Dialects* (2 vols., 1897); R. von Planta, *Grammatik der oskisch-umbrischen Dialekte* (2 vols., 1892–97); C. D. Buck, *Grammar of Oscan and Umbrian* (1904), all three with bibl. New inscriptions are reported in the official *Notizie degli Scavi* (Hoepli), but often more promptly in F. Ribezzo's *Rivista Indo-greco-italica* (since 1917); those discovered between 1897 and 1925 will be found collected by W. Schwering and M. Bacherler in Bursian's *Jahresbericht,* vol. 176 (1916–18), pp. 69 *sqq.,* Bacherler, *ibid.* vol. 184 (1920), pp. 140 *sqq.,* vol. 205 (1925), pp. 51 *sqq.; see* also Ribezzo, *l.c.,* vol. 8 (1924), pp. 83 *sqq.; résumés* of discoveries and new studies in the field appear regularly also in *Glotta* (since 1907) and in the *Indogermanisches Jahrbuch* (since 1912). G. Herbig, in M. Ebert's *Real-lexikon der Vorgeschichte, s.v.* Italiker (1925; bibl.), and R. S. Conway in *Cambridge Ancient History,* vol. iv. (1926) pp. 444 *sqq.,* give summary accounts of the Italic peoples and dialects. (J. WH.)

**OSCAR I.** (1799–1859), king of Sweden and Norway, was the son of General Bernadotte, afterwards King Charles XIV. In 1838 the king began to suspect his heir of plotting with the Liberal party to effect a change of ministry, or even his own abdication. Oscar, however, avoided an actual rupture. After his accession (March 8th, 1844) it appeared that his liberalism was very restricted. He refused any radical reform of the cumbrous and obsolete constitution. But one of his earliest measures was to establish freedom of the press. Most of the legislation during his reign aimed at improving Sweden's economic position.

In foreign affairs Oscar I. was a friend of the principle of nationality. In 1848 he supported Denmark against Germany; placed Swedish and Norwegian troops in cantonments in Fünen and North Schleswig (1849–1850); and mediated the truce of Malmö (August 26, 1848). He was also one of the guarantors of the integrity of Denmark (London protocol, May 8, 1852). Oscar I. left four sons, of whom two, Carl (Charles XV.) and Oskar Fredrik (Oscar II.), succeeded to his throne.

*See* T. Almén, *Ätten Bernadotte* (Stockholm, 1896); and C. E. Akrell, *Minnen från Carls XIV., Oscars I. och Carls XV. Lagar* (Stockholm, 1884, 1885). Also NORWAY: *History,* and SWEDEN: *History.*

**OSCAR II.** (1829–1907), king of Sweden and Norway, son of Oscar I., was born at Stockholm on Jan. 21, 1829. In 1857 he married Princess Sophia Wilhelmina, youngest daughter of Duke William of Nassau. He succeeded his brother Charles XV. on Sept. 18, 1872, and was crowned in the Norwegian cathedral of Drontheim on July 18, 1873. At his accession he adopted as his motto *Brödrafolkens Väl,* "the welfare of the brother folk," and from the first he realized the essential difficulties in the maintenance of the union between Sweden and Norway. The political events which led up to the final crisis in 1905, by which the thrones were separated, are dealt with in the historical articles under NORWAY and SWEDEN. But it may be said that the peaceful solution eventually adopted could hardly have been attained but for the tact and patience of the king himself. He declined, indeed, to permit any prince of his house to become king of Norway, but better relations between the two countries were restored before his death, which took place at Stockholm on Dec. 8, 1907. His acute intelligence and his aloofness from the dynastic considerations affecting most European sovereigns gave the king considerable weight as an arbitrator in international questions. At the request of Great Britain, Germany and the United States in 1889 he appointed the chief justice of Samoa, and he was again called in to arbitrate in Samoan affairs in 1899. In 1897 he was empowered to appoint a fifth arbitrator if necessary in the Venezuelan dispute, and he was called in to act as umpire in the Anglo-American arbitration treaty that was quashed by the senate.

Himself a distinguished writer and musical amateur, King Oscar was a generous friend of learning and of education. His works, which included his speeches, translations of Herder's *Cid* and Goethe's *Torquato Tasso,* a play, *Castle Cronberg,* poems and historical works, were collected in 1875–76 (new and enl. ed.,

1885–88). His *Memoirs of Charles XII.* were translated into English in 1879.

*See* A. Hasselgren, *Oskar II., en lefnadsteckning* (1908).

**OSCEOLA** (*c.* 1804–1838), a Seminole American Indian, leader in the second Seminole War, was born in Georgia, near the Chattahoochee river. His father was an Englishman named William Powell; his mother a Creek of the Red Stick or Mikasuki division. In 1808 he removed with his mother into northern Florida. When the U.S. commissioners negotiated with the Seminole chiefs the treaties of 1832–33 for the removal of the Seminoles to Arkansas, Osceola seized the opportunity to lead the opposition of the young warriors, and declared to the U.S. agent, Gen. Wiley Thompson, that any chief who prepared to remove would be killed. Late in 1835 he murdered Charley Emathla (or Emartla), a chief who was preparing to emigrate with his people, and with a few companions shot and killed Gen. Thompson.

In 1836 Generals Edmund P. Gaines (1777–1849), Winfield Scott (1786–1866) and Richard K. Call (1791–1862) waged war against them with little effect, and the year closed with General Thomas Sidney Jesup (1788–1860) in command with 8,000 troops at his disposal. General Jesup drove the enemy from the Withlacoochee country and was pursuing them southward toward the Everglades when several chiefs expressed a readiness to treat for peace. On March 6, 1837, they agreed to cease hostilities, to prepare for emigration to Arkansas, and gave hostages to bind them to their agreement. But on June 2 Osceola came to the camp at the head of about 200 Mikasuki (Miccosukees) and effected the flight of all the Indians there, about 700 including the hostages, to the Everglades. Hostilities were then resumed, but in September, after the capture of several chiefs, Osceola requested an interview. This was granted, and by command of General Jesup he was taken captive and carried to Fort Moultrie, at Charleston, S.C., where he died in January, 1838. The war continued until 1842, but after Osceola's death the Indians did little but attack the unarmed inhabitants.

*See* J. T. Sprague, *The Origin, Progress and Conclusion of the Florida War* (1848).

**OSCHERSLEBEN,** a town in the Prussian province of Saxony, on the Bode, 24 m. by rail W.S.W. of Magdeburg, and at the junction of lines to Halberstadt and Jerxheim. Pop. (1939) 17,761. Oschersleben is first mentioned in 803. Among its industrial establishments are sugar-refineries, iron-foundries, breweries, machine-shops and brick works.

**OSCILLATOR.** A non-rotating device used in radio apparatus for producing alternating current. The output frequency of the oscillation is determined by the characteristics of the device.

**OSCILLATORY CIRCUIT,** as applied to radio apparatus, is a relatively low resistance circuit containing both inductance and capacity, such that the voltage impulse will produce a current which periodically reverses in direction.

**OSCILLOGRAPH,** an instrument for the delineation of alternating current wave forms. In the type devised by Duddell (*Electrician* xxxix., Sept. 1897, 636) two phosphor bronze strips under tension pass, side by side, between the poles of an electromagnet. The current is led up one strip and down the other so that they move in opposite directions at right angles to their length. A small mirror bridged across the strips is thus tilted to an extent dependent on the strength of the current. The mirror reflects a spot of light on to a photographic film whose movement at right angles to that of the light spot provides the time scale. The natural period of vibration of the strips is arranged to be very small ($\frac{1}{8,000}$–$\frac{1}{10,000}$ sec.) to enable them to move in accordance with the fluctuations of the current. Other types of oscillograph have been designed by Blondel, Irwin (the *hot-wire* oscillograph) and others. The Cathode Ray Oscillograph is available for high-frequency observations. For further information *see* INSTRUMENTS, ELECTRICAL; BALLISTICS; OSISO.

**OSH,** a town of Asiatic Russia, in the Kirghiz A.S.S.R. in 40° 35′ N., 72° 55′ E., 31 m. S.E. of Andijan railway terminus, at an altitude of 4,030 ft. Pop. (1933) 44,800. It is on the Ak-bara river, a tributary of the Kara-Su, in a fertile cotton, grain and fruit growing valley leading to the Alai and Pamir. The famous Takht-i-Suleiman (Solomon's Throne) rock, the theme of so many Eastern legends, is near the town and is frequented by pilgrims.

**O'SHAUGHNESSY, ARTHUR WILLIAM EDGAR** (1844–1880), English poet, was born in London on March 14, 1844, and at seventeen became a copyist in the library of the British Museum. Later, he specialised in ichthyology. He published his *Epic of Women* in 1870, *Lays of France,* a free version of the *Lais* of Marie de France, in 1872, and *Music and Moonlight* in 1874. He died on Jan. 30, 1880, his *Songs of a Worker* appearing immediately afterwards. In Palgrave's words, he had "a haunting music all his own."

**OSHAWA,** a manufacturing city and port of entry of Ontario county, Ontario, Canada, on Lake Ontario and the Canadian National and Canadian Pacific railways, 30 m. E.N.E. of Toronto. Pop. (1941) 28,813. It contains large motor works, flour, woollen and grist-mills, piano, farm implement and carriage factories, foundries, tanneries, canning factories, etc.

**OSHIMA,** a group of three small islands belonging to Japan, lying southwards of Kiushiu, in 30° 50′ N. and 130° E. Their names, from west to east, are Kuro-shima, Iwo-shima and Take-shima. Kuro-shima rises to a height of 2,475 ft., and Iwo-shima has an active volcano 2,480 ft. high. These islands are not to be confounded with Oshima, the most northerly island of the Izu-noshichito, or with the northern group of the Luchu Islands.

**OSHKOSH,** a city of Wisconsin, U.S.A., 75 m. N.N.W. of Milwaukee, on the west shore of Lake Winnebago, where the Fox river flows into it; the county seat of Winnebago county. It is on federal highways 41, 45 and 110, and is served by the Chicago and North Western, the Chicago, Milwaukee, St. Paul and Pacific, the Soo Line, motor coaches and motor-truck lines. Population in 1940 was 39,089 by federal census.

Oshkosh is the seat of a state teachers' college with an enrolment of 800. Lumber used to be the main industry, but products are now highly diversified. The output in 1937 was $23,418,725. Bank clearings for 1940 were $18,487,158, and the valuation for 1940 was $41,779,875. The city has an aldermanic government.

The Fox river and Lake Winnebago early became an important line of communication, under French control, on the route between the Great Lakes and the Mississippi. Trading posts were established on the site of Oshkosh in the 18th century, and a flotilla of 50–100 fur-laden barges and bateaux was not an uncommon sight on the river. Permanent settlement here began about 1836. The north side of the river was at first called Saukeer and the south side Algoma, but in 1840 the name Oshkosh was adopted, to honour a friendly Menominee chief. In 1874 and in 1875 the city suffered serious loss from fire. It was chartered as a city in 1853.

**OSIANDER, ANDREAS** (1498–1552), German reformer, was born at Gunzenhausen, near Nuremberg, on Dec. 19, 1498. His German name was Heiligmann, or, according to others, Hosemann. After studying at Leipzig, Altenburg and Ingolstadt, he was ordained priest in 1520 and appointed Hebrew tutor in the Augustinian convent at Nuremberg. Two years afterwards he was appointed preacher in the St. Lorenz Kirche, and about the same time he publicly joined the Lutheran party, taking a prominent part in the discussion which ultimately led to the adoption of the Reformation by the city. He married in 1525. He was present at the Marburg conference in 1529, at the Augsburg diet in 1530 and at the signing of the Schmalkald articles in 1537. His vehemence, coarseness and arrogance in controversy brought him many personal enemies. The introduction of the Augsburg Interim in 1548 necessitated his departure from Nuremberg; he went first to Breslau, and afterwards settled at Königsberg as professor in its new university at the call of Duke Albert of Prussia. Here in 1550 he published two disputations, the one *De lege et evangelio* and the other *De justificatione,* which aroused a controversy still unclosed at his death on Oct. 17, 1552. While he was fundamentally at one with Luther in opposing both Romanism and Calvinism, his mysticism led him to interpret justification by faith as not an imputation but an infusion of the essential righteousness or divine nature of Christ. His party was afterwards led by his son-in-law Johann Funck, but disappeared after the latter's

execution for high treason in 1566. Osiander's son Lukas (1534–1604), and grandsons Andreas (1562–1617) and Lukas (1571–1638) were well-known theologians.

Osiander, besides a number of controversial writings, published a corrected edition of the Vulgate, with notes, in 1522, and a *Harmony* of the Gospels—the first work of its kind—in 1537. The best-known work of his son Lukas was an *Epitome* of the *Magdeburg Centuries*. *See* the *Life* by W. Möller (Elberfeld, 1870).

**OSIER,** the common term under which are included those species, varieties and hybrids of the genus *Salix* used in the manufacture of baskets. The chief species in cultivation are: *Salix viminalis* (the common osier), *S. triandra, S. amygdalina, S. purpurea* and *S. fragilis,* which botanically are willows. The first named with some 40 of its varieties formerly comprised the staple basket-making material in England. It is an abundant cropper, sometimes attaining on low-lying soils a height of 13 ft. Full-topped and smooth, it is by reason of its pithy nature mainly cultivated for coarse work and is generally used as brown stuff. Some harder varieties, known as stone osiers and raised on drier upland soils, are peeled and used for fine work.

*S. fragilis,* with some half-score varieties, is almost exclusively used by market gardeners for bunching greens, turnips and other produce.

Owing to the increased demand for finer work much attention has been given (*see* BASKET) to the cultivation of the more ligneous and tougher species, *S. triandra, S. purpurea* and *S. amygdalina* with their many varieties and hybrids.

It is commonly supposed that osiers or willows will prove remunerative and flourish with little attention on any poor, wet, marshy soil. This is, however, not the case. No crop responds more readily to careful husbandry and skilful cultivation. For the successful raising of the finer sorts of willows good, well-drained, loamy upland soil is desirable, which before planting should be deeply trenched and cleared of weeds.

At any time, from late winter to early spring, the ground may be planted with "sets," *i.e.*, cuttings of about 9 to 16 in. in length, taken from clean, well-ripened rods. These are firmly set to within 3 to 6 in. of the top in rows, 16 to 20 in. apart and spaced at intervals of 8 to 12 in. Yearling sets are largely planted, but the practice of the best Midland and west of England growers proves the superior productiveness of sets cut from two yearling rods. Great care should be exercised in planting lest the bark be fractured, loosened or removed from the wood and if not subject to periodical alluvial floods the ground should be manured yearly. The coarser *S. viminalis* may be raised on lowland soil if not water-logged or marshy. The more valuable kinds are known as: New kind, Black mauls, Spaniards, Glibskins, Long-bud, Long-skin, Lancashire red-bud, French, Italians, Pomeranians and Councillors and scores of other local names. A hybrid of *S. viminalis* and *S. triandra,* known as Black-top has been found to produce the heaviest crops on the best Leicestershire grounds.

Cutting and binding take place in early winter after the fall of the leaf, the crop being known as green whole stuff. The coarser kinds are sorted, cured (dried in the sun and wind) and stacked ready for market. These are known as brown rods. The finer kinds, after the more shrubby or ill-grown rods, termed Ragged, have been rejected, are peeled or buffed. Two methods of stripping are chiefly practised: from the heads (sets) and from the pit. By the former method the rods are left on the ground until spring advances, when a rapid growth of the cambium begins. They are then cut direct from the head and the bark is easily removed by drawing the rods through a bifurcated hand-brake of smooth, well-rounded steel, framed in wood. Improved brakes worked by a treadle strip two rods at a time. For the smaller sizes, rubber brakes are sometimes used and, for the very smallest, the fingers either bare or protected by linen bands. This method ensures a clean-butted unfractured rod, but unless great judgment is exercised in selecting the proper time for cutting the rods will remain double-skinned and the head may bleed. By the "pit" process the green rods are stood upright in shallow pits of water at a depth of about 6 to 9 in. until the sap rises and growth begins, when they are ready for the brake. The defects of this method are that the tops are liable to split in the brake and the butts to remain foul. A third, known as the "pie" system, enables the grower to bridge over the interval, and to keep his hands employed, between the end of the "head" and the beginning of the "pit" strippings.

The willows are cut at the first indication of the sap rising and 'couched" in rotten peelings and soil at a slight angle, the butts being on the ground, which should be strewn with damp straw from a manure heap. The tops are covered lightly with rotted peelings and by periodical application of water, fermentation is induced at the bottom, heat is engendered, the leaves force their way through the covering and peeling may begin. Peeling is chiefly done by women and lasts from early May to the middle of July, but a motor peeler has been introduced in some osier grounds. After stripping, the rods are bleached in the sun and stored for sale as White. If the rods are to be buffed they are immersed in large tanks of boiling water from 4 to 6 hours. They are then allowed to cool and mellow, are stripped and carefully dried in sun and air and remain dyed a rich tawny brown or buff colour. Brown rods may also be buffed by sinking them in cold water which is heated to boiling point, and maintained at that temperature for the requisite period.

In its natural habitat the osier or willow is a dioecious plant reproduced by cross fertilization but for at least 2,000 years has been cultivated from cuttings. The stocks have therefore become enfeebled; their cultivation is attended with many disturbing causes—ground vermin, fungoid and insect pests as well as winter floods and spring frosts.

The British Ministry of Agriculture and Fisheries has shown that under suitable conditions improved stocks of basket willows can be produced by cross fertilization and their disease-resisting power strengthened.

In eastern North America the name red-osier has been applied to *Cornus stolonifera,* one of the shrubby dogwoods.

*See* W. P. Ellmore, *The Cultivation of Osiers and Willows,* 2nd ed.; also a leaflet (No. 36) on the same subject published gratis by the British Ministry of Agriculture. (T. O.; X.)

**OSIJEK** (Germ. *Esseg,* Magyar, *Eszek*), town of Croatia-Slavonia, Yugoslavia, occupied by Italy in 1941. Pop. (1931) 40,339, chiefly Magyars and Croats. It is situated on the Drave, which is here crossed by two bridges, below which the river is navigable by small steamers. The upper, or old town, contains the fortress, while the lower or new town is the commercial centre. It has several Orthodox and Roman Catholic churches, Franciscan and Capuchin monasteries, a synagogue, gymnasium, school, hospital, chamber of commerce and law courts. Osijek has a thriving trade in grain, fruit, livestock, plum brandy and timber. There are cotton mills, tanneries and a sugar beet factory, while silk weaving, glass blowing and the making of hats and caps are also carried on.

Osijek owes its origin to its fortress, which existed in Roman times under the name of *Mursia.*

**OSIMO,** a town and episcopal see (anc. *Auximum, q.v.*), the Marches, Italy, province of Ancona, 10 mi. S. of that town by rail. Pop. (1936) 6,817 (town); 21,182 (commune). It is on the top of a hill 870 ft. above sea-level and it retains a portion of its ancient town wall (2nd century B.C.). The cathedral has a portal with sculptures of the 13th century, an old crypt and a fine bronze font of the 16th century; the town hall contains a number of statues found on the site of the ancient forum and also a few pictures. Silk spinning and the raising of cocoons are carried on.

**OSIRIS,** one of the principal gods of the ancient Egyptians. *See* EGYPT: *Religion.*

**OSISO,** an instrument for recording the exact character of vibrations. It has been used for the investigation of electrical phenomena, recording sounds, enabling the totally deaf to understand speech and to speak, studying and eliminating vibration in machinery, determining the recoil action of guns, locating heavy artillery, aeroplanes and vessels, studying heart-beats, respiration and other bodily functions, locating oil, ore bodies, etc. The osiso consists of a tiny mirror mounted on two wires and suspended between the poles of a magnet. If a current flows through the wires in a strong magnetic field, they will tend to move, the direction and

extent of the motion depending upon the direction and strength of the current flow. A beam of light, reflected from the mirror, provides a means for making visible the movements of the mirror and for recording them on a photographic film. Every sound produces its own individual wave form, and the meaning of these waves can be read. (*See* INSTRUMENTS, ELECTRICAL: *Oscillograph.*)

**OSKALOOSA,** a city of southeastern Iowa, U.S.A., on federal highway 63 and state highways 92, 163, 309 and 371 and near the Des Moines river and Keomah Lakes State park; the county seat of Mahaska county. It is served by the Minneapolis and St. Louis, and the Rock Island railways. Pop. (1940 federal census) 11,024. It is in a farming and coal-mining region, and has a number of important factories. Penn college, founded in 1873, is located on the northern edge of the city. In the suburb of University park, adjoining it on the east, is John Fletcher college. Oskaloosa was settled in 1843, chosen for the county seat in 1844, and chartered as a city in 1853. It was named after a Seminole princess.

**OSLER** (*ōs'lur*), **SIR WILLIAM** (1849–1919), British physician, born at Bond Head, Canada, July 12, 1849, was educated at Trinity college school, Port Hope, Trinity College, Toronto, and McGill university, Montreal, where he took the M.D. degree in 1872. He studied medicine in London, Leipzig and Vienna and in 1874 was appointed professor of medicine at McGill university. From 1884 to 1889 he was professor of clinical medicine in the University of Pennsylvania, and from 1889 to 1904 professor of medicine at Johns Hopkins university. In 1905 he was appointed regius professor of medicine at Oxford, where he also served as a curator of the Bodleian library, as a delegate of the University Press and as one of the Radcliffe trustees. In 1911 he was created a baronet. Sir William Osler carried out original and valuable researches on the diseases of the spleen and blood and also made eminent contributions to the study of infections of the heart, of angina pectoris, of malaria and of many minor maladies. Sir William died at Oxford Dec. 29, 1919.

His most important work was *The Principle and Practice of Medicine* (1892, latest edition 1920). He also wrote monographs on *Cerebral Palsies in Children* (1889); and *Chorea and Choreiform Affections* (1894); a volume of essays *Aequanimitas* (1901); and *A Way of Life* (1913).

**OSLO** (known as KRISTIANIA or CHRISTIANIA from 1624 to 1925), capital of Norway, forming a separate county (*amt*), and the seat of a bishopric (*stift*). Pop. (1930 census) 253,124; (1943 est.) 275,000. Area, 6·5 sq.mi. It lies in southern Norway, on the Aker river, at the head of Oslo fjord some 80 mi. from the Skagerrak. The modern city, with its busy, island-studded harbour, lies in a basin surrounded by pine-wooded hills. Before World War II it developed rapidly as the great town of Norway, containing not only the governmental offices, courts and parliament, but the university and the important national theatres and museums. Karl Johans Gate is the chief thoroughfare, with the royal castle and its statue of Karl Johan at the western end, and along its sides some of the leading banks and business houses, the Grand Hotel, the Frederician university (founded in 1811), the National theatre (1899) with its huge statues of Ibsen and Björnson, and the *Storting* (parliament) building (1866). The art museum lies just north of the university; the historical museum nearby. Across the harbour in Bygdö is a special structure housing Nansen's unique exploring ship, the *Fram;* another building for three fine old Viking ships, and the large Folk museum with typical early dwellings, a *stavkirke,* Ibsen's workroom, and exhibits of native handicraft and industry.

The city's population growth (7,500 in 1769; 13,600 in 1815; 134,000 in 1886; about 275,000 in 1943), resulted in the absorption of many of the surrounding communities and the creation of garden suburbs and large modernistic apartment units. At Ullevaal is the largest municipal hospital in the country. High above the city rises Holmenkollen with its famous ski-jump and ski museum. At Tören is a science museum. Still incomplete but in use at the time of the German invasion in 1940 was an impressive new city hall, built in a former slum area on the inner harbour called Pipervik. Immediately to the east is the Akershus fortress, extensive but not kept up to date.

The site of the old city of Oslo lies east of the Aker river. It was founded by Harald Hardrada in 1048, became soon the seat of a bishopric, and in the 14th century was the *de facto* capital. Its period of brilliance was from 1286 to 1350, but it was repeatedly burned and plundered; after complete destruction by fire in 1624 it was left to ruin and the inhabitants were ordered to build Kristiania (named for King Christian IV of Denmark and Norway). On Jan. 1, 1878, the site was incorporated in Kristiania.

Like the other municipalities of Norway, Oslo before 1940 enjoyed a high degree of local autonomy, especially after the charter of 1837. Its Council of 84 elected an executive committee of 21; both were under control of the Labour party after the elections of 1937. The city budget of about $30,000,000 supported farreaching social activities such as the child welfare clinic, mothers' pensions, summer camps for more than 3,000 children, the famous "Oslo breakfast" for school children, economic advisers for housewives, and an employment bureau.

Oslo is well connected by rail and highway with other cities of Norway and Sweden; it is also the chief seaport of a seafaring nation. It ordinarily imports about three times as much as it exports and has floating dock, dry dock and elevator facilities; the harbour is kept ice free. Two railway stations serve the city: Östbanegaard or Hovedbanegaard by the Björvik and Vestbanegaard by the Pipervik. There is a special railway up to Holmenkollen and good tram service. There are two large shipbuilding yards and many factories, mostly concentrated in Sagene, manufacturing woollens, linens, paper, pulp, machinery, brick and tile, flour, condensed milk, margarine, oil, soap, hardware, glass, chemicals, beer and liquors.

Electric power is supplied by a huge project at Solbergfoss on the Glommen river.

BIBLIOGRAPHY.—L. Daae, *Det gamle Christiania, 1624–1824* (Christiania, 1890); Y. Nielsen, *Christiania und Umgegend* (Christiania, 1894); G. Amnéus, *La Ville de Christiania . . . Resumé historique, etc.* (Christiania, 1900); *Social Work in Oslo* (Oslo, 1939).

**OSMAN** ('UṢMĀN), the usual form of the Arabic name 'OTHMAN, as representing the Turkish and Persian pronunciation of the name. It is used, therefore, for (1) the founder of the Osmanli or Ottoman dynasty, Osman I., who took the title of sultan, ruled in Asia Minor, and died in 1326, and (2) the sixteenth sultan Osman II., who reigned 1616–1621. (*See* TURKEY: *History;* OTHMAN and CALIPHATE.)

**OSMAN** (1832–1900), Turkish pasha and mushir (field marshal), was born at Tokat, in Asia Minor, in 1832. Educated at the military academy at Constantinople, he entered the cavalry in 1853, and served under Omar Pasha in the Russian War of 1853–56, in Wallachia and the Crimea. Appointed a captain, in the Imperial Guard, he distinguished himself in the campaigns of the Lebanon in 1860 and of Crete in 1867 to 1869, and was promoted lieut.-colonel. He served under Redif Pasha in suppressing an insurrection in Yemen in 1871, was promoted major-general in 1874, and general of division in 1875. Appointed to command the army corps at Widin in 1876 on the declaration of war by Serbia, he defeated Tchnernaieff at Saitschar and again at Yavor in July, invaded Serbia and captured Alexinatz and Deligrad in October, when the war ended. Osman was promoted to be mushir, and continued his command at Widin.

When the Russians crossed the Danube in July 1877, Osman moved his force to Plevna, and, with the assistance of his engineer, Tewfik Pasha, entrenched himself on the right flank of the Russian line of communication, and gradually made the position a most formidable one. He repulsed the three assaults of the Russians and after being closely invested, held the position until Dec. 9, when, compelled to cut his way out, he was severely wounded and forced to capitulate. This famous improvised defence delayed the Russians for five months, and entailed their crossing the Balkan range in the depth of winter after the third battle of Plevna. The sultan conferred on Osman the Grand Cross of the Osmanie and the title of "Ghazi" (victorious), and, when he returned from imprisonment in Russia, made him commandant of the Imperial Guard, grand-master of the artillery and marshal

of the palace.

In December 1878 he became war minister, and held the post, with a small break, until 1885. He died at Constantinople on April 14, 1900.

**OSMANLI,** the tribal name of the Turks of the Ottoman empire. The Osmanli include a heterogeneous group of peoples, the original conquering Osmanli having mixed very considerably with the conquered peoples, until physically they have ceased to have a definite separate existence.

**OSMIUM,** a chemical element found in small quantities in platinum ores but obtained chiefly from the mineral osmiridium by the method of Deville and Debray (*see* RUTHENIUM); together with iridium it was first isolated by Smithson Tennant in 1803 (symbols Os, atomic number 76, atomic weight 190·8). Osmiridium is fused with metallic zinc, the excess of zinc is dissolved in hydrochloric acid and the residue ignited with a mixture of barium nitrate and barium peroxide. When cold, the mass is finely powdered and treated with cold dilute hydrochloric acid in a stoppered bottle; this is necessary as osmium is present in the form of volatile tetroxide. After all action has ceased, nitric and sulphuric acids are added, the mixture is well shaken and the barium sulphate allowed to deposit. The liquid is then distilled, when the volatile osmium tetroxide passes over in an almost pure state. The residue from the distillation is concentrated, ammonium chloride is added, and ammonium iridium chloride $(NH_4)_2IrCl_6$ (together with a little ruthenium) is precipitated. Another method of obtaining osmium from osmiridium is to heat the alloy mixed with common salt in a slow stream of chlorine. The sodium osmichloride, $Na_2OsCl_6$, produced is extracted with water; sal ammoniac is added to precipitate sparingly soluble ammonium osmichloride, $(NH_4)_2OsCl_6$, which on gentle ignition leaves a residue of spongy osmium.

Osmium in the massive state is a metal of a bluish-white colour. It can be obtained crystalline by alloying any of its forms with metallic tin and subsequently removing the tin by means of hydrochloric acid. It has a specific gravity of 22·48, and melts at about 2,700° C, although it begins to volatilize at a lower temperature. It is a very hard metal, especially when combined with iridium, and the alloy was at one time used extensively for tipping gold pens, but for this purpose cheaper alloys are now employed free from platinum metals and generally having tungsten for their basis. It is not suitable in alloys with other platinum metals for high-temperature work, for, owing to the ease with which it oxidizes, it causes the alloy to disintegrate.

Osmium forms several oxides of which four are known with certainty, namely, OsO, $Os_2O_3$, $OsO_2$ and $OsO_4$, while $OsO_3$ is present in the metallic osmates. The lower oxides are unimportant. *Osmium tetroxide,* $OsO_4$, known in commerce under the name of osmic acid, can readily be obtained in a state of purity, and is the source from which other osmium compounds are generally prepared. If metallic osmium in any form is heated in a tube in a current of air, or preferably oxygen, to a bright red heat, combination takes place and a yellowish liquid, $OsO_4$, condenses in the cold part of the tube, afterwards crystallizing in yellowish needles which melt at 40° C; the liquid boils at 100° C giving a colourless vapour. Traces of the vapour of osmium tetroxide have a very strong odour somewhat resembling that of chlorine. The vapour is poisonous and exceedingly corrosive and attacks animal membranes vigorously, becoming reduced and leaving a deposit of metallic osmium. In small quantities the physiological effect is transitory but larger quantities entail serious consequences. It is largely used for preparing microscopic slides as it acts preferentially on certain portions of tissue, staining them black. If alcohol is added to $OsO_4$ dissolved in caustic potash, the solution becomes red and on concentration potassium osmate, $K_2OsO_4,2H_2O$, crystallizes out. This salt is stable in neutral solutions but decomposes on acidification, forming $OsO_4$ and lower oxides. Osmium has several chlorides such as $OsCl_2$, $OsCl_3$ and $OsCl_4$; these, and especially the last two, have a great tendency to combine with alkaline chlorides producing double chlorides of the form $M_3OsCl_6$ and $M_2OsCl_6$. They are readily formed from the tetroxide by the use of suitable reducing agents. Two sulphides of osmium are known, $OsS_2$ and $OsS_4$; the latter is formed by the action of sulphuretted hydrogen upon acid solutions of the tetroxide. Qualitatively, osmium is detected by the odour of $OsO_4$ produced when the metal is ignited in air. A delicate test for $OsO_4$ is to warm an aqueous solution with thiocarbamide and dilute hydrochloric acid, when a red coloration shows the presence of osmium. (F. E. M.)

**OSNABRÜCK,** a town and episcopal see in the Prussian province of Hanover, Germany, on the Hase, 70 mi. W. of the city of Hanover, 31 mi. by rail N.E. of Münster, and at the junction of the lines Hamburg–Cologne and Berlin–Amsterdam. Pop. (1939) 98,731. In 888 Osnabrück received the right to establish a mint, a market and a toll-house. Surrounded with walls towards the close of the 11th century, it maintained an independent attitude towards its nominal ruler, the bishop, and joined the Hanseatic League, reaching the height of its prosperity in the 15th century. The older streets contain examples of Gothic and Renaissance domestic architecture. The Roman Catholic cathedral, with its three towers, is a building of the 13th century, partly in the Romanesque and partly in the Transitional style; but it is inferior in architectural interest to the Marienkirche, a Gothic structure of the 14th and 15th centuries. The town hall, a 15th century Gothic building, contains portraits of some of the plenipotentiaries engaged in concluding the peace of Westphalia. Other important buildings are the museum, containing scientific and historical collections; the episcopal palace and the law courts. The lunatic asylum on the Gertrudenberg occupies the site of an ancient nunnery. Linen was formerly the staple product, but it no longer retains that position. The manufactures include machinery, paper, celluloid, chemicals, tobacco and cigars, pianos, cloth and beer. It has large iron and steel works, and coal mines in the neighbourhood. It was bombed repeatedly and very severely during World War II.

**OSORNO,** a province in south Chile, bounded north along the Río Bueno by Valdivia, east by Argentina, south by Llanquihue, and west by the Pacific. Area, 3,867 sq.mi.; population (1940) 107,341. The province was created by law Jan. 19, 1940, about two-thirds the territory having been taken from the province of Llanquihue, the remainder from the province of Valdivia. Osorno lies in the temperate rain forest zone of the south, and is divided longitudinally into the three physiographic regions (coastal mountains, interior valley and cordillera) which characterize the majority of the provinces of Chile. The west is sparsely settled, and there are no towns, ports or roads in the region. The central valley, traversed by the Santiago-Puerto Montt line of the State railways, is a productive agricultural and stock-raising region, settled in considerable part by German colonists and their descendants. The valley is integrated by a good network of roads, many of which lead eastward to the Lake district. The eastern part of the province is noted for its lakes (especially Ranco, the southern half of which is in Osorno, Puyehue and Rupanco), resorts (Lago Ranco, Salto del Pilmaiquén, Baños de Azufre and Termas de Puyehue), forests and mountains.

Osorno, capital of the province and department of the same name (population 25,075 in 1940), was founded in 1553 and named in honour of the Marqués de Osorno, viceroy of Peru. Centrally located in the valley, Osorno has the distinction of being the only large urban centre in the province, the fourth largest city in south Chile, the gateway to southern Chile's famous tourist region, and the western terminus of the important international route which leads to the Argentine town of San Carlos de Bariloche. The province is divided into two departments, Osorno and Río Negro, the capital of the latter being Río Negro, with a population of but 1,897 in 1940.

**OSPREY** or **OSPRAY,** a bird of prey of conspicuously marked plumage, the white of its lower parts and head contrasting sharply with the dark brown of the back when it is on the wing. It is the representative of the family *Pandionidae,* closely related to the *Falconidae.* Its special characters are the presence of a reversible outer toe and spicules on the soles of the feet.

The osprey (*Pandion haliaetus*) is one of the most cosmopolitan birds of prey. Where, through abundance of food, it is numerous,

the nests of the fish-hawk (to use its American name) may be placed on trees to the number of 30 close together. Where food is scarcer and the species accordingly less plentiful, a single pair will occupy an isolated rock, as formerly in Scotland. Few birds lay eggs so rich in colouring: their white or pale ground is spotted, blotched or marbled with almost every shade of purple, orange and red, from the most delicate lilac and buff, through violet, chestnut and crimson, to black. The fierceness with which ospreys defend their eggs and young, in addition to the dangerous situation chosen for the aerie, makes the task of robbing the nests difficult. It no longer breeds in Great Britain. The term "osprey," applied to the nuptial plumes of the egrets in the feather trade, is derived from the French *esprit;* it has nothing to do with the osprey bird.

BY COURTESY OF THE NATIONAL ASSOCIATION OF AUDUBON SOCIETIES

THE OSPREY (PANDION HALIAETUS)
A bird of prey, known in America as the fish-hawk

**OSROENE** or **OSRHOENE,** a district of northwestern Mesopotamia, in the hill country on the upper Bilechas (Belichus; mod. *Nahr Belik,* Bilikh), the tributary of the Euphrates, with its capital at Edessa (*q.v.*), founded by Seleucus I. About 130 B.C. Edessa was occupied by a nomadic Arabic tribe, the Orrhoei (Plin. v, 85; vi, 25, 117, 129), who founded a small state ruled by their chieftains with the title of kings. After them the district was called Orrhoene (thus in the inscriptions, in Pliny and Dio Cassius), which occasionally has been changed into Osroene, in assimilation to the Parthian name Osroes or Chosroes (Khosrau). The founder of the dynasty is therefore called Osroes by Procop. (*Bell Pers.* i, 17) but Orhāi or Urhāi, son of Hewyā (*i.e.* "the snake"), in the chronicle of Dionysius of Tellmahre; he is no historical personality, but the eponym of the tribe. The kings soon became dependants of the Parthians; their names are mostly Arabic (Bekr, Abgar, *Ma'nu*), but among them occur some Iranian (Parthian) names, as Pacorus and Phratamaspates. Under Tigranes of Armenia they became his vassals, and after the victories of Lucullus and Pompey, vassals of the Romans. Their names occur in all wars between Romans and Parthians, when they generally inclined to the Parthian side; *e.g.,* in the wars of Crassus and Trajan. Trajan deposed the dynasty, but Hadrian restored it. The kings generally used Greek inscriptions on their coins, but when they sided with the Parthians, as in the war of Marcus Aurelius and Verus (A.D. 161–165), an Aramaic legend appears instead. Hellenism soon disappeared and the Arabs adopted the language and civilization of the Aramaeans. This development was hastened by the introduction of Christianity, which is said to have been brought here by the apostle Judas, the brother of James, whose tomb was shown in Edessa. In 190 and 201 we hear of Christian churches in Edessa. King Abgar IX (or VIII) (179–214) himself became a Christian and abolished the pagan cults. Caracalla in 216 abolished the kingdom of Osroene (Dio Cass. 77. 12, 14) and Edessa became a Roman colony. The list of the kings of Osroene is preserved in the Syrian chronicle of Dionysius of Tellmahre, which is checked by the coins and the data of the Greek and Roman authors; it has been reconstructed by A. von. Gutschmid, "Untersuchungen über die Geschichte des Königreichs Osroene," in *Mémoires de l'Acad. de St. Pétersbourg,* t. xxxv (1887). Edessa remained Roman till it was taken by Chosroes II in 608; but in 625 Heraclius conquered it again. In 638 it was taken by the Arabs. (ED. M.)

**OSS,** an industrial town in North Brabant, Netherlands. Pop. (1940) 17,467. It is the centre of the Dutch margarine industry.

**OSSA** (mod. *Kissovo, Kissavo*), a mountain (el. *c.* 6,400 ft.) in Larissa, S.E. part of Thessaly, Greece; S. of Olympus, from which it is separated by the valley of Tempe, and N. of Pelion which the Giants are said to have piled on it to scale Olympus.

**OSSETE.** This member of the northern group forms of Iranian speech was spoken in the area north of the Caucasus. It is the survival of a number of Scythian languages formerly current in S. Russia before the Slav onset. It is divided into two divisions, eastern and western. A number of words in Hungarian indicate an ancient association between the languages.

*See* Miller, *Grundriss der Iranische Philologie* Vol. I.

**OSSETIAN AUTONOMOUS AREAS,** two administrative units of Russia. (1) The South Ossetian Area created in 1922 is linked administratively with the Georgian S.S.R. Area 1,429 sq.mi. Pop. (1933) 95,300. (2) The North Ossetian Area created in 1924 is linked administratively with the North Caucasian Area. Area 2,327 sq.mi. Pop. (1939) 328,885.

The Ossetes are descended from the Alans, the strongest and most numerous of the Sarmatian tribes, and their language belongs to the Iranic group of the Aryan tongues. The earliest reference to the Alans is A.D. 35 when, according to Josephus, they occupied the Kuban valley; later they occupied the Don and Dnieper regions, where they joined forces with Germanic tribes in attacks on the Romans. Legend gives the Emperor Maximin a Gothic father and an Alan mother. The Hun invasion swept them from the steppe, but they took refuge in the Caucasus and were probably settled in their present territory in the 5th and 6th centuries. They have been described by some writers as long headed, blue eyed and fair haired, but recent Russian investigators describe them as rather broad headed, with swarthy complexions, dark eyes and hair, and straight noses, their stature being above the average. In the Caucasus they held the grassy passes leading from the sources of the Terek and the Ardon to those of the Rion and the Kura, by which alone horsemen and troops can cross the range in summer, and in the height of their prosperity their flocks whitened the steppe and their vintages were famous. The rude walls and towers of their fortified farms and villages still remain on high and defensible ridges in the mountain fastnesses. Later they formed villages with two storied stone houses, the lower for the cattle and the upper for human habitation, with flat wooden roofs and balconies.

Queen Thamar of Georgia introduced Christianity among them in the 12th century, but later the Kabardians drove them from many of their pastures and Turkish tribes supplanted them in the lower valleys and introduced the Islamic faith within their borders. The Ossetes, however, even in their decline, still held the upper passes, the keys of the Caucasus. The Russian hold on the region began when a small fortress was established at Vladikavkaz in 1784 and the Ossetes were conquered in 1802. Later the famous Georgian military road through the Dariel gorge of the Terek, constructed 1811 to 1864, brought the Ossetes more definitely under Russian rule. For a description of the rich treasures found in the tombs of the Alans, *see* Rostovtseff, M., *Iranians and Greeks in South Russia,* 1922.

Most of the territory of the Ossetes consists of the mountain region of the Caucasus, with snow clad peaks, *e.g.,* the Adai Khokh (15,242 ft.). Numerous streams ultimately join the Terek; in their upper courses they have carved deep valleys. They are of no use for floating timber or for navigation, owing to their rapidity and the numerous falls, but are of great potential value as a source of hydroelectric energy, and a hydroelectric station has recently been built on the Gizeldon. The chief pass is the Mamison, over which goes the Ossetian military road, constructed in 1889. No other good road exists in the whole Ossetian area. A loop from the Black Sea–Caspian railway passes through the north of the territory, with a branch to Alagir and Vladikavkaz. The latter town is the administrative centre for the North Ossetes, but forms a separate administrative division of the North Caucasian Area. Stalinir (formerly Tskinvali), a settlement of 5,809 inhabitants, is the administrative centre of the South Ossetes. The chief range apart from the Central Caucasus, is the Bokovoi Ridge, exceeding a height of 10,000 feet. The average altitude of South Ossetia is 10,000 feet. (*See* CAUCASUS.)

Forest and shrub are general in the region, oak and hardbeam being the prevailing varieties in the north, where timber is exported through Alagir. The forests extend to the upper limit of the limestone gorges, but the crystalline schists are bare of

vegetation. Coniferous forests extend above the oak, hardbeam, ash, maple and lime and alpine meadows with a rich variety of blossoms are found above the tree limit. On the plateau in the north maize gives good harvests and occupies 76% of the sown area; winter wheat, potatoes, fruit, sunflower seed, tobacco and vegetables are also cultivated; the latter find a market in Vladikavkaz, and in the tomato canning factory recently established at Alagir. Milk, meat and cheese, from sheep and goats especially, and from cows in some regions, form the staple food of the herdsmen and shepherds. Small patches of summer wheat, barley, oats and potatoes are grown in sheltered spots among the hills, but frost or early snow often spoils the harvest. Unworked coal, naphtha, iron, manganese, graphite, asbestos, wolfram and arsenic exist; the only mineral at present exploited is lead. South Ossetia is essentially a grazing region, with sheep and goats in the east and cattle in the west. It is thinly peopled in comparison with the north, and its population was further diminished by the disastrous war conditions following the 1917 revolution, when many natives left their homes and went northwards. Conditions in this region are recovering very slowly. Peasant industries include the making of daggers and metal goods, fur caps, leather goods, and small metal wares.

There are two main Ossetian dialects, the Iron and the Digor; the South Ossetians call themselves Tualte and speak a dialect related to the Iron group. Ossetes form about 85% of the population and Russians and Ukrainians about 12%. The literacy rate among this scattered population in a region of poor communications is low and decreases from north to south. Since the Ossetes received cultural autonomy the Latin script has been adopted and some newspapers and books are now printed in Ossete.

School provision is made for less than half the children, mainly for those in the plateau region. The problem of providing education and medical help for the herdsmen and shepherds of the mountain regions is at present unsolved. (R. M. F.)

**OSSETIAN LANGUAGE:** *see* OSSETE.

**OSSETT,** a municipal borough in the Batley and Morley parliamentary division of the West Riding of Yorkshire, England, 2½ mi. W. of Wakefield on the L.M.S.R. Pop. (1938) 14,360. Area 5.2 sq.mi. It lies along a spur of upland about 300 ft. high, which forms part of the Aire-Calder divide. The town is mentioned in Domesday book and it suffered devastation under the Conqueror. In the 17th century, Ossett was visited by plague, but the discovery of medicinal springs on the northeastern side gave to the town a temporary attraction. It is one of the main centres of "shoddy" manufacture, an industry severely depressed in the post-World War I period. Ossett was incorporated in 1890.

**OSSINING,** a village of Westchester county, New York, U.S.A., on the east bank of the Hudson river, 30 m. above New York city; served by the New York Central railroad and river steamers. Pop. (1920) 10,739 (77% native white); 1940 federal census, 15,996. Ossining has a fine site, looking over the Tappan Zee and beyond Croton point to Haverstraw bay (expansions of the Hudson), and is surrounded by wooded rolling country. Two beautiful residential villages (Scarborough and Briarcliff Manor) adjoin it on the south and southeast. It is the seat of several private schools and Sing Sing (state) prison is within the village limits. The manufactures are varied, including porous plasters, pills, brass, wire, medical and aviation instruments, and maps. The site of Ossining (originally part of the Phillipse Manor) was settled about 1700 and the name Sing Sing was taken from the Sin Sinck Indians. The village was incorporated in 1813 and adopted its present name in 1901.

**OSSORY** (*Osraighe*), an ancient kingdom of Ireland, in the south-west of Leinster. Its name is preserved by dioceses of the Church of Ireland and the Roman Catholic Church and its kings maintained their position until 1110.

**OSTADE,** the name of two Dutch painters whose ancestors were settled at Eyndhoven, near the village of Ostade. Early in the 17th century Jan Hendricx, a weaver, moved from Eyndhoven to Haarlem, where he married and founded a large family. The eldest and youngest of his sons became celebrated artists.

1. ADRIAEN VAN OSTADE (1610–1685), the eldest of Jan Hendricx's sons, was born and died at Haarlem. According to Houbraken he was taught by Frans Hals, at that time master of Adrian Brouwer. He was president of the painters' gild at Haarlem, in 1662. A striking picture in the Louvre represents the father of a large family sitting in state with his wife at his side in a handsomely furnished room, surrounded by his son and five daughters, and a young married couple. The number of Ostade's pictures is given by Smith at three hundred and eighty-five, but by Hofstede de Groot (1910) at over 900. At his death the stock of his unsold pieces was over two hundred. His engraved plates were put up to auction, with the pictures, and fifty etched plates—most of them dated 1647–1648—were disposed of in 1686. Two hundred and twenty of his pictures are in public and private collections, of which one hundred and four are signed and dated, while seventeen, though signed, are undated.

Adrian Ostade was the contemporary of David Teniers and Adrian Brouwer. Like them he spent his life in the delineation of the homeliest subjects—tavern scenes, village fairs and country quarters. Between Teniers and Ostade the contrast lies in the different condition of the agricultural classes of Brabant and Holland, and the atmosphere and dwellings that were peculiar to each region. Brabant has more sun, more comfort and a higher type of humanity; Teniers, in consequence, is silvery and sparkling; the people he paints are fair specimens of a well-built race. Holland seems to have suffered much from war; the air is moist and hazy, and the people, as depicted by Ostade, are short, ill-favoured and marked with the stamp of adversity on their features and dress. The key of his harmonies remains for a time in the scale of greys. But his treatment is dry and careful, and he shuns no difficulties of detail, representing cottages inside and out, with the vine leaves covering the poorness of the outer walls, and nothing inside to deck the patchwork of rafters and thatch, or tumbledown chimneys and ladder staircases, that made up the sordid interior of the Dutch rustic of those days.

Before the dispersion of the Gsell collection at Vienna in 1872, it was easy to study the steel-grey harmonies and exaggerated caricature of his early works in the period intervening between 1632 and 1638. There is a picture of a "Countryman having his Tooth Drawn," in the Vienna Gallery, unsigned, and painted about 1632; a "Bagpiper" of 1635 in the Liechtenstein Gallery at Vienna; cottage scenes of 1635 and 1636, in the museums of Karlsruhe, Darmstadt and Dresden; and "Card Players" of 1637 in the Liechtenstein palace at Vienna, which make up for the loss of the Gsell collection. The same style marks most of those pieces. About 1638 or 1640 the influence of Rembrandt changed his style. "The Angels appearing to the Shepherds" in the Brunswick gallery is very much in the style of Rembrandt. In 1642, he painted the beautiful interior at the Louvre, in which a mother tends her child in a cradle at the side of an immense chimney. In 1667, he produced an admirable "Nativity" (collection of Otto Beit, London) which is only surpassed as regards arrangement and colour by Rembrandt's "Carpenter's Family" at the Louvre. He devoted himself to familiar themes, from small single figures, representing smokers or drinkers, to vulgarized allegories of the five senses (Hermitage and Brunswick galleries), half-lengths of fishmongers and bakers and cottage brawls, or scenes of gambling, or itinerant players and quacks, and nine-pin players in the open air. His art is seen in the large series of dated pieces which adorn every European capital, from St. Petersburg to London. Buckingham Palace has a large number. At Amsterdam we have the likeness of a painter, sitting with his back to the spectator, at his easel. The colour-grinder is at work in a corner, a pupil prepares a palette and a black dog sleeps on the ground. A replica of this picture, with the date of 1663, is in the Dresden gallery. The same subject is represented on a picture in the Johnson collection at Philadelphia. In his etching (*Bartsch,* 32) the painter shows himself in profile, at work on a canvas. In the signatures of Ostade, the first two letters are generally interlaced. Up to 1635 Ostade writes himself Ostaden, *e.g.,* in the "Bagpiper" of 1635 in the Liechtenstein collection at Vienna. Later on he uses the long *s* (ſ), and occasionally he signs in capital letters. His pupils are

his own brother Isaac, Cornelis Bega and Cornelis Dusart.

2. ISACK VAN OSTADE (1621–1649) was born in Haarlem, and began his studies under Adriaen. At an early period he felt the influence of Rembrandt, and this is apparent in a "Slaughtered Pig" of 1639, in the gallery of Augsburg. A specimen of Isaac's work when under the influence of his brother may be seen in the "Laughing Boor with a Pot of Beer" (1643), in the museum of Amsterdam. The low price he received for such subjects—in which he could only hope to remain a satellite of Adriaen—led him to prefer landscapes in the fashion of Esaias Van de Velde and Salomon Ruisdael. He died young and was buried at Haarlem on Oct. 16, 1649, having painted about 340 pictures. (*See* H. de Groot, 1910.)

The first manifestation of Isack's surrender of Adriaen's style is apparent in 1644 when the skating and sledging scenes were executed which are in the Lacaze collection and the galleries of the Hermitage, Antwerp and Lille. Three of these examples bear the artist's name, spelled Isack van Ostade, and the dates of 1644 and 1645. The roadside inns, with halts of travellers, form a compact series from 1646 to 1649. In this, the last form of his art, Isaac has very distinct peculiarities. The air which pervades his composition is warm and sunny, yet mellow and hazy, as if the sky were veiled with a vapour coloured by moor smoke. The trees are rubbings of umber, in which the prominent foliage is tipped with touches hardened in a liquid state by amber varnish mediums. It is in winter scenes that Isack displays the best qualities. The absence of foliage and crisp atmosphere, preclude the use of the brown tinge, and leave the painter no choice but to ring the changes on opal tints of great variety, upon which the figures emerge with masterly effect on the light background upon which they are thrown. Amongst the roadside inns which will best repay attention may be noted those of Buckingham Palace, the National Gallery, the Wallace collections in England, and those of the Louvre, Berlin, Hermitage and Rotterdam museums and the Rothschild collection at Vienna on the Continent. The finest of the ice scenes is the famous one at the Louvre.

For paintings and etchings see *Les Frères Ostade,* by Marguerite van de Wiele (Paris, 1893). For his etchings see *L'Oeuvre d'Ostade, ou description des eaux-fortes de ce maître,* etc., by Auguste d'Orange (1860); and *Catalogue raisonné de toutes les estampes qui forment l'oeuvre gravé d'Adrian van Ostade,* by L. E. Faucheux (Paris, 1862); Hofstede de Groot, *Catalogue of Dutch Painters* (1910).

(J. A. C.; X.)

**OSTASHKOV,** a town of Russia in the province of Tver, in 57° 10′ N., 33° 5′ E., on the south shore of Lake Seliger, near the outlet of its waters into a stream that joins the Upper Volga and was at one time thought to be the source of that river. It is in a damp and marshy situation, but became a centre for pilgrims visiting the Stolbenski monastery on an island in the lake. Later the railway passed through the town, and it became the terminus of a telegraph line. Its population (15,660) is mainly occupied in tanning and the making of leather goods, in iron founding and brick making and in fishing on the lake.

**OSTEND** (Flemish *Oostende*), West Flanders, Belgium. Pop. (est. 1938) 50,263. It is the most fashionable seaside resort and the third port of the kingdom. In the middle ages it was strongly fortified and underwent several sieges; notably in 1601–04, when it only surrendered by order of the states to Spinola. The creation in 1722 of the Compagnie de Commerce des Indes seemed to assure a hopeful future to the port of Ostend. But the success obtained caused the envy of neighbouring nations, who forced Emperor Charles VI to revoke the grant made. Under Joseph II Ostend enjoyed another period of commercial prosperity. In the 20th century a new town was created. The digue or parade, constructed of solid granite, extends for over 3 mi. along the shore in a southerly direction from the long jetty which protects the entrance to the port. A casino and the royal châlet are prominent on the sea front. In the rear of the town is a fine park to which a racecourse has been added. The modern docks accommodate ships of large tonnage. Apart from these docks Ostend has a very considerable passenger and provision traffic with England, and is the headquarters of the Belgian fishing fleet, estimated to employ 400 boats and 1,600 men and boys. Ostend supplies sea-fish and is renowned for its oyster and lobster beds. It has a school of navigation and a fishery training school. There is a daily service from Ostend to Tilbury carrying food produce for England. Ostend is in direct railway communication with Brussels, Cologne and Berlin. It is also the starting point of several light railways along the coast and to the southern towns of Flanders.

Ostend was occupied by the Germans for four years during World War I, and was at first, until it was rendered untenable by aerial bombardments, a base for destroyers and submarines. In May 1918 the entrance channel to the harbour and the canal to Ghent and Bruges were blocked to all craft except the smallest submarines by the sinking of the "Vindictive." After the war she was raised and broken up. Parts of the "Vindictive," "Intrepid" and "Thetis" were made into a memorial on the digue.

The city was occupied by the Germans again in World War II.

**OSTEND COMPANY.** The success of the Dutch, English and French East India Companies led the merchants and shipowners of Ostend to desire to establish direct commercial relations with the Indies. A private company was accordingly formed in 1717 and some ships sent to the East. The Emperor Charles VI. encouraged his subjects to raise subscriptions for the new enterprise, but did not grant a charter or letters patent. Some success attended these early efforts, but the jealousy of the neighbouring nations was shown by the seizure of an Ostend merchantman with its rich cargo by the Dutch in 1719 off the coast of Africa, and of another by the English near Madagascar.

The Ostenders, however, despite these losses, persevered in their project. The opposition of the Dutch made Charles VI. hesitate for some time to grant their requests, but on Dec 19, 1722, letters patent were granted by which the Company of Ostend received for the period of 30 years the privilege of trading in the East and West Indies and along the coasts of Africa on this side and on that of the Cape of Good Hope. Six directors were nominated by the emperor, and subscriptions to the company flowed in so rapidly that the shares were at the end of Aug., 1723 at 12 to 15% premium. Two factories were established, one at Coblom on the coast of Coromandel near Madras, the other at Bankibazar on the Ganges. At the outset the prospects of the company appeared to be most encouraging, but its promoters had not reckoned with the jealousy and hostility of the Dutch and English. The Dutch appealed to the treaty of Westphalia (1648) by which the king of Spain had prohibited the inhabitants of the southern Netherlands from trading with the Spanish colonies. The transference of the southern Netherlands to Austria by the peace of Utrecht (1713) did not, said the Dutch, remove this disability. The Spanish government, however, after some hesitation concluded a treaty of commerce with Austria and recognized the Company of Ostend. The reply to this was a defensive league concluded at Herrenhausen in 1725 by England, the United Provinces and Prussia. Confronted with such formidable opposition the court of Vienna judged it best to yield. By the terms of a treaty signed at Paris on May 31, 1727 the emperor suspended the charter of the company for seven years, and the powers in return guaranteed the Pragmatic Sanction. The company, after nominally existing for a short time in this state of suspended animation, became extinct. (G. E.)

**OSTEND MANIFESTO,** a document issued (Oct. 18, 1854) by James Buchanan, J. Y. Mason and Pierre Soulé, U.S. ministers respectively to Great Britain, France and Spain, who had met by President Pierce's orders at Ostend, Belgium, to discuss and adopt measures for concerted diplomatic action at Madrid on the subject of alleged injuries by Spain to American commerce with Cuba. The manifesto recommended that "the United States ought, if practicable, to purchase Cuba as soon as possible," and, if Spain should refuse to sell, then "by every law, human and divine, we shall be justified in wresting it from Spain if we have the power." William L. Marcy, secretary of State, promptly disavowed the document.

**OSTEOLOGY,** that part of the science of anatomy which has for its subject the bony framework of the body (*see* BONE,

SKELETON, ANATOMY, etc.).

**OSTEOPATHY.** According to its advocates, osteopathy is a system of health and healing founded on the theory that the living body is a vital machine which will make the remedies necessary to protect itself against disease so long as it is in correct mechanical adjustment. In addition, osteopathy insists upon a wholesome physical and mental environment, good food, proper exercise and rest, and pure air and water.

Structural derangement is considered as the most important underlying disease cause. What is called a "lesion" may be in bony, muscular, ligamentous, fascial or other tissue. For example in the bony "lesion," a joint usually lacks free movement. This stiffness may come from injury, strain, inflammation, infection, reflexes or other causes. The resultant lack of normal movement in surrounding tissues allows blood and lymph to stagnate, causing acidosis, irritating nerves which pass that way, and through them affecting the functions of various organs including blood vessels. The oedema and swelling and the contraction of muscles may also affect, by pressure or otherwise, the nerves, arteries and veins. Not only is there said to be a resultant interference with the body's ability to make its own serums and antitoxins to fight infectious disease processes, but "lesions" also produce positive suffering and disease in the form of neuritis and neuralgia, lumbago and sciatica, foot troubles, and disturbances of the special senses and of the functions of the various organs including endocrine and other glands.

Osteopathic diagnosis comprises physical examination of the entire body, its distinguishing feature being an intensive search for and study of the lesions described above. There is physical, chemical, and microscopic study of secretions and excretions, and if necessary of tissues, and the use of the x-ray, basal metabolism apparatus and other scientifically accepted appliances.

Osteopathic therapy is based on the specific manipulative removal of the "lesion" already discussed. It includes also correction of hygienic, dietetic, environmental and psychic conditions; surgery for fractures and lacerations, and the removal of abnormal growths or organs so diseased as to be dangerous to life; obstetrics and the administration of antidotes for poisons.

The American School of Osteopathy was organized at Kirksville, Mo., in 1892. In 1937 there were other recognized colleges at Los Angeles, Kansas City, Des Moines, Chicago and Philadelphia. At the beginning, when the standards of medical education were low, the length of the course was two years. By about 1916, all the colleges required a high school education followed by four standard college years in osteopathy.

Osteopathy was promulgated by Dr. A. T. Still (*q.v.*). There are (1937) about 9,100 practitioners. What is now the American Osteopathic association was organized in 1897. Its headquarters are in Chicago. It publishes a *Journal* and four other monthly periodicals. There are State, provincial and local societies, British, Canadian, New England, Eastern, Middle-Atlantic and Western associations, the Osteopathic Women's National association, and several societies of specialists. Osteopathy is regulated by law throughout the United States and most of Canada. In a majority of States examination for license to practice is in the hands of examining boards composed of osteopathic physicians. In several States, there is no legal distinction between "doctor of osteopathy" and "doctor of medicine," while in others osteopathic practice is somewhat restricted.

Many osteopathic physicians have served and are serving on State and local health boards.

In Great Britain, though osteopathy is not recognized or regulated by law, the British Osteopathic Association admits to membership graduates of recognised osteopathic colleges.

AUTHORITIES.—Lane's *A. T. Still, Founder of Osteopathy;* McConnell and Teall's *Practice of Osteopathy;* Tasker's *Principles of Osteopathy;* Booth's *History of Osteopathy and Twentieth Century Medical Practice;* and the publications of the A. T. Still Research Institute.

(R. G. HU.)

**OSTERMAN, ANDREI IVANOVICH,** COUNT (1686–1747), Russian statesman, born at Bochum, Westphalia, became secretary to vice-admiral Cornelis Kruse, who had a standing commission from Peter the Great to pick up promising young men, and in 1767 entered the tsar's service. He assisted the vice-chancellor Shafirov during the negotiations which terminated in the peace of the Pruth (1711). Osterman, together with General Bruce, represented Russia at the Åland peace congress of 1718. Shrewdly guessing that Sweden was at exhaustion point, and that Görtz, the Swedish plenipotentiary, was acting *ultra vires*, he advised Peter to put additional pressure on Sweden to force a peace. In 1721 Osterman concluded the peace of Nystad with Sweden, and was created a baron for his services. In 1723 he was made vice-president of the ministry of foreign affairs. Peter consulted him in domestic affairs, and he introduced many administrative novelties, *e.g.*, "the table of degrees" and the reconstruction of the college of foreign affairs on more modern lines. During the reign of Catherine I. (1725–1727) the conduct of foreign affairs was left entirely in Osterman's hands, and he held also the posts of minister of commerce and postmaster-general. On the accession of Peter II. Osterman was appointed governor to the young emperor, and on his death (1730) he refused to participate in the attempt of Golitsuin and the Dolgorukis to convert Russia into a limited constitutional monarchy. He held aloof till Anne was established on the throne as autocrat.

His unique knowledge of home and foreign affairs made him indispensable to the empress. It was at his suggestion that the cabinet system was introduced into Russia. All the useful reforms introduced between 1730 and 1740 are to be attributed to his initiative. He improved the state of trade and materially raised the credit of Russia. The successful conclusions of the War of the Polish Succession (1733–1735) and of the war with Turkey (1736–1739) were entirely due to his diplomacy. During the brief regency of Anna Leopoldovna (October 1740–December 1741) Osterman stood at the height of his power, and the French ambassador, La Chetardie, reported to his court that "it is not too much to say that he is tsar of all Russia." Osterman's foreign policy was based upon the Austrian alliance. He had, therefore, guaranteed the Pragmatic Sanction with the deliberate intention of defending it. Hence the determination of France to remove him at any cost. Indeed it was only the Russian alliance which, in 1741, seemed to stand between Maria Theresa and ruin.

The most obvious method of rendering the Russian alliance unserviceable to the queen of Hungary was by implicating Russia in hostilities with Sweden. A rupture was brought about in 1741 by French influence and French money, but the Swedes were defeated. It now became evident to La Chetardie that only a revolution would overthrow Osterman, and this he proposed to promote by elevating to the throne the tsarevna Elizabeth, who hated the vice-chancellor because, though he owed everything to her father, he had systematically neglected her. Osterman was therefore the first and the most illustrious victim of the *coup d'état* of Dec. 6, 1741. He was condemned but, reprieved on the scaffold, was banished to Siberia, where he died.

*See* S. Shubinsky, "Count A. I. Osterman" (Rus.) in *Syevernoye Siyanie,* vol. ii. (St. Petersburg, 1863); D. Korsakov, *From the Lives of Russian Statesmen of the XVIIIth Century* (Rus.) (Kazan, 1891); A. N. Filippov, "Documents relating to the Cabinet Ministers of the Empress Anne" (Rus.) (St. Petersburg, 1898) in the collections of the Russ. Hist. Soc., vol. 104; A. A. Kochubinsky, *Count A. I. Osterman and the proposed Partition of Turkey* (Rus.) (Odessa, 1889); Hon. C. Finch, *Diplomatic Despatches from Russia, 1740–1742* (St. Petersburg, 1893–94) in the collections of the Russ. Hist. Soc., vols. 85 and 91; R. Nisbet Bain, *The Pupils of Peter the Great* (London, 1897); and *The Daughter of Peter the Great* (London, 1899), chapters 1–3.

(R. N. B.; X.)

**OSTERODE,** a town in East Prussia, Germany, 75 mi. N.E. of Thorn, on Lake Drewenz, at the junction of lines to Memel, Elbing and Neidenburg. Pop. (1939) 19,399. It has a castle built by the Teutonic knights in 1270, to whom the town owes its birth. Its chief manufactures are machinery, beer, furniture and bricks; it has several saw-mills. Osterode trades in grain and timber.

**OSTERODE,** a town in the Prussian province of Hanover, at the south foot of the Harz mountains, 34 m. N.W. of Nordhausen by rail. Pop. (1933) 8,743. The church of St. Aegidius was founded in 724 and rebuilt after a fire in 1578. The dukes of Brunswick-Grubenhagen, made Osterode their residence from

1361 to 1452. There are manufactures of woollen goods, cigars, casks and leather, and iron foundries, tanneries, dyeworks and gypsum quarries. In recent years Osterode has become celebrated as a health resort.

**OSTIA,** an ancient town and harbour of Latium, Italy, at the mouth of the river Tiber, on its left bank. It lies 14 m. S.W. from Rome by the Via Ostiensis, a road of very ancient origin followed by the modern road which preserves some traces of the old pavement and remains of several ancient bridges, until the construction of a new motor road to Ostia Mare. It was said to be the first colony ever founded by Rome—according to the Romans themselves, by Ancus Martius—and took its name from its position at the mouth (*ostium*) of the river. Excavations have, however, brought to light nothing earlier than the 4th century B.C., the date of a small rectangular fort, measuring 200 by 125 yd., built of hewn blocks of volcanic stone, which may have been in Virgil's mind when he wrote his description of the fortified camp which Aeneas founded at the Tiber mouth. It was out of this fort that the city developed the establishment of the salt-marshes (*salinae—see* SALARIA, VIA) which only ceased to exist in 1875. We learn much as to its cults, magistrates and trade guilds (for the last *see* J. P. Waltzing, *Les Corporations professionelles* [Brussels and Liège]) from the large number of inscriptions found. The city was divided into five regions. Vulcan was the most important deity worshipped at Ostia, and the priesthood of Vulcan was held sometimes by Roman senators. The Dioscuri, too, as patrons of mariners, were held in honour. Later we find the worship of Isis and of Cybele, the latter being especially flourishing, with large corporations of *dendrophori* (priests who carried branches of trees in procession) and *canephori* (basket-carriers); the worship of Mithras, too, had a large number of followers. There was a temple of Serapis at Portus. At Portus a considerable number of Jewish inscriptions in Greek have come to light. In the 4th century Ostia began to be abandoned while the importance of Portus increased.

Until Trajan formed the port of Centumcellae (Civitavecchia) Ostia was the best harbour along the low sandy coast of central Italy between Monte Argentario and Monte Circeo. It is mentioned in the history of the year 354 B.C. as a trading port, and became important as a naval harbour during the Punic Wars. Its commerce increased with the growth of Rome, and this, and the decay of agriculture in Italy, which obliged the capital to rely almost entirely on imported corn (which was, from 267 B.C. onwards, under the charge of a special quaestor stationed at Ostia), rendered the possession of Ostia the key to the situation on more than one occasion (87 B.C., A.D. 409 and 537). Ostia, however, was by no means an ideal harbour; the mouth of the Tiber is exposed to the south-west wind, which often did damage in the harbour itself; in A.D. 62 no less than 200 ships with their cargoes were sunk, and there was an important guild of divers (*urinatores*) at Ostia. The difficulties of the harbour were increased by the continued silting up, produced by the enormous amount of solid material brought down by the river. Even in Strabo's time the harbour of Ostia had become dangerous.

Caesar had projected remedial measures, but it was only under Claudius that the problem was approached. He constructed a large new harbour on the right bank, $2\frac{1}{2}$ m. N. of Ostia, with an area of 170 ac. enclosed by two curving moles, with an artificial island, supporting a lofty lighthouse, in the centre of the space between them. This was connected with the Tiber by an artificial channel, and by this work Claudius, according to his inscriptions of A.D. 46, freed the city of Rome from the danger of inundation. The harbour was named by Nero Portus Augusti.

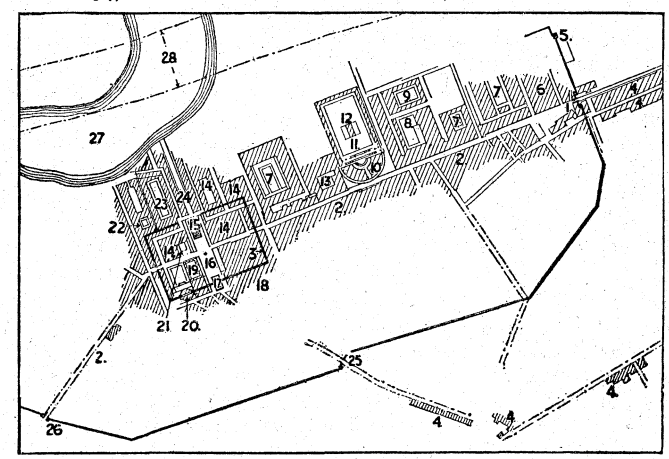
Trajan found himself obliged in A.D. 103, owing to the silting up of the Claudian harbour and the increase of trade, to construct another port further inland—a hexagonal basin enclosing an area of 97 ac., with enormous warehouses and docks attached, communicating with the harbour of Claudius and with the Tiber by means of the channel already constructed by Claudius, which was prolonged so as also to give direct access to the sea. This became blocked in the middle ages, but was reopened by Paul V. in 1612, forming the right arm of the Tiber, by which navigation is carried on at the present day, and is known as the Fossa Trajana. The island between the two arms Procopius calls Insula Sacra (it is still named Isola Sacra).

Ostia thus lost a considerable amount of its trade, but its importance still continued to be great. The 2nd and 3rd centuries, indeed, are the high-water mark of its prosperity: and it still possessed a mint in the 4th century A.D. The first bishop of Ostia of whom we have knowledge dates from A.D. 313, and the first bishop of Portus from about the same time. Both sees exist; the former is held by the dean of the College of Cardinals.

During the Gothic wars, trade was confined to Portus and the ravages of pirates led to the gradual abandonment of Ostia. Gregory IV. constructed in 830 a fortified enceinte, called Gregoriopolis, in the eastern portion of the ancient city, and the Saracens were signally defeated here under Leo IV. (847–856). The battle is represented in Giulio Romano's fresco from Raphael's design in the Stanza dell' Incendio in the Vatican.

In the middle ages Ostia became a quarry for the cathedral of Orvieto, etc., some of its marbles being conveyed by the Pisans as far as Sardinia. Later it regained something of its importance owing to the silting up of the right arm of the Tiber. In 1483–1486 Giuliano della Rovere (nephew of Pope Sixtus IV., and afterwards himself Pope Julius II.) caused the castle to be erected by Baccio Pontelli, a little to the east of the ancient city. It is built of brick and is one of the finest specimens of Renaissance fortification, and exemplifies especially the transition from the old girdle wall to the system of bastions: it still has round corner towers, not polygonal bastions. An agricultural colony, founded after 1875, and consisting mainly of cultivators from the neighbourhood of Ravenna, has produced a great change for the better in the condition of the place. The modern village is part of the commune of Rome. The marshes have been drained, and a pumping station erected near Castel Fusano. An electric railway has been constructed from Rome to Ostia and thence to the sea-bathing resort of Ostia Mare.

Excavations on the site of Ostia were only begun towards the close of the 18th century, and no systematic work was done until 1854, when under Pius IX. a considerable amount was



FROM ADAPTATION AFTER GISMONDI IN "THE QUARTERLY REVIEW" (JOHN MURRAY)

OSTIA

1, 25, 26. Gates. 2. Decumanus. 3. Walls of original *castrum*. 4. Tombs. 5. City wall tower. 6, 7, 22, 23. Storehouses. 8, 18. Thermae. 9. Barracks of *vigiles*. 10. Theatre. 11. "Piazzale delle Corporazioni." 12, 13, 17, 20 (?) Temples. 14. Private Houses. 15. Capitolium. 16. Forum. 19. Basilica. 21. Curia. 24. Cardo. 27. Present course of Tiber. 28. Course of Tiber prior to flood, 1557

done (the objects are now in the Lateran museum). The Italian Government laid bare many of the more important buildings in 1880–89: and resumed work in 1907. Owing to the fact that the site is largely covered with sand and to the absence of any later alterations, the preservation of the buildings excavated is very good, and Ostia is, with the exception of Pompeii, the best example in Italy of a town of the Roman period, while its houses, the massive concrete walls of which were faced with brick and reticulate work (both as a rule left unplastered on the outside) rose to a height of three or four storeys and had balconies and

numerous windows. They were frequently planned like modern apartment houses, and show us what the ancient Roman *insula* or block was. On the east the site is approached by the ancient road from Rome, flanked by tombs. It entered the enceinte of the 1st century B.C. (*see* plan) by a gate still preserved. This wall enclosed an irregular area far larger than that of the 4th century fort, extending down to the ancient coast line and the continuation of the road forms the main street of the town. A considerable part of it had porticoes on each side. On the right (N.) are some small well-preserved thermae, and the barracks of the firemen (*vigiles*), a special cohort of whom was stationed here. On one side of the central courtyard of the latter building is a chapel with inscribed pedestals for imperial statues (2nd and 3rd century A.D.) and a well-preserved black and white mosaic representing a sacrifice.

To the south-west is the theatre, an area 265 ft. square surrounded by colonnades, in which were placed the offices of the various *collegia* or guilds of boatmen, raftmen and others, which had a special importance at Ostia; the names of the guilds may still be read in inscriptions in the mosaic pavements of the chambers. In the centre of the area are the substructions of a temple, and on the south-east side are the remains of the theatre, built in the early imperial period, restored by Septimius Severus in 196–197 and again in the 4th or 5th century. To the south-west of the theatre are the remains of four small temples, one dedicated to Venus, and a well-preserved Mithraeum, with mosaics representing the seven planets, etc. To the south-west again is the conspicuous brick cella of a lofty temple, on arched substructures, hitherto supposed to be that of Vulcan, but more probably the Capitolium or temple of Jupiter, Juno and Minerva, with a threshhold block of *africano* (Euboean) marble over 15 ft. long; from it a street over 20 ft. wide leads north-west to the river. It is flanked on each side by well-preserved warehouses, another group of which, surrounding a large court, lies to the south-west. Further still are the well-preserved Horrea Epaphroditiana et Epagathiana, a large private warehouse. Hence an ancient road, leading between warehouses (into which the Tiber is encroaching), in one room of which a number of well-preserved large jars may be seen embedded in the floor, runs close to the river to a large private house with thermae, in which fine mosaics were found; it (groundlessly) bears the name of "imperial palace." Farther to the south-west are remains of other warehouses, and (possibly) of the docks—long narrow chambers, which may have served to contain ships. The mediaeval Torre Bocacciana marked approximately the mouth of the river in Roman times.

The south-eastern portion of the city has been excavated only partially. Opposite the Capitolium is the Forum, with remains of a temple of Rome and Augustus, a basilica (much destroyed by mediaeval plunderers), the curia, etc. To the south-west of this are the remains of the temple of Cybele, with a portico. This lay close to the commencement of the Via Severiana (*see* SEVERIANA, VIA), and the line of tombs which flanked it soon begins. Farther south-east, a line of sand dunes, covering the ruins of ancient villas, marks the coast line of the Roman period.

*See* G. Calza, *Ostia* (trans. by R. Weeden Cooke, 1926), and reff.

(T. A.)

**OSTIAKS** or **OSTYAKS,** a tribe who inhabit the basin of the Ob in western Siberia. The so-called Ostyaks of the Yenisei speak an entirely different language. The trans-Uralian Ostiaks and Samoyedes are probably identical with the Yugra of the Russian annals. During the Russian conquest their abodes extended much farther south than now, 41 of their fortified places having been destroyed by the Cossacks in 1501, in the region of Obdorsk alone. Remains of these "towns" are still to be seen at the Kunovat river, on the Ob 20 m. below Obdorsk and elsewhere. Those on the Irtysh are mostly settled, and have adopted the manner of life of Russians and Tatars. Those on the Ob are mostly nomads, and own large herds of reindeer. The Ob Ostiaks are russified to a great extent. They live almost exclusively by fishing, buying from Russian merchants corn for bread.

The Ostiaks call themselves As-yakh (people of the Ob), and it is supposed that their present designation is a corruption of this name. By language they belong with the Voguls to the East Ugrian branch of the Ugrian division of the Ugro-Finnish section of the Ural-Altaic languages. Three or four leading dialects can be distinguished.

The Ostiaks are middle-sized, or short. The skull is roundish, mostly of moderate size and height. The hair is dark and soft for the most part, fair and reddish individuals being rare; the eyes are dark, generally narrow; the nose is flat and broad; the mouth is large and with thick lips; the beard is scanty. Mongoloid traits are more strongly pronounced in the women than in the men. The purest type is found among the fishers on the Ob, the reindeer-breeders of the tundra being largely intermixed with Samoyedes. They are very skilful in carving wood and bone, tanning (with egg-yolk and brains), preparation of implements from birch-bark, etc. Some of their carved or decorated bark implements show considerable artistic skill. Christianity has made some progress among them, but their ancient pagan observances are still retained.

For customs, religion, etc., see *Journal de la Société Finno-Ougrienne,* particularly papers by Sirelius and Karjalainen, and the papers by Munkácsi, Gennep, Fuchs and others in the *Revue orientale pour les études Ouralo-Altaïques;* Patkanov, *Die Irtysch-Ostiaken und ihre Volkspoesie* (1900); Patkanov, *Irtirsch-Ostjaken und ihre Volkspoesie* (1897–1900); Papay, *Sammlung ostjakischer Volksdichtungen* (1906); M. Czaplicka, *Aboriginal Siberia* (1914).

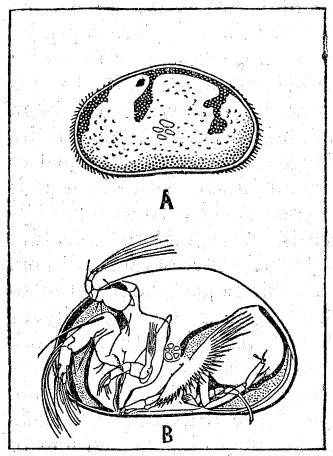
**OSTRACISM,** a political device instituted as a constitutional safeguard for the Athenian democracy. Its effect was to remove from Athens for a period of ten years any person who threatened the harmony and tranquillity of the body politic. In the sixth prytany (*see* PRYTANEUM) of each year the representatives of the Boulē asked the Ecclesia whether it was for the welfare of the state that ostracism should take place. If the answer was in the affirmative, a day was fixed for the voting in the eighth prytany. No names were mentioned, but it is clear that two or three names at the most could have been under consideration. The people met, not as usual in the Pnyx, but in the Agora, in the presence of the archons, and recorded their votes by placing in urns small fragments of pottery (*ostraka*) on which they wrote the name of the person whom they wished to banish. Ostracism did not take effect unless ten thousand votes in all were recorded. The ostracised person was compelled to leave Athens for ten years, but he was not regarded as a traitor or criminal. When he returned, he resumed possession of his property and his civic status was unimpaired. The adverse vote simply implied that his power was so great as to be injurious to the state. Ostracism must therefore be carefully distinguished from *exile* in the Roman sense, which involved loss of property and status, and was for an indefinite period (*i.e.,* generally for life). At the same time it was strictly unjust to the victim, and a heavy punishment to a cultured citizen for whom Athens contained all that made life worth living. Its political importance really was that it transferred the protection of the constitution from the Areopagus to the Ecclesia. It was later replaced by the *Graphē Paranomōn.*

The object was primarily to get rid of the Peisistratid faction without perpetual recourse to armed resistance. Aristotle's *Constitution of Athens* (22) gives a list of ostracized persons, the first of whom was a certain Hipparchus of the Peisistratid family (488 B.C.). This, however, may conceivably be simply the list of those recalled from ostracism at the time of Xerxes' invasion, all of whom must have been ostracized less than ten years before 481 (*i.e.,* since Marathon). With the end of the Persian Wars, the original object of ostracism was removed, but it continued in use for forty years and was revived in 417 B.C. It then became a mere party weapon, and the farcical result of its use in 417 in the case of Hyperbolus led to its abolition. Such a device inevitably lent itself to abuse (*see* Aristotle, *Pol.* 38, 1284 b. 22).

BIBLIOGRAPHY.—G. Gilbert, *Constitutional Antiquities* (Eng. trans., 1895); A. H. J. Greenidge, *Greek Constitutional Antiquities* (1896); L. Whibley, *Companion to Greek Studies* (1923); histories of Greece in general, Grote.

**OSTRACODA,** a sub-class of the Crustacea (*q.v.*) comprising minute forms found in fresh water and in the sea and distinguished by having the body and limbs completely enclosed in a bivalve shell. They are remarkable for having a smaller num-

ber of appendages than any other Crustacea, there being not more than four pairs and sometimes only two pairs of limbs behind the mandibles. The antennules and antennae are used for swimming or creeping. The mandibles have a large palp, often biramous and sometimes leg-like. The remaining limbs are very varied in form but some of them are usually leg-like and used in locomotion.




FROM (A) SARS, "CRUSTACEA OF NORWAY," AND FROM (B) THE "ZOOLOGICAL JOURNAL"

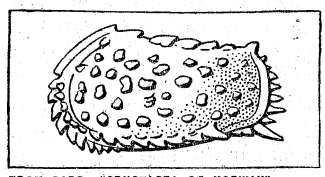
**FIG. 1.—FRESH-WATER OSTRACOD** (PIONOCYPRIS VIDUA) ENLARGED

A. External appearance. B. Appendages after removal of left valve shell; left, Antennule and antenna; center, mouth-parts, and behind them to the right, two leg-like appendages

The breeding habits of the ostracods present several features of interest. Parthenogenesis is common, at least among the freshwater species, in many of which males are rarely seen; while in some species they have not yet been discovered. A colony of a species of *Cypris* has been kept in an aquarium for more than 30 years and during the whole of that time no males made their appearance, the colony reproducing exclusively by parthenogenesis. In some *Ostracoda* the thread-like spermatozoa are not only relatively but absolutely larger than those of any other animals. In one species which, when adult, is no more than ·6 millimetres in length the spermatozoa are from 5 to 7 millimetres long.

Most species live on or near the bottom, creeping among weeds or burrowing in mud, but some marine species are planktonic. One of the latter, *Gigantocypris*, is the largest member of the group, reaching a length of 23 millimetres, but most species are much smaller and some do not exceed half a millimetre in length.

Numerous fossil *Ostracoda* have been described from all geological formations from the oldest to the most recent, but the affinities of many of them are obscure.



FROM SARS, "CRUSTACEA OF NORWAY"

**FIG. 2.—MARINE OSTRACOD** (CYTHEREIS MUCRONATA) MUCH ENLARGED, SHOWING STRONGLY SCULPTURED SHELL

The recent *Ostracoda* are generally grouped in two orders. The *Myodocopa* are exclusively marine and can usually be recognized by the presence of a notch in the margin of the shell near the anterior end. They generally have paired compound eyes and a heart. The *Podocopa* include both marine and freshwater species. There is no notch in the shell, no paired eyes and no heart. (W. T. C.)

**OSTRACODERMS,** a name given collectively to a number of fish-like vertebrate animals found fossil in the Silurian and Devonian formations of Europe and North America, in most of which the body was protected by a bony armour. The recent researches of Kiaer and Stensio have established that the Pteraspida, Anaspida and Cephalaspida are related to the Cyclostomata (*q.v.*), but that the Asterolepida (*Pterichthys*) are akin to the Anthrodira, which have been shown to be armoured Selachians (*q.v.*). They are small animals, some only a few centimetres long.

BIBLIOGRAPHY.—R. H. Traquair, "The Asterolepidae," *Monagr. Palaeont. Soc.* (1894–1906); J. Kiaer, "Anaspida," *Vidensk. Skrift. Kristiania* (1924); A. Stensio, "Cephalaspida," *Vindeskaps-Akad. Result, Norske Spitsbergenexpedite,* No. 12 (Oslo, 1927).

**OSTRAU:** *see* MORAVSKÁ OSTRAVA and SLEZSKÁ OSTRAVA.

**OSTRICH,** the largest living bird; the male may be nearly 8 ft. high, and weigh 300 lb. The ostrich forms the type of the subclass Ratitae (*q.v.*), characterized by the absence of a keel on the breast-bone (*see* ORNITHOLOGY). The genus *Struthio* is unique in possessing only two toes, thus distinguishing it from *Rhea* (*q.v.*), the South American ostrich, which has three toes.

The ostrich, in a wild state, is much less abundant now than formerly. It inhabits sandy plains and open country in Arabia and Africa, the latter more abundantly. It occurs in small troops of five or six, of which one is a cock and the rest hens. At other times it will form mixed herds with zebras and various antelopes. Extremely fleet of foot, when brought to bay the ostrich uses its strong legs as weapons with great effect. Several hens combine to lay their eggs in one nest, and on these the cock sits by night while the females relieve one another by day, though this is more to guard the eggs from beasts of prey than to incubate them, the heat of the sun sufficing for that. The parents display great solicitude for their young. The great value of ostrich feathers, combined with the growing scarcity of the birds themselves, has led to the establishment of ostrich farms, where the birds are kept and deprived of their plumes at regular intervals. Ostrich farming is carried on in Cape Colony, Egypt, Algeria, the French Riviera, southern U.S. and elsewhere. There appear to be four existing species: *S. camlus* of North Africa and Arabia, and *S. australis* of South Africa being the best known.

BY COURTESY OF THE N.Y. ZOOLOGICAL SOCIETY

OSTRICH (STRUTHIO CAMELUS), THE LARGEST OF LIVING BIRDS

**OSTROG,** a town of Poland, in the province of Volhynia, on the Vilya river. It is an episcopal see of the Orthodox Greek Church, and in the 16th century had a classical academy, converted later into a Jesuit college. Here was made and printed in 1581 the first translation of the Bible into old Slav. In the town is a brotherhood of Cyril and Methodius, which maintains schools of its own. Industries include tanning, potteries, oil-works, soap, candle and tobacco factories. After being plundered by the Cossack chieftain Ghmielnicki in 1648, and later conquered by the Russians, the town fell into decay. Polish after 1918, it was taken by the Russians in 1939 and the Germans in 1941.

**OSTROGOTHS** or **EAST GOTHS,** one of the two main branches into which the Goths were divided, the other being the Visigoths, or West Goths. *See* GOTHS.

**OSTROVSKY, ALEXANDER NIKOLAEVICH** (1823–1886), Russian dramatic author, was born on April 12, 1823 in Moscow, where his father was an official of the senate. He studied law in the university of that city, which he quitted without having submitted to the final examination. He was then employed as a clerk in the office of the "Court of Conscience," and subsequently in that of the Commercial Court at Moscow. Among his early comedies are *Byednaya Nivesta* ("The Poor Bride"), *Byednost ne Porok* ("Poverty not a Vice"), and *Ne v'svoi sani ne sadis* (literally "Don't put yourself in another's sledge"). Of this last Nicholas I. said, "it was not a play, but a lesson." The Moscow merchants are strikingly portrayed in *Groza* (1860, Eng. trans. *The Storm,* by C. Garnett, 1898) the most famous of all his plays, and *Svoyi lyudi sotchtyomsya* ("Between near relatives no accounts are needed") (1850) which was originally called "The Bankrupt." *The Bankrupt* was prohibited for ten years, until the accession of Alexander II., and Ostrovsky was dismissed from the government service and placed under the supervision of the police. The Liberal tendencies of the new reign, however, soon brought relief; Ostrovsky was one of several well-known literary men who were sent into the provinces to report on the condition of the people. Ostrovsky's field of inquiry lay along the upper Volga. This mission inspired several historical dramas, such as *Kuzma Zakharich Minin Soukhorouk, Vassilisa Melentieva* and others. Four of his *Plays* have been translated into English by G. R. Noyes (1917). Ostrovsky enjoyed the patronage of Alexander III., and received a pension of 3,000 roubles a year. With the help of Moscow capitalists he established in that city a model theatre and school of dramatic art, of which he became the first director. He also founded the Society of Russian Dramatic Art and Opera

Composers. He died on June 24, 1886.

**OSTUNI,** a picturesque walled city of Apulia, Italy, province of Brindisi, 23 mi. N.W. of Brindisi. Pop. (1936) 21,826 (town); 28,247 (commune). It has a 15th century cathedral.

**OSTWALD, WILHELM** (1853–1932), German chemist, was born in Riga Sept. 2, 1853, and educated at the University of Dorpat. In 1882 he became a professor in Riga, and five years later was appointed professor of physical chemistry in the University of Leipzig, where he was later director of the Physico-chemical Institute. In 1906 he resigned his university appointments and subsequently lived in retirement in Saxony. Ostwald may be regarded as one of the pioneers of modern physical chemistry and with van't Hoff (*q.v.*) he founded the important *Zeitschrift für physikalische Chemie.* His own contributions to the science have been mainly in the fields of electrochemistry and solutions. He applied the law of mass action to the equilibrium resulting from electrolytic dissociation and obtained in this way the affinity constants of acids and bases. By means of these constants, and by the use of other methods which he developed, he was able to compare the strengths of these reagents. Ostwald made some experiments on the viscosity of solutions and devised the viscometer known by his name. On the technical side he will be chiefly remembered for his discovery in 1900 of a method of oxidizing ammonia to form oxides of nitrogen; a mixture of air and ammonia being passed over a platinum catalyst. By means of this process and by later developments in connection with it, Germany was enabled to continue the manufacture of explosives during the World War after the Allied blockade had been enforced; the method is being used in various countries, under the name of the Ostwald-Brauer process, for the manufacture of nitric acid from ammonia. In 1909 Ostwald was awarded the Nobel Prize for chemistry. His published works include *Lehrbuch der allgemeinen Chemie* (2nd ed. 1884–87), *Grundlinien der anorganischen Chemie* (5th ed. 1922) and *Die wissenschaftlichen Grundlagen der analytischen Chemie* (1894) which have been translated into English. Ostwald died in 1932.

**OSUNA,** a town of southern Spain, in the province of Seville; 57 mi. by rail E.S.E. of Seville. Pop. (1940) 19,552 (mun., 24,083). Osuna is built on a hill, overlooking the fertile plain watered by the Salado, a sub-tributary of the Guadalquivir. Osuna, the Urso of Hirtius, famous in the 1st century B.C. for its long resistance to the troops of Caesar, and its fidelity to the Pompeians, was subsequently called by the Romans Orsona and Gemina Urbanorum, the last name being due, it is said, to the presence of two urban legions here. Osuna was taken from the Moors in 1239, and given by Alphonso X to the knights of Calatrava in 1264. Don Pedro Giron appropriated it to himself in 1445. One of his descendants, Don Pedro Tellez, was the first holder of the title duke of Osuna, conferred on him by Philip II in 1562. The University of Osuna, founded in 1549, was suppressed in 1820. The industries are agriculture and the making of esparto mats, pottery, bricks, oil, soap, cloth, linen and hats.

**OSWALD** (d. 992), archbishop of York, was a nephew of Oda, archbishop of Canterbury, and at an early age became, by purchase, head of the Old Minster at Winchester. Desiring to become a monk, he went with Oda's approval to the monastery of Fleury on the Loire—at that time the great centre of reviving Benedictinism. Here he soon distinguished himself by the monastic austerity of his life. In 959 he returned to England at the request of Oda, who, however, died before his arrival. He now went to York to his kinsman the Archbishop Oskytel, who took him with him on a pilgrimage to Rome. Soon after his return he was appointed bishop of Worcester at the recommendation of Dunstan, his predecessor in the see (961). As bishop he took a prominent part in that revival of monastic discipline on Benedictine lines of which Aethelwold, bishop of Winchester, was the most ardent leader. Among other religious houses he founded that of Ramsey in conjunction with Aethelwine, Ealdorman of East Anglia. In 972 he was translated (again at Dunstan's recommendation) to the archbishopric of York, with which he continued to hold the see of Worcester. He died on Feb. 29, 992.

See *Memorials of St. Dunstan,* ed. by W. Stubbs, Rolls series (1874); and T. Raine, *Historians of the Church of York* (1879–86).

**OSWALD** (*c.* 605–642), king of Northumbria, was one of the sons of Aethelfrith and was expelled from Northumbria on the accession of Edwin, though he himself was a son of Edwin's sister Acha. He appears to have spent some of his exile in Iona, where he was instructed in the principles of Christianity. In 634 he defeated and slew the British king Ceadwalla at a place called by Bede Denisesburn, near Hefenfelth, which has been identified with St. Oswald's Cocklaw, near Chollerford, Northumberland. By this he avenged his brother Eanfrith, who had succeeded Edwin in Bernicia, and became king of Northumbria. Oswald reunited Deira and Bernicia, and soon raised his kingdom to a position equal to that which it had occupied in the time of Edwin, with whom he is classed by Bede as one of the seven great Anglo-Saxon kings. His close alliance with the Celtic church is the characteristic feature of his reign. In 635 he sent to the elders of the Scots for a bishop. On the arrival of Aidan in answer to this request he assigned to him the island of Lindisfarne as his see, near the royal city of Bamborough. He also completed the minster of St. Peter at York which had been begun by Paulinus under Edwin. Bede declares that Oswald ruled over "all the peoples and provinces of Britain, which includes four languages, those of the Britons, Picts, Scots and Angles." His relationship to Edwin may have helped him to consolidate Deira and Bernicia. Early in his reign he was sponsor to the West Saxon king Cynegils, whose daughter he married. In 642 he was defeated and slain at a place called Maserfeld, probably Oswestry in Shropshire, by Penda of Mercia.

*See* Bede, *Historia Ecclesiastica* (ed. C. Plummer, 1896), ii. 5, 14, 20; iii. 2, 3, 5, 6, 7, 9–14; *Anglo-Saxon Chronicle* (ed. J. Earle and C. Plummer, 1899), *s.a.,* 617, 634, 635, 642, 654.

**OSWALDTWISTLE,** urban district, Accrington parliamentary borough, Lancashire, England, on Leeds and Liverpool canal, and the L.M.S. railway (Church and Oswaldtwistle station). Pop. (1938) 12,620. Area, 7.6 sq.mi. It possesses cotton-mills, printworks, bleachworks and chemical works, and in the neighbourhood are collieries, stone quarries and potteries.

**OSWEGO,** a city of New York, U.S.A., the county seat of Oswego county; on Lake Ontario, 35 m. N.N.W. of Syracuse, at the mouth of the Oswego river and the Oswego canal, which connects with the State Barge canal at Three River Point, 25 m. S.E. It is served by the Lackawanna, the New York Central and the New York, Ontario and Western railways, lake steamers and canal barges. Pop: (1920) 23,626 (84% native white); 1940 federal census 22,062. The city has a fine harbour, water power, large hydro and steam electric developments. Water-borne commerce (largely coal, petroleum products, sand and gravel, raw sugar and grain) amounted in 1940 to 1,059,595 tons by lake vessels and 1,118,804 tons by canal.

Among the manufactures are, notably, matches, cotton and woollen goods, candy, peanut butter, boilers, paper and paper bags. Oswego is the seat of a State normal school (established by the city in 1861 and taken over by the State in 1867), a State armory and a U.S. life-saving station. Ft. Ontario (within the city limits) is the oldest fort in North America which is still garrisoned. The site of Oswego was visited by Champlain in 1616. Later it became a station for the Jesuit missionaries and the *coureurs des bois.* An English trading post was established in 1722, and in 1727 Governor William Burnet of New York built the first fort. It was an important base of operations during King George's War and the French and Indian War. In 1755–56 the British erected two new forts (Oswego and Ontario) on either side of the mouth of the river, both of which were taken by Montcalm (Aug. 14–15, 1756) and dismantled. The British restored Ft. Ontario in 1759 and kept it garrisoned until they turned it over to the United States in 1796. It was here that Pontiac in 1766 made his acknowledgment to Sir William Johnson of Great Britain's authority. On May 6, 1814, the fort was captured by the British and Canadians, and was held by them for a short time. It was rebuilt and garrisoned by the United States in 1839, abandoned in 1899, and again reconstructed and garrisoned in 1905. Oswego became the county seat in 1816, was incorporated as a village in 1828 (when the canal was completed) and as a city in 1848.

**OSWEGO CANAL:** *see* NEW YORK STATE BARGE CANAL SYSTEM.

**OSWEGO TEA** (*Monarda didyma*), a North American plant of the mint family (Labiatae), called also American bee-balm, native to moist soil from Quebec to Michigan and southward to North Carolina and Georgia. It is a stout perennial, 2 to 3 ft. high, with opposite, lance-shaped, sharply toothed leaves, and showy scarlet flowers, about 2 in. long, borne in dense bracted heads terminating the branches. The Oswego tea, so named because of former medicinal use, is one of the most handsome flowering plants native to eastern North America; several choice varieties are cultivated.

**OSWESTRY,** municipal borough in the Oswestry parliamentary division of Shropshire, England, near the Welsh border in the N.W. corner of the county. Pop. (est. 1938) 9,726. Area, 3.4 sq.mi. The town is placed where valleys open from the Berwyn mountains, and is a market town between hill and plain as well as a route centre. There are various accounts of the early history of the settlement (*Trer Cadeirau*). The present name comes from Oswald's Tree (alternative Oswald's Cross, Welsh *Croes Oswallt*) and is said to refer to the death of Oswald, king of Northumbria, in a battle fought here against Penda, the ruler of Mercia. The heavily fortified encampment of "Old Oswestry," about a mile from the town, suggests early border warfare. The town was twice burned by Welsh invaders in the middle ages. In the Domesday Survey it is included in the manor of Maesbury. Richard II, by a charter dated 1398, granted all the privileges which belonged to Shrewsbury. In 1582 Elizabeth incorporated the town; her charter was confirmed by James I, 1616.

In the 15th and 16th centuries a weekly market was held at Oswestry for the sale of woollen goods manufactured in the adjoining parts of Wales, but the drapers of Shrewsbury, a rival centre, ruined the trade by refusing to buy cloth there. In 1642 it was garrisoned for Charles I, but two years later surrendered to the parliamentary forces. The church of St. Oswald, originally conventual, is Early English and Decorated, but has been much restored. The grammar school, founded in the reign of Henry IV, occupies modern buildings. During World War I Oswestry benefited greatly by the presence of thousands of troops at Park Hall camp. The Cambrian railway had its headquarters in the town but the engine and carriage works were in part removed by the G.W.R. after 1922. The chief industries are malting, tanning, currying, fellmongery and wool stapling.

**OTHMAN** (*c.* 574–656), in full OTHMĀN IBN 'AFFĀN, the third of the Mohammedan caliphs, a kinsman and son-in-law of Mohammed and cousin of Abu Sofiān, whose son Moawiya became the first of the Omayyad dynasty. He was elected caliph in succession to Omar in 644, but owing to his weakness and cruelty and his preference of the Koreish for all responsible positions irrespective of their capacity, he produced strife throughout the empire which led to his assassination by Mohammed, son of Abu Bekr. He was succeeded by Ali. *See* CALIPHATE.

**OTHO, MARCUS SALVIUS** (A.D. 32–69), Roman emperor, was born on April 28, A.D. 32. He appears first as one of the wildest of Nero's court. In 58 he refused to divorce his wife Poppaea Sabina at Nero's bidding, and was thereupon sent to be governor of Lusitania, where he remained ten years. In 68 Galba, governor of the neighbouring province of Tarraconensis, rebelled against Nero, and Otho accompanied him to Rome, hoping to succeed him. In Jan. 69 Galba adopted Piso as his successor, and Otho at once organized a revolt of the praetorian guard, and on Jan. 15 had himself proclaimed emperor, murdered Galba and Piso, and was accepted by the Senate. He owed his success partly to Galba's disciplinary measures being unpopular with the guards, partly to the power of the memory of Nero, which he further enlisted by restoring his statues and the officials of his household, and proposing to complete his palace, the Golden House. News soon arrived, however, that the army in Germany had declared for Vitellius. On March 14 he started northwards to prevent the Vitellians entering Italy. In this he failed, but his advance guard successfully defended Placentia against Alienus Caecina, compelling him to retire to Cremona, and he held the line of the Po. Opinions were divided in Otho's camp, he himself wishing to force a decisive battle, others advising him to wait for the arrival of the troops from Dalmatia. Otho prevailed, and the main army crossed the Po to Bedriacum, Otho staying behind with the reserve at Brixellum, on the southern bank. The Othonian forces were defeated outside Cremona, and deserted to the enemy. Otho refused to renew the struggle and committed suicide in his tent on the morning of April 15, 69, and was buried at Brixellum.

*See* Tacitus, *Histories,* i. 12–50, 71–90, ii. 11–51; *Lives* by Suetonius and Plutarch; Dio Cassius lxiv.; L. Paul, "Kaiser M. Salvius Otho" in *Rhein. Mus.* lvii. (1902); W. A. Spooner's Introd. to his edition (1891) of the *Histories* of Tacitus; B. W. Henderson, *Civil War and Rebellion in the Roman Empire,* A.D. *69–70* (1908).

**OTIDIDAE:** *see* BUSTARD.

**OTIS, HARRISON GRAY** (1837–1917), American journalist, was born near Marietta, O., on Feb. 10, 1837. He became a printer's apprentice, working in various offices in Illinois, Iowa, Ohio and Kentucky. He served throughout the Civil War, and rose to be lieutenant-colonel He was in the Government printing office at Washington, D.C., 1867–70, and in 1870 moved to California, where he managed the Santa Barbara *Press.* In July 1882 he became connected with the Los Angeles *Daily Times,* obtaining control of that paper in 1886. He served in the war with Spain as brigadier-general in the Philippines 1898–99. In 1910 the *Times* building was dynamited, 21 employees being killed. He died at Los Angeles on July 30, 1917.

**OTIS, JAMES** (1725–1783), American patriot, was born at West Barnstable, Mass., on Feb. 5, 1725. He was the eldest son of James Otis (1702–1778), fourth in descent from John Otis (1581–1657), a native of Barnstaple, Devon, and one of the first settlers (in 1635) of Hingham, Mass. The elder James Otis was elected to the provincial general court in 1758, was its speaker in 1760–1762, and was chief justice of the court of common pleas from 1764 until 1776; he was a prominent patriot in the colony of Massachusetts. The son graduated at Harvard in 1743; and after studying law in the office of Jeremiah Gridley (1702–1767), a well-known lawyer with Whig sympathies, rose to great distinction at the bar, practising first at Plymouth and after 1750 at Boston. In 1760 he published *Rudiments of Latin Prosody,* a book of authority in its time. Soon after the accession of George III. to the throne of England in 1760, the British Government decided upon a rigid enforcement of the navigation acts, which had long been disregarded by the colonists and had been almost wholly evaded during the French and Indian War. The writs of assistance issued in 1755 were about to expire, and it was decided to issue new ones, which would empower custom house officers to search any house for smuggled goods, though neither the house nor the goods had to be specifically mentioned in the writs. Much opposition was aroused in Massachusetts, the legality of the writs was questioned, and the superior court consented to hear argument. Otis held the office of advocate-general at the time, and it was his duty to appear on behalf of the Government. He refused, resigned his office, and appeared for the people against the issue of the writs. The case was argued in the old town house of Boston in Feb. 1761, and the chief speech was made by Otis. His plea was fervid in its eloquence and fearless in its assertion of the rights of the colonists. Going beyond the question at issue, he dealt with the more fundamental question of the relation between the English in America and the home Government, and argued that even if authorized by act of parliament such writs were null and void. The young orator was elected in May of the same year a representative from Boston to the Massachusetts general court. To that position he was re-elected nearly every year of the remaining active years of his life, serving there with his father. In 1766 he was chosen speaker of the house of representatives, but the choice was negatived.

In Sept. 1762 the younger Otis published *A Vindication of the Conduct of the House of Representatives of the Province of Massachusetts Bay,* in defence of the action of that body in sending to the governor a message (drafted by Otis) rebuking him for asking the assembly to pay for ships he had (with authorization of the council and not of the representatives) sent to protect New England fisheries against French privateers; according to this

message "it would be of little consequence to the people whether they were subject to George or Louis, the king of Great Britain or the French king, if both were as arbitrary as both would be if both could levy taxes without parliament." He also wrote various State papers addressed to the colonies to enlist them in the common cause, or sent to the Government in England to uphold the rights or set forth the grievances of the colonists. His influence at home in controlling and directing the movement of events which led to the War of Independence was universally felt and acknowledged; and abroad no American was so frequently quoted, denounced or applauded in parliament and the English press before 1769 as the recognized head and chief of the rebellious spirit of the New England colonists. In 1765 Massachusetts sent him as one of her representatives to the Stamp Act congress at New York, and here he was a conspicuous figure, serving on the committee which prepared the address sent to the British House of Commons. From 1769 almost continually until his death, Otis was harmlessly insane, though he had occasional lucid intervals, serving as a volunteer in the battle of Bunker Hill in 1775 and arguing a case in 1778. He was killed by lightning (it is said that he had often expressed a wish that he might die in this way) at Andover, Mass., on May 23, 1783.

Otis's political writings exercised an enormous influence, his pamphlets being among the most effective presentations of the arguments of the colonists against the arbitrary measures of the British ministry. His more important pamphlets were *A Vindication of the Conduct of the House of Representatives of the Province of Massachusetts Bay* (1762); *The Rights of the British Colonies Asserted and Proved* (1764); *A Vindication of the British Colonies against the Aspersions of the Halifax Gentleman in his Letter to a Rhode Island Friend*—a letter known at the time as the "Halifax Libel" (1765); and *Considerations on Behalf of the Colonists in a Letter to a Noble Lord* (1765).

The best biography is that by William Tudor (Boston, 1823); there is a shorter one by Francis Bowen (Boston, 1847). The best account of Otis's characteristics and influence as a writer may be found in M. C. Tyler's *Literary History of the American Revolution* (1897). Consult the notes on the Writs of Assistance by Horace Gray, Jr., in Quincy's *Massachusetts Reports, 1761–1772* (Boston, 1865). *See* also Francis Wilson Sprague, *Birthplace of the Patriot James Otis* (1917).

**OTLEY,** an urban district in the West Riding of Yorkshire, England, 10 mi. N. of Bradford on the L.M.S. and L.N.E. railways. Pop. (1938) 11,060. Area, 4.7 sq.mi. It stands on the Wharfe at the foot of the precipitous Chevin. To the S.W. the Guiseley gap affords a route, only 4 mi. long, between the Aire and the Wharfe. It is traversed by both roads and railways and brings much of the Aire valley within range of Otley markets.

In 937 King Aethelstan granted to the archbishop of York the manor of Otley. The town and the church were laid waste in 1069. Otley became an important local centre of the woollen cloth industry, which was introduced late in the 11th century. An annual fair was granted in 1222 and a weekly market in 1248.

The growth of cereals, which was important until the 18th century, was abandoned in favour of pastoral industries for the supply of meat to the dense population on the Yorkshire coalfield. To-day the prosperity of Otley depends, not on its importance as an agricultural centre, which has been decreasing for a century, but on its industries. Worsted spinning and weaving, tanning and leather-dressing, paper-making and the manufacture of printing machines are the chief amongst these industries. Excellent building stone is quarried.

**OTOLITH:** *see* EQUILIBRIUM, ANIMAL.

**OTOMACAN,** an independent linguistic stock of South American Indians, named from the Otomacas, its best known tribe. The Otomacas lived in south-western Venezuela, along the Orinoco between the Meta and Arauca rivers. In recent times they have spread westward. Described by early writers as one of the most barbarous tribes of the whole Orinoco region, they appear to have been sedentary agriculturalists, cultivating their fields of manioc and maize communally, the produce, with that from hunting and fishing, being divided among all by the chief. They were noted as clay-eaters, even their bread being mixed with it, and made great use of narcotic snuff. They were monogamous, and it is said that they married all young girls to old widowers, and all young men to elderly widows.

*See* J. Gumilla, *Histoire naturelle, civile et géographique de l'Orénoque* (Avignon, 1758).

**OTOMI,** an important group of Indians on the central mesa of Mexico. The ancient territory of the Otomi proper comprised the states of Guanajuato and Querétaro, south-western Hidalgo and northern Mexico, extending to the hills overlooking Mexico valley and city. With them are reckoned, on the basis of related speech, the Pame of eastern San Luis Potosi and the Mazahua and Pirinda of western Mexico (state). The Otomian languages are tonal and built up from monosyllabic elements. This analogy to Chinese has led to theories of relationship, generally fantastic. Remote kinship with the Zapotecan group is, however, possible. The Otomi passed as dull boors among the Aztec; they were provincially backward as compared with centres of native culture like Mexico, Tezcoco, Cholula, and possessed no large towns. The nearer ones were all subject to the Aztec. To-day they are peaceful and number about a quarter of a million.

**OTRANTO,** seaport and archiepiscopal see, Apulia, Italy, in province of Lecce, 29½ mi. S.E. from it by rail, 49 ft. above sea-level. Pop. (1936) 2,507 (town), 3,033 (commune). It is on the E. coast of the peninsula of ancient Calabria (*q.v.*). The castle was erected by Alfonso of Aragon; the cathedral, consecrated in 1088, has a rose window and side portal of 1481. The interior, a basilica with nave and two aisles, contains a mosaic pavement of 1165. It has a crypt supported by 42 marble columns. The church of S. Pietro has Byzantine frescoes.

Otranto occupies the site of the ancient Hydrus or Hydruntum, a town of Greek origin. In Roman times it was less important than Brundisium as a point of embarkation for the East. It was taken by Robert Guiscard in 1068. In 1480 it was utterly destroyed by the Turkish fleet, and has never since recovered its importance. About 30 mi. S.E. lies the promontory of S. Maria di Leuca (so called since ancient times from its white cliffs), the southeast extremity of Italy, the ancient Promontorium Iapygium or Sallentinum. The district between this promontory and Otranto is thickly populated, and very fertile. It was a supply base in World Wars I and II. The straits are about 40 mi. wide; cables leave here for Valona and Corfu.

**OTTAKAR I.** (d. 1230), king of Bohemia, was a younger son of King Vladislav II. (d. 1174) and a member of the Premyslide family, hence he is often referred to as Premysl Ottakar I. Recognized as ruler of Bohemia by the emperor Henry VI. in 1192, he was, however, soon overthrown, but in 1196 forced his brother, King Vladislav III., to abandon Bohemia to him and to content himself with Moravia. Ottakar first sought the support of the German king Philip, duke of Swabia, but then went over to his rival Otto of Brunswick. Philip thereupon invaded Bohemia, and Ottakar changed sides once more. Later still, he supported the young king, Frederick II. He united Moravia with Bohemia in 1222, and when he died in 1230 he left to his son, Wenceslaus I., a kingdom united and comparatively peaceable.

**OTTAKAR II.,** or PREMYSL OTTAKAR II. (*c.* 1230–1278), king of Bohemia, was son of King Wenceslaus I.; his maternal grandfather was the German king, Philip, duke of Swabia. In his father's lifetime he ruled Moravia, and in 1251 secured his election as duke of Austria, where he strengthened his position by marrying (Feb. 11, 1252) Margaret (d. 1267), sister of Duke Frederick II., the last of the Babenbergs and widow of the German king, Henry VII. In Sept. 1253 he succeeded his father in Bohemia, and in 1254 concluded peace with Bela IV. of Hungary, who had claimed Styria, advancing the Austrian frontier to the present line. In 1259 he expelled the Hungarians from the rest of Styria, then divorced his wife, married a granddaughter of Bela IV. and secured his investiture (by letter) with Austria and Styria from the German king, Richard Cornwallis.

In 1269 Ottakar II. inherited Carinthia and part of Carniola; and having made good his claim, contested by the Hungarians, in battle, he was the most powerful prince in Germany when an election for the German throne took place in 1273. The electors, however, fearing his power, chose Rudolph of Habsburg, who in 1276 placed Ottakar under the ban, besieged Vienna, and com-

pelled Ottakar to renounce all his possessions except Bohemia and Moravia. (*See* AUSTRIA.) Ottakar was killed at Dürnkrut on the March, Aug. 26, 1278, in an attempt to recover his lands. Clever, strong and handsome, he is a famous figure both in history and in legend, and is the subject of a tragedy by F. Grillparzer, *König Ottokars Glück und Ende.*

*See* O. Lorenz, *Geschichte König Ottokars,* ii. (Vienna, 1866); and F. Palacky, *Geschichte von Böhmen,* vol. i. (Prague, 1844).

**OTTAVA RIMA,** a stanza of eight iambic lines, containing three rhymes, invariably arranged as follows:—*a b a b a b c c.* It is an Italian invention of the 14th century. Boccaccio employed it for the *Teseide* (1340) and for the *Filostrato* (some seven years later). These epics gave to *ottava rima* its classic character. In the succeeding century it was employed by Politian, and by Boiardo for his famous *Orlando Innamorato* (1486). It was Pulci, however, in the *Morgante Maggiore* (1487), who invented the peculiar mock-heroic, or rather half-serious, half-burlesque, style with which *ottava rima* has been most commonly identified. The most striking monument in *ottava rima* in English is *Don Juan* (1819–24). Byron also employed this measure in *The Vision of Judgment* (1822). Meanwhile Shelley also became attracted by it, and in 1820 translated the *Hymns* of Homer into *ottava rima.* In the Peninsula the form was largely used, *e.g.,* by Boscán (1490–1542), by Ercilla y Zúñiga (1533–95) in the *Araucana,* by Camoens in the *Lusiads* (1572) and by Lope de Vega.

**OTTAWA,** a city of Carleton county, province of Ontario, and the capital of the dominion of Canada, on the right bank of the Ottawa river, 101 m. W. of Montreal and 217 m. N.E. of Toronto. Pop. (1941) 154,951. Greater Ottawa 215,022, to include the city of Hull (32,947) and various suburbs.

The city stands for the most part on a cluster of hills, 60 to 155 feet above the river. It is on the transcontinental lines of both the Canadian National and Canadian Pacific railways, and has direct communication by both systems to Montreal, Toronto and other points in Canada, as well as by the Ottawa and New York and other railroads to New York and elsewhere in the United States. Electric railways afford communication with all parts of the city and the suburbs, as well as through the neighbouring city of Hull to Aylmer. Several bridges connect Ottawa with Hull and others cross Rideau river and the Rideau canal.

The site of the city is very picturesque. For three miles it follows the high southern bank of the Ottawa from the Chaudière falls, whose mist-crowned cauldron is clearly visible from the summit of Parliament Hill, to and beyond the Rideau falls, so named by early French explorers because of their curtain-like appearance. The Rideau, a southern tributary of the Ottawa, once formed the eastern boundary of the city, which, however, is now absorbing a string of suburbs that lie along its eastern banks. The Rideau canal cuts the city in two, the western portion being known as Upper Town and the eastern as Lower Town. Roughly speaking, the canal divides the two sections of the population, the English occupying Upper Town and the French Lower Town.

Opposite and a little below the mouth of the Rideau river, the Gatineau flows into the Ottawa from the north. The river is now the scene of very large hydro-electric developments. Above the Chaudière falls the river is broken by the Deschenes rapids, and beyond these again it expands into Lake Deschenes, a favourite summer resort. To the north the Laurentian Hills, broken by the picturesque Gatineau valley, offer skiing in winter.

**Buildings.**—The crowning architectural feature of the city is the splendid group of Gothic buildings on the summit of Parliament Hill. The three blocks form sides of a great quadrangle, the fourth side remaining open. The corner stone of the main building was laid by the then prince of Wales in 1860. With the exception of the library, it was destroyed by fire in 1916, and has since been rebuilt. In the tower is a remarkably beautiful war memorial chamber, and above it is hung a carillon of 53 bells. The Langevin block on the south side of Parliament Hill is used for departmental purposes, and to meet the increasing needs of the government, a group of buildings is being erected on the banks of the Ottawa, west of Parliament Hill. Other national institutions are the Public Archives, Royal Mint, Department of National Revenue, National Museum and the National Art Gallery, and Dominion Observatory. Other buildings are the City hall, public library, university of Ottawa, the collegiate institutes, Normal and Model school, St. Patrick's college and the Roman Catholic and Church of England cathedrals. City charities include a large civic hospital and nurses' home, a general hospital supported by the Roman Catholics and three special hospitals devoted to contagious diseases.

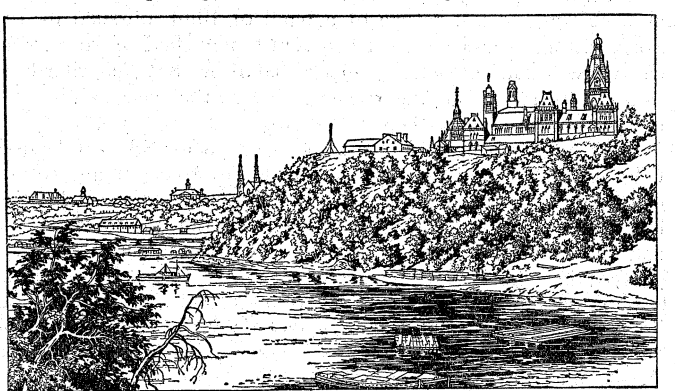
A system of public parks and driveways, partly within and partly without the city, add very largely to its attractions. These have been built and are maintained by the federal district commission. Statues of Queen Victoria, as well as of Sir John Macdonald, Sir Wilfrid Laurier and other Canadian statesmen, stand on Parliament Hill. A very beautiful war memorial has been erected in honour of those killed in action (1914–18).

Rideau Hall, the official residence of the governor general, lies on the eastern boundary of the city at the entrance to Rockcliffe park.

Ottawa is governed by a mayor, and board of control of four members, elected by the city at large, and a board of 22 aldermen, two elected by each of the 11 wards. The city returns two members to the dominion house of commons, and two to the Ontario legislature.

**History.**—The earliest description of the site of Ottawa is that of Samuel de Champlain, in his *Voyages.* In June 1613, on his way up the river, he came to a tributary on the south side, "at the mouth of which is a marvellous fall. For it descends a height of twenty or twenty-five fathoms with such impetuosity that it makes an arch nearly four hundred paces broad. The savages take pleasure in passing under it, not wetting themselves, except from the spray that is thrown off." This was the Rideau falls, but a good deal of allowance must be made for exaggeration in Champlain's account. Continuing up the river, "we passed," he says, "a fall, a league from there, which is half a league broad and has a descent of six or seven fathoms. There are many little islands. The water falls in one place with such force upon a rock that it has hollowed out in course of time a large and deep basin, in which the water has a circular motion and forms large eddies in the middle, so that the savages call it *Asticou,* which signifies boiler. This cataract produces such a noise in this basin that it is heard for more than two leagues." The present name, Chaudière, is the French equivalent of the old Indian name.

For two hundred years and more after Champlain's first visit the Chaudière portage was the main thoroughfare from Montreal



BY COURTESY OF THE CANADIAN NATIONAL RAILWAYS

BARRACK HILL, IN OTTAWA, WITH A PART OF THE PARLIAMENTARY BUILDINGS IN THEIR ORIGINAL STATE. FROM AN OLD PRINT

to the great western fur country; but it was not until 1800 that any permanent settlement was made in the vicinity. In that year Philemon Wright, of Woburn, Massachusetts, built a home for himself at the foot of the portage, on the Quebec side of the river, where the city of Hull now stands; but for some time the precipitous cliffs on the south side seem to have discouraged settlement there. Finally about 1820 one Nicholas Sparks moved over the river and cleared a farm in what is now the heart of Ottawa. Seven years later Colonel John By, R.E., was sent out

to build a canal from a point below the Chaudière falls to Kingston on Lake Ontario. The canal, completed at a cost of $2,500,000 has never been of any great commercial importance; it has never been called upon to fulfil its primary object, as a military work to enable gun-boats and military supplies to reach the lakes from Montreal without being exposed to attack along the St. Lawrence frontier. The building of the canal created a fair-sized settlement at its Ottawa end, which came to be known as Bytown. As the lumber trade developed Bytown rapidly increased in wealth and importance. In 1854 it was incorporated as a city, the name being changed to Ottawa; and four years later Queen Victoria selected Ottawa as the capital of the province of Canada. Ottawa was admirably situated for a capital from a political and military point of view; but there is reason to believe that the deciding factor was the pressure exerted by the four other rival claimants, Montreal, Quebec, Toronto and Kingston, any three of which would have fiercely resented the selection of the fourth. The first session of parliament in Ottawa was opened in 1865. The British North America act of 1867 (§16) makes Ottawa the capital of the dominion of Canada.

BIBLIOGRAPHY.—J. D. Edgar, *Canada and its Capital* (Toronto, 1898); A. S. Bradley, *Canada in the Twentieth Century* (1903), pp. 130–140; Gertrude Kenny, "Some Account of Bytown," Transactions, vol. i., *Women's Canadian Historical Society of Ottawa;* Mrs. H. J. Friel, "The Rideau Canal and the Founder of Bytown," ibid.; M. Jamieson, "A glimpse of our city fifty years ago," ibid.; Godfrey T. Vigne, *Six Months in America* (1832), pp. 191–198; Andrew Wilson, *History of Old Bytown* (Ottawa, 1876); Charles Pope, *Incidents connected with Ottawa* (Ottawa, 1868); Wm. P. Lett, *Recollections of Bytown* (Ottawa, 1874); Wm. S. Hunter, *Ottawa Scenery* (Ottawa, 1855); A. H. D. Ross, *Ottawa Past and Present* (Toronto, 1927). For current description: D. Duncan, *Here's to Canada* (1941).

(L. J. B.; X.)

**OTTAWA,** a city of Illinois, U.S.A., 84 mi. S.W. of Chicago, at the confluence of the Illinois and the Fox rivers; the county seat of Lasalle county. It is on the Illinois and Michigan canal and the Illinois waterway, and is served by the Burlington Route and the Rock Island railway. Population in 1940, 16,005.

Ottawa is surrounded by a rich agricultural country, and there are medicinal springs and large deposits of clay and silica in the vicinity. The city's manufactures (including plate glass, building tile, firebrick and agricultural implements) had a value of over $10,000,000 in 1940. The mouth of the Fox river was visited early by the French explorers, and Father Hennepin discovered coal here in 1680. On Starved Rock (8 m. W., on the south bank of the Illinois, in a State park of 900 ac.) La Salle in 1683 built Fort St. Louis, which was used by fur traders as late as 1718, and in 1770 was the last refuge of a band of Illini, pursued by the Pottawattomies and besieged here until they died of starvation. Ottawa was laid out in 1831, incorporated in 1837 and chartered as a city in 1853. On Aug. 21, 1858 it was the scene of the first of the Lincoln-Douglas debates.

**OTTAWA,** a city of Kansas, U.S.A., 58 m. S.W. of Kansas City, on the Marais des Cygnes (or Osage) river, at an altitude of 926 ft.; the county seat of Franklin county. It is on Federal highways 50S and 59, and is served by the Missouri Pacific and the Santa Fe railways. Pop. 9,018 in 1920 (92% native white); in 1940 it had increased to 10,193. Ottawa has a large trade in poultry and dairy products, fruit and other farm produce. Its manufacturing establishments include large repair shops of the Santa Fe Company, creameries, flour-mills, poultry-packing plants and factories making steel products, brooms and chicken-coops. It is the seat of Ottawa university (Baptist) established in 1865. The city owns its electric light and power and water plants, and natural gas is supplied from the Kansas fields. Ottawa was in the reservation of the Ottawa Indians until they were moved (1865) to the Indian Territory. A mission was established here in 1839. The city was chartered in 1866.

**OTTAWA,** the largest tributary of the river St. Lawrence; ranking ninth in length among the rivers of Canada, being 685 m. long. It flows first westward to Lake Timiscaming; thence south-east and east. The principal tributaries on the left bank are the Rouge (115 m.), North Nation (60), Lièvre (205), Gatineau (240), Coulonge (135), Dumoine (80); and on the right bank, the South Nation (90), Mississippi (105), Madawaska (130) and Petawawa (95). Canals at Ste. Anne, Carillon and Grenville permit the passage of vessels drawing 9 ft., from Montreal up to the city of Ottawa. At Ottawa the river is connected with Lake Ontario by the Rideau Canal.

The Ottawa was first explored by Samuel de Champlain in 1613. Champlain describes many of its tributaries, the Chaudière and Rideau Falls, the Long Sault, Chats and other rapids, as well as the character of the river and its banks, with minuteness and reasonable accuracy. The Long Sault Rapids on the Ottawa, about midway between Montreal and the capital, were the scene of one of the noblest exploits in Canadian history, when in 1661 the young Sieur des Ormeaux with sixteen comrades and a handful of Indian allies deliberately gave their lives to save New France from an invasion of the Iroquois. They intercepted the war party at the Long Sault, and for nearly a week held them at bay. When finally the last Frenchman fell under a shower of arrows, the Iroquois were thoroughly disheartened and returned crestfallen to their own country. For a hundred and fifty years thereafter the Ottawa was the great highway from Montreal to the west for explorers and fur-traders. Throughout the 19th century the Ottawa was the thoroughfare of lumbermen, whose immense rafts went from its upper waters to Montreal and Quebec.

**OTTER,** the name of an aquatic carnivore inhabiting Europe and Asia. The otter (*Lutra vulgaris*) has an elongated body, short limbs terminating in broad webbed feet, the toes of which are armed with claws, a broad, flat head and a tail about half the length of the body. The muzzle is broad, the whiskers thick, the eyes small and the ears short and rounded. The fur consists of a short, soft, grey underfur, interspersed with longer, stiffer hairs, the points of which are bright brown. The average length is about 3½ft., the weight of a male 18 to 24 lb., the female being about 4 lb. less. The otter lives on fish and inhabits streams, rivers, lakes and, in some localities, the sea. The female produces 3 to 5 young in March or April, bringing them up in a nest of grass in a hollow in a river-bank or under the roots of an overhanging tree. Otter hunting, with packs of special hounds, is a pastime in parts of England.

In North America, *L. vulgaris* is replaced by the larger *L. canadensis* and other species with similar habits occur in North and South America, South Africa and southern Asia.

BY COURTESY OF THE N.Y. ZOOLOGICAL SOCIETY

OTTERS (LUTRA VULGARIS), WIDELY DISTRIBUTED THROUGH EUROPE AND ASIA

The sea-otter (*Latax lutris*) is confined to the North Pacific. It is larger and more heavily built than the European otter and possesses a very valuable coat of fur, on account of which it has been almost exterminated; they are very wary animals. Sea-otters feed on shellfish. *See* Elliott Coues, *Monograph of North American Fur-bearing Animals.*

Otters form a section of the family Mustelidae (*see* CARNIVORA).

**OTTERY ST. MARY,** a market town of Devonshire, England, 12 m. N.E. of Exeter on the S.R. Pop. of urban district (1938) 3,562. Area 15·6 sq.mi. The parish church is Early English, with Decorated and Perpendicular additions. It has transeptal towers, imitated from Exeter cathedral. The manor of Ottery belonged to the abbey of Rouen in the time of Edward the Confessor. The church was dedicated in 1260 by Walter Bronescombe, bishop of Exeter; and enlarged by Bishop John Grandisson, *c.* 1335. The town has a large agricultural trade, and Honiton lace is a home industry. It was the birthplace of S. T. Coleridge.

**OTTO I.** (912–973), the Great, Roman emperor, eldest son of King Henry I. the Fowler by his second wife Matilda, was born on Nov. 23, 912. Little is known of his early years, but he probably shared in some of his father's campaigns. In 929 he married Edith, daughter of Edward the Elder, king of the English, and sister of the reigning King Aethelstan. In 936 Otto was chosen German king and crowned by Hildebert, archbishop of Mainz. Otto soon showed his intention of breaking with the policy of his father, who

had been content with a nominal superiority over the duchies; in 937 he punished Eberhard, duke of Franconia, for an alleged infringement of the royal authority; and in 938 deposed Eberhard, duke of Bavaria. Trouble soon arose in Saxony, probably from his refusal to give certain lands to his half-brother, Thankmar, who, although the king's senior, had been passed over in the succession as illegitimate. Thankmar, aided by an influential Saxon noble named Wichmann, and by Eberhard of Franconia, seized the fortress of Eresburg and took Otto's brother Henry prisoner; but soon afterwards he was defeated by the king and killed whilst taking sanctuary. The other conspirators were pardoned, but in 939 a fresh revolt broke out under the leadership of Henry, and Giselbert, duke of Lorraine. Otto gained a victory near Xanten, which was followed by the surrender of the fortresses held by his brother's adherents in Saxony, but the rebels, joined by Eberhard of Franconia and Archbishop Frederick of Mainz, continued the struggle, and Giselbert of Lorraine transferred his allegiance to Louis IV., king of France. Otto's precarious position was saved by a victory near Andernach when Eberhard was killed, and Giselbert drowned in the subsequent flight. Henry took refuge with Louis of France, but was soon restored to favour and entrusted with the duchy of Lorraine, where, however, he was unable to restore order. Otto therefore crossed the Rhine and deprived his brother of authority. Henry then became involved in a plot to murder the king, which was discovered in time, and the good offices of his mother secured him a pardon at Christmas 941.

The deaths of Giselbert of Lorraine and of Eberhard of Franconia, quickly followed by those of two other dukes, enabled Otto to unite the stem-duchies more closely with the royal house. In 944 Lorraine was given to Conrad, surnamed the Red, who in 947 married the king's daughter Liutgard; Franconia was retained by Otto in his own hands; Henry married a daughter of Arnulf, duke of Bavaria, and received that duchy in 947; and Swabia came in 949 to the king's son Ludolf, who had married Ida, a daughter of the late duke, Hermann. During these years the tribes living between the Elbe and the Oder were made tributary, bishoprics were founded in this district, and in 950 the king himself marched against the Bohemians and reduced them to dependence. Strife between Otto and Louis IV. of France had arisen when the French king sought to obtain authority over Lorraine and aided the German rebels in 939; but after the German king had undertaken an expedition into France, peace was made in 942. Afterwards, when Louis became a prisoner in the hands of his powerful vassal Hugh the Great, duke of France, Otto attacked the duke, who, like the king, was his brother-in-law, captured Reims, and negotiated a peace between the two princes; and in subsequent struggles between them his authority was several times invoked.

In 945 Berengar I., margrave of Ivrea, left the court of Otto and returned to Italy, where he soon obtained a mastery over the country. After the death in 950 of Lothair, king of Italy, Berengar sought the hand of his widow Adelaide for his son Adalbert; and Henry of Bavaria and Ludolf of Swabia had already been meddling independently of each other in the affairs of northern Italy. In response to an appeal from Adelaide, Otto crossed the Alps in 951. He assumed the title of king of the Lombards, and having been a widower since 946, married Adelaide and negotiated with Pope Agapetus II. about his reception in Rome. The influence of Alberic, prince and senator of the Romans, prevented the pope returning a favourable answer to the king's request. But when Otto returned to Germany in 952 he was followed by Berengar, who did homage for Italy at Augsburg. The chief advisers of Otto at this time were his wife and his brother Henry. Henry's influence seems to have been resented by Ludolf, who in 946 had been formally designated as his father's successor. When Adelaide bore a son, and a report gained currency that Otto intended to make this child his heir, Ludolf rose in revolt and was joined by Conrad of Lorraine and Frederick of Mainz. Otto fell into the power of the rebels at Mainz and was compelled to agree to demands made by them, which, however, he promptly revoked on his return to Saxony. Ludolf and Conrad were declared deposed, and in 953 war broke out in Lorraine and Swabia, and afterwards in Saxony and Bavaria. Otto was finally victorious and with the capture of Regensburg in 955 the rising ended. Conrad and Ludolf retained their estates, but their duchies were not restored to them. Meanwhile the Magyars had renewed their ravages and were attacking Augsburg. Otto marched against them, and in a battle fought on the Lechfeld Aug. 10, 955, the king's troops gained a victory which freed Germany from these invaders; while in the same year Otto defeated the Slavs ravaging the Saxon frontier.

About this time the king seems to have perceived the necessity of ruling in closer union with the church. Lands and privileges were granted to prelates, additional bishoprics were founded, and some years later Magdeburg was made the seat of an archbishop. In 960 Otto was invited to come to Italy by Pope John XII., who was hard pressed by Berengar, and he began to make preparations for the journey. As Ludolf had died in 957 and Otto, his only son by Adelaide, had been chosen king at Worms, the government was entrusted to Bruno of Cologne, and Archbishop William of Mainz, a natural son of the king. Reaching Pavia at Christmas 961, the king promised to defend and respect the church. He then proceeded to Rome, where he was crowned emperor on Feb. 2, 962. After the ceremony he confirmed the rights and privileges which had been conferred on the papacy, while the Romans promised obedience, and Pope John took an oath of fidelity to the emperor. But as he did not long observe his oath he was deposed at a synod held in St. Peter's, after Otto had compelled the Romans to swear they would elect no pope without the imperial consent; and a nominee of the emperor, who took the name of Leo VIII., was chosen in his stead. A pestilence drove Otto to Germany in 965, and finding the Romans again in arms on his return in 966, he allowed his soldiers to sack the city, and severely punished the leaders of the rebellion. His next move was against the Greeks and Saracens of southern Italy, but seeking to attain his objects by negotiation, sent Liudprand, bishop of Cremona, to the eastern emperor Nicephorus II. to arrange for a marriage treaty between the two empires. Nicephorus refused to admit the validity of Otto's title, and the bishop was roughly repulsed; but the succeeding emperor, John Zimisces, was more reasonable, and Theophano, daughter of the emperor Romanus II., was married to the younger Otto in 972. The same year witnessed the restoration of peace in Italy and the return of the emperor to Germany, where he received the homage of the rulers of Poland, Bohemia and Denmark; but he died suddenly at Memleben on May 7, 973.

The empire was less universal under Otto, its restorer, than Charlemagne, but what it lacked in splendour it gained in stability. His object was not to make the state religious but the church political, and the clergy must first be officials of the king, and secondly members of an ecclesiastical order. He shared the piety and superstition of the age, and did much for the spread of Christianity. Although himself a stranger to letters he welcomed scholars to his court and eagerly seconded the efforts of his brother Bruno to encourage learning; and while he neither feared nor shirked battle, he was always ready to secure his ends by peace.

BIBLIOGRAPHY.—*See* Widukind, *Res gestae Saxonicae;* Liudprand of Cremona, *Historia Ottonis;* Flodoard of Rheims, *Annales;* Hrotsvit of Gandersheim, *Carmen de gestis Oddonis*—all in the *Monumenta Germaniae historica. Scriptores,* Bände iii. and iv. (Hanover and Berlin, 1826 fol.); *Die Urkunden des Kaisers Ottos I.,* edited by Th. von Sickel in the *Monumenta Germaniae historica. Diplomata* (Hanover, 1879); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit* (Leipzig, 1881); R. Köpke and E. Dümmler, *Jahrbücher des deutschen Reichs unter Otto I.* (Leipzig, 1876); Th. von Sickel, *Das Privilegium Otto I. für die römische Kirche* (Innsbruck, 1883); H. von Sybel, *Die deutsche Nation und das Kaiserreich* (Düsseldorf, 1862); O. von Wydenbrugk, *Die deutsche Nation und das Kaiserreich* (Munich, 1862); J. Ficker, *Das deutsche Kaiserreich in seinen universalen und nationalen Beziehungen* (Innsbruck, 1861); and *Deutsches Königthum und Kaiserthum* (Innsbruck, 1862); G. Maurenbrecher, "Die Kaiserpolitik Otto I." in the *Historische Zeitschrift* (Munich, 1859); G. Waitz, *Deutsche Verfassungsgeschichte* (Kiel, 1844); J. Ficker, *Forschungen zur Reichs- und Rechtsgeschichte Italiens* (Innsbruck, 1868–74); F. Fischer, *Über Ottos I. Zug in die Lombardei vom Jahre 951* (Eisenberg, 1891); and K. Kötler, *Die Ungarnschlacht auf dem Lechfelde* (Augsburg, 1884).

**OTTO II.** (955–983), Roman emperor, was the son of the emperor Otto the Great, by his second wife Adelaide. He was chosen German king at Worms in 961 and on Dec. 25, 967, was crowned joint emperor at Rome by Pope John XIII. On

April 14, 972, he married Theophano, daughter of the eastern emperor Romanus II., and after sharing in various campaigns in Italy, returned to Germany and became sole emperor on the death of his father in May 973. After suppressing a rising in Lorraine, difficulties arose in southern Germany, probably owing to Otto's refusal to grant the duchy of Swabia to Henry II., the Quarrelsome, duke of Bavaria. The first conspiracy was easily suppressed, and in 974 an attempt on the part of Harold III., king of the Danes, to throw off the German yoke was also successfully resisted; but an expedition against the Bohemians led by the king in person in 975 was a partial failure owing to the outbreak of further trouble in Bavaria. In 976 Otto deposed Duke Henry, restored order for the second time in Lorraine, and made another expedition into Bohemia in 977, when King Boleslaus II. promised to return to his earlier allegiance. Having crushed an attempt made by Henry to regain Bavaria, Otto was suddenly attacked by Lothair, king of France, who held Aix in his possession for a few days; but when the emperor retaliated by invading France he met with little resistance. He was, however, compelled by sickness among his troops to raise the siege of Paris, and on the return journey the rearguard of his army was destroyed and the baggage seized by the French. An expedition against the Poles was followed by peace with France, when Lothair renounced Lorraine.

The emperor then prepared for a journey to Italy. In Rome, where he restored Pope Benedict VII., he held a splendid court, attended by princes and nobles from all parts of western Europe. He was next required to punish inroads of the Saracens on the Italian mainland, and in September 981 he marched into Apulia, where he met at first with considerable success; but an alliance between the Arabs and the Eastern Empire, whose hostility had been provoked by the invasion of Apulia, resulted in a severe defeat for Otto's troops near Stilo in July 982. Without revealing his identity, the emperor escaped on a Greek vessel to Rossano. At a diet held at Verona, largely attended by German and Italian princes, a fresh campaign was arranged against the Saracens. Proceeding to Rome, Otto secured the election of Peter of Pavia as Pope John XIV. Just as the news reached him of a general rising of the tribes on the eastern frontier of Germany, he died in his palace in Rome on Dec. 7, 983.

See *Die Urkunden des Kaisers Otto II.*, ed. Th. von Sickel, in the *Monumenta Germaniae historica. Diplomata* (Hanover, 1879); L. von Ranke, *Weltgeschichte,* Part vii. (Leipzig, 1886); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit* (Leipzig, 1881–90); and *Jahrbücher des deutschen Reichs unter Kaiser Otto II.* (1837–40); H. Detmer, *Otto II. bis zum Tode seines Vaters* (Leipzig, 1878); J. Moltmann, *Theophano die Gemahlin Ottos II. in ihrer Bedeutung für die Politik Ottos I. und Ottos II.* (Göttingen, 1878); and A. Matthaei, *Die Händel Ottos II. mit Lothar von Frankreich* (Halle, 1882).

**OTTO III.** (980–1002), Roman emperor, son of the emperor Otto II. and Theophano, daughter of the eastern emperor Romanus II., was born in July 980, chosen as his father's successor at Verona in June 983 and crowned German king at Aix-la-Chapelle on Dec. 25. Otto II. had died a few days before this ceremony, but the news did not reach Germany until after the coronation. Early in 984 the king was seized by Henry II., the Quarrelsome, the deposed duke of Bavaria, who claimed the regency as a member of the reigning house, and probably entertained the idea of obtaining the kingly dignity himself. A strong opposition was quickly aroused, and when Theophano and Adelaide, widow of the emperor Otto the Great, appeared in Germany, Henry was compelled to hand over the young king to his mother. Otto's abilities were carefully cultivated by Bernward, afterwards bishop of Hildesheim, and by Gerbert of Aurillac, archbishop of Reims, and he was called "the wonder of the world." The government of Germany during his minority was in the hands of Theophano, and after her death in June 991 passed to a council in which the chief influence was exercised by Adelaide and Willigis, archbishop of Mainz.

Having accompanied his troops in expeditions against the Bohemians and the Wends, Otto was declared of age in 995. In 996 he crossed the Alps and was recognized as king of the Lombards at Pavia. Before he reached Rome, Pope John XV., who had invited him to Italy, had died, whereupon he raised his own cousin Bruno, son of Otto duke of Carinthia, to the papal chair as Pope Gregory V., and by this pontiff Otto was crowned emperor on May 21, 996. On his return to Germany, the emperor learned that Gregory had been driven from Rome, which was again in the power of John Crescentius, patrician of the Romans, and that a new pope, John XVI., had been elected. Leaving his aunt, Matilda, abbess of Quedlinburg, as regent of Germany, Otto, in Feb. 998, led Gregory back to Rome, took the castle of St. Angelo by storm and put Crescentius to death. A visit to southern Italy, where many of the princes did homage to the emperor, was cut short by the death of the pope, to whose chair Otto then appointed his former tutor Gerbert, who took the name of Sylvester II.

In the palace which he built on the Aventine, Otto sought to surround himself with the splendour and ceremonial of the older emperors of Rome, and dreamed of making Rome once more the centre of a universal empire. Many names and customs were introduced into his court from that of Constantinople; he proposed to restore the Roman senate and consulate, revived the office of patrician, called himself "consul of the Roman senate and people" and issued a seal with the inscription, "restoration of the Roman empire." Passing from pride to humility he added "servant of the apostle," and "servant of Jesus Christ" to the imperial title, spent a fortnight in prayer in the grotto of St. Clement and did penance in various Italian monasteries.

Leaving Italy in the summer preceding the year 1000, when it was popularly believed that the end of the world was to come, Otto made a pilgrimage to the tomb of his old friend Adalbert, bishop of Prague, at Gnesen, and raised the city to the dignity of an archbishopric. He then went to Aix, and opened the tomb of Charlemagne, where, according to a legendary tale, he found the body of the great emperor sitting upright upon a throne, wearing the crown and holding the sceptre.

On his return to Rome, trouble arose between Otto and the citizens, and for three days the emperor was besieged in his palace. After a temporary peace, he fled to the monastery of Classe near Ravenna. Troops were collected, but whilst conducting a campaign against the Romans, Otto died at Paterno near Viterbo on Jan. 23, 1002, and was buried at Aix-la-Chapelle.

*See* Thangmar, *Vita Bernwardi episcopi Hildesheimensis* in the *Monumenta Germaniae historica. Scriptores,* Band iv. (Hanover, and Berlin, 1826 fol.); *Lettres de Gerbert,* ed. J. Havet (1889); *Die Urkunden Kaisers Ottos III.*, ed. Th. von Sickel in the *Monumenta Germaniae historica. Diplomata* (Hanover, 1879); R. Wilmans, *Jahrbücher des deutschen Reichs unter Kaiser Otto III.* (1837–40); P. Kehr, *Die Urkunden Otto III.* (Innsbruck, 1890).

**OTTO IV.** (*c.* 1182–1218), Roman emperor, second son of Henry the Lion, duke of Saxony, and Matilda, daughter of Henry II., king of England, was most probably born at Argenton in central France. His father died when he was still young, and he was educated at the court of his uncle Richard I., king of England, under whose leadership he gained valuable experience in war, being appointed duke of Aquitaine, count of Poitou and earl of Yorkshire. When the emperor Henry VI. died in September 1197, some of the princes under the leadership of Adolph, archbishop of Cologne, were anxious to find a rival to Philip, duke of Swabia, who had been elected German king. After some delay their choice fell upon Otto, who was chosen king at Cologne on June 9, 1198. Hostilities broke out at once, and Otto, after a series of defeats, was driven to Brunswick. Preparations were made to drive him from here, when he was saved by the murder of Philip in June 1208. Many of the supporters of Philip now made overtures to Otto, and an attempt to set up Henry I., duke of Brabant, having failed, Otto submitted to a fresh election and was chosen German king at Frankfort on Nov. 11, 1208, in the presence of a large gathering of princes. A general reconciliation followed, which was assisted by the betrothal of Otto to Philip's eldest daughter Beatrix, but as she was only ten years old, the marriage was deferred until July 22, 1212. The pope, who had previously recognized the victorious Philip, hastened to return to the side of Otto; large concessions were made to the church.

In August 1209 the king set out for Italy. Meeting with no opposition, he was received at Viterbo by Innocent, but refused the papal demand that he should concede to the church all the territories which, previous to 1197, had been in dispute between

the Empire and the Papacy, consenting, however, not to claim supremacy over Sicily. He was crowned emperor at Rome on Oct. 4, 1209, a ceremony which was followed by fighting between the Romans and the German soldiers. The pope then requested the emperor to leave Roman territory; but he remained near Rome for some days, demanding satisfaction for the losses suffered by his troops. The breach with Innocent soon widened, and in violation of the treaty made with the pope Otto attempted to recover for the Empire all the property which Innocent had annexed to the Church, and rewarded his supporters with large estates in the disputed territories.

Having occupied Tuscany he marched into Apulia, part of the kingdom of Frederick of Hohenstaufen, afterwards the emperor Frederick II., and on Nov. 18, 1210, was excommunicated by the pope. Regardless of this sentence Otto completed the conquest of southern Italy, but the efforts of Innocent had succeeded in arousing considerable opposition in Germany, where the rebels were also supported by Philip Augustus, king of France. A number of princes assembled at Nuremberg declared Otto deposed, and invited Frederick to fill the vacant throne. Returning to Germany in March 1212, Otto made some headway against his enemies until the arrival of Frederick towards the close of the year. The death of his wife in August 1212 had weakened his hold on the southern duchies, and he was soon confined to the district of the lower Rhine, although supported by money from his uncle King John of England. The final blow to his fortunes came when he was decisively defeated by the French at Douvines in July 1214. He escaped with difficulty from the fight and took refuge in Cologne. His former supporters hastened to recognize Frederick; and in 1216 he left Cologne for Brunswick, which he had received in 1202 by arrangement with his elder brother Henry. The conquest of Hamburg by the Danes, and the death of John of England, were further blows to his cause. On May 19, 1218, he died at the Harzburg after being loosed from the ban by a Cistercian monk, and was buried in the church of St. Blasius at Brunswick. He left no children.

See *Regesta imperii V.*, ed. J. Ficker (Innsbruck, 1881); L. von Ranke, *Weltgeschichte*, Part viii. (Leipzig, 1887–88); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit*, Band v. (Leipzig, 1888); O. Abel, *Kaiser Otto IV. und König Friedrich II.* (1856); E. Winkelmann, *Philipp von Schwaben und Otto IV. von Braunschweig* (Leipzig, 1873–78); G. Langerfeldt, *Kaiser Otto der Vierte* (Hanover, 1872); R. Schwemer, *Innocenz III. und die deutsche Kirche während des Thronstreites* (Strassburg, 1882); and A. Luchaire, *Innocent III., la papauté et l'empire* (1906); and *Innocent III., la question d'Orient* (1906).

**OTTO,** king of Greece (1815–1867), second son of Louis I., king of Bavaria, and his wife Teresa of Saxe-Altenburg, was born at Salzburg on June 1, 1815, and was educated at Munich. In 1832 he was chosen by the conference of London to occupy the newly-erected throne of Greece, and on Feb. 6, 1833, he landed at Nauplia, then the capital of independent Greece. Otto, who was not yet eighteen, was accompanied by a council of regency composed of Bavarians under the presidency of Count Josef Ludwig von Armansperg (1787–1853). In 1835 Otto came of age, but, on the advice of his father and under pressure of Great Britain and of the house of Rothschild, who all believed that a capable finance minister was the supreme need of Greece, he retained Armansperg as chancellor of state. The Greeks were more heavily taxed than under Turkish rule; they had exchanged government by the sword, which they understood, for government by official regulations, which they hated; they had escaped from the sovereignty of the Mussulman to fall under that of a devout Catholic, to them a heretic. Otto was well intentioned, honest and inspired with a genuine affection for his adopted country; but it needed more than mere amiable qualities to reconcile the Greeks to his rule.

In 1837 Otto married Princess Amalie of Oldenburg, who made herself unpopular by interfering in the government. Meanwhile Armansperg had been dismissed by the king, but a Greek minister was not put in his place, and the granting of a constitution was postponed. The attempts of Otto to conciliate Greek sentiment by efforts to enlarge the frontiers of his kingdom, *e.g.*, by the suggested acquisition of Crete in 1841, only succeeded in embroiling him with the powers. His power rested wholly on Bavarian bayonets; and when, in 1843, the last of the German troops were withdrawn, he was forced by the outbreak of a revolutionary movement in Athens to grant a constitution and to appoint a ministry of native Greeks.

For the British blockade of the Peiraeus and Greek intervention in the Crimean War *see* GREECE: *History*. Otto's position in Greece became untenable. In 1861 a student named Drusios attempted to murder the queen, and was hailed by the populace as a modern Harmodius. In October 1862 the troops in Acarnania under General Theodore Srivas declared for the king's deposition; those in Athens followed suit; a provisional government was set up and summoned a national convention. The king and queen, who were at sea, took refuge on a British warship, and returned to Bavaria, where, on July 26, 1867, Otto died.

*See* E. A. Thouvenel, *La Grèce du roi Othon* (Paris, 1890); G. L. von Maurer, *Das griechische Volk*, etc. (1836); C. W. P. Mendelssohn-Bartholdy, "Die Verwaltung König Ottos von Griechenland und sein Sturz" (in *Preuss. Jahrbücher*, iv. 365); K. T. v. Heigel, *Ludwig I., König von Baiern*, pp. 149 *et seq.* (Leipzig, 1872); H. H. Parish, *The Diplomatic History of the Monarchy of Greece from the Year 1830* (London, 1838).

**OTTO OF FREISING** (1114?–1158), German bishop and chronicler, was the fifth son of Leopold III., margrave of Austria, by his wife Agnes, daughter of the emperor Henry IV. By her first husband, Frederick I. of Hohenstaufen, duke of Swabia, Agnes was the mother of the German king Conrad III., and grandmother of the emperor Frederick I.; and Otto was thus related to the most powerful families in Germany. He studied in Paris, and became abbot of the Cistercian monastery of Morimond in Burgundy about 1136, soon afterwards being elected bishop of Freising. In 1147 he took part in the disastrous crusade of Conrad III., returning to Bavaria in 1148 or 1149. He enjoyed the favour of Conrad's successor, Frederick I.; was probably instrumental in settling the dispute over the duchy of Bavaria in 1156; was present at the famous diet at Besançon in 1157, and died at Morimond on Sept. 22, 1158.

Otto wrote a *Chronicon*, sometimes called *De duabus civitatibus*, an historical and philosophical work in eight books, which follows to some extent Augustine and Orosius. It goes down to 1146, and from this date until 1209 has been continued by Otto, abbot of St. Blasius (d. 1223). Of the *Gesta Friderici imperatoris* the first two books were written by Otto, and the remaining two probably by his pupil Ragewin, or Rahewin. First printed by John Cuspinian at Strasbourg in 1515, Otto's writings are now issued in the *Monumenta Germaniae historica*, Band xx. (Hanover, 1868); German trans. by H. Kohl (Leipzig, 1881–86). The *Gesta Friderici* has been published separately with introduction by G. Waitz.

*See* J. Hashagen, *Otto von Freising als Geschichtsphilosoph und Kirchenpolitiker* (Leipzig, 1900); J. Schmidlin, *Die geschichtsphilosophische und kirchenpolitische Weltanschauung Otto von Freising* (Freiburg i./B., 1906); A. Hofmeister, "Studien über O. v. Freising" in *Gesellschaft für ältere deutsche Geschichtskunde* (Hanover, 1911); A. Potthast, *Bibliotheca historica* (1896).

**OTTO OF NORDHEIM** (d. 1083), duke of Bavaria, belonged to the rich and influential Saxon family of the counts of Nordheim, and received the duchy of Bavaria from Agnes, widow of the emperor Henry III., in 1061. In 1062 he assisted Anno, archbishop of Cologne, to seize the German king, Henry IV.; led a successful expedition into Hungary in 1063; and took a prominent part in the government during the king's minority. In 1064 he went to Italy to settle a papal schism, secured the banishment from court of Adalbert, archbishop of Bremen, and crossed the Alps in the royal interests on two other occasions. In 1070 Otto was accused of being privy to a plot to murder the king, and was required to submit to the ordeal of battle with his accuser. The duke asked for a safe-conduct to and from the place of meeting, and when this was refused he declined to appear, and was consequently deprived of Bavaria, while his Saxon estates were plundered. He obtained no support in Bavaria, but raised an army among the Saxons and carried on a campaign of plunder against Henry until 1071, when he submitted; in the following year he received back

his private estates. When the Saxon revolt broke out in 1073 Otto is represented by Bruno, the author of *De bello Saxonico,* as delivering an inspiring speech to the assembled Saxons at Wormsleben, after which he took command of the insurgents. By the peace of Gerstungen in 1074 Bavaria was restored to him; he shared in the Saxon rising of 1075, after which he was again pardoned and made administrator of Saxony. After the excommunication of Henry IV. in 1076 Otto attempted to mediate between Henry and the Saxons, but when these efforts failed he again placed himself at their head. He assented to the election of Rudolph, count of Rheinfelden, as German king, when his restoration to Bavaria was assured, and by his skill and bravery inflicted defeats on Henry's forces at Mellrichstadt, Flarchheim and Hohenmölsen. He remained in arms against the king until his death on Jan. 11, 1083. By his wife Richenza, widow of Hermann, count of Werla, he left six children.

*See* H. Mehmel, *Otto von Nordheim, Herzog von Bayern* (Göttingen, 1870); E. Neumann, *De Ottone de Nordheim* (Breslau, 1871); and A. Vogeler, *Otto von Nordheim* (Göttingen, 1880).

**OTTOMAN BANK.** The establishment of the "Imperial Ottoman Bank" was authorized by *Firman* in 1863 and effected by a Convention between the Turkish Government and a banking consortium of the English and French founders. Its function then was to act as the State Bank of the Turkish Empire. It was granted the exclusive right of note issue, but this has since been transferred to the Central Bank of the Republic.

In 1925 the concession under which the bank works was extended, with certain modifications, for ten years. At the same time the title "Imperial" was dropped, and the institution is now known as the "Ottoman Bank." Subsequently a further extension was made to 1952. Its legal domicile is Istanbul; the directing committees reside and meet in London and Paris, in which cities the bank has important offices. It has also a branch at Manchester and branches at Marseilles and Nice. In addition the bank has branches in the following countries: Turkey (27), Egypt (8), Cyprus (6), 'Iraq (3), Palestine (5), Greece (1), Iran (2), and Transjordan (1). A subsidiary institution, the Banque de Syrie et du Liban, has some fifteen branches throughout Syria. The Ottoman Bank is actively interested in the Banque Franco-Serbe, The Bank of Rumania Ltd., and the British-French Discount Bank Ltd. The capital of the bank is £10,000,000, of which half is paid up, the reserve is £1,250,000. The Ottoman Bank maintains its character as an Anglo-French institution.

(C.E.L.C; X.)

**OTTOMAN EMPIRE,** the empire founded by Osman (1288–1320), which lasted six centuries and a half, and fell before the democratic movement inaugurated at Angora in 1919 by Mustafa Kemal Pasha (*q.v.*). (*See* CALIPHATE; TURKEY.)

**OTTRELITE** (from Ottrez, Belgium, the original locality), in mineralogy, a member of a group of closely related minerals with the general composition $H_2O$. RO. $Al_2O_3$. $SiO_2$, in which RO is dominantly FeO, but is often in part represented by a content of MgO or MnO. On account of its petrographic importance the term ottrelite is often used as the group name for this series of minerals, though the name clintonite is also in use. The chief members are chloritoid ($H_2$ Fe $Al_2$ $SiO_7$), sismondine ($H_2$ [Fe, Mg] $Al_2SiO_7$) in which the magnesia rises to 7%, and ottrelite the manganiferous variety ($H_2$[FeMn] $Al_2SiO_7$) in which the MnO content may rise to 8%. They are grey, green or black micaceous minerals, but in distinction from the "elastic" micas and "flexible" chlorites they are often referred to as the "brittle micas" on account of the brittleness of their laminae. Like the micas and chlorites they possess monoclinic symmetry and a perfect cleavage parallel to the flat surface (001) of the plates. Their superior hardness (H=6·5) readily distinguishes them from both these groups of minerals. Multiple twinning on the mica law is exceedingly common, and a zonal structure (often of hour-glass type) is often apparent. The ottrelite group of minerals is confined to metamorphic rocks—particularly those developed in regional metamorphism—in slates, phyllites and schists. Noteworthy occurrences of this mineral are the slates of the Ardennes, of Tintagel (Cornwall) and in the Mesozoic and Permian schists of the Swiss and Italian Alps.

The minerals margarite, xanthophyllite and kossmatite show some relations with the ottrelite group of minerals. They are distinguished by an inferior hardness and contain calcium as an essential constituent. Margarite ($H_2Ca$ $Al_4Si_2$ $O_{12}$) occurs in white pearly scales associated with corundum and is a common mineral of emery deposits. Xanthophyllite occurs in talc-chlorite schists at Slatoust in the Urals and in altered limestone at Riverside, California, while kossmatite is a recently described lime-rich mineral (H=2·5) occurring in the dolomite marbles of West Macedonia.

(C. E. T.)

**OTTUMWA,** a city of south-eastern Iowa, U.S.A., on the Des Moines river, at an altitude of 650 ft.; the county seat of Wapello county. It is on Federal highways 34 and 63, and is served by the Burlington Route, the Chicago, Milwaukee, St. Paul and Pacific, the Rock Island and the Wabash railways. Pop. 1940 Federal census, 31,570. The city is built on a series of terraces rising from the river. It is in the bituminous coalfields of Iowa, at the heart of the corn and meat producing area of the Middle West. Pork products, serum, agricultural implements, boilers, car loaders, hoisting engines, chicken coops, lawn mowers, mine equipment and supplies, carpenters' squares and ice-cream cabinets are among the leading manufactures. The aggregate factory product in 1939 was valued at $70,000,000. Ottumwa was founded in 1843, incorporated as a town in 1851, and chartered as a city in 1857. The name is a modification of an Indian word meaning "rippling water."

**OTUQUIAN,** a tribe or small group of tribes of South American Indians, constituting an independent linguistic stock, so called from the Otuquis, the most important tribe. The group, which was nearly extinct in the early part of the 19th century, lived in north-eastern Bolivia in the eastern portion of the province of Chiquitos, on the Otuquis river and between it and the Paraguay, between 17° and 18° S. lat. At that time the remnant of the people were located at the mission of Santa Corazon de Chiquitos, and had already lost their original culture.

*See* G. L. Kriegk, *Das Land Otuquis in Bolivia* (Frankfurt, 1838); G. de Crequi-Montfort and P. Rivet, "Le groupe Otuke" (*J. Soc. Americanistes de Paris* [n.s.] vol. ix., pp. 317–337); *ibid.,* "Les affinités des dialectes Otuke" (*ibid.* vol. x., pp. 369–377).

**OTWAY, THOMAS** (1652–1685), English dramatist, was born at Trotten, near Midhurst, Sussex, on March 3, 1652. His father, Humphrey Otway, was at that time curate of Trotton, but Otway's childhood was spent at Woolbeding, a parish 3 m. distant, of which his father had become rector. He was educated at Winchester College, and in 1669 entered Christ Church, Oxford, as a commoner, but left the university without a degree in the autumn of 1672. In 1675 Thomas Betterton produced at Dorset Garden theatre Otway's first drama, *Alcibiades,* which was printed in the same year. It is a poor tragedy saved from absolute failure by the actors. He made a great advance on this first work in *Don Carlos, Prince of Spain* (licensed June 15, 1676; an undated edition probably belongs to the same year). In it the two characters familiar throughout his plays make their appearance. Don Carlos is the impetuous, unstable youth, who seems to be drawn from Otway himself, while the queen's part is the gentle pathetic character repeated in his more celebrated heroines, Monimia and Belvidera. In 1677 Betterton produced two adaptations from the French by Otway, *Titus and Berenice* (from Racine's *Bérénice*), and the *Cheats of Scapin* (from Molière's *Fourberies de Scapin*). These were printed together, with a dedication to Lord Rochester. In 1678 he produced an original comedy, *Friendship in Fashion,* popular at the moment, though it was hissed off the stage for its gross indecency when it was revived at Drury Lane in 1749.

Meanwhile he had conceived an overwhelming passion for Mrs. Barry, who filled many of the leading parts in his plays. Six of his letters to her survive, the last of them referring to a broken appointment in the Mall. In 1678, driven to despair by her, Otway obtained a commission through Charles, earl of Plymouth, a natural son of Charles II., in a regiment serving in the Netherlands. The English troops were disbanded in 1679, but

were left to find their way home as best they could. They were also paid with depreciated paper, and Otway arrived in London late in the year, ragged and dirty, a circumstance utilized by Rochester in his "Sessions of the Poets," which contains a scurrilous attack on his former protégé.

Early in the next year (February 1680) was produced at Dorset Garden the first of Otway's two tragic masterpieces, *The Orphan, or The Unhappy Marriage,* Mrs. Barry playing the part of Monimia. Written in blank verse, which shows a study of Shakespeare, its success was due to the tragic pathos, of which Otway was a master, in the characters of Castalio and Monimia. *The History and Fall of Caius Marius,* produced in the same year, and printed in 1692, is a curious grafting of Shakespeare's *Romeo and Juliet* on the story of Marius as related in Plutarch's *Lives.* In 1680 Otway also published *The Poet's Complaint of his Muse, or A Satyr against Libells,* in which he retaliated on his literary enemies. An indifferent comedy, *The Soldier's Fortune* (1681), was followed in February 1682 by *Venice Preserved, or A Plot Discover'd.* The story is founded on the *Histoire de la conjuration des Espagnols contre la Venise en 1618,* by the Abbé de Saint-Réal, but Otway modified the story considerably. The character of Belvidera is his own, and the leading part in the conspiracy, taken by Bedamor, the Spanish ambassador, is given in the play to the historically insignificant Pierre and Jaffier. The piece has a political meaning, enforced in the prologue. The Popish Plot was in Otway's mind, and Anthony, 1st earl of Shaftesbury, is caricatured in Antonio. The play won instant success. It was translated into almost every modern European language, and even Dryden said of it: "Nature is there, which is the greatest beauty."

*The Orphan* and *Venice Preserved* remained stock pieces on the stage until the 19th century, and the leading actresses of the period played Monimia and Belvidera. One or two prefaces, another weak comedy, *The Atheist* (1684), and two posthumous pieces, a poem, *Windsor Castle* (1685), a panegyric of Charles II., and a *History of the Triumvirates* (1686), translated from the French, complete the list of Otway's works. He apparently ceased to struggle against his poverty and misfortunes. The generally accepted story regarding the manner of his death was first given in Theophilus Cibber's *Lives of the Poets.* He is said to have emerged from his retreat at the Bull on Tower Hill to beg for bread. A passer-by, learning who he was, gave him a guinea, with which Otway hastened to a baker's shop. He began too hastily to satisfy his ravenous hunger, and choked with the first mouthful. Whether this account of his death be true or not, it is certain that he died in the utmost poverty, and was buried on April 16, 1685, in the churchyard of St. Clement Danes. A tragedy entitled *Heroick Friendship* was printed in 1686 as Otway's work, but the ascription is unlikely.

*The Works of Mr. Thomas Otway with some account of his life and writings,* published in 1712, was followed by other editions (1757, 1768, 1812). The standard edition is that by T. Thornton (1813). A selection of his plays was edited for the Mermaid series (1891 and 1903) by Roden Noel. *See* E. Schumacher, *Thomas Otway* (Bonn, 1924).

**OUBLIETTE,** a French architectural term used in two senses, of a dungeon in a prison or castle which could only be reached by a trap-door from another dungeon, and of a concealed opening or passage leading from a dungeon to the moat or river, into which bodies of prisoners might be dropped. Many so-called "oubliettes" in mediaeval castles were in reality the cesspools or receptacles of the castle latrines.

**OUDENARDE,** a town of Belgium in the province of East Flanders, 18 mi. S. of Ghent. Pop. (1939) 6,483. Known for the victory by Marlborough and Eugene over the French under Vendôme in 1708, Oudenarde has other features of interest. The town hall, which took ten years to build (1525–1535), has after that of Louvain the most elaborately decorated façade in Belgium. It was designed by H. van Peede and G. de Ronde, and is in tertiary Gothic style. The belfry tower of five storeys with three terraces, surmounted by a golden figure, is a striking feature. The council chamber contains a fine oak door and Gothic chimney-piece, both *c.* 1530. There are also two interesting old churches, St. Walburga, partly of the 12th and partly of the 14th century, and Our Lady, dating from the 13th century. The former contains several pictures by Craeyer and other Flemish masters.

The Battle of Oudenarde (June 30–July 11, 1708) was fought on the ground north-west and north of the town, which was then regularly fortified and was garrisoned by a force of the Allies. For an account of the strategic situation which led up to the battle, *see* SPANISH SUCCESSION, WAR OF THE. The French army under the duke of Burgundy and Marshal Vendôme, after an abortive attempt to invest Oudenarde, took up a defensive position north of the town when Marlborough and Eugene, after a forced march, arrived with the main Allied army. The advanced guard of the Allies under General (Lord) Cadogan promptly crossed the Scheldt, annihilated an outlying body of French troops, and established itself on the ground it had won, in front of the French centre. But the Allied main army took a long time to defile over the Scheldt and could form up (on the left of Cadogan's detachment) only slowly and by degrees. Observing this, Burgundy resolved to throw forward his right towards Oudenarde to engage and hold the main body of the Allies before their line of battle could be formed. This effected, it was hoped that the remainder of the French army could isolate and destroy Cadogan's detachment, which was already closely engaged with the French centre. But he miscalculated both the endurance of Cadogan's men (amongst whom the Prussians were conspicuous for their tenacity) and the rapidity with which in Marlborough's and Eugene's hands the wearied troops of the Allies could be made to move. Marlborough, who personally directed the operations on his left wing, not only formed his line of battle successfully, but also began seriously to press the forces that had been sent to check his deployment. Before long, while the hostile left wing still remained inactive, the unfortunate troops of the French centre and right were gradually hemmed in by the whole force of the Allies. The decisive blow was delivered by the Dutch marshal, Overkirk, who was sent by Marlborough with a large force (the last reserve of the Allies) to make a wide turning movement round the extreme right of the French, and at the proper time attacked them in rear. A belated attempt of the French left to intervene was checked by the British cavalry, and the pressure on the centre and right, which were now practically surrounded, continued even after nightfall. A few scattered units managed to escape, and the left wing retreated unmolested, but at the cost of about 3,000 casualties the Allies inflicted a loss of 6,000 killed and wounded and 9,000 prisoners on the enemy, who were, moreover, so shaken that they never recovered their confidence to the end of the campaign. The battle of Oudenarde was not the greatest of Marlborough's victories, but it affords almost the best illustration of his military character. Contrary to all the rules of war then in vogue, he fought a piecemeal and unpremeditated battle, with his back to a river, and with wearied troops, and succeeded.

**OUDINÉ, EUGÈNE ANDRÉ** (1810–1887), French sculptor and medallist, was born in Paris in 1810, and devoted himself from the beginning to the medallist's branch of sculpture, although he also excelled in monumental sculpture and portrait busts. He gained the grand prize for medal engraving in 1831, and in the same year exhibited his "Wounded Gladiator." He subsequently occupied official posts as designer to the Inland Revenue and to the Mint. His most famous medals are those struck in commemoration of the annexation of Savoy by France and of the peace of Villafranca. Others are "The Apotheosis of Napoleon I.," "The Universal Exposition," "The Establishment of the Republic," and "Napoleon's Tomb at the Invalides." Oudiné, who may be considered the father of the modern medal, died in 1887.

**OUDINOT, CHARLES NICOLAS** (1767–1847), duke of Reggio, marshal of France, was born at Bar-le-duc, on April 25, 1767. He served in the regiment of Médoc from 1784 to 1787, retiring with the rank of sergeant. On the outbreak of war in 1792 he became lieutenant colonel in the volunteers of the Meuse, being transferred to the regular army after his defence of the fort of Bitsch (1792). He was promoted general of brigade in June 1794, after the battle of Kaiserslautern. He served on the German frontier under Hoche, Pichegru and Moreau, and in the

Swiss campaign of 1799 with Masséna. He was made inspector-general of infantry, and in the war of 1805 he commanded the famous "grenadiers Oudinot," with which he seized the Vienna bridges, and gave the decisive blow at Austerlitz. In 1808 he was made governor of Erfurt and count of the Empire, and in 1809 after Wagram, he was promoted marshal. He was made duke of Reggio, and received a large money grant in April 1810. Oudinot governed Holland from 1810 to 1812, and commanded the II. corps of the *Grande Armée* in the Russian campaign. For his defeat at Grossbeeren *see* NAPOLEONIC CAMPAIGNS. He was superseded by Ney, who was defeated at Dennewitz. Oudinot again held important commands at Leipzig and in the 1814 campaign. He was made a peer under Louis XVIII., and did not join Napoleon in 1815. His last active service was in the French invasion of Spain in 1823, in which he commanded a corps, and was for a time governor of Madrid.

**OUIDA,** the pen name—derived from a childish attempt to pronounce "Louisa"—of Maria Louise [de la] Ramée (1839–1908), English novelist, born at Bury St. Edmunds, where her birth was registered on Jan. 7, 1839. Her father, Louis Ramée, was French, and her mother, Susan Sutton, English. In 1860 her first story, afterwards republished as *Held in Bondage* (1863), appeared in the *New Monthly* under the title of *Granville de Vigne,* and this was followed in quick succession by *Strathmore* (1865), *Chandos* (1866) and *Under Two Flags* (1867). The list of Ouida's subsequent works is a very long one; but it is sufficient to say that, together with *Moths* (1880), those already named are not only the most characteristic, but also the best. In a less dramatic genre, her *Bimbi: Stories for Children* (1882) may also be mentioned; but it was by her more flamboyant stories, such as *Under Two Flags* and *Moths,* that her popular success was achieved. She died at Viareggio Jan. 25, 1908.

**OULU,** a seaport and industrial town of Finland on the Gulf of Bothnia in 65° N., 25° 29′ E., linked by rail to Helsinki. Pop. (1939) 31,200. It is the chief town of a forested department of the same name. The accommodation in the harbour depends on the wind. The exports are timber, tar, leather, flour and wood products and the imports colonial produce, coals, iron, hides and salt.

**OUNCE.** (1) A unit of weight, being the twelfth part of a pound troy,=480 grains (through O.Fr. *unce,* modern *once,* from Lat. *uncia,* twelfth part, of weight, of a pound, of measure, of a foot, in which sense it gives the O.Eng. *ynce,* inch); in avoirdupois=437.5 grains, $\frac{1}{16}$ of a pound. The *fluid ounce* is a measure of capacity; in the United Kingdom it is equivalent to an avoirdupois ounce of distilled water at 62° F; in the United States of America it is the 128th part of the gallon,=$\frac{1}{4}$ gill,=456·033 grains of distilled water at its maximum density (*see* MEASURES AND WEIGHTS). (2) A name properly applied to the *Felis uncia* or snow-leopard (*q.v.*) It appears to have been originally used of various species of lynx, and is still sometimes the name of the Canada lynx.

**OUNDLE** (a corruption of "Avondale"), a town of Northamptonshire, England, 27 mi. N.N.E. of Northampton on the L.M.S. railway. Pop. (1938) 2,712; area, 3·6 sq.mi. The manor, with a market and tolls, belonged to the abbot of Peterborough. After the Dissolution they were granted to John, earl of Bedford, and the market still belongs to the lord of the manor. The church of St. Peter has Early English, Decorated and Perpendicular porticos. Oundle school was founded in 1556 under the will of Sir William Laxton, lord mayor of London, and in 1930 was granted a royal charter to be governed by the Grocers' company.

**OURO PRETO** ("Black Gold"), a city of the state of Minas Gerais, Brazil, 336 mi. by rail N. by W. of Rio de Janeiro, and about 300 mi. W. of Vitória, Espírito Santo, on the eastern slope of the Serra do Espinhaço and within the drainage basin of the Rio Doce. Pop. of the city and *município* (1940) 42,090. The city is built upon the lower slope of the Serra do Ouro Preto, a spur of the Espinhaço, deeply cut by ravines and divided into a number of irregular hills, up which the narrow, crooked streets are built and upon which groups of houses form each a separate nucleus. From a mining settlement the city grew as the inequalities of the site permitted. The rough streets are too steep and narrow for vehicles. The climate is sub-tropical and humid, though the elevation (3,700–3,800ft.) gives a temperate climate in winter. The days are usually hot and the nights cold. Ouro Preto has several historic buildings; the more noteworthy are the old government house (now occupied by the school of mines), the legislative chambers, municipal hall and prison—all fronting on the Praça da Independencia—the old Casa dos Contos (afterward the public treasury), a theatre (the oldest in Brazil, restored in 1861–62) and a hospital. There are 15 churches in the city, all dating from more prosperous days. Ouro Preto is the seat of one of Brazil's leading schools of mines, in connection with which there is a museum containing an outstanding collection of native minerals.

The city dates from 1701, when a gold-mining settlement was established in its ravines by Antonio Dias of Taubaté. The circumstance that the gold turned black on exposure to the humid air (owing to the presence of silver) gave the name of Ouro Preto to the mountain spur and the settlement. In 1711 it became a city with the name of Vila Rica, a title justified by its size and wealth. In 1720 Vila Rica became the capital of the newly created captaincy of Minas Gerais, and in 1823 the capital of the province of the same name under the empire of Dom Pedro I. When the empire was overthrown in 1889 and Minas Gerais was reorganized as a republican state, it was decided to remove the capital to a more favourable site and Belo Horizonte was chosen, but Ouro Preto remained the capital until 1898, when the new town (also called Cidade de Minas) became the seat of government. In 1933 the town was decreed a national monument and the region in which it lies a national park. (*See* MINAS GERAIS.)

**OUSE,** the name of several English rivers, an ancient word of disputed etymology.

(1) The Great Ouse rises in Northamptonshire, in the hills between Banbury and Brackley, and falls about 500 ft. in 160 m. to its mouth in the Wash (North sea). It flows east past Brackley and Buckingham and then turns north-east to Stony Stratford, receiving the Tove and the Ouzel at Newport Pagnell. It then follows a sinuous course past Olney to Sharnbrook, where it turns abruptly south to Bedford, then to flow north-east past St. Neot's to Godmanchester and Huntingdon, when the river trends easterly to St. Ives. Hitherto the Ouse has watered an open valley, but below St. Ives the river debouches suddenly upon the Fens; its fall from this point to the mouth, a distance of 55 m. by the old course, is little more than 20 feet. From Earith to Denver the waters of the Ouse flow almost wholly in two straight artificial channels called the Bedford Rivers, the old course being called the Old West River. This is joined by the Cam 4 m. above Ely. North of this point the river receives the Lark, the Little Ouse, or Brandon river, and the Wissey. Below Denver sluice, 16 m. from the mouth, the Ouse is tidal. It flows past King's Lynn, and enters the Wash near the south-east corner. The river is locked up to Bedford, a distance of 74½ m. by the direct course. A recent attempt to clear the river in order to make it more navigable and less liable to floods has been made, but has met with opposition from the farmers of the upper reaches.

(2) A river of Yorkshire. The river Ure, rising in the Pennines, and traversing Wensleydale, unites with the river Swale to form the Ouse near Boroughbridge, in the central plain of Yorkshire. The course of the Swale, which rises on the eastern flank of the Pennines, is mostly through this plain, and that of the Ouse is wholly so. It flows south-east passing York, Selby and Goole to the Trent, to form with that river the Humber estuary (*q.v.*). The course of the Ouse, thus defined, is 61 miles. The Swale and Ure are each about 60 m. long. Goole is a growing port, and the river bears much traffic up to York, smaller traffic up to Boroughbridge, from which the Ure Navigation (partly a canal) continues up to Ripon. The Swale is not navigable. The chief tributaries are the Nidd, the Wharfe, the Don and the Aire on the right, and the Derwent on the left. All traverse beautiful valleys, and the Aire and the Don, with canals, afford communications between south Yorkshire and the Humber ports. The Derwent is also navigable. It is tidal up to Naburn, 37 m. from the junction with the Trent.

(3) A river of Sussex, rising in the Forest Ridges between Horsham and Cuckfield, and draining part of the Weald. Like other streams here, it breaches the South Downs, and reaches the English channel at Newhaven after a course of 30 mi. The Ouse is navigable for small vessels to Lewes, and Newhaven is an important harbour.

**OUSEL** or **OUZEL,** the ancient name of the blackbird, but now applied, in combination, to the dipper (*q.v.*) or water-ousel, and to the ring-ousel (*Turdus torquatus*). This latter is a relative of the blackbird. The water-ousels (*Cinclidae*) are found near mountain streams in Europe and northern Asia, in the western United States, Central and South America.

**OUSELEY, SIR FREDERICK ARTHUR GORE** (1825–1889), English composer, son of Sir Gore Ouseley, ambassador to Persia, was born on Aug. 12, 1825, in London. He was a precocious child, and composed an opera at the age of eight years. Educated at Christ Church, Oxford, he took orders, and held two London curacies. In 1855 he succeeded Sir Henry Bishop as professor of music in the University of Oxford, was ordained priest and appointed precentor of Hereford. In 1856 he became vicar of St. Michael's, Tenbury, and warden of St. Michaels college. His works include the oratorio *Polycarp,* written for his Mus. Doc. degree (1854), a second oratorio, *Hagar* (Hereford, 1873), a great number of services and anthems, chamber music, songs, etc., and theoretical works. He died on April 6, 1889.

His uncle, SIR WILLIAM OUSELEY (1769–1842), British orientalist, wrote *Travels in Various Countries in the East, Especially Persia, in 1810, 1811 and 1812* (3 vol., 1819–23).

**OUSTER,** a legal term signifying dispossession, especially the wrong or injury suffered by a person dispossessed of freeholds or chattels real. The wrongdoer by getting into occupation forces the real owner to take legal steps to regain his rights. Ouster of the freehold may be effected by *abatement, i.e.,* by entry on the death of the person seized before the entry of the heir, or devisee; by *intrusion,* entry after the death of the tenant for life before the entry of the reversioner or remainderman; by *disseisin,* the forcible or fraudulent expulsion of the occupier or person seized of the property. Ouster of chattels real is effected by *disseisin,* the turning out by force or fraud of the legal proprietor before his estate is determined. Ouster by force, or forcible entry, was made a criminal offense by a statute of 1381.

**OUTLAWRY,** the process of putting a person out of the protection of the law; a punishment for contemptuously refusing to appear when called in court, or evading justice by disappearing. It was of very early existence in England, and was the punishment of those who could not pay the *were* or blood-money to the relatives of the deceased. By the Saxon law, an outlaw lost his *libera lex* and had no protection from the frank-pledge in the decennary in which he was sworn. He was, too, a *frendlesman,* because he forfeited his friends; for if any of them rendered him any assistance, they became liable to the same punishment. An outlaw was *civiliter mortuus.*

He could not sue in any court, nor had he any legal rights which could be enforced, but he was personally liable upon all causes of action. It was finally abolished in civil proceedings in 1879, while in criminal proceedings it has practically become obsolete, being unnecessary through the general adoption of extradition treaties.

In Scotland outlawry or fugitation may on the motion of the crown be pronounced by the supreme criminal court when the panel has absconded and fails to appear to plead to the indictment on the day of trial.

**OUTLAWRY OF WAR.** When, under the older conceptions of international law, nations went to war, their inter-state relations were regulated, for the period of belligerency, by the law of war instead of by the law of peace. "International law," writes Professor F. L. Schuman (*International Politics, An Introduction to the Western State System,* p. 109) "does not justify or sanction war but recognizes it as a fact of international politics and seeks to restrict and mitigate its cruel and destructive features." He goes on to point out that on the whole the principles of international law, governing the conduct of hostilities, have been reasonably well observed despite appearances to the contrary, the motives probably being expediency and fear of retaliation on the part of the belligerents. This is the case even where there is no formal declaration of war, as in the Sino-Japanese hostilities.

In the late twenties a group of American authorities interested in peace came to feel that the resort to war would be less likely if it were formally deprived of its legal status and definitely "outlawed." The advocates of the outlawry of war theory felt that so long as the institution of war remained respectable and enjoyed a recognized place in the field of international relations, the root of the evil remained.

Their solution of the problem was, in part, to oust war from its privileged position by denying it a legal status and placing a state indulging in hostilities against another state beyond the pale, that is to say, literally to outlaw it.

Among the principal advocates of the outlawry of war movement in the United States were Judge Florence E. Allen, Senator William E. Borah, Dr. Nicholas Murray Butler, Professor John Dewey, Reverend John Haynes Holmes, S. O. Levinson, Dr. C. C. Morrison, Reverend M. V. Oggel and the American Committee for the Outlawry of War.

The draft treaty to outlaw war which this last named committee suggested as a basis for discussion provided that the signatory states would:—

". . . condemn and abandon forever the use of war as an instrument for the settlement of international disputes and for the enforcement of decisions and awards of international tribunals, and hereby outlaw the immemorial institution of war by making its use a public crime as the fundamental law of nations."

would

". . . agree to take immediate action for the equipment of an international court of justice with a code of the laws of peace . . . jurisdiction over all purely international disputes as defined and enumerated in the code or arising under treaties, with power to summon in a defendant nation at the petition of a complaining nation and to hear and decide the matters in controversy."

and would

"agree to abide by and in full good faith to carry out the decisions of such international tribunal[1] . . ."

thus dropping the idea of other than moral sanctions for the enforcement of the outlawry of war plan.

The statesman primarily responsible for the idea of bringing about the renunciation of war by means of an *ad hoc* treaty was Aristide Briand, French minister of foreign affairs. On June 20, 1927, Briand proposed to the United States the conclusion of a bilateral treaty covering the ground suggested by the advocates of the outlawry of war.

In replying to this proposal the United States suggested that instead of contenting themselves with a bilateral declaration of the nature suggested by Briand, the two governments might make a more signal contribution to world peace by joining in an effort to obtain the concurrence therein of a large group of powers with a view to perfecting among all the nations of the world a mechanism for peace heretofore suggested only as between France and the United States.

The draft multilateral anti-war treaty proposed by the United States on June 23, 1928, was promptly accepted by 14 other governments and signed at Paris on Aug. 27, 1928. Its terms were as follows:

ARTICLE I.

"The High Contracting Parties solemnly declare in the names of their respective peoples that they condemn recourse to war for the solution of international controversies, and renounce it as an instrument of national policy in their relations with one another.

ARTICLE II.

"The High Contracting Parties agree that the settlement or solution of all disputes or conflicts of whatever nature or of whatever origin they may be, which may arise among them, shall never be sought except by pacific means.

ARTICLE III.

"The present Treaty shall be ratified by the High Contracting Parties

[1] *The Outlawry of War* by C. C. Morrison, p. 62 (Chicago, 1927).

named in the Preamble in accordance with their respective constitutional requirements, and shall take effect as between them as soon as all their several instruments of ratification shall have been deposited at Washington.

"This Treaty shall, when it has come into effect as prescribed in the preceding paragraph, remain open as long as may be necessary for adherence by all the other Powers of the world. Every instrument evidencing the adherence of a Power shall be deposited at Washington and the Treaty shall immediately upon such deposit become effective as between the Power thus adhering and the other Powers parties hereto.

"It shall be the duty of the Government of the United States to furnish each Government named in the Preamble and every Government subsequently adhering to this Treaty with a certified copy of the Treaty and of every instrument of ratification or adherence. It shall also be the duty of the Government of the United States telegraphically to notify such Governments immediately upon the deposit with it of each instrument of ratification or adherence."

The treaty was ratified by the United States senate on Jan. 15, 1929. On March 2 eleven nations deposited their ratifications at Washington. The ratifications of other nations followed rapidly so that on July 15 President Hoover set aside July 24 as the date for the formal proclamation of the treaty, and the ceremony marking the deposit of the ratifications of the 45 nations adhering to it was carried out on July 24, 1929.

Although great hopes were entertained at the time of the effect which these declarations would have in the preservation of peace, they had no observable deterrent effect upon the aggressions which shortly followed in Manchuria in 1931 or in China proper at a later stage; nor upon the Italian invasion of Ethiopia, nor upon the German-Italian interventions in Spain, nor on any of those which finally culminated in World War II. The Kellogg pact and other agreements for the renunciation of war, however, had one legal effect of some importance. They helped to make it expedient for states to refrain from formal declarations of war. Thus, though Japan in 1937 began to bombard Chinese cities and kill Chinese citizens in great numbers, she was not formally at "war." The bombardment and the killings were an "incident" of "intervention for the restoration of order." Other states at times followed the example so set. (N. AL.)

**OUTPUT:** *see* PRODUCTION, CENSUS OF.

**OUTRAM, SIR JAMES** (1803–1863), English general, and one of the heroes of the Indian Mutiny, was the son of Benjamin Outram of Butterley Hall, Derbyshire, civil engineer, and was born on Jan. 29, 1803. His father died in 1805, and his mother, a daughter of Dr. James Anderson, the Scottish writer on agriculture, removed in 1810 to Aberdeenshire. From Udny school the boy went in 1818 to the Marischal college, Aberdeen; and in 1819 an Indian cadetship was given him. Soon after his arrival at Bombay his remarkable energy attracted notice, and in July 1820 he became acting adjutant to the first battalion of the 12th regiment on its embodiment at Poona. In 1825 he was sent to Khandesh, where he trained a light infantry corps, formed of the wild robber Bhils, gaining over them a marvelous personal influence, and employing them with great success in checking outrages and plunder. Their loyalty to him had its principal source in their boundless admiration of his hunting achievements. For some time he was political agent in the Mahi Kantha district of Gujarat. In the first Afghan War in 1838 he was extra aide-de-camp on the staff of Sir John Keane. After conducting various raids against Afghan tribes, he was in 1839 promoted major, and appointed political agent in lower Sind, and later in upper Sind. He opposed the policy of his superior, Sir Charles Napier, which led to the annexation of Sind. When war broke out he heroically defended the residency at Hyderabad against 8,000 Baluchis; and it was Napier who then described him as "the Bayard of India."

On his return from a short visit to England in 1843, he was, with the rank of brevet lieutenant colonel, appointed to a command in the Mahratta country, and in 1847 he was transferred from Satara to Baroda, where he incurred the resentment of the Bombay government by his fearless exposure of corruption. In 1854 he was appointed resident at Lucknow, in which capacity two years later he carried out the annexation of Oudh and became the first chief commissioner of that province. Appointed in 1857, with the rank of lieutenant general, to command an expedition against Persia, he defeated the enemy with great slaughter at Khushab, and brought the campaign to a rapid conclusion.

From Persia he was summoned in June to India, with the brief explanation—"We want all our best men here." It was said of him at this time that "a fox is a fool and a lion a coward by the side of Sir J. Outram." Immediately on his arrival in Calcutta he was appointed to command the two divisions of the Bengal army occupying the country from Calcutta to Cawnpore; and to the military control was also joined the commissionership of Oudh. Already the mutiny had assumed such proportions as to compel Havelock to fall back on Cawnpore, which he only held with difficulty, although a speedy advance was necessary to save the garrison at Lucknow. On arriving at Cawnpore with reinforcements, Outram, "in admiration of the brilliant deeds of General Havelock," conceded to him the glory of relieving Lucknow, and, waiving his rank, tendered his services to him as a volunteer.

Resuming supreme command, he then held the town till the arrival of Sir Colin Campbell, after which he conducted the evacuation of the residency so as completely to deceive the enemy. In the second capture of Lucknow, on the commander in chief's return, Outram was entrusted with the attack on the side of the Gumti, and afterwards, having recrossed the river, he advanced "through the Chattar Manzil to take the residency," thus, in the words of Sir Colin Campbell, "putting the finishing stroke on the enemy." After the capture of Lucknow he was gazetted lieutenant general. In February 1858 he received the special thanks of both houses of parliament, and in the same year the dignity of baronet with an annuity of £1,000. Shattered in health he returned finally to England in 1860. He died on March 11, 1863.

*See* Sir F. J. Goldsmid, *James Outram, a Biography* (2 vols., 1880); and L. J. Trotter, *The Bayard of India* (1903).

**OUT RELIEF:** *see* POOR LAW.

**OVAL:** a figure or body shaped like the longitudinal section of an egg.

**OVAR,** a town of Portugal, at the northern extremity of the lagoon of Aveiro (*q.v.*); 21 mi. south of Oporto by the Lisbon-Oporto railway. Population 12,729. Ovar is the centre of important fisheries. Millet, wheat and vegetables—especially onions—are the chief products of the low-lying and unhealthy regions in which Ovar is situated.

**OVARIOTOMY** or **OÖPHORECTOMY,** the operation for removal of one or of both of the female ovaries (for anatomy *see* REPRODUCTIVE SYSTEM, ANATOMY OF). The progress of modern surgery has been conspicuously successful in this department. From 1701, the date when Houston of Carluke, Lanarkshire, carried out his successful partial extirpation, progress was arrested for some time, although the Hunters (1780) indicated the practicability of the operation. In 1809 Ephraim McDowell of Kentucky, inspired by the lectures of John Bell, his teacher in Edinburgh, performed ovariotomy, and, continuing to operate with success, established the possibility of surgical interference. He was followed by others in the United States. The cases brought forward by Lizars of Edinburgh were not sufficiently encouraging; the operation met with great opposition; and it was not until Charles Clay, Spencer Wells, Baker Brown and Thomas Keith began work that the procedure was placed on a firm basis and was regarded as justifiable. Improved methods were introduced, and surgeons vied with one another in trying to obtain good results. Eventually, by the introduction of the antiseptic, and later, the aseptic, system of treating wounds, this operation, formerly regarded as one of the most grave and anxious in the domain of surgery, came to be attended with a lower mortality than any other of a major character.

**OVEN-BIRD,** the name given to birds of the genus *Furnarius* of the American family of wood-hewers (*Dendrocolaptidae*), on account of the structure of the nest. They are small thrush-like birds confined to South America.

The name oven-bird is commonly given in the United States to the golden crowned water-thrush (*Seiurus aurocapillus*), one of the wood warblers, which builds an oven-shaped nest on the

ground.

*See* C. Darwin, *Voyage of the Beagle* (1845); W. H. Hudson, *A Naturalist in La Plata* (1892).

**OVERBECK, JOHANN FRIEDRICH** (1789–1869), German painter, the reviver of "Christian art" in the 19th century, was born in Lübeck on the 4th of July 1789. His ancestors for three generations had been Protestant pastors; his father was doctor of laws, poet, mystic pietist and burgomaster of Lübeck. In 1806, after finishing his course at the gymnasium, Overbeck left Lübeck and entered the Academy of Vienna, then under the direction of Füger, a painter of the pseudo-classic school of David. Not finding the help on which he had counted, Overbeck turned to the early and pre-Raphaelite masters of Italy for inspiration. At the end of four years he was expelled. He thereupon went to live in Rome, where he gathered about him a group of friends which included Cornelius, Veit and Wilhelm Schadow.

The little group made their home in the old Franciscan monastery of San Isidoro on the Pincian, and in 1813 Overbeck joined the Roman Catholic church. The group became known as the "Nazarites," "pre-Raphaelites," or "German-Roman artists." They believed in hard, honest work and holy living, eschewed the antique as pagan and the Renaissance as false, and aimed at bringing about a revival on the basis of nature and the serious art of Perugino, Pinturicchio, Francia and the young Raphael. Their painting was characterized by nobility of conception, precision—not to say hardness—of outline, and scholarly composition. Light, shade and colour they admitted only in the interests of clearness and correctness, and not as softening elements. Overbeck, with his saintly character and lofty ideals, was the natural leader and mentor of the party. They would have fared badly however from a practical point of view but for the timely help of Niebuhr, Bunsen, Friedrich Schlegel, and the Prussian consul Bartholdi, who commissioned the four friends to decorate his villa with frescoes on the story of Joseph and his Brethren. This led to another commission from Prince Massimo to paint the ceilings and walls of his pavilion. Overbeck's failing health did not allow him to finish his share of this undertaking and he delegated it to Joseph Führich. His last work was a "Vision of St. Francis" with life-size figures for the walls of Sta. Maria degli Angeli near Assisi. All his paintings bear the mark of religious fervour and careful preparation and have an element of religious propaganda. The handling is dry and severe and the colour restrained. His faith found its clearest expression in his religious cartoons, the *Gospels* (1852), *Via Crucis* (1857) and the *Seven Sacraments* (1861). He died in Rome on Nov. 12, 1869, and was buried in San Bernardo.

Overbeck's principal oil and easel paintings are: "Christ's Entry into Jerusalem" (1824), in the Marien Kirche, Lübeck; "Christ's Agony in the Garden" (1835), in the great hospital, Hamburg; "Lo Sposalizio" (1836), Raczynski gallery, Berlin; the "Triumph of Religion in the Arts" (1840), in the Städel Institut, Frankfort; "Pietà" (1846), in the Marien Kirche, Lübeck; the "Incredulity of St. Thomas" (1851), in the possession of Mr. Beresford Hope, London; the "Assumption of the Madonna" (1855), in Cologne Cathedral; "Christ delivered from the Jews" (1858), tempera, on a ceiling in the Quirinal Palace—a commission from Pius IX., and a direct attack on the Italian temporal government, therefore later covered by a canvas.

There are biographies by J. Beavington Atkinson (1882) and Howitt (1886).

**OVERBURY, SIR THOMAS** (1581–1613), English poet and essayist, and the victim of one of the most sensational crimes in English history, was the son of Nicholas Overbury, of Bourton-on-the-Hill, and was born in 1581 at Compton Scorpion, near Ilmington, in Warwickshire. In the autumn of 1595 he became a gentleman commoner of Queen's college, Oxford, took his degree in 1598 and came to London to study in the Middle Temple.

About the year 1601, being in Edinburgh on a holiday, he met Robert Carr, then an obscure page to the earl of Dunbar; and the two youths came up to London together. When Carr attracted the attention of James I., in 1606, by breaking his leg in the tilt-yard, Overbury had for some time been servitor-in-ordinary to the king. He was knighted in 1608, and in 1609 travelled in France and the Low Countries. When Carr was made Lord Rochester in 1610, the intimacy between the two was maintained.

But early in 1611 the Court became aware of the mutual attraction between Rochester and the youthful countess of Essex. To this intrigue Overbury was from the first violently opposed, and expressed his opinion of the countess in unmeasured terms. But Rochester was now infatuated, and he repeated to the countess what Overbury had said. Overbury also wrote, and circulated widely in ms., the poem called *The Wife,* which was a picture of the virtues which a young man should demand in a woman. The situation now resolved itself into a duel for the person of Rochester between the mistress and the friend. Overbury was thrown into the Tower on April 22, 1613, on a charge of disrespect to the king. Lady Essex, however, was not satisfied with his imprisonment; she was determined that "he should return no more to this stage." She bribed the gaoler, aided by Mrs. Turner, the widow of a physician, and by an apothecary called Franklin, to poison Overbury with copper vitriol. His constitution long withstood the timid doses they gave him, and he lingered until Sept. 15, 1613, when more violent measures put an end to his existence.

Two months later Rochester, now earl of Somerset, married Lady Essex. More than a year passed before suspicion was aroused, and when it was, the king showed disinclination to bring the offenders to justice. In the trial which followed, the plot was discovered. The four accomplices were hanged; the countess of Somerset pleaded guilty but was spared, and Somerset himself was disgraced. Meanwhile, Overbury's poem, *The Wife,* was published in 1614, and ran through six editions within a year. Much that must be spurious was added to the gathering snowball of Overbury's *Works,* the most famous of which are the *Characters.*

*See* C. Whibley, *Essays in Biography* (1913); E. A. Parry, *The Overbury Mystery* (1925).

**OVERHEAD CHARGES.** Overhead charges, or on-costs, are an important factor in cost accounts. Prime cost represents outlays directly incurred for a particular purpose, and thus capable of being charged directly thereto. In addition, there are a number of indirect expenses which can only be dealt with by spreading them as equitably as may be over the total output.

Generally speaking, Overhead charges consist of such items as rent, rates, taxes, salaries, depreciation, interest, discounts, bad debts, etc., from which may be deducted corresponding credits. But in order to arrive at costs that are comparable with those of similar undertakings, various adjustments become necessary. Thus, where business premises are owned, the rental value should be included, although not actually expended. When time is of importance, interest on outlays should be included, even although no interest may actually have been paid away. *Per contra,* interest on borrowed monies (including debentures) is not properly a factor in costs at all; and interest received on investments, although undoubtedly a profit, does not tend to reduce operative costs and should therefore be excluded. Many authorities also consider that bad debts have nothing to do with the costs. Depreciation of equipment is generally a very important factor but the modern tendency is to charge a *machine rate* of so much per hour as part of the direct costs, such rate being designed to cover depreciation, repairs and interest on capital; when this is done, no charge in respect of depreciation falls to be included as Overhead.

Formerly, it was thought to be sufficiently accurate to add a given percentage to prime cost as a loading to cover Overhead. It is now recognized that no satisfactory results can be achieved in this way. A uniform percentage of loading for Overhead would result in the aggregate amount actually charged against output varying directly with the prime cost, and thus the amount so charged would almost certainly be appreciably more or appreciably less than the true figure, according to whether the output was above or below the average. Further, such a system of allocation assumes that the fair loading for Overhead varies directly with the prime cost, whereas the employment of expensive materials does not necessarily increase the Overhead burden, and in many cases economies in labour costs can only be achieved by increasing the Overhead burden, *e.g.,* when machine work is substituted for hand work. Most production is complex, and consists of a series of successive processes or operations, each involving its own Overhead

charges. The modern practice is accordingly in the direction of analysing Overhead into departments, and distributing the burden of the departmental Overhead over the output of the department, usually *pro rata* according to the time occupied. In this way some approach to substantial accuracy may be reached, but no cut and dried formula will meet all cases.

Sometimes costs are appreciably increased by "spoils"—the curtailment of saleable output as a result of defective materials, machinery, workmanship or supervision. The only satisfactory way to deal with losses arising from spoils is to charge them as part of the Overhead burden of the department causing the spoil. If and when this is done the loss is thrown upon the right shoulders, and the effect commonly is to reduce very materially the loss arising from spoils by compelling managers to enquire more carefully into causes and possible remedies. (L. R. D.)

**OVERSEA INVESTMENTS:** *see* CAPITAL, EXPORT OF.

**OVERSEA SETTLEMENT COMMITTEE.** This important body was appointed in 1919 to assist and advise the British Government in their policy of undertaking closer responsibility than they had exercised in the past in connection with the movement of British subjects wishing to settle in other parts of the empire or to emigrate to foreign countries. The functions of the Emigrants' Information Office, which was established in 1886, were absorbed by the Oversea Settlement Committee. The president of the committee is the secretary of state for dominion affairs. It is a representative and non-political body, composed partly of official members representing various Government departments and partly of unofficial members. The staff of the committee forms a department (the oversea settlement department) of the Dominions Office.

The committee is entrusted with the administration of the Empire Settlement Act, 1922, which now forms the basis of the policy of State-aided empire settlement. The act was passed as the result of a conference with representatives of the self-governing dominions in 1921 and empowers the secretary of state "in association with the Government of any part of His Majesty's Dominions, or with public authorities or public or private organisations either in the United Kingdom or in any part of such Dominions, to formulate and co-operate in carrying out agreed schemes for affording joint assistance to suitable persons in the United Kingdom who intend to settle in any part of His Majesty's Oversea Dominions." Such schemes may take the form of development or land settlement schemes, or of schemes for facilitating settlement overseas by assistance with passages, training or in other ways. The contribution of the secretary of state may not exceed half the cost of any approved scheme and the maximum expenditure allowed under the act in any one year is £3,000,000.

**OVERSTONE, SAMUEL JONES LOYD,** 1ST BARON (1796–1883), English banker, the son of a Welsh dissenting minister, was born on Sept. 25, 1796. He became a partner in Jones, Loyd and Company (afterwards incorporated in the London and Westminster Bank), and by 1832 was recognized as one of the foremost authorities on banking. As Liberal member for Hythe, he sat in parliament from 1819 to 1826. He gave important evidence before various committees of the House of Commons, and was responsible for the main outlines of the Bank Charter Act (1844). In 1850 he was created Baron Overstone. He died in London on Nov. 17, 1883, leaving one daughter.

In 1858 a volume of *Tracts and other Publications on Metallic and Paper Currency,* by Lord Overstone, was edited by M'Culloch.

**OVERT ACT:** *see* INTENT; TREASON.

**OVERTURE** (Fr. *ouverture,* opening), in music, a detachable instrumental introduction to a dramatic or choral composition. The notion of an overture had no existence until the 17th century. The *toccata* at the beginning of Monteverdi's *Orfeo* is a barbaric flourish of every procurable instrument, alternating with a melodious section entitled *ritornello;* and, in so far as this constitutes the first instrumental movement prefixed to an opera, it may be called an overture. As an art-form the overture began to exist in the works of J. B. Lully. His favourite, but not his only, form constitutes the typical French overture that became classical in the works of Bach and Handel. This French overture consists of a slow introduction in a marked "dotted rhythm" (*i.e.,* exaggerated iambic, if the first chord is disregarded), followed by a lively movement in fugato style. The slow introduction was always repeated, and sometimes the quick movement concluded by returning to the slow tempo and material, and was also repeated (*see* Bach's French Overture in the *Klavierübung*).

The operatic French overture was frequently followed by a series of dance tunes before the curtain rose. It thus naturally became used as the prelude to a suite (*q.v.*); and the term was then applied to the whole suite.

Bach was able to adapt the French overture to choruses, and even to the treatment of chorales. Thus the overture—movements of his fourth orchestral suite became the first chorus of the church cantata *Unser Mund sei voll Lachens;* the choruses of the cantatas *Preise Jerusalem den Herrn* and *Höchst erwünschtes Freudenfest* are in overture form; and, in the first of the two cantatas entitled *Nun komm, der Heiden Heiland,* Bach has adapted the overture form to the treatment of a chorale.

Gluck could find no use for the French overture. In the epoch-making preface to *Alceste* he laid down the rule that the overture should be the musical argument of the drama. And the perfunctory overture to *Orfeo* is the only exception to the rule that in his great operas the orchestral introduction is actually interrupted by the rise of the curtain. In *Iphigénie en Tauride* it is merely the calm before the storm.

The abolition of the French overture did not, however, lead at first to any widespread adoption of Gluck's loose-knit Italian texture. The next form of overture was that of a three-movement symphony (*q.v.*) in sonata style. In Mozart's early opera *La Finta Giardiniera* the curtain rises upon what should have been the third movement; and in all later works the overture is distinguished from symphonic music in style as well as form. It is a single quick movement (with or without a slow introduction) in sonata form, loose in texture, without repeats, and frequently without a development section. Sometimes, in place of development, there is a melodious episode in slow time; as in Mozart's overtures to *Die Entführung* and to the fragment *Lo Sposo deluso,* in both of which cases the curtain rises at a point which throws a dramatic light upon this feature. Mozart at first intended a similar episode in the overture to *Figaro,* but struck it out as soon as he had begun it.

In Beethoven's hands the overture became more and more unlike the symphony, but it no longer remained an inferior species; and the final version of the overture to *Leonora* is the most gigantic single orchestral movement ever based on the sonata style. Weber's overtures work out prominent themes in his operas in a loose but effective sonata form, and are effective concert-pieces besides serving Gluck's purposes admirably. On the overture to Mendelssohn's *Elijah, see* MENDELSSOHN.

Overtures to plays naturally tend to become detached from their surroundings; and hence arises the concert overture, led by Beethoven's mighty *Coriolan,* and second only to the symphony as an orchestral art-form. Its derivation implies that it is programme-music (*q.v.*), but the programme need not impair the form, whether the form be Berlioz's or Brahms's, and the programme particular or generalized. Among overtures with a generalized programme Mendelssohn's *Hebrides* overture is a perfect masterpiece; and so is Brahms's Tragic overture, one of the greatest orchestral movements since Beethoven. Brahms's *Academic Festival Overture* is a glorious working out of German student songs.

In modern opera the overture, *Prelude, Vorspiel,* or whatever else it may be called, is often nothing more definite than that portion of the music which takes place before the curtain rises. *Tannhäuser* is the last important opera in which the overture retains vestiges of a self-contained sonata form. Fifty years before Wagner's wonderful *Vorspiel* to *Lohengrin,* Méhul had achieved an equally complete departure from classical forms in his interesting overtures to *Ariodant* and *Uthal,* in the latter of which a voice is heard on the stage before the rise of the curtain. Even the most self-contained of Wagner's later preludes lose by transference to the concert-room. The glorious *Vorspiel* to *Die*

*Meistersinger* is nobler when its long *crescendo* leads to the rise of the curtain and the engaging of all the listener's sense of sight and language, than when it can merely lead to a final tonic chord. Wagner himself added a page to finish the *Vorspiel* to *Tristan,* and by the richness and subtlety of that page he reveals how unready for independent existence the original *Vorspiel* was. He also finished the *Parsifal* Vorspiel for concert use by the addition of a few extra bars, which will always sound perfunctory. The four dramas of the *Ring* begin with introductions designed to prepare the hearer immediately for the rise of the curtain; and these works can no more be said to have overtures than Verdi's *Falstaff* and Strauss's *Salome, Electra* and *Die Frau ohne Schatten,* in which the curtain rises at the first note of the music. (D. F. T.)

**OVERYSSEL,** a Netherlands province, bounded south and southwest by Gelderland, west by the Zuider Zee, north by Friesland and Drente, and east by Germany. The project to connect the northeast Polder with the north of the province was in preparation when Germany invaded the Netherlands in May 1940. Pop. of the province (1938) 569,920, showing about 50% increase during the 20th century; area, 1,295 sq.mi. It is a varied glaciated delta land consisting of a sandy flat relieved by hillocks, and covered with waste stretches of heath broken by patches of wood and high fen; but the coastal strip north of Zwartsluis consists largely of low-lying fertile pasture lands with cattle-rearing and associated butter and cheese manufactures, while along the shores mats and brushes are made.

The river system is determined by two main glacial ridges, of which the eastern one, which separates the Dinkel and Regge, extends from Enschede northwards into the German enclave; the larger one runs parallel with it and commencing at Lochem (Gelderland) extends into south Drente. In the south it separates the Yssel and Regge; its summit height (Lemeler Hill, 262 ft.) is near where it is breached by the Vecht. This river crosses the province from east to west and joins a part of the Yssel near Zwolle to form the Zwarte Water, which communicates with the Zuider Zee by the Zwolsche Diep; the main Yssel enters the Zuider Zee separately below Kampen. The streams are flanked by small-estate fertile grasslands from which agriculture and cattle-rearing have gradually spread over the sand-grounds; much of the area, however, is still waste though forest culture is practised locally, especially in the east, and pigs are largely bred. The deposits of the Yssel and the Dinkel streams contain iron ore, which is extracted and exported to Germany. Peat-digging and fen reclamation have long been practised and much high fen north of the Vecht in the neighbourhood of Dedemsvaart has been reclaimed though the main reclamation at present is taking place along and near to the eastern ridge. Large scale manufactures are not important in Overyssel but cotton-spinning, together with bleaching-works, came into some prominence in the 19th century in the south-east district of Twente. The inhabitants for long had practised weaving as a home craft but capitalist Baptist refugees who arrived in the 17th and 18th centuries organized it into an industry. Deventer has iron foundries and carpet-factories but is more famed for its honey cakes. The capital of the province is Zwolle, pop. (1940) 42,136, though Enschede (90,289) is the largest town. Deventer, Hengelo and Almelo each exceed 20,000 population and all four are situated in the south. Deventer is an old but busy little river port with a 16th century weigh-house of unusual design. Kampen, on the Yssel with its harbour long since silted up, has lost much of its importance of Hanseatic days but its 14th century churches and gateways are interesting. Its Stadhuis (16th and 18th century) is probably the finest town hall in the Netherlands. It shares a fishing trade with Vollenhove and Blokzijl, all on the Zuider Zee. Tucked away in the extreme north near the Drente border is the delightful little settlement of Giethoorn, literally a water village, each house possessing its own quay, drawbridge and punt. The railway system of the province is supplemented by tramlines and the roads are good but the waterways still carry much traffic.

**OVID** [PUBLIUS OVIDIUS NASO] (43 B.C.–A.D. 17), Roman poet, the last of the Augustan age, was born in 43 B.C., the last year of the republic. Thus the only form of political life known to Ovid was that of the absolute rule of Augustus and his successor. He was born on March 20 at Sulmo, picturesquely situated among the mountains of the Abruzzi: its wealth of waters and natural beauties seem to have quickened in him that appreciative eye for the beauties of nature which is one of the chief characteristics of his poems. Ovid, whose father was of equestrian family, belonged by birth to the same social class as Tibullus and Propertius, that of old hereditary landowners; but he was more fortunate than they in the immunity which his native district enjoyed from the confiscations made by the triumvirs. He and his brother had been brought early to Rome for their education, where they attended the lectures of two most eminent teachers of rhetoric, Arellius Fuscus and Porcius Latro, to which influence is due the strong rhetorical element in Ovid's style. His father did his best to dissuade him from poetry, and to drive him into the legal profession.

The earliest edition of the *Amores,* which first appeared in 5 books, and the *Heroides* were given by him to the world at an early age. "Virgil," he informs us, "he had only seen"; but Virgil's friend and contemporary Aemilius Macer used to read his didactic poems to him; and even the fastidious Horace sometimes delighted his ears with the music of his verse. He had a close bond of intimacy with the younger poets of the older generation—Tibullus, whose death he laments in one of the few pathetic pieces among his earlier writings, and Propertius, to whom he describes himself as united in the close ties of comradeship. The name of Maecenas he nowhere mentions. The time of his influence was past when Ovid entered upon his poetical career. But the veteran politician Messalla, the friend of Tibullus, together with his powerful son Cotta Messallinus and Fabius Maximus and other influential persons whose names are preserved in the *Epistles from Pontus* supported him. With the older poet, Macer, he travelled for more than a year. Whether this was immediately after the completion of his education, or in the interval between the publication of his earlier poems and that of the *Medea* and *Ars amatoria* is unknown, but it is in his later works, the *Fasti* and *Metamorphoses,* that we chiefly recognize the impressions of the scenes he visited. In one of the *Epistles from Pontus* (ii. 10) to his fellow-traveller there is a vivid record of the pleasant time they had passed together. They visited Athens, of course, the Mecca of all artistic pilgrimages then; went on to the site of Troy, and through the cities of Asia Minor; and finally spent a year in Sicily.

**Life in Rome.**—When settled at Rome, although a public career leading to senatorial position was open to him, and although he filled various minor posts, he had no ambition for such distinction, and looked upon pleasure and poetry as the occupations of his life. He was three times married; when little more than a boy to his first wife, whom he naïvely describes as unworthy of himself; but he was soon separated from her and took a second wife, with whom his union also did not last long. She was probably the mother of his one daughter. Later he married a third, of whom he always speaks with affection and respect. She was a lady of the great Fabian house, and thus connected with his powerful patron Fabius Maximus, and was a friend of the empress Livia. It therefore seems likely that he may have been admitted into the intimacy of the younger society of the Palatine. His liaison with his mistress Corinna, whom he celebrates in the *Amores,* took place probably in the period between his first and second, or between his second and third marriages. Ovid is not only a less constant but he is a less serious lover than his great predecessors Catullus, Tibullus and Propertius. His tone is that either of mere sensuous feeling or of irony. In his complete emancipation from all restraint he goes beyond them, and thus reflects the tastes and spirit of fashionable Rome between the years 20 B.C. and the beginning of our era.

Society was then bent simply on amusement; and, as a result partly of the loss of political interests, women came to play a more important and brilliant part in its life than they had done before. Julia, the daughter of the emperor, was by her position, her wit and beauty, and her reckless dissipation, the natural

leader of such a society. But the discovery of her intrigue (2 B.C.) with Iulus Antonius, the son of Mark Antony, was deeply resented by Augustus as being at once a shock to his affections and a blow to his policy of moral reform. Julia was banished and disinherited; Antonius and her many lovers were punished; and the Roman world awoke from its fool's paradise of pleasure. Nearly coincidently with this scandal appeared Ovid's *Ars amatoria,* perhaps the most immoral work ever written by a man of genius, though not the most demoralizing, since it is entirely free from morbid sentiment. By its brilliancy and heartlessness it appealed to the prevailing taste of the fashionable world; but its appearance excited deep resentment in the mind of the emperor, as is shown by his edict, issued ten years later, against the book and its author. Ovid appears to have had no idea of the storm that was gathering over him.

But he was aware that public opinion had been shocked, or professed to be shocked, by his last work; and after writing a kind of apology for it, called the *Remedia amoris,* he turned to other subjects, and wrote during the next ten years the *Metamorphoses* and the *Fasti.* He had already written the *Heroides,* in which he had imparted a modern and romantic interest to the heroines of the old mythology, and a tragedy, the *Medea,* which must have afforded greater scope for the dramatic and psychological treatment of the passion with which he was most familiar. In the *Fasti* Ovid assumes the position of a national poet by imparting poetical life and interest to the ceremonial observances of the Roman religion; but it is as the brilliant narrator of the romantic tales that were so strangely blended with the realistic annals of Rome that he succeeds in the part assumed by him. The *Metamorphoses* is a narrative poem which recounts legends in which the miraculous involved transformations of shape. Beginning with the change from Chaos to Cosmos, legends first Greek and then Roman are passed in review, concluding with the metamorphosis of Julius Caesar into a star and a promise of immortality to Augustus. The *Metamorphoses* is strongly tinged with Alexandrine influence, being in fact a succession of epyllia in the Alexandrine manner. This work, which Ovid regards as his most serious claim to immortality, had not been finally revised at the time of his disgrace, and in his despair he burnt it; but other copies were in existence, and when he was at Tomi it was published at Rome by one of his friends. He often regrets that it had not received his final revision. The *Fasti* also was broken off by his exile, after the publication of the first six books, treating of the first six months of the year.

**Banishment.**—In A.D. 8 Ovid was ordered by Augustus into banishment; for this he assigns two causes, his *Ars amatoria* and an actual offence (*Trist.* ii. 207). It is natural that Augustus should have felt resentment against the *Ars,* because its doctrine was a direct challenge to his policy of moral reform. What the actual offence was is a secret which the poet leaves unrevealed; since his disgrace coincided with the banishment of Augustus' granddaughter, the younger Julia, on account of an intrigue with Silanus, it has been supposed that Ovid was concerned in abetting that intrigue, and that this constituted his unforgivable sin. But if Ovid had really assisted to bring about the moral scandal which befell the emperor's family, it is incredible that he could have dared to allude to it, as he does constantly, in his poems. This, and the fact that, even after Augustus' death, his successor Tiberius left Ovid unpardoned, makes it probable that the offence was political and specially displeasing to Tiberius and Livia because it somehow interfered with their dynastic policy. Ovid may have been implicated with those who were over-zealous in the interests of rival possible successors to the throne, either Agrippa Postumus, the grandson of Augustus, or Germanicus, the brilliant and popular nephew of Tiberius, with many of whose friends Ovid was associated. Ovid's banishment was the mildest possible (*relegatio*); it involved no deprivation of civic rights, and left him the possession of his property. He was ordered to remove to the half-Greek, half-barbaric town of Tomi, near the mouth of the Danube. For eight years he bore up in his dreary solitude, suffering from the unhealthiness of the climate and the constant alarm of inroads of barbarians.

**The Epistle.**—In the hope of procuring a remission of his punishment he wrote poetical complaints, first in the series of the five books of the *Tristia,* sent successively to Rome, addressed to friends whose names he suppresses; afterwards in a number of poetical epistles, the *Epistulae ex Ponto,* addressed by name to friends who were likely to have influence at court. He believed that Augustus had softened towards him before his death, but his successor Tiberius was inexorable to his appeals. His chief consolation was the exercise of his art, though as time goes on he is painfully conscious of failure in power. But although the works written by him in exile lack the finished art of his earlier writings, their personal interest is greater. They have, like the letters of Cicero to Atticus, the fascination exercised by all confessions; they are a sincere literary expression of the state of mind produced by a unique experience—that of a man, when well advanced in years but still retaining extraordinary sensibility to pleasure and pain, withdrawn from a brilliant social and intellectual position, and cast upon his own resources in a place and among people affording the dreariest contrast to the brightness of his previous life. The letters, which compose the *Tristia* and *Epistulae ex Ponto,* are addressed either to his wife, the emperor, or the general reader, or to his patrons and friends. To his patrons he writes in a vein of supplication, beseeching them to use their influence on his behalf. To his rather large circle of intimate acquaintances he writes in the language of familiarity, and often of affectionate regard; he seeks the sympathy of some, and speaks with bitterness of the coldness of others, and in three poems (*Trist.* iii., 11, iv. 9; v. 8) he complains of the relentless hostility of the enemy who had contributed to procure his exile, and whom he attacked in the *Ibis.* There is a note of true affection in the letter to the young lyric poetess Perilla, of whose genius and beauty he speaks with pride, and whose poetic talents he had fostered by friendly criticism (*Trist.* iii., 7). He was evidently a man of gentle and genial manners; and, as his active mind induced him to learn the language of the new people among whom he was thrown, his active interest in life enabled him to gain their regard and various marks of honour. One of his last acts was to revise the *Fasti,* and re-edit it with a dedication to Germanicus. The closing lines of the *Epistulae ex Ponto* sound like the despairing sigh of a drowning man who had long struggled alone with the waves:—

> Omnia perdidimus: tantummodo vita relicta est,
> Praebeat ut sensum materiamque mali.

Shortly after these words were written he died in his sixty-first year in A.D. 17.

**Temperament.**—The temperament of Ovid, as indicated in his writings, has more in common with the suppleness of the later Italian than with the strength and force of the ancient Roman. That stamp of her own character and understanding which Rome impressed on the genius of those other races which she incorporated with herself is fainter in Ovid than in any other great writer. He disclaims the manliness which was regarded as the birthright of the Roman. He is equally devoid of dignity in his brilliant prime, and in his later disgrace. His religion is devoid of reverence, his feeling for nature of depth, his loves of sincerity and, almost, even of passion.

These defects in strength and gravity show a corresponding result in Ovid's writings. Though possessing diligence, perseverance and literary ambition, he seems incapable of conceiving a great and serious whole. But with all the levity of his character he must have had qualities which made him, if not much esteemed, yet much liked in his own day, and which are apparent in the genial amiability of his writings. He claims for himself two virtues highly prized by the Romans, *fides* and *candor*—the qualities of social honour and kindly sincerity. There is no indication of anything base, ungenerous or morose in his relations to others. Literary *candor,* the generous appreciation of all sorts of excellence, he possesses in a remarkable degree. He heartily admires everything in literature, Greek or Roman, that had any merit. In him more than any of the Augustan poets we find words of admiration applied to the rude genius of Ennius and the majestic style of Accius. It is by him that

Lucretius is first named and his sublimity is first acknowledged. The image of Catullus that most haunts the imagination is that of the poet who died so early—

hedera iuvenalia cinctus
Tempora,

as he is represented by Ovid coming to meet the shade of the young Tibullus in Elysium. To his own contemporaries, known and unknown to fame, he is as liberal in his words of recognition. He enjoyed society too in a thoroughly amiable and unenvious spirit. In his exile he did retaliate on one enemy and persistent detractor in the *Ibis,* a poem written in imitation of a similar work by Callimachus; but the *Ibis* is not a satire, but an invective remarkable rather for recondite learning than for epigrammatic sting.

But Ovid's chief personal endowment was his vivacity, and his keen interest in and enjoyment of life. The age in which he lived was, as he tells us, that in which more than any other he would have wished to live. He is its most gifted representative, and by not rising above it he reflects it the more perfectly. The sympathy which he felt for the love adventures of his contemporaries, to which he probably owed his fall, quickened his creative power in the composition of the *Heroides* and the romantic tales of the *Metamorphoses.* None of the Roman poets can people a purely imaginary world with such spontaneous fertility of fancy as Ovid. In the power and range of imaginative vision he is surpassed by no ancient and by few modern poets. This power of vision is the counterpart of his lively sensuous nature. He has a keener eye for the apprehension of outward beauty, for the life and colour and forms of nature, than any Roman or perhaps than any Greek poet. This power, acting upon the wealth of his varied reading, gathered with eager curiosity and received into a singularly retentive mind, has enabled him to depict with consummate skill and sympathy legendary scenes of the most varied and picturesque beauty. If his tragedy, the *Medea,* highly praised by ancient critics, had been preserved, we should have been able to judge whether Roman art was capable of producing a great drama. In many of the *Heroides,* and in several speeches scattered through his works, he gives evidence of true dramatic creativeness. Among the poets of all times he can imagine a story with the most vivid inventiveness and tell it with the most unflagging animation. The faults of his verse and diction are those which arise from the vitality of his temperament—too facile a flow, too great exuberance of illustration. He has as little sense of the need of severe restraint in his art as in his life. He is not without mannerism, but he is quite unaffected, and, however far short he might fall of the highest excellence of verse or style, it was not possible for him to be rough or harsh, dull or obscure.

As regards the school of art to which he belongs, he may be described as the most brilliant representative of Roman Alexandrinism. The latter half of the Augustan age was, in its social and intellectual aspects, more like the Alexandrine age than any other era of antiquity. Poetry was the chief branch of literature, and the chief subjects of poetry were mythological tales, various phases of the passion of love, the popular aspects of science and some aspects of the beauty of nature. These two were the chief subjects of the later Augustan poetry. Ovid was the last of this class of writers.

**Works.**—His extant works fall naturally into three divisions, those of his youth, of middle life and of his later years. To the first of these divisions belong the amatory poems: (1) the three books of *Amores* (originally five, but reduced later to three) relating to his amours with his mistress Corinna; (2) the *Heroidum Epistolae;* (3) the *Medicamina formae,* a fragment of 100 lines on the use of cosmetics; (4) the three books of the *Ars amatoria;* (5) the *Remedia amoris* (one book), a kind of recantation of the *Ars amatoria.* To the second division belong (6) the fifteen books of the *Metamorphoses,* and (7) the six books of the *Fasti,* which was originally intended to be in twelve books, but which breaks off the account of the Roman calendar with the month of June. To the third division belong (8) the five books of the *Tristia,* (9) the *Ibis,* an invective against an enemy who had assisted to procure his fall, written in elegiac couplets probably soon after his exile; (10) the four books of *Epistulae ex Ponto.* Of these the first three were published soon after the *Tristia,* while the fourth book is a collection of scattered poems published by some friend soon after the author's death. The *Halieutica* is a didactic fragment in hexameters on the natural history of fishes, of doubtful genuineness, though it is certain that Ovid did begin such a work at the close of his life.[1]

In his extant works Ovid confined himself to two metres—the elegiac couplet and the hexameter. The great mass of his poetry is written in the first; while the *Metamorphoses* and the *Halieutica* are composed in the second. Of the elegiac couplet he is the acknowledged master. By fixing it into a uniform mould he brought it to its highest perfection; and the fact that the great mass of elegiac verse written subsequently has endeavoured merely to reproduce the echo of his rhythm is evidence of his pre-eminence. In the direct expression and illustration of feeling his elegiac metre has more ease, vivacity and sparkle than that of any of his predecessors, while he alone has communicated to it, without altering its essential characteristic of recurrent and regular pauses, a fluidity and rapidity of movement which make it an admirable vehicle for pathetic and picturesque narrative. It was impossible for him to give to the hexameter greater perfection, but he imparted to it also a new character, rapid, varied, animated in complete accord with the swift, versatile and fervid movement of his imagination. One other proof he gave of his irrepressible energy by composing during his exile a poem in the Getic (Gothic) language in praise of the imperial family, the loss of which, whatever it may have been to literature, is much to be regretted in the interests of philology.

It was in Ovid's writings that the world of romance and wonder created by Greek imagination was first revealed to modern times. His influence was first felt in the literature of the Italian Renaissance. But in the most creative periods of English literature he seems to have been read more than any other ancient poet, not even excepting Virgil, and it was on minds such as those of Marlowe, Spenser, Shakespeare, Milton and Dryden that he acted most powerfully. His influence is equally unmistakable during the classical era of Addison and Pope. The most successful Latin verse of modern times has been written in imitation of him; the faculty of literary composition and feeling for ancient Roman culture has been largely developed in the great schools of England and France by the writing of Ovidian elegiacs. His works afforded also abundant stimulus and materials to the great painters who flourished during and immediately after the Renaissance. Thus his first claim on the attention of modern readers is the influence which he has exercised on the development of literature and art; for this, if for no other reason, his works must always retain an importance second only to those of Virgil and Horace.

He is interesting further as the sole contemporary exponent of the last half of the Augustan age, the external aspects and inner spirit of which is known from the works, not of contemporary historians or prose-writers, but from its poets. The successive phases of Roman feeling and experience during this critical period are revealed in the poetry of Virgil, Horace and Ovid. Virgil throws an idealizing and religious halo around the hopes and aspirations of the nascent empire. Horace presents the most complete image of its manifold aspects, realistic, and ideal. Ovid reflects the life of the world of wealth and fashion under the influence of the new court, its material prosperity, its refinement, its frivolity and its adulation. He is the last true poet of the great age of Roman literature, which begins with Lucretius and closes with him. But the type of genius of which he affords the best example is more familiar in modern Italian than in ancient Roman literature. While the serious spirit of Lucretius and Virgil reappeared in Dante, it is Ariosto who may be said to reproduce the light-hearted gaiety and brilliant fancy of Ovid.

BIBLIOGRAPHY.—The life of Ovid was first treated systematically by J. Masson, *Ovidii vita ordine chronologico digesta* (1780) (often reprinted, *e.g.,* in Burmann's edition). Modern literature on this subject will be found in Teuffel's *History of Roman Literature* (Eng. trans., ed. 2), § 247, and S. G. Owen's edition of *Tristia,* bk. i. The very numerous manuscripts of Ovid are chiefly of late date, 13th to

[1] Plin. *Hist. Nat.* xxxii. 152.

15th century. The earliest and best are: for the *Heroides,* a Paris ms. of the 9th, a Wolfenbüttel ms. of the 12th and an Eton fragmentary ms. of the 11th century (the *Epistula Sapphus,* found in no early ms., is best preserved in a 13th-century Frankfurt, and a 15th-century Harleian ms.); for the *Amores, Ars amatoria, Remedia amoris,* two Paris mss. of the 9th and 10th century respectively; for the *Medicamina formae,* a Florence ms. (Marcianus) of the 11th; for the *Metamorphoses,* two Florence mss. (Marcianus and Laurentianus), and a Naples ms., all of the 11th century; for the *Fasti* two Vatican mss. of the 10th and 11th centuries; for the *Tristia,* a Florence ms. of the 11th; for the *Epistulae ex Ponto,* a fragmentary Wolfenbütten ms. of the 6th, and a Hamburg and two Munich mss. of the 12th; for the *Ibis* a Trinity college, Cambridge, ms. of the 12th; for the *Halieutica,* a Paris ms. of the 9th or 10th, and a Vienna ms. of the 9th century. Important for the text of the *Heroides* and *Metamorphoses* is the interesting paraphrase written in Greek by the monk Maximus Planudes in the latter half of the 13th century at Constantinople; that of the *Heroides* is printed in Palmer's edition of the *Heroides* (1898), that of the *Metamorphoses* in Lemaire's edition of *Ovid,* vol. v, edited by Boissonade. *See* also Gudeman, *De Heroidum Ovidii codice Planudeo* (Berlin, 1888).

Two indepedent *editiones principes* of Ovid were published contemporaneously in 1471, one at Rome, printed by Sweynheym and Pannartz, and one at Bologna by Balthasar Azoguidius: these present entirely different texts. *See* Owen's *Tristium libri,* v. p. lv. ff. The following are the most important editions: those marked with an asterisk have explanatory notes. Of the whole works: *Heinsius-Burmann (1727); *Amar-Lemaire (1820–24); Merkel-Ehwald (1874–88); Riese (1871–89); Postgate's *Corpus poetarum Latinorum,* by various editors (1894), reprinted separately (1898). Of separate works: *Amores,* *Némethy (1907); *Heroides,* Sedlmayer (critical) (1886); *Palmer (1898); *Epistula Sapphus* (separately), *De Vries (1888); *Ars amatoria,* *P. Brandt (1902); *Medicamina formae* (critical), Kunz (1881); *Metamorphoses,* *J. C. Jahn (1821); *Loers (1843); Korn (critical) (1880); *Haupt-Ehwald (1898–1903); Magnus (1914); *R. S. Lang (Oxford, 1927); *Fasti,* *Gierig (1812); Merkel (1841); (critical, with learned prolegomena on the sources, the Roman calendar, etc.); *Keightley (1848); *Paley (1854); *Peter (1889); *Cyril Bailey (Oxford, 1921); *Tristia,* *Loers (1839); S. G. Owen (1889) (critical), with notes and translation (1924); *Bk. i (1885), *Bk. iii (1889); *Cocchia (1900); *Epistulate ex Ponto,* Korn (1868) (critical), Bk. i; *Ellis (1881); *Némethy (1915); *Halieutica,* *Birt, *De Halieuticis Ovidio poetae falso adscriptis* (1878). There is a free verse translation of the *Amores* by Marlowe (*c.* 1600), and Dryden, with other hands under his supervision, published translation of various works between 1683 and 1717.

The special treatises on matters connected with Ovid are very numerous; a fairly complete list up to the time of publication is given in Owen's *Tristia* (critical edition), p. cviii ff.; in Teuffel's *History of Roman Literature* (trans. by Warr) and in Schanz's *Geschichte der römischen Litteratur;* and by Ehwald in the *Jahresbericht über die Fortschritte der classischen Altertumswissenschaft,* xxxi (1884) pp. 157 ff., lxxx (1894) pp. 1 ff., cix (1902) pp. 157 ff. The following deserve special mention. On the history of the text: Ehwald, *Ad historiam carminum Ovidianorum symbolae* (1889); *Kritische Beiträge zu Ovids Epistulae ex Ponto* (1896); Sedlmayer, *Prolegomena ad Heroidas* (1878); Gruppe, *Minos,* pp. 441 ff. (on interpolations). On style: Ovid's diction in connection with other writers—A. Zingerle, *Ovidius und sein Verhältnis zu den Vorgängern* (1869–71); *Martial's Ovid-Studien* (1877); W. Zingerle, *Untersuchungen zur Echtheitsfrage der Heroiden Ovids* (1878); W. Vollgraff, *Nikander und Ovid* (Groningen, 1909 foll.). Peculiarities of Ovid's style: van Iddekinge, *De Ovidii Romani iuris peritia* (1811); Washietl, *De similitudinibus imaginibusque Ovidianis* (1883); M'Crea, *On Ovid's Use of Colour and Colour Terms* (Classical studies in honour of H. Drisler) (1894). Metre: the structure of the Ovidian pentameter examined in relation to the textual criticism—Hilberg, *Gesetze der Wortstellung im Pentameter des Ovid* (1894) (fully reviewed by Ellis, *Classical Review,* ix 157). Literary appreciation: Sellar, *Roman Poets of the Augustan Age;* Lafaye, *Les Métamorphoses d'Ovid et leurs modèles grecs.* Ovid's relation to works of art: Wunderer, *Ovids Werke in ihrem Verhältnis zur antiken Kunst* (1890–91); Engelmann, *Bilder-Atlas zu Ovid's Metamorphosen* (1890). Cause of exile: the most interesting discussion is by Boissier in his *L'Opposition sous les Césars. See* also Nageotte, *Ovide, sa vie, ses oeuvres* (1872); Huber, *Die Ursachen der Verbannung des Ovid* (1888). Influence of Ovid upon Shakespeare: T. S. Baynes, *Shakespeare Studies* (1894); pp. 195 ff.; Constable, Shakespeare's "Venus und Adonis," in *Verhältnis zu Ovid's Metamorphosen* (1890). *See* also S. G. Owen, *Ovid and Romance* (1912).

(S. G. O.; X.)

**OVIEDO,** a maritime province of northern Spain, bounded on the north by the Bay of Biscay, east by Santander, south by León and west by Lugo. Pop. (1940) 836,642; area, 4,207 sq.mi. In popular speech Oviedo is often called by its ancient name of Asturias, which only ceased to be the official title of the province in 1833, when the Spanish system of local government was reorganized. An account of the physical features, history and inhabitants of this region is given under ASTURIAS. Oviedo is rich in forests, coal, streams and waterfalls, greatly contributing to its modern industrial development. The horses of Oviedo rank among the best in Spain. Wild deer, boars and bears were formerly common among the mountains; and the sea coasts, as well as the streams, abound with fish, including salmon and lampreys. The climate is mild and wet; the broken relief hinders cultivation. Although no trace exists of the gold for which Asturias was celebrated under its Roman rulers, Oviedo possesses valuable coal measures, which are worked at Langreo (mun. 43,797), Mieres (9,616, mun. 51,967), Siero (mun. 30,931) and elsewhere. The copper mines near Avilés (10,695, mun. 18,035) and Cangas de Onis (1,932, mun. 9,936) have lost their importance; but lead, magnesia, arsenic, cobalt, lapis lazuli, alum, antimony, jet, marble and rock crystal are found in various parts of the province, while amber and coral are gathered along the coast. There are manufactures of fine textiles, coarse cloth and ribbons in Salas (mun., 13,851), Piloña (mun., 16,948) and Avilés; of paper in Pianton; of porcelain and glass in Gijón (72,053, mun. 101,341), Avilés and Pola de Siero; of arms in Oviedo and Trubia; while foundries and works for the manufacture of agricultural implements, rails and pig iron are numerous. An important highway is the 16th century *Camino real,* or royal road, leading from Gijón to León and Madrid, which cost so much that the emperor Charles V inquired if it were paved with silver. A railway from Madrid to Oviedo, Gijón and Avilés runs through difficult parts of the Cantabrian chain.

Oviedo was the scene of serious uprisings in 1934, and of much fighting in the civil war of 1936–39.

**OVIEDO,** an episcopal city and capital of the Spanish province of Oviedo; 16 mi. S. of the Bay of Biscay, on the river Nalon, and on the León-Gijón, Oviedo-Trubia and Oviedo-Infiesto railways. Pop. (1940) 51,410 (mun., 82,548). Oviedo is built on a hill rising from a broad and picturesque valley, which is bounded on the north-west by the Sierra de Naranco. Oviedo, founded in the reign of Fruela (762), became the fixed residence of the kings of the Asturias in the time of Alphonso II, and continued to be so until about 924, when the advancing reconquest of Spain from the Moors led them to remove their capital to León. The university was founded by Philip III in 1604. The Gothic cathedral, founded in 1388, occupies the site of a chapel founded in the 8th century, of which only the Camara Santa remains. The Camara Santa (dating from 802) contains the famous *arca* of Oviedo, an 11th century Byzantine chest of cedar, overlaid with silver reliefs of Biblical scenes. In it are preserved two crosses dating from the 8th and 9th centuries. The cathedral library has some old mss., including a deed of gift made by Alpsonso II of Asturias in 812, and a collection of illuminated documents of the 12th century, the *Libro gótico.* Oviedo possesses historic churches, the ancient Santa María de Naranco, San Miguel de Lino, and the church of St. Julian or the Santullano, all of early date. Oviedo is an agricultural centre; other industries are marble quarrying, the manufacture of arms, fabrics, iron goods, leather and matches. In the 1936–39 rebellion, the Nationalists gained control of Oviedo early, but were then besieged by Asturian miners. A Nationalist relief expedition from Galicia lifted the siege Oct. 17, 1936.

**OVIEDO Y VALDES, GONZALO FERNANDEZ DE** (1478–1557), Spanish historian, was present at the surrender of Granada and saw Columbus previous to his voyage to America. He visited America himself on several occasions in an official capacity. Appointed historiographer of the Indies, Oviedo wrote —besides a romance of chivalry, *Don Claribalte* (1519)—two historical works: *Sumario de la natural y general historia de las Indias* (1526) and *La historia natural y general de las Indias, Islas e Tierra Firme del mar oceano* (1535–57). The latter work embodies a mass of curious information collected at first hand.

**OVOLO,** in architecture, a convex moulding (*q.v.*), whose profile approximates a quarter circle, a quarter ellipse or a similar curve; known commonly in the building trades as a quarter round. In its elliptical forms it is the characteristic moulding of the echinus of the Greek Doric order and in its round forms of the echinus of the Roman Doric. It is also important as part of the bed-mould (*q.v.*) of many cornices. In

carpentry, at a small scale, it is one of the most common mouldings used to cover a joint in a re-entrant angle, as between a base board and the floor, or between the side of a beam and the ceiling.

**OWATONNA,** a city of southeastern Minnesota, U.S.A., on the Straight river at an altitude of 1,154 ft., 70 mi. S. of Minneapolis; the county seat of Steele county. It is on federal highways 14, 65 and 218, and is served by the Chicago, Milwaukee, St. Paul and Pacific, the Chicago and North Western, and the Rock Island railways and by bus lines. Pop., 1940 federal census, 8,694. It is a trading centre of a farming and dairying region; its manufactures include 21 co-operative creameries, jewellery, tools, ventilating systems and farm implements. It is the home of the state school for dependent children (1886) and has eight schools: six public, including a high school, Pillsbury academy, a military school for boys, and St. Mary's parochial. Owatonna was settled about 1855, incorporated in 1865 and chartered as a city in 1875. The name Owatonna is of Sioux origin meaning "straight."

**OWEGO,** a village of southern New York, U.S.A., the county seat of Tioga county; on the north bank of the Susquehanna river, 21 mi. W. of Binghamton. It is served by the Erie, the Lackawanna and the Lehigh Valley railways. Pop. 1940 federal census, 5,068. Its factories produce shoes, folding furniture and other products. Owego occupies the site of an Indian village called Ah-wa-ga ("where the valley widens"), which was destroyed by Gen. Clinton in 1779. A white settlement was established in 1785, and the village was incorporated in 1827.

**OWEN, JOHN** [OVENUS or AUDOENUS] (*c.* 1560–1622), Welsh epigrammatist, born at Plas Dhu, Carnarvonshire, about 1560, was educated at Winchester school, and at New college, Oxford. He was a fellow of his college from 1584 to 1591, when he became a schoolmaster, first at Trelleck, near Monmouth, and then at Warwick. His perfect mastery of the Latin language brought him the name of "the British Martial."

Owen's *Epigrammata* are divided into twelve books, of which the first four were published in 1606, and the rest at four different times. Owen frequently adapts and alters to his own purpose the lines of his predecessors in Latin verse, and one such borrowing has become celebrated as a quotation, though few know where it is to be found. It is the first line of this epigram:—

> Tempora mutantur, nos et mutamur in illis:
> Quo modo? fit semper tempore peior homo.
> (Lib. I. ad Edoardum Noel, epig. 58.)

This first line is altered from an epigram by Matthew Borbonius, one of a series of mottoes for various emperors, this one being for Lothaire I.

> Omnia mutantur, nos et mutamur in illis:
> Illa vices quasdam res habet, illa vices.

There are editions of the *Epigrammata* by Elzevir and by Didot; the best is that edited by Renouard (2 vols., Paris, 1795). Translations into English, either in whole or in part, were made by Vicars (1619); by Pecke, in his *Parnassi Puerperium* (1659); and by Harvey in 1677, which is the most complete. La Torre, the Spanish epigrammatist, owed much to Owen, and translated his works into Spanish in 1674. French translations of the best of Owen's epigrams were published by A. L. Lebrun (1709) and by Kérivalant (1819).

**OWEN, JOHN** (1616–1683), English Nonconformist divine, was born at Stadham in Oxfordshire in 1616, and educated at Queen's college, Oxford. He was chaplain and tutor in the families, first of Sir Robert Dormer, and later of Lord Lovelace, but lost his place by siding with parliament in the Civil War. He then lived in Charterhouse yard, in London, and on April 29, 1646, preached, before the Long Parliament, a sermon which showed his tendency towards the tolerant Independent or Congregational system of Church government. He now became pastor at Coggeshall in Essex. He was chosen to preach to parliament on the day after the execution of Charles. Cromwell took him in 1649 as his chaplain to Ireland, where he regulated the affairs of Trinity college, and in 1650 to Scotland, making him chancellor of Oxford (1651), dean of Christ-church (1651–52) and vice-chancellor in 1652.

When Richard Cromwell succeeded his father, Owen lost his vice-chancellorship, and joined the Wallingford House party, throwing his influence on the side of a simple republic as against a protectorate. In March 1660 the Presbyterian party being uppermost, he was deprived of his deanery and returned to Stadham. Driven to London by the Conventicle and Five Mile Acts, he gathered a congregation there; at the revival of the Conventicle Acts in 1670 he drew up a protest to the House of Lords. After the Declaration of Indulgence (1672) he frequently preached in congregations of Independents and Presbyterians, and was in favour with Charles II. and James II. He died at Ealing on Aug. 24, 1683.

*See* Goold's edition of Owen's *Works* (1850–55); W. Orme, *Memoirs of Owen* (1820); and *The Golden Book of John Owen,* edited with a study of his life by James Moffat (1904).

**OWEN, SIR RICHARD** (1804–1892), English biologist, was born at Lancaster on July 20, 1804. In 1820 he was apprenticed to a local surgeon and apothecary, and in 1824 he proceeded as a medical student to the university of Edinburgh. After completing his medical course in St. Bartholomew's Hospital, London, where he came under the influence of the eminent surgeon, John Abernethy, he contemplated a professional career; but being induced by Abernethy to accept the position of assistant to William Clift, conservator of the museum of the Royal College of Surgeons, he devoted himself to the more congenial work of scientific research. He prepared an important series of catalogues of the Hunterian collection in the Royal College of Surgeons; and in the course of this work acquired the unrivalled knowledge of comparative anatomy which facilitated his researches on the remains of extinct animals. In 1836 he was appointed Hunterian professor in the Royal College of Surgeons, in 1849 he succeeded Clift as conservator, and in 1856 he became superintendent of the natural history department of the British Museum. He then devoted his energies to a scheme for a National Museum of Natural History, which eventually resulted in the removal of the natural history collections of the British Museum to a new building at South Kensington, the British Museum (Natural History). He retained office until the completion of this work in 1884, when he received the K.C.B., and thenceforward lived in retirement at Sheen Lodge, Richmond Park, until his death on Dec. 18, 1892.

While occupied with cataloguing the Hunterian collection, Owen seized every opportunity of dissecting fresh subjects. He had the privilege of investigating the animals which died in the Zoological Society's gardens; and when that society began to publish scientific proceedings in 1831, he was the most voluminous contributor of anatomical papers. His first notable publication, however, was his *Memoir on the Pearly Nautilus* (1832), which was soon recognized as a classic. Henceforth he continued to make important contributions to every department of comparative anatomy and zoology for over fifty years. Among Entozoa his most noteworthy discovery was that of *Trichina spiralis* (1835), the parasite infesting the muscles of man in the disease now termed trichinosis. (*See* also, however, the article on PAGET, SIR JAMES.) He also studied the Brachiopoda, Mollusca and he proposed the universally-accepted subdivision of the Cephalopoda into the two orders of Dibranchiata and Tetrabranchiata (1832). The problematical Arthropod *Limulus* was also the subject of a special memoir by him in 1873.

Owen's technical descriptions of the Vertebrata were still more numerous and extensive than those of the invertebrate animals. He not only studied existing forms, but also devoted great attention to the remains of extinct groups, and immediately followed Cuvier as a pioneer in vertebrate palaeontology. Early in his career he made exhaustive studies of teeth, both of existing and extinct animals, and published his work on *Odontography* (1840–1845). Most of his work on reptiles related to the skeletons of extinct forms, and his chief memoirs on British specimens were reprinted in a connected series in his *History of British Fossil Reptiles* (4 vols., 1849–1884). He also wrote widely on extinct birds. With regard to living mammals, the more striking of Owen's contributions relate to the monotremes, marsupials, and the anthropoid apes. Most of his writings on mammals, however, deal with extinct forms. Sir Thomas Mitchell's discovery of fossil bones in New South Wales provided material for the first of Owen's long series of papers on the extinct mammals of Australia,

which were eventually reprinted in book-form in 1877.

Owen's detailed memoirs and descriptions require laborious attention in reading, on account of their nomenclature and ambiguous modes of expression. But it must be remembered that he was a pioneer in concise anatomical nomenclature.

Besides the above mentioned works, Owen wrote: *Comparative Anatomy and Physiology of Vertebrates* (3 vols., 1866–68); *History of British Fossils, Mammals and Birds* (1844–46); *Monograph of the Fossil Mammalia of the Mesozoic Formations* (Paleont. Soc., 1871); *Antiquity of Man as deduced from the Discovery of a Human Skeleton* (1884). *Catalogue of the Fossil Reptilia of South Africa* (1876); *Archetype and Homologies of the Vertebrate Skeleton* (1848).

**OWEN, ROBERT** (1771–1858), British reformer and Socialist, was born at Newtown, Montgomeryshire, on May 14, 1771. His father had a small business in Newtown as saddler and ironmonger, and there young Owen received his school education, which terminated at the age of nine. After serving in a draper's shop for some years he settled in Manchester, where his success was rapid. When only 19 years of age he became manager of a cotton mill in which 500 people were employed, and by his administrative intelligence and energy soon made it one of the best establishments of the kind in Great Britain. In this factory Owen used the first bags of American sea-island cotton ever imported into the country; it was the first sea-island cotton from the Southern States. Owen also made improvements in the quality of the cotton spun; and indeed there is no reason to doubt that at this early age he was the first cotton-spinner in England, a position entirely due to his own capacity and knowledge of the trade. On becoming manager and partner in the Chorlton Twist Company at Manchester, Owen induced his partners to purchase the new Lanark mills, and after his marriage with Miss Dale, the daughter of the former proprietor, he settled there as manager and part-owner. Encouraged by his great success in Manchester, he had already formed the intention of conducting New Lanark on higher principles than the current commercial ones.

Connected with the mills were about 2,000 people, 500 of whom were children, brought, most of them, at the age of five or six from the poorhouses and charities of Edinburgh and Glasgow. The children especially had been well treated by Dale, but the general condition of the people was unsatisfactory. Crime and vice bred by demoralizing conditions were common; education and sanitation were alike neglected; and housing conditions were intolerable. It was this population which Owen set himself to elevate and ameliorate. He greatly improved their houses, and mainly by his personal influence trained them to habits of order, cleanliness and thrift. He opened a store, where the people could buy goods of the soundest quality at little more than cost price; and the sale of drink was placed under the strictest supervision. His greatest success, however, was in the education of the young, to which he devoted special attention. The first infant school in Great Britain was started, or rather evolved, by James Buchanan, with Owen's approval and support, at the New Lanark mills, and though earlier experiments had been made abroad, the new creation probably owed nothing to them.

In all these plans Owen obtained success. Though at first regarded with suspicion as a stranger, he soon won the confidence of his people. The mills continued to be a commercial success, but some of Owen's schemes involved considerable expense, which was displeasing to his partners. Tired at last of the restrictions imposed on him by men who wished to conduct the business on the ordinary lines, Owen formed a new firm, who, content with 5% of return for their capital, were ready to give freer scope to his philanthropy (1813). In this firm Jeremy Bentham and the well-known Quaker, William Allen, were partners. In the same year Owen published *A New View of Society, or Essays on the Principle of the Formation of the Human Character,* in which he expounded the principles on which his system of educational philanthropy was based. From an early age he had lost all belief in the prevailing forms of religion, and had thought out a creed for himself, which he considered an entirely new and original discovery. The chief points in this philosophy were that man's character is formed by circumstances over which he had no control and that he is not a proper subject either of praise or blame. These convictions led Owen to the conclusion that the great secret in the right formation of man's character is to place him under the proper influences from his earliest years. The irresponsibility of man and of the effect of early influences are the keynote of Owen's whole system of education and social amelioration.

Owen's new views theoretically belong to an old system of philosophy; his originality is to be found in his application of them. For the next few years Owen's work in New Lanark continued to have a national and even European significance. New Lanark itself became a much frequented place of pilgrimage for social reformers, statesmen, and royal personages, including Nicholas, afterwards emperor of Russia. According to the unanimous testimony of all who visited it, the results achieved by Owen were singularly good. The children brought up on his system, which included instruction through the eye as well as the ear, country walks, nature study, singing and dancing, were graceful, genial and unconstrained; health, plenty and contentment prevailed; and the business was a commercial success.

In 1815 Owen started, apparently single-handed, an agitation for factory reform. He drafted a bill to apply to all textile factories, prohibiting employment before ten years of age, and night-work before 18, limiting hours for those under 18 to 10½ a day, and providing for inspection. He failed to gain support from his fellow employers in Scotland, but found influential sympathizers in London, and the bill was introduced into parliament. There it was so emasculated that, after two sessions, Owen ceased to work for it, and disclaimed all responsibility for the mutilated measure passed in 1819. Hitherto Owen's work had been that of the practical reformer, whose distinction was the originality and ceaseless unselfishness of his methods. It was in 1817 that he first put forward the ideas which made him the forerunner of Socialism and Co-operation. These ideas were embodied in a report communicated to the committee of the House of Commons on the poor law.

The general misery and stagnation of trade consequent on the termination of the Napoleonic Wars was engrossing the attention of the country. After clearly tracing the special causes connected with the war which had led to such deplorable conditions, Owen pointed out that the permanent cause of distress was to be found in the competition of human labour with machinery, and that the only effective remedy was the united action of men, and the subordination of machinery. His proposals for the treatment of pauperism were based on these principles. He recommended that communities of about 1,200 persons each should be settled on quantities of land from 1,000 to 1,500 ac., all living in one large building in the form of a square, with public kitchen and mess-rooms. Each family should have its own private apartments, and the entire care of the children till the age of three, after which they should be brought up by the community, their parents having access to them at meals and all other proper times. These communities might be established by individuals, by parishes, by counties, or by the State; in every case there should be supervision by duly qualified persons. Work, and the enjoyment of its results, should be in common. The size of his community was no doubt suggested by his village of New Lanark; and he soon advocated such a scheme for the reorganization of society in general. In its fully developed form it was as follows. He desired that communities of from 500 to 3,000, mainly agricultural but possessing the best machinery, and being, as far as possible, self-contained, "should increase in number, unions of them federatively united shall be formed in circles of tens, hundreds and thousands," till they should embrace the whole world in a common interest.

His plans for the cure of pauperism were received at first with considerable favour. The *Times* and *Morning Post* and many of the leading men of the country countenanced them, one of his most steadfast friends being the duke of Kent, father of Queen Victoria. But at a large meeting in London, Owen declared his hostility to the received forms of religion. After this act of defiance his theories became suspect to the ruling classes though he did not lose all support from them. The radicals were intent

on political reform, which seemed to Owen on the wrong lines. His point of view was that machinery had come to stay and made social control of industry necessary to prevent the oppression and poverty of the workers. When he found there was no hope of Government action he turned to groups of sympathizers to carry out his plan of self-contained Communities. In 1825 he bought 30,000 ac. of land in Indiana, U.S.A., from the Rappite religious community, and re-named it New Harmony. There was no effective choice of colonists, and some necessary trades were inadequately represented. For a time the community life was well ordered and contented under Owen's practical guidance, and a constitution was adopted within a year, based on community of property and a representative government. But differences about the form of government and religion soon appeared, and all the numerous attempts at reconstruction failed to compose them, though there is a consensus of testimony to the admirable spirit which prevailed amidst all the dissensions. The community was wound up in 1828, and Owen lost £40,000—four-fifths of his fortune. The other chief Owenite Community experiments were at Queenwood, Hants (1839–45), in which Owen took part for three years; and Orbiston, near Glasgow (1825–28) and Ralahine in Ireland (1831–33), with neither of which he was directly concerned.

In 1828, after a long period of friction with William Allen and some of his other partners, Owen resigned all connection with New Lanark, and made his headquarters in London. Before he established New Harmony, U.S.A., he had begun to turn to the workers for support for his ideas. In his *Report to the County of Lanark* (a body of landowners) in 1820, he declared definitely that not reforms but a transformation of the social order was required. The appeal of such a doctrine to the workers is obvious. From 1820, his proposals for communities attracted the younger workers, brought up under the factory system, and between 1820 and 1830 numerous societies were formed and papers started to advocate his views. The growth of trade unionism and the emergence of a working-class point of view caused Owen's doctrines to be accepted as the expression of the workers' aspirations. When he returned to England in 1829 he found himself regarded as their leader. In the trade unions, Owenism stimulated the formation of self-governing workshops, and their need for a market led to the formation of "The Equitable Labour Exchange" in 1832.

Here Owen applied his principle that labour is the source of all wealth. Prices were calculated according to the cost of raw material and the time expended in making the article, and "Labour Notes" were used as the currency for dealings with the Exchange. After a few months of prosperity, rapacious demands from the landlord and the fact that the prices did not correspond with real exchange value brought the Labour Exchange to an end. The unprecedented growth of trade unions made it seem possible that the separate industries and eventually all industry might be organized by these bodies. Owen and his followers carried out an ardent propaganda all over the country, with the result that the new National Operative Builders Union turned itself into a Guild to carry on the building industry, and the Grand National Consolidated Trades Union was formed (1833–4). The enthusiasm and the numbers joining were remarkable, but the determined opposition of the employers and the severe repression by the Government and law courts, ended the movement in a few months. It was two generations before socialism, which was first popularly discussed at this time, again influenced trade unionism.

Throughout these years Owen's community ideas maintained their hold. From 1825 numerous co-operative societies for mutual trading were organized by Owen's followers, the profits being accumulated to provide funds for starting Owenite communities. Although the communities did not materialize, these short-lived co-operative stores showed that co-operative trading was possible and started the idea of using it as a means of changing the social system. They thus performed an important part in preparing the ground for the world-wide Consumers' Co-operative Movement which sprang from the Rochdale Pioneers Co-operative Society founded in 1844. These Pioneers were inspired by Owen's teaching, though their method of organizing production to supply their own needs developed on very different lines from his communities.

After 1834, Owen devoted himself to preaching his educational, moral, rationalist and marriage reform ideas. He formed the Association of All Classes of All Nations, and he was untiring in writing and speaking. His love of children and his great personal charm impressed all who came in contact with him up to the end of his life. At the age of 82, he became a spiritualist. He died on a visit to his birthplace, Newtown, on Nov. 17, 1858, his last act, the day before his death, being to draw up a plan for re-organizing the education of the town. He was buried at Newtown, and a memorial tablet was erected on his grave in 1902 by the Co-operative Union.

Robert Owen's four sons all became American citizens. The eldest, ROBERT DALE OWEN (1801–1877), sat in Congress (1844–47), and drafted the bill founding the Smithsonian Institution. In the Indiana House of Representatives, 1836–39 and 1851–52, and Constitutional Convention, 1850, he was instrumental in securing a married woman's property law, a common free school system, and more freedom in divorce. From 1853 to 1858 he was United States ambassador to Naples. He was a strong believer in spiritualism.

Of R. Owen's numerous works in exposition of his system, the most important are the *New View of Society;* the *Report* communicated to the Committee on the Poor Law; *The Report to the County of Lanark;* the *Book of the New Moral World;* and *Revolution in the Mind and Practice of the Human Race.* See *Life of Robert Owen written by himself* (1857), and *Threading my Way, Twenty-seven Years of Autobiography,* by R. D. O. (1874). There are also *Lives* of Owen by A. J. Booth (1869), W. L. Sargant (1860), Lloyd Jones (1889), F. A. Packard (Philadelphia, 1866), F. Podmore (1906) and G. D. H. Cole (with bibliography 1925). *See* also H. Simon, *Robert Owen: sein Leben und seine Bedeutung für die Gegenwart* (Jena, 1905); E. Dolléans, *Robert Owen* (Paris, 1905); G. J. Holyoake, *History of Co-operation in England* (1906); Leonard Woolf, *Co-operation and the Future of Industry* (1919) and the article COMMUNISM.

**OWENSBORO,** a city of Kentucky, U.S.A., the county seat of Daviess county; on the Ohio river and Federal highway 60, 114 mi. S.W. of Louisville. It is served by the Illinois Central and Louisville and Nashville railroads, motor bus lines and river steamers. Vehicular bridge across Ohio river from centre of city. Pop. 1920, 17,424; 1930, 22,765 (about 10·5% Negroes); in 1940, 30,245, an increase of 32·9% in ten years. It is an important market for tobacco as well as corn, wheat, potatoes, dairy and poultry products and livestock. Its manufactures are varied and important, with an output in 1937 valued at $9,592,810. It is the centre of a gas and oil field, the production in Daviess and four surrounding counties for 1940 being 2,854,722 bbl. The city has a commission form of government. The site of Owensboro was known to the early boatmen of the Ohio as Yellow Banks. The first cabin was built in 1799. The town was laid out for the county seat in 1815 and named Rossborough. In 1817 it was incorporated under the present name, after Col. Abraham Owen (1769–1811), but the old name of Yellow Banks clung to it until the '40s.

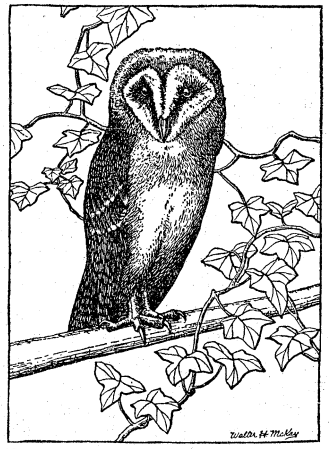
It was chartered as a city in 1866.

**OWEN SOUND,** a city and port of entry in Ontario, Canada, and capital of Grey county, situated 120 mi. N.W. of Toronto, on Georgian Bay. Pop. (1941) 14,002. It is the terminus of branches of the Canadian Pacific and Canadian National railways, and of the Canadian Pacific and other steamship lines plying to ports on Lakes Huron and Superior. The sound is 12 mi. long and the port harbour is one of the best on Lake Huron, and navigable by lake vessels of the largest size. It is a flourishing town, containing shipbuilding yards, and manufactories of mill machinery, agricultural implements, furniture and sewing-machines, flour-mills, saw-mills and large grain elevators.

**OWL,** the general name for the nocturnal birds of prey. The owls form a very natural assemblage, and this suborder, *Striges,* is not closely related to the hawks and eagles. Owls vary in length from 5in. in *Glaucidium cobanense* to more than 2ft. The plumage is very soft, rendering the flight noiseless. On each side of the base of the beak are several rows of small, curved, stiff-shafted feathers, which form a ruff to support the long feathers of the

"disc" or space around the eyes. The ears are large, with well-developed, and often asymmetrical folds of skin, so that the right and left ears may be differently shaped. Many species of owl show two phases of colouration—one in which the brown inclines to red, the other in which it inclines to grey. The outer toes of all owls are reversible. Unlike most birds, owls incubate from the laying of the first egg.

The type of the family *Aluconidae* is the tawny owl (*Strix aluca*), found throughout Europe and in Asia Minor, Palestine and Barbary. A woodland bird, it feeds largely on rats, mice, voles, and shrews. Allied species are found in America, northern Europe and Asia. The remaining owls form the family *Strigidae*.



EUROPEAN BARN-OWL (STRIX FLAMMEA); THE AMERICAN BARN-OWL IS VERY SIMILAR

The eagle owl, *Bubo ignavus*, ranges over most of Europe and Asia north of the Himalayas. The allied *B. virginianus* extends over all North America. They are sombre-coloured birds and among the largest species. Equally large is the snowy owl (*Nyctea scandiaca*), a circumpolar species with white plumage. In winter it migrates southward. The long- and short-eared owls (*Asio otus* and *A. accipitrinus*) are common to the northern parts of Europe and America; the latter, often seen abroad in the daytime, preferring open country, also extending into North Africa, all South America, and the Sandwich Islands. The long-eared owl keeps to woods. Both possess erectile tufts on the side of the head. *Speotyto cunicularia* of America lives in burrows, frequently sharing those of the prairie dog and biscacha. The bird of Pallas Athene is *Athene noctua*, the little owl of Europe, which has been introduced into Great Britain, where it has spread rapidly of late. *A. brama* replaces it in India. The American screech-owl (*Megascops asio*), in its numerous varieties, is found practically throughout North America except at the far north. It varies much in colour and size. It can be distinguished from other owls at night by its peculiar screams, snarls and hisses.

SPOTTED-OWL (SYRNIUM OCCIDENTALE), OF WESTERN U.S.

**OWOSSO,** a city of Shiawassee county, Michigan, U.S.A., 33 m. N.E. of Lansing, on the Shiawassee river. It is the home of Thomas E. Dewey and the late J. O. Curwood and is served by the Ann Arbor, the Grand Trunk and the Michigan Central railways and by bus lines. The population was 12,575 in 1920 (87% native white) and was 14,424 in 1940. It is division point for the Ann Arbor railroad, which has repair shops there, and Indian Trails Bus lines. It is the trade centre of a rich agricultural county and has many diversified industries employing over 3,500 men. Main industries are electric motors, radiators, sandpaper, caskets, screen doors, snow shovels and stoves. The city was founded in 1833 and chartered in 1859.

**OX,** strictly speaking, the Saxon name for the males of domesticated cattle (*Bos taurus*), but in a zoological sense employed so as to include not only the extinct wild ox of Europe but likewise bovine animals of every description, that is to say true oxen, bison and buffaloes. The characteristics of the sub-family Bovinae, or typical section of the family Bovidae, are given in the article BOVIDAE; for the systematic position of that family *see* PECORA. For the typical oxen, as represented by the existing domesticated breeds, *see* CATTLE.

**OXALIC ACID,** one of the oldest known organic acids. Scheele in 1776 prepared it by oxidizing sugar with nitric acid, and showed it to be identical with the acetosellic acid obtained from wood-sorrel, with the formula $H_2C_2O_4$, or, in its usual crystalline form, $H_2C_2O_4{\cdot}2H_2O$. It is found in the form of its acid potassium salt in many plants, especially in wood-sorrel (*Oxalis Acetosella*) and in varieties of *Rumex;* as ammonium salt in guano; as calcium salt in rhubarb root, in various lichens and in plant cells; as sodium salt in species of *Salicornia* and as free acid in varieties of *Boletus*. It is also present in urine and in urinary calculi. It is formed in the oxidation of many organic compounds (*e.g.*, sugar, starch and cellulose) by nitric acid, and also by the fusion of many oxygen-containing compounds with caustic alkalis, the latter method being employed for the manufacture of oxalic acid. In this process cellulose (in the form of sawdust) is made into a stiff paste with a mixture of strong caustic potash and soda solution and heated in flat iron pans to 200–250° C. The somewhat dark-coloured mass is lixiviated with a small amount of warm water in order to remove excess of alkali, the residual alkaline oxalates converted into insoluble calcium oxalate by boiling with milk of lime, the lime salt separated, and decomposed by means of sulphuric acid. It is found that the sawdust obtained from soft woods is the best material for use in this process. It may be obtained synthetically (as sodium salt) by heating sodium in a current of carbon dioxide to 360° C, or by heating sodium formate to 400° C (V. Merz and W. Weith, 1882), by the oxidation of ethylene glycol and by the spontaneous hydrolysis of an aqueous solution of cyanogen gas.

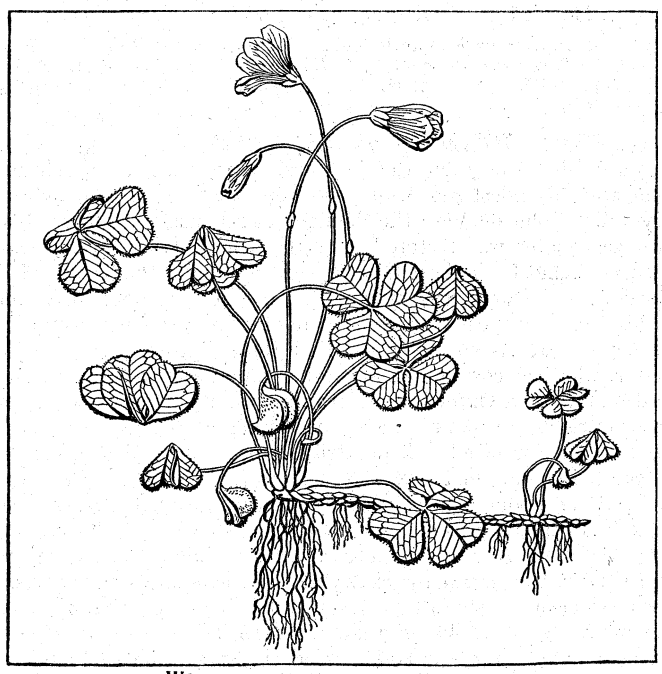
The hydrated acid crystallizes in prisms which effloresce in air, and are readily soluble in water. It loses its water of crystallization at 100° C, and begins to sublime at about 150–160° C, whilst on heating to a still higher temperature it partially decomposes into carbon dioxide and formic acid, or into carbon dioxide, carbon monoxide and water, the latter decomposition being also brought about by heating oxalic acid with concentrated sulphuric acid. The anhydrous acid melts at 189·5° C and is frequently used as a condensing agent. Phosphorus pentachloride decomposes it into carbon monoxide and dioxide, the reaction being the one generally applied for the purpose of preparing phosphorus oxychloride. When heated with glycerin to 100° C it yields formic acid and carbon dioxide; above this temperature, allyl alcohol is formed. Nascent hydrogen reduces it to glycollic acid. Potassium permanganate in acid solution oxidizes it to carbon dioxide and water; the manganese sulphate formed has a catalytic accelerating effect on the decomposition.

Oxalic acid is very poisonous, and by reason of its great similarity in appearance to Epsom salts, it has been very frequently mistaken for this substance with, in many cases, fatal results. The antidotes for oxalic acid poisoning are milk of lime, chalk, whiting or even wall-plaster, followed by evacuation brought about by an enema or castor oil. Only the salts of the alkali metals are soluble in water. Beside the ordinary acid and neutral salts, a series of salts called quadroxalates is known, these being salts containing one molecule of acid salt, in combination with one molecule of acid, one of the most common being "salt of sorrel," $KHC_2O_4{\cdot}H_2C_2O_4{\cdot}2H_2O$. The oxalates are readily decomposed on heating, leaving a residue of carbonate, or oxide of the metal. The silver salt decomposes with explosive violence, leaving a residue of the metal.

*Potassium ferrous oxalate,* $FeK_2(C_2O_4)_2{\cdot}H_2O$, is a strong reducing agent and is used as a photographic developer. *Potassium ferric oxalate,* $FeK_3(C_2O_4)_3$, is used in the preparation of platinotypes, owing to the fact that its solution is rapidly decomposed by sunlight, $2FeK_3(C_2O_4)_3 = 2FeK_2(C_2O_4)_2 + K_2C_2O_4 + 2CO_2$. *Ethyl oxalate,* $(CO{\cdot}OC_2H_5)_2$, prepared by boiling anhydrous oxalic acid with absolute alcohol, is a colourless liquid which boils at 186° C. *Methyl oxalate,* $(CO{\cdot}OCH_3)_2$, which is prepared in a similar manner, is a solid melting at 54° C. It is used in the preparation of pure methyl alcohol (*q.v.*). *Oxalyl chloride,* a liquid boiling at 64° C (m.p. −12° C), has been obtained by the action of phosphorus pentachloride on anhydrous oxalic acid. *Oxamic acid,*

$HO_2C{\cdot}CONH_2$, is obtained on heating acid ammonium oxalate; by boiling oxamide with ammonia; and among the products produced when amino-acids are oxidized with potassium permanganate. It is a crystalline powder difficultly soluble in water and melting at 210° C (with decomposition). Its ethyl ester, known as oxamethane, crystallizes in rhombic plates which melt at 114–115° C. *Oxamide* $(CONH_2)_2$, is best prepared by the action of ammonia on the esters of oxalic acid. It is also obtained by the action of hydrogen peroxide on hydrocyanic acid, or of manganese dioxide and sulphuric acid on potassium cyanide. It is a white crystalline powder which is almost insoluble in cold water. It melts at 417–419° C (with decomposition) when heated in a sealed tube (A. Michael, 1895). When heated with phosphorus pentoxide it yields cyanogen. It is readily hydrolysed by hot solutions of the caustic alkalis. Substituted oxamides are produced by the action of primary amines on ethyl oxalate.

**OXALIS,** a large genus of small herbaceous plants, comprising, with a few small allied genera, the family Oxalidaceae. The name is derived from Gr. ὄξυς, acid, the plants being highly acid to the taste. The genus contains about 800 species, chiefly South African and tropical and South American. It is represented in Great Britain and eastern North America by the wood-sorrel (*O. acetosella*), a small, stemless plant with radical, trefoil-like leaves growing from a creeping, scaly rootstock, and the flowers borne singly on an axillary stalk; the flowers are regular with five sepals, five obovate, white, purple-veined, free petals, ten stamens and a central five-lobed, five-celled ovary with five free styles. The fruit is a capsule, splitting by valves; the seeds have a fleshy coat, which curls back elastically, ejecting the true seed. The leaves, as in the other species of the genus, show a "sleep-movement," becoming pendulous at night. Besides the wood-sorrel, some 20 other species occur in North America, among which are the yellow wood-sorrel (*O. stricta*), of the eastern United States and Canada, with yellow flowers; the violet wood-sorrel (*O. violacea*), of the eastern United States, with rose-purple flowers; the



WOOD SORREL (OXALIS ACETOSELLA)

redwood wood-sorrel (*O. oregana*), of the coast redwood belt from California to Oregon with pink to white flowers and *O. cernua,* known as Bermuda buttercups, with showy yellow flowers, native to South Africa and naturalized in Florida and the Bermudas. *Oxalis crenata,* the oca of South America, is a tuberous-rooted half-hardy perennial, native of Peru. Its tubers are comparatively small, and somewhat acid; but if they be exposed in the sun from 6 to 10 days they become sweet and floury. *Oxalis deppei,* a bulbous perennial of Mexico, has scaly bulbs, from which are produced fleshy, tapering, white, semi-transparent, edible roots, about 4 in. in length and 3 to 4 in. in diameter.

Various species are in cultivation as basket plants for window gardens, border plants and hot house ornamentals. *See* R. Knuth, "Oxalidaceae," *Pflanzenreich* 95 (iv, 130): 1–481, fig. 1–28 (1930).

**OXENSTJERNA, COUNT AXEL GUSTAFSSON** (1583–1654), chancellor of Sweden, was born at Fönö, and was educated with his brothers at the universities of Rostock, Jena and Wittenberg. On returning home in 1603 he was appointed *kammerjunker* to King Charles IX. In 1606 he was entrusted with his first diplomatic mission, to Mecklenburg, was appointed a senator during his absence, and henceforth became one of the king's most trusted servants. In 1610 he was sent to Copenhagen to prevent a war with Denmark. This unsuccessful embassy marks the beginning of Oxenstjerna's long diplomatic struggle with Sweden's traditional rival in the north. Oxenstjerna was appointed a member of Gustavus Adolphus's council of regency. High aristocrat as he was, he would at first willingly have limited the royal power. An oligarchy guiding a limited monarchy was his ideal government, but the genius of the young king was not to be fettered. On Jan. 6, 1612, he was appointed chancellor. His controlling, organizing hand was speedily felt in every branch of the administration. For his services as first Swedish plenipotentiary at the Peace of Knäred, 1613, he was richly rewarded.

During the frequent absences of Gustavus in Livonia and Finland (1614–1616) Oxenstjerna acted as his vice-regent. It was his principal duty during the king's Russian and Polish wars to supply the armies and the fleets with everything necessary, including men and money. In 1622 he accompanied Gustavus to Livonia, where Oxenstjerna was appointed governor-general and commandant of Riga. His services in Livonia were rewarded with four castles and the whole bishopric of Wenden. He was entrusted with the peace negotiations which led to the truce with Poland in 1623, and succeeded, by skilful diplomacy, in averting a threatened rupture with Denmark in 1624. On Oct. 7, 1626, he was appointed governor-general of the newly-acquired Prussian province. In 1629 he concluded the truce of Altmark with Poland. In 1628 he had arranged with Denmark a joint occupation of Stralsund, to prevent the fortress from falling into the hands of the Imperialists. After the battle of Breitenfeld (Sept. 7, 1631) he was summoned to assist the king with his counsels and co-operation in Germany. During the king's absence in Franconia and Bavaria in 1632 he was appointed *legatus* in the Rhine lands, with plenipotentiary authority over all the German generals and princes in the Swedish service.

Although he never fought a battle, Oxenstjerna was a born strategist. His military capacity was strikingly demonstrated by the skill with which he conducted large reinforcements to Gustavus through the heart of Germany in the summer of 1632. But it was only after the death of the king at Lützen that Oxenstjerna's true greatness came to light. He inspired the despairing Protestants both in Germany and Sweden with fresh hopes. He reorganized the government both at home and abroad. He united the estates of the four upper circles into a fresh league against the common foe (1634), in spite of the envious and foolish opposition of Saxony. By the patent of Jan. 12, 1633, he had already been appointed legate plenipotentiary of Sweden in Germany with absolute control over all the territory already won by the Swedish arms. No Swedish subject, either before or after, ever held such an unrestricted and far-reaching authority. Richelieu himself declared that the Swedish chancellor was "an inexhaustible source of well-matured counsels."

Less original but more sagacious than the king, he had a firmer grasp of the realities of the situation. Gustavus would not only have aggrandized Sweden, he would have transformed the German empire. Oxenstjerna wisely abandoned these vaulting ambitions. All his efforts were directed towards procuring for the Swedish crown adequate compensation for its sacrifices. Simple to austerity in his own tastes, he nevertheless recognized the political necessity of impressing his allies and confederates by an almost regal show of dignity; and at the abortive congress of Frankfort-on-Main (March 1634), held for the purpose of uniting all the German Protestants, Oxenstjerna appeared in a carriage drawn

by six horses, with German princes attending him on foot. But from first to last his policy suffered from the slenderness of Sweden's material resources, a cardinal defect which all his craft and tact could not altogether conceal from the vigilance of her enemies. The success of his system postulated an uninterrupted series of triumphs, whereas a single reverse was likely to be fatal to it. Thus the frightful disaster of Nördlingen (Sept. 6th, 1634; *see* SWEDEN: *History*) compelled him to solicit direct assistance from France. But he refused at the conference of Compiègne (1635) to bind his hands in the future for the sake of some slight present relief. In 1636, however, he concluded a fresh subsidy-treaty with France at Wismar.

The same year he returned to Sweden and took his seat in the Regency. For the next nine years his voice, especially as regarded foreign affairs, was omnipotent in the council of state. He drew up beforehand the plan of the Danish War of 1643–1645, so brilliantly executed by Lennart Torstensson, and saw Denmark crippled by the Peace of Brömsebro (1645). His later years were embittered by the jealousy of the young Queen Christina, who thwarted the old statesman in every direction. He always attributed the exiguity of Sweden's gains by the Peace of Osnabrück to Christina's undue interference. Oxenstjerna was opposed at first to the abdication of Christina, because he feared mischief to Sweden from her appointed successor, Charles Gustavus. The extraordinary consideration shown to him by the new king ultimately, however, reconciled him to the change. He died at Stockholm on Aug. 28, 1654.

See *Axel Oxenstjernas skriften och brefvexling* (Stockholm, 1888–1905); A. de Marny, *Oxenstjerna et Richelieu à Compiègne* (Paris, 1878); F. V. Wrangel, *Voyage en France d'Oxenstierna* (1917); *Gabriel Gustafssons bref till Riks Konsler Axel Oxenstjerna, 1611–1640* (Stockholm, 1890).

**OXENSTJERNA, COUNT BENGT** OR **BENEDICT GABRIELSSON** (1623–1702) was the son of Axel Oxenstjerna's half-brother, Gabriel Bengtsson (1586–1656). After a careful education he began his diplomatic career at the great peace congress of Osnabrück. During his stay in Germany he made the acquaintance of the count palatine, Charles Gustavus, afterwards Charles X., whose confidence he completely won. Two years after the king's accession (1654), Oxenstjerna was sent to represent Sweden at the *Kreistag* of Lower Saxony. In 1655 he accompanied Charles to Poland and was made governor of the conquered provinces of Kulm, Kujavia, Masovia and Great Poland. The firmness and humanity which he displayed in this new capacity induced the German portion of them, notably the city of Thorn, to side with the Swedes against the Poles. During Charles's absence in Denmark (1657), Oxenstjerna, in the most desperate circumstances, tenaciously defended Thorn for ten months; the terms of capitulation were made the basis of the subsequent peace negotiations at Oliva. During the domination of Magnus de la Gardie he played but a subordinate part in affairs. From 1662 to 1666 he was governor-general of Livonia. In 1674 he was sent to Vienna to try and prevent the threatened outbreak of war between France and the empire, and he was one of the Swedish envoys to the Congress of Nijmwegen (1676). From 1680 to 1697 he conducted the foreign relations of Sweden.

His leading political principles were friendship with the maritime powers (Great Britain and Holland) and the emperor, and a close anti-Danish alliance with the house of Holstein. Charles XI. appointed Oxenstjerna one of the regents during the minority of Charles XII. The martial proclivities of the new king filled the prudent old chancellor with alarm and anxiety. He advised Charles in vain to accept the terms of peace offered by the first anti-Swedish coalition. Oxenstjerna has been described as "a shrewd and subtle little man, of gentle disposition, but remarkable for his firmness and tenacity of character."

*See* F. F. Carlson, *Sveriges historia under Konungarne of Pfalziska huset* (Stockholm, 1883, 1885); O. Sjögren, *Karl den elfte och Svenska folket* (Stockholm, 1897); and *Négociations du comte d'Avaux pendant les années 1693, 1697–1698* (Utrecht, 1882, etc.). (R. N. B.; X.)

**OXFORD, EARLS OF,** an English title held successively by the families of Vere and Harley. The three most important earls of the Vere line are noticed separately below. The Veres held the earldom from 1142 until March 1703, when it became extinct on the death of Aubrey de Vere, the 20th earl. In 1711 the English statesman Robert Harley was created earl of Oxford (*q.v.*); but the title became extinct in this family on the death of the 6th earl in 1853. It was revived in favour of H. H. Asquith who became earl of Oxford and Asquith (*q.v.*).

**OXFORD, EDWARD DE VERE,** 17TH EARL (in the Vere line) OF (1550–1604), son of John de Vere, the 16th earl, was born on April 12, 1550. He studied at Queen's and St. John's Colleges, Cambridge. He was known as Lord Bolebec or Bulbeck until he succeeded in 1562 to the earldom and to the hereditary dignity of great chamberlain of England. As a royal ward the boy lived under the care of Lord Burghley, who in 1571 gave him his eldest daughter, Anne, in marriage. Oxford wished for a military or a naval command, but Burghley hoped that he would win a high position at court. His accomplishments secured Elizabeth's favour, but he offended her by going to Flanders without her consent in 1574, and more seriously in 1582 by a duel with one of her gentlemen, Thomas Knyvet. In 1579 he insulted Sir Philip Sidney on the tennis-court at Whitehall.

Sidney challenged Oxford, but the queen forbade him to fight, and required him to apologize on the ground of their difference of rank. On Sidney's refusal and consequent disgrace Oxford is said to have schemed to murder him. The earl sat on the special commission (1586) for the trial of Mary queen of Scots; he took part in the trials of Philip Howard, earl of Arundel, for high treason in 1589, and of Essex and Southampton in 1601. In 1575 he brought back from Italy various inventions for the toilet, and his estate was rapidly dissipated in satisfying his extravagant whims. His first wife died in 1588, and from that time Burghley withdrew his support, Oxford being reduced to the necessity of seeking help among the poor men of letters whom he had befriended. He was a lyric poet of no small merit. His fortunes were partially retrieved on his second marriage with Elizabeth Trentham, by whom he had a son, Henry de Vere, 18th earl of Oxford (1593–1625). He died at Newington, near London, on June 24, 1604.

His poems, from various anthologies—the *Paradise of Dainty Devices, England's Parnassus, Phoenix Nest, England's Helicon*—and elsewhere, were collected by Dr. A. B. Grosart in vol. iv of the Fuller Worthies Library (1876).

**OXFORD, JOHN DE VERE,** 13TH EARL OF (1443–1513), was second son of John, the 12th earl, a prominent Lancastrian, who, with his eldest son Aubrey de Vere, was executed in February 1462. John de Vere the younger was himself attainted, but two years later was restored as 13th earl. But his loyalty was suspected, and for a short time in 1468 he was in the Tower. He sided with Warwick, the king-maker, in 1469, accompanied him in his exile next year, and assisted in the Lancastrian restoration of 1470–1471. As constable he tried John Tiptoft, earl of Worcester, who had condemned his father nine years before. At the battle of Barnet, Oxford was victorious in command of the Lancastrian right, but was ultimately defeated and escaped to France. In 1473 he organized a Lancastrian expedition, which, after an attempted landing in Essex, seized St. Michael's Mount in Cornwall. After a four months' siege Oxford was forced to surrender in Feb. 1474. He was sent to Hammes near Calais, whence, ten years later, in Aug. 1484, he escaped and joined Henry Tudor in Brittany. He fought for Henry at Bosworth, and was rewarded by restoration to his title, estates and hereditary office of Lord Chamberlain. At Stoke on June 16, 1486, he led the van of the royal army. In 1492 he commanded the expedition to Flanders, and in 1497 was foremost in the defeat of the Cornish rebels on Blackheath. Oxford was high steward at the trial of the earl of Warwick, and one of the commissioners for the trial of Sir James Tyrell and others in May 1502. He died March 10, 1513.

See *The Paston Letters*, ed. J. Gairdner; *Chronicles of London*, ed. C. L. Kingsford (1905); Sir James Ramsay, *Lancaster and York;* and *The Political History of England*, vols. iv and v. (1906).

**OXFORD, ROBERT DE VERE,** 9th Earl of (1362–1392), English courtier, was the only son of Thomas de Vere, 8th earl of Oxford, and Maud de Ufford, a descendant of King Henry III. He became 9th earl of Oxford in 1371, and married Philippa (d.

1412), daughter of his guardian Ingelram de Couci, earl of Bedford, a son-in-law of Edward III. Already hereditary great chamberlain of England, Oxford was made under Richard II. a member of the privy council and a Knight of the Garter; while castles and lands were bestowed upon him, and he was constantly in the company of the young king. In 1385 Richard sent him to govern Ireland, but although preparations were made for his journey he did not leave England. The king's partiality for Oxford was one of the causes of the dissatisfaction of the barons. Oxford also made powerful enemies by divorcing his wife, Philippa, and by marrying a Bohemian lady.

The king, however, indifferent to the gathering storm, created Vere duke of Ireland in Oct. 1386, and gave him still more powers in that country. Richard was deprived of his authority for a short time, and Vere was ordered in vain to proceed to Ireland. He was then accused by the king's uncle Thomas of Woodstock, duke of Gloucester, and his supporters in 1387; and rushing into the north of England he gathered an army to defend his royal master and himself. At Radcot bridge in Oxfordshire, however, his men fled before Gloucester's troops and Oxford himself escaped in disguise to the Netherlands. In the parliament of 1388 he was found guilty of treason and condemned to death, but as he remained abroad the sentence was never carried out. With another exile, Michael de la Pole, duke of Suffolk, he lived in Paris until after the treaty between England and France in 1389, when he took refuge at Louvain. He was killed by a boar whilst hunting, and left no children.

*See* T. Walsingham, *Historia Anglicana,* edited by H. T. Riley (London, 1863–64); J. Froissart, *Chroniques,* edited by S. Luce and G. Raynaud (Paris, 1869–97); H. Wallon, *Richard II.* (Paris, 1864); and W. Stubbs, *Constitutional History,* vol. ii. (Oxford, 1896).

**OXFORD, ROBERT HARLEY,** 1ST EARL OF (1661–1724), English statesman, commonly known by his surname of HARLEY, eldest son of Sir Edward Harley (1624–1700), a Herefordshire land-owner, was born in Bow street, London, on Dec. 5, 1661. His school days were passed at Shilton, near Burford, in Oxfordshire, in a small school which produced at the same time a lord high treasurer (Harley), a lord high chancellor (Simon Harcourt) and a lord chief justice of the common pleas (Thomas Trevor). The principles of Whiggism and Nonconformity were instilled into his mind at an early age, and if he changed the politics of his ancestors he never formally abandoned their religious opinions. At the Revolution of 1688 Sir Edward and his son raised a troop of horse in support of the cause of William III., and took possession of the city of Worcester in his interest. Young Harley then (1689) entered parliament for the "pocket" borough of Tregony. Later he sat for New Radnor, a seat which he held until his elevation to the peerage in 1711.

From the first Harley gave great attention to the conduct of public business, and from the general election of Feb. 1701 until the dissolution of 1705 he held the office of speaker. In 1704 he became a principal secretary of State for the northern department. In 1703 Harley first made use of Defoe's talents as a political writer, and this alliance with the press proved so successful that he afterwards called the genius of Swift to his aid in many pamphlets against his political opponents. While he was secretary of State the union with Scotland was effected. At the time of his appointment as secretary of State Harley had given no outward sign of dissatisfaction with the Whigs, and it was mainly through Marlborough's good opinion of his abilities that he was admitted to the ministry. For some time Harley acted loyally with his colleagues. But in the summer of 1707 it became evident to Godolphin that some secret influence behind the throne was shaking the confidence of the queen in her ministers. Abigail Hill, who was secure in the queen's confidence, was Harley's cousin, and his instrument in influencing the queen against her ministers. These bided their time, until an opportunity for Harley's overthrow was provided. A clerk in Harley's department divulged the contents of secret documents in his office, which should have been inaccessible to anyone but the chief, and the queen was thereupon informed that Godolphin and Marlborough could no longer serve in concert with him. They did not attend her next council (Feb. 8, 1708), and the queen found herself forced (Feb. 11) to accept the resignations of both Harley and St. John.

Harley went out of office, but his cousin, who had now become Mrs. Masham, remained at court to further his interests. The cost of the protracted war with France, and the danger to the national church, the chief proof of which lay in the prosecution of Sacheverell, were the weapons which he used to influence the masses of the people. Marlborough himself could not be dispensed with, but his relations were dismissed from their posts in turn. When the greatest of these, Lord Godolphin, was ejected from office, five commissioners to the treasury were appointed (Aug. 10, 1710), and among them figured Harley as chancellor of the exchequer. It was the aim of the new chancellor to frame an administration from the moderate members of both parties, and to adopt with but slight changes the policy of his predecessors; but he failed. By an unexpected event, his popularity was restored at a bound. A French refugee, the ex-abbé de la Bourlie (better known by the name of the marquis de Guiscard), was being examined before the privy council on a charge of treachery, when he stabbed Harley in the breast with a penknife (March 8, 1711). On May 23, 1711, the minister became Baron Harley of Wigmore and earl of Oxford and Mortimer; and immediately afterwards lord treasurer and a Knight of the Garter.

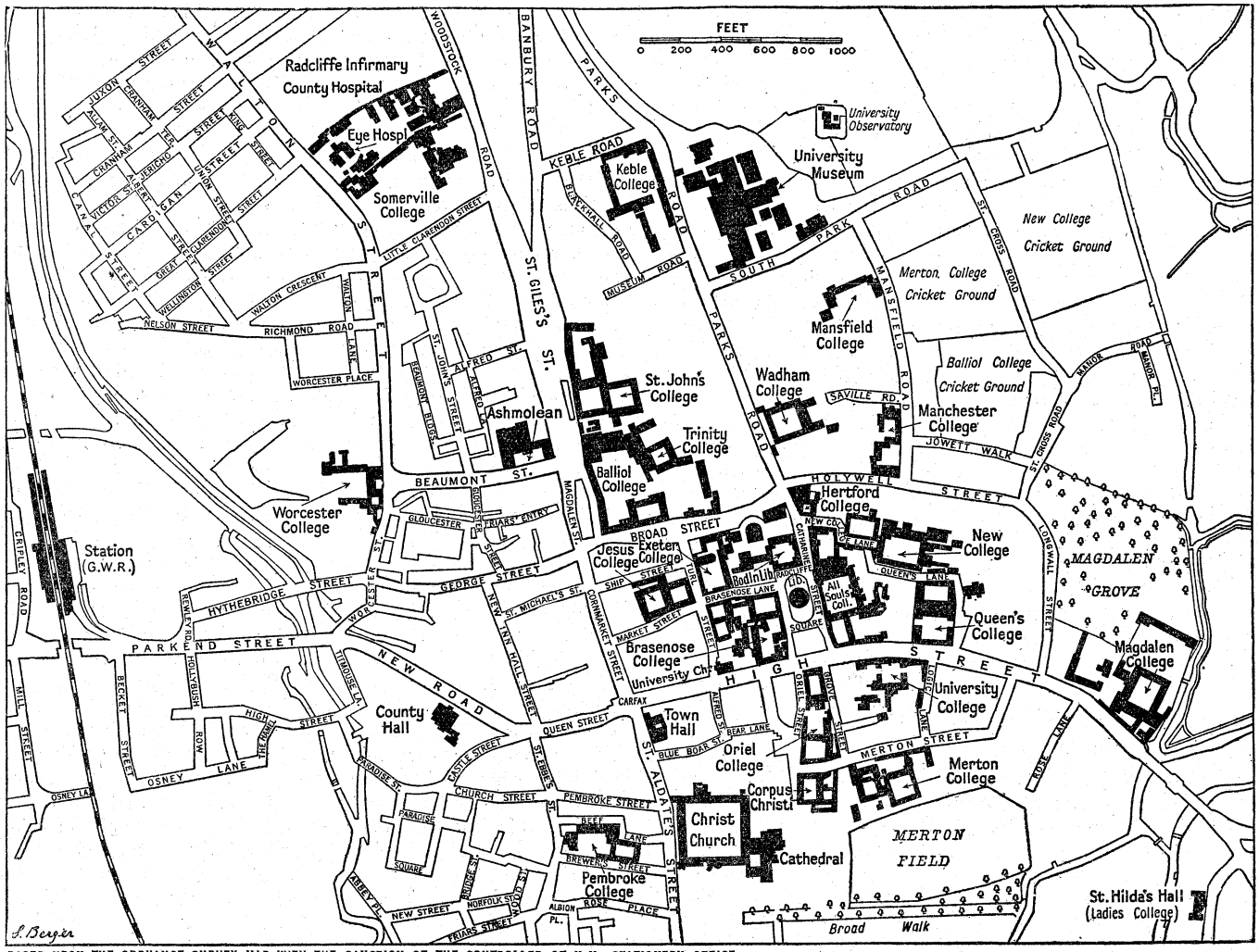
Oxford rearranged the nation's finances, and supplied resources for carrying on the campaign, though his emissaries were in communication with the French king, and were settling the terms of a peace independently of England's allies. After many weeks of vacillation and intrigue, the preliminary peace was signed, and in spite of the opposition of the Whig majority in the Upper House, which was met by the creation of 12 new peers, the treaty of Utrecht was concluded (March 31, 1713). While these negotiations were under discussion the friendship between Oxford and St. John, who had become secretary of State in Sept. 1710, was fast changing into hatred. The latter had resented the rise in fortune which the stabs of Guiscard had secured for his colleague, and when he received a viscounty instead of the expected earldom, his resentment knew no bounds. Mrs. Masham deserted her cousin for his more vivacious rival. The Jacobites lost faith in his repeated promises. Queen Anne transferred her confidence from Oxford to Bolingbroke; and he surrendered his office a few days before the queen died.

On the accession of George I. the defeated minister retired to Herefordshire, but a few months later he was committed to the Tower (July 16, 1715). After an imprisonment of nearly two years he was released in July 1717, but he took little part in public affairs, and died almost unnoticed in London on May 21, 1724.

The books and the manuscripts which the first earl of Oxford and his son collected were among the glories of their age. The manuscripts became the property of the nation in 1753 and are now in the British Museum; the books were sold to a bookseller called Thomas Osborne in 1742 and described in a printed catalogue of five volumes (1743–45), Dr. Johnson writing an account of the library. A selection of the rarer pamphlets and tracts, which was made by William Oldys, was printed in eight volumes (1744–46), with a preface by Johnson. The best edition is that of Thomas Park, ten volumes (1808–13). In the recollection of the Harleian manuscripts, the Harleian library and the *Harleian Miscellany,* the family name will never die.

BIBLIOGRAPHY.—The best life of Harley is by E. S. Roscoe (1902). Articles relating to him are in *Engl. Hist. Rev.* xv. 238–250 (Defoe and Harley by Thomas Bateson); *Trans. of the Royal Hist. Soc.* xiv. N.S. 69–121 (development of political parties *temp.* Q. Anne by W. Frewen Lord); *Edinburgh Review,* clxxxvii. 151–178, cxciii. 457–488 (Harley papers). For his relations with St. John *see* Walter Sichel, *Bolingbroke* (1901–02, 2 vols.); for those with Swift, consult the *Journal to Stella* and Sir H. Craik, *Life of Swift* (2nd ed., 1894).

**OXFORD,** the county town of Oxfordshire, England, a municipal and parliamentary borough, cathedral city, and seat of an ancient university, lies on the river Thames, 51 m. by road and 63¾ m. by rail W.N.W. of London (G.W. railway); main railways also to Worcester and Birmingham (G.W. railway); direct service also via Banbury to Leicester and Sheffield (L.N.E. railway), branch line L.M.S. to Cambridge crossing main line at




BASED UPON THE ORDNANCE SURVEY MAP WITH THE SANCTION OF THE CONTROLLER OF H.M. STATIONERY OFFICE

MAP OF OXFORD, SHOWING THE PRINCIPAL COLLEGES

Bletchley. The Thames is navigable below Oxford; there is a canal to the Avon valley and Birmingham; and numerous local road motor services. Population (1938), 94,090.

The site of Oxford is a low gravel terrace between the upper Thames and its tributary, the Cherwell, which meet in wide water meadows within a gap in a line of oolitic plateaux represented by Headington hill on the East and the twin crests of Cumnor Hurst and Wytham on the west. Though there are sparse Romano-British habitations on both sides of the valley, the Roman road northwards from Dorchester to Alchester lies far back to the east, and only a few finds betray a track across the valley from Headington towards Binsey. Oxford itself only becomes perceptible in Saxon times, in the church of St. Martin (whose dedication and some rude masonry in the tower mark its early date) close to Carfax (Lat. *quadrifurcus*, French *carrefour*) the intersection, in the heart of the city, of north-south and east-west roads. Eastward the High street crosses the Cherwell by Magdalen bridge, and offers alternative routes to London via Headington or Littlemore; southwards St. Aldate's, formerly Fish street, crosses the Thames (Isis) at Folly bridge, for Abingdon and Newbury; northwards, by Cornmarket, are the roads to Banbury and Woodstock; westward, Queen street leads round the south side of the Norman castle to Quaking bridge, over the mediaeval mill stream towards Osney: the modern New road, north of the castle, leads direct to the railway stations and Seven Bridges road for the upper Thames, and south-west England. Early traces are: (1) the Priory (afterwards Augustinian), commemorating St. Frideswide, a local heroine whose good works and adventures, about 720–740, touch also Binsey and Abingdon; of her original church there are arches near her shrine in the cathedral; (2) the conspicuous mound raised (probably about A.D. 900) to command the passage from Mercia into Wessex; (3) Oseney village, beyond the nearest channel of the upper Thames, whose name (Ousen-eye: "water-island") explains the Oksnaforda and Orsnaforda of 10th century Saxon coins, whence *Oxenford* and *Oxford* arose by assimilation to names like Swinford and Shefford. Upstream, between Osney, Binsey and Wolvercote, the "Port Meadow" is still held in common by the freemen of Oxford.

Oxford just appears in history when Edward the Elder, in A.D. 912, "held Lundenbyrg (London) and Oxnaford and all the lands that were obedient thereto" as flanking fortresses of his Thames valley frontier. But the principal centres of the district were not here, but at Abingdon, commanding access to the Vale of White Horse, with an early and wealthy abbey, and Dorchester, similarly dominating the Thames valley, with its pre-Roman earthworks, and Saxon bishopric. River traffic bound for Oxford long paid toll to the abbott of Abingdon. However, several "gemots" were held at Oxford, under Edric, Canute, and Harold I.; and repeated devastation by the Danes (979, 1002, 1010, 1013) attests military and economic importance.

The Norman governor, Robert d'Oiloi (d'Oyly), incorporated the Saxon mound in a great fortress (1170–1219), of which one tower stands, and Bullock lane and St. Peter le Bailey mark the outworks; he built the Hythe bridge, which reveals the terminal wharfs of the river traffic; enclosed the town (partially "wasted" in Domesday) with walls of which foundations remain at the (north) Bocardo gate, the fine tower annexed to St. Michael's church. To d'Oiloi's time belong the rebuilding of St. Frideswide's (the present cathedral dates mainly from the fire of 1120), St. Ebbs' near Carfax, St. Peter's, in the east, probably outside the first

east wall, and Holywell by the Cherwell beyond. His son Robert founded the splendid Osney abbey, beyond the castle (fragments in the cemetery beyond the G.W. railway). Outside the city, also, north of the cattle market in Gloucester Green, Henry I. built his Beaumont palace overlooking Osney and Port Meadow, and under his "Beau-clerc" patronage Theobald of Etampes already, about 1120, was teaching "60 to 100 clerks." As residence of the empress queen Maud, Oxford suffered siege by Stephen.

While domestic business was conducted between the Corn Market and the High, within the walls, the wool fair and strangers' market, outside the north gate, had, about 1200, a church of St. Giles, its patron. Beyond it lay the leper house (later St. Giles' parsonage), and east of it other establishments mainly for strangers, the Scots college of John de Balliol, Durham college (afterwards Trinity), a Cistercian house (afterwards St. Bernard's, then St. John Baptist's college); and, when Beaumont palace was granted by Edward II. to the Carmelites, the Benedictines occupied the site they had left with the older "cottages" of Worcester college. Other Cistercians built Rewley abbey beyond Hythe bridge; Dominican and Franciscan houses in the poorer south-west quarter leave their names in Blackfriar street, Preacher's bridge and Friars wharf; and the Austin Canons of St. Frideswide acquired endowments for teaching and added the Latin chapel to their church. By the mid 13th century then mediaeval Oxford had taken permanent shape. The walls were reconstructed, and probably extended from an older line in Cat street, to include St. Peter's in the east, with an East gate spanning the High near the hotel of that name, between the splendid north-east stretch of wall conserved by New college, and the south-east angle around Merton.

But before this, in the old north-east angle, now occupied by the Bodleian and Radcliffe libraries, "School street" traversed a kind of "Latin quarter" frequented by wandering scholars, whose *universitas* or guild comes into history with the visit of Giraldus Cambrensis in 1185, and the nomination of a chancellor in 1214. (*See* OXFORD UNIVERSITY.) On the south frontage of this resort of scholars, St. Mary's church became their meeting hall and lecture room; its bell tower and spire, congregation house and library were built about 1320; a new nave and aisles replaced, in 1388, the old Faculty chapels; and the Renaissance porch marks Archbishop Laud's reconstitution of the university, and still dates *"in parviso"* the certificates of satisfactory "responsions" of novices to the "masters of the schools" who controlled their admittance. For the history of this university, and the several fortunes of its colleges, *see* below.

The 13th century was the great age of mediaeval Oxford. Several parliaments were held here, notably the "Mad Parliament" of 1256, with its "Provisions of Oxford." But the growth of the university, and the wealth and influence of its colleges, were unfavourable to normal development as a mediaeval borough, with its guilds of craftsmen and traders. The "liberties" of the university, in relation with the city, were defined by charter in 1248, and revised in favour of the "chancellor, masters and scholars" after the town-and-gown riots of St. Scholastica's day, 1354–55, and other occasions; in 1523 the university was even allowed to incorporate all kinds of tradesmen, exempting them from civic jurisdiction. These unusual but once necessary provisions were only revoked or became obsolete with the modern transformation of the university itself, which retains, however, magisterial authority over its students, a censorship of public entertainments, and direct representation on the City Council and Guardians.

The Renaissance and the Reformation affected Oxford mainly through academical controversies, the foundation of a fresh series of colleges, and the creation by Henry VIII. of a bishopric, with St. Frideswide's church as its cathedral, and a chapter, the dean and canons of Christ church, economized out of Wolsey's "Cardinal college." But in the Civil War, Oxford's strategical importance made it the Royalist headquarters. The king retired hither after defeats at Edgehill, Newbury and Naseby; Prince Rupert made hence his raids in 1643. Not till May 1644 was the king forced by the concerted advances of the earl of Essex and Sir W. Waller to evacuate this fortress, and after Cropredy bridge he re-occupied it. Only in May 1646, when all other strongholds were lost and Charles himself had escaped in disguise, was Oxford besieged by Fairfax and surrendered on June 24. The extent of the city at this time beyond the mediaeval wall is outlined by traces of the "Kings Mound," enclosing Holywell, Wadham college (1611) and St. Giles. Though the university was mainly Royalist, the citizens had been secretly Parliamentarian; on both sides were losses, and party feelings were disastrous; and though Cromwell himself was chancellor (1651–57), his successor, Gilbert Sheldon, had much work to restore efficiency; his monument is the Sheldonian theatre, for the business and ceremonies of the reconciled masters; the Clarendon press and the Ashmolean museum, Christ church library and Peckwater quadrangle, large additions to New college and Magdalen, and the total rebuilding of Queen's college, are academical counterpart to a general rebuilding of mediaeval and Tudor Oxford, in the next half century. Though Charles II. held a parliament here in 1681, the restored Stuarts temporarily alienated university loyalty, but in the 18th century the university became Jacobite, and the city strongly Hanoverian. This feud, however, was reconciled at the visit of George III. in 1785, and Oxford passed out of national politics. The city, however, grew but little, until the reform of the university in 1858 admitted "married dons," while restricting membership of congregation to residents within 1½ m. from Carfax. The obstinate opposition of the university to Brunel's project for a "great western" railway system radiating from Oxford; and the restrictive policy of St. John's college, which owned almost all land north of St. Giles', had already aggravated urban congestion. The modern Oxford which emerged includes: (1) northward, a compact residential area, not wholly academic, along the Banbury and Woodstock roads beyond St. Giles', Keble, the Museum and laboratories, and the university parks and college playing fields; (2) eastward, beyond Magdalen bridge, the diverging roads to Marston, Headington, Cowley and Iffley, already enclosed fan shaped suburbs mainly of small dwellings, when the establishment of the Morris motor works at Cowley introduced a new and strenuous element into Oxford's industrial life, hitherto almost confined to the Clarendon press and private printing firms, robe making and tailoring, and the distribution of local dainties, sausages, marmalade, and the like; (3) to west and south, "ribbon development" along the trunk roads has disfigured the water meadows without adding to health or convenience. The real suburban areas here lie beyond, around or upon the Boar's-hill-Cumnor-Wytham upland. The Oxford Preservation Trust, established almost too late in 1927, a town planning scheme, 1925, and a new Incorporation Act, 1928, are attempts to adjust to the strict and peculiar circumstances of the site and its past, the requirements of "post-war" Oxford, with its partially modernized university, its interminable "summer schools" and vacation-conferences, its growing industries, trade, and professional interests, and the perennial stream of tourists. (J. L. My.)

**OXFORD,** a village of Butler county, Ohio, U.S.A., 40 mi. N.W. of Cincinnati, at an altitude of 1,000 ft.; on federal highway 27 and the Baltimore and Ohio railroad. Pop. (1940) 2,756. It is an educational centre, the seat of Miami university (chartered 1809, opened 1824) with which Oxford College for Women (1830) was consolidated in 1928; and the Western college (for women) (1853). The students and faculty of the educational institutions outnumber the resident population. The village was founded about 1800.

**OXFORD, PROVISIONS OF,** the articles constituting a preliminary scheme of reform enacted by a parliament which met at Oxford on June 11, 1258. King Henry III. had promised on May 2 that the state of his realm should be rectified and reformed by 24 counsellors who were to meet at Oxford for this purpose five weeks later. Twelve of these counsellors were chosen by the king, and 12 by the earls and barons. When the parliament met the 24 drew up a provisional scheme of reform, known as the Provisions of Oxford. By this it was arranged that a council of 15, chosen by four of the 24, should be appointed to advise the king in all matters. The new council was to meet three times a year in parliaments to which 12 commissioners

were to be summoned to discuss the affairs of the realm on behalf of the whole community. Another body of 24 was appointed to treat of an aid. Desiring to limit the power of the king and his household officers, the barons determined to revive the justiciarship, in abeyance since 1234. But they did not want over-powerful great officials. It was therefore decided that one or two justiciars should be appointed for one year who should be paid, but should be accountable at the end of the year. The chancellor and treasurer similarly had to account; the sheriffs, too, were appointed for one year only. Enquiries into abuses were begun and further reforms were to be reported on by Christmas. The king declared his adhesion to the Provisions on Oct. 18.

Disputes broke out in the baronial party. Simon de Montfort, earl of Leicester, supported by Edward, the king's son, demanded the logical extension of the reforms in local government to include the baronial franchises. The earl of Gloucester opposed this. Forced by Edward, a second series of Provisions, known as the Provisions of Westminster, was issued in Oct. 1259. The quarrels among the barons encouraged Henry to break free. On April 13, 1261, a papal bull absolved him from his oath to observe the Provisions. After three years on the verge of civil war, both parties agreed to refer the question to the arbitration of Louis IX. of France, who formally annulled them on Jan. 23, 1264, but expressly declared that his decision was not to invalidate the privileges, liberties and laudable customs of the realm of England, which had existed before the time of the provisions.

*See* the *Annales monastici*, vol. i. (Burton), Rolls series; *Foedera* (Record Commission edition); W. Stubbs, *Constitutional History* (1873), and *Select Charters* (1870, several later editions); Charles Bémont, *Simon de Montfort* (1884); T. F. Tout, *Chapters in the Administrative History of Mediaeval England* (1920); and E. F. Jacob, *Studies in the Period of Baronial Reform and Rebellion* (1925).

**OXFORD AND ASQUITH, HERBERT HENRY ASQUITH,** 1st Earl of (1852–1928), born at Morley, Yorks., on Sept. 12, 1852. His origins were Liberal, Nonconformist and middle class in character. Joseph Dixon Asquith, his father, owned a cloth manufacturing business in Morley, and his mother was the daughter of William Willans, a Huddersfield merchant. His father died while he, his brother (who afterwards became a master at Clifton), and his sister were children, and the two boys were left in the care of an uncle in London, where they went to the City of London school, then under the able headmastership of Dr. Abbott. Upon him the future prime minister made a deep impression, and to him Asquith in after life was accustomed to express a great debt of gratitude. He won a Balliol scholarship, and at Oxford he took a Craven university scholarship and firsts in "Mods" and "Greats," became president of the Union and a fellow of his college.

Adopting the bar as a profession, he first attracted public notice by his defence of Cunninghame Graham and John Burns for their part in the riot in Trafalgar square, but it was the Parnell Commission, in 1889, in which he acted as junior to Sir Charles Russell, that established his legal reputation, his deadly cross-examination of the manager of *The Times* giving the first indication of the dramatic issue of the trial. His success at the bar was assured, and in the next year he took silk, but the law was only a stepping-stone to the political career that from boyhood he had always had in view. He had entered parliament as member for East Fife in 1886, and on the formation of the Gladstone Government in 1892 he was appointed home secretary. He had just previously sustained a heavy domestic blow by the death of his wife, Helen, the daughter of a Manchester surgeon, whom he had married in 1877 and by whom he had four sons and one daughter. In office, Asquith's great parliamentary gifts were at once apparent, and his administration of the Home Office was made memorable by the appointment of the first women inspectors, improvements in the administration of the Factory Acts, the stiffening of the machinery, and the passing of the Employers' Liability bill, which was rejected by the Lords, and of a Factory bill which became law. He was bitterly and most unjustly attacked in connection with the shooting of two miners by soldiers who were called in to deal with a strike at the Featherstone colliery. He did not summon the soldiers, and appointed a commission immediately to enquire into the affair, but the legend that he was personally responsible pursued him, and for years his platform appearances were always greeted with cries of "Featherstone."

In 1894, while still at the Home Office, Asquith married a second time, his bride being the brilliant Miss Margaret ("Margot") Tennant, one of the daughters of the wealthy iron-master, Sir Charles Tennant. She was a prominent member of the most exclusive society circle, and the marriage very definitely changed the current of Asquith's social life, and in some measure affected his political relationships. The period was one of great disruption within the Liberal Party. The feud between the Rosebery and Harcourt groups was at its height, and after the fall of the Liberal Government in 1895, the conflict with the Boer republics divided the party into two hostile camps, the Liberal Imperialists, led by Lord Rosebery, and the pro-Boers led by Campbell-Bannerman. Asquith, who had returned to the bar, associated himself with the Rosebery group, which endorsed the Chamberlain policy. In this he was influenced, no doubt, by his confidence in Sir Alfred Milner, who had been his friend from his Balliol days, and who had become the instrument of British policy in South Africa. When the Boer controversy culminated in war, it seemed that the quarrel between the Roseberyite and Campbell-Bannerman factions must result in permanent separation, and the formation of the Liberal League, of which Lord Rosebery was president and Asquith vice-president, apparently put reconciliation out of the question.

From this catastrophe the Liberal Party was saved by the raising of the Tariff Reform issue. On this subject Lord Rosebery spoke with an equivocal voice, but Asquith at once became the most formidable protagonist of Free Trade. The discussion of the subject became largely a duel between him and Chamberlain, and the series of speeches he delivered throughout the country were among the most conspicuous triumphs of his career. It restored him to the full confidence of the party, and when Campbell-Bannerman formed his Government at the end of 1905 his appointment as chancellor of the exchequer was a matter of course. The moderation of his temper, and the entirely public-spirited motives that always inspired him contributed to the return of harmony within the party, and his achievements as chancellor established his claim to the succession to the premiership. His record at the Treasury, culminating in his final budget, which inaugurated old age pensions, give him a place among the most illustrious chancellors in history. On the resignation of Campbell-Bannerman, through illness, in 1908, Asquith became prime minister by universal consent, with Lloyd George as chancellor of the exchequer. No prime minister since Pitt had been called upon to face such grave issues as those which confronted Asquith at the beginning and developed as his long term of office—the longest of any prime minister since Lord Liverpool—advanced. A new mood of revolt filled the labour world with unrest and menace, the long struggle for the enfranchisement of women had passed out of the academic phase into a phase of unprecedented and almost fantastic violence, the sky over Europe was visibly darkening with the naval activity of Germany, and over and above all two capital issues reached a crisis—the issue of the House of Lords and the issue of Ireland. It was the first of these two questions that first tested the stuff of which the new prime minister was made. The budget of 1909, which dealt with the taxation of land, was rejected by the House of Lords. Asquith appealed to the country against its rejection in Jan. 1910, and his Government was reinstated, though only with the support of Labour and the Irish members. He addressed himself forthwith to the question of the abolition of the veto of the House of Lords, and during the summer made efforts to reach a pacific solution of the question by compromise. But the conference with the Opposition leaders broke down, and in the following December he appealed once more to the country and was once more returned —this time with a majority over the opposition of 126.

The opening of the session of 1911 may be taken as the crowning moment in Asquith's public career. The issue of the constitutional struggle with the Lords was not yet decided, but it was

no longer in doubt. The decisive mandate which the country had given in December dictated the issue that immediately occupied the new parliament. A bill abolishing the veto of the House of Lords was introduced into the House of Commons and passed all its stages by the beginning of the summer. But the final struggle had yet to come. The battle had still to be won in the Lords and there the opposition were entrenched in overwhelming power. Ever since the emergence of the issue it had been evident that the attainment of Asquith's goal depended on whether he could in the last resort invoke the authority of the Crown to dilute the House of Lords with new peers sufficient to change its complexion. The question was answered on July 20. The Parliament Bill, then in the House of Lords undergoing its second reading, was so amended as to deprive it of any utility for the purpose for which it was framed. Asquith therefore addressed to Balfour, the leader of the Opposition, a letter stating that the Government had decided, if the bill in its essential form could be passed in no other way, the Crown would be advised to create a sufficient number of peers to ensure its passage, and that the Crown had signified its willingness to accept such advice. The publication of this letter aroused an unprecedented storm, and on July 24, on rising in the House of Commons to make a statement, Asquith was greeted with a demonstration without parallel in living memory. For the best part of an hour he stood speechless before the roar of anger that issued from the Opposition benches, and at last resumed his seat without having uttered a continuous sentence. What became known as "the pothouse brawl" inaugurated the last stage of the struggle. The Government was accused of "dragging in the King," and the Opposition organized an uncompromising resistance in the belief that they would not dare to carry their threat into execution. But on Aug. 10, when the final debate was taking place in the House of Lords, Lord Morley confirmed the Government's previous intimation of His Majesty's intention. Up to this point the "Die-Hards" seemed to be assured of a majority, but in the division they were defeated. The bill was passed. On Aug. 18 the Parliament Act received the Royal Assent.

From this victory Asquith proceeded to his next great task, with the ground sensibly cleared for action. Gladstone's successive Home Rule adventures had broken on the rock of the Lords' veto; that rock no longer obstructed the channel. But before the Irish issue was fully launched another controversy absorbed the prime minister's activities. Discontent had long been growing prevalent in the mining industry, and at the end of Feb. 1912, having failed to secure the concessions and advances they demanded, the miners' union declared a strike. Vast dislocation followed. From the outset the Government endeavoured to bring the conflicting parties to agreement and Asquith took on himself the personal charge of the negotiations. After a month's fruitless efforts, the Government thereupon introduced the Miners' Minimum Wage Bill, which, by providing a half-way solution, forced the hands of both sides and brought the immediate struggle to an end, although the issue incidentally raised—that of the reorganization and control of the coal industry—was to perplex parliament and the country for many years to come.

Meanwhile, the Home Rule Bill had been introduced and passed through the House of Commons, while the Parliament Act provided adequately against the resistance of the House of Lords. That House fought the delaying action, which was all the Opposition now had in its power, by rejecting the bill in two successive sessions. After its next passage through the Commons it would have overridden opposition and automatically become law. By this time, however, the opposition to the measure had taken an extra-parliamentary shape. The Ulster Covenant had been promulgated in the previous September and talk of open rebellion, should Home Rule be passed, was already current. In June arms had been discovered both at Belfast and Dublin. As the year wore on the outlook became still more serious and a speech by Bonar Law, the leader of the Conservative Party, at Blenheim, seemed to give encouragement to the idea of resistance by force. On Sept. 25 the Ulster Unionist Council appointed a Provisional Government and prominent Conservatives openly preached armed resistance; Sir Edward Carson, the leader of the Ulster Unionists, left no doubt that in the last resort Ulster would fight.

With the close of the session of 1913 there came a brief lull, and during the recess conversations with the Opposition leaders were opened by Asquith, who throughout preserved an attitude of patience and forbearance. It will always be matter for controversy whether, when the policy of violent resistance had been adopted, he was justified in ignoring so direct a challenge to constitutional government. His natural disposition was to allow the utmost scope for the play of discussion and the influence of the time element; but it is an open secret that he would have taken up the challenge but for the persuasions of John Redmond, the leader of the Irish Nationalists, who believed that the prosecution of the Ulster leaders would prejudice the prospects of friendly relations with Ulster when Home Rule was actually on the statute book. In any case, the conversations of the autumn were futile, and on March 9, 1914, the Government announced the provisions of their amending bill, their last word of compromise. The chief provision of this bill was that any county in the north of Ireland was to be allowed to vote itself out of the operation of Home Rule for a period of five years.

The offer was rejected by the Opposition and now events rushed forward to an apparently unavoidable catastrophe. On the night of April 24–25, 55,000 rifles were landed at Larne from a German port for the use of the Ulster army. On the other side of the border the Nationalists were beginning to enrol a volunteer army and to make counter-preparations. Meanwhile a more sinister menace appeared. In the debate on the vote of censure on the Government on March 19 Bonar Law, speaking on the Home Rule issue, had used the ominous phrase "soldiers are citizens like the rest of us." There had been much talk of disaffection in the army in regard to the coercion of Ulster, and on March 20 it took shape in the Curragh incident (*see* IRELAND; IRELAND, NORTHERN), which led to the resignation of Col. Seely, the secretary for war. For a moment it seemed that the loyalty of the army was imperilled and the situation that confronted the Government looked desperate. But the announcement by Asquith next day that he would assume the secretaryship for war created a profound impression in parliament and stopped for the time being, at all events, what had seemed like a riot in the army. Following the mutilation of the amending bill by the House of Lords and Sir Edward Carson's challenge to the Government to "give us a clean cut or come and fight us," the king, on Asquith's advice, summoned a conference at Buckingham Palace on July 20 to see if some agreement was still not possible. It broke down four days later and the last hope of avoiding violence seemed gone.

What Asquith would have done to avert a civil war while maintaining the authority of the Constitution was not to be revealed, for on the day that the Buckingham Palace Conference broke up Austria sent her ultimatum, and within ten days the British army was embarking, not for Ulster, but for Flanders. In the feverish struggle within the Cabinet that preceded the entry of Great Britain into the World War Asquith's position was never in doubt. He had throughout been a party to the ambiguous military understandings and conversations which had been in progress with France since before the fall of the Balfour Government in 1905, and when the war came he did not waver in his conviction that both the duty and the interest of the country lay in throwing the country's whole weight into the scales against what he considered to be the calculated design of the Central Powers to establish a military despotism over Europe.

The invasion of Belgium by Germany saved his Government from disruption, and he addressed himself, free from domestic disquietudes, to the heaviest task ever imposed on a British prime minister. For the moment even the Irish trouble subsided, all political differences were shelved and Asquith became the voice of a united nation in a measure unequalled in modern Parliamentary history. The speeches he delivered in the early days of the war have taken their place beside the classic orations of Pitt during the Napoleonic wars, and his constancy of mind and freedom from all personal ambition played a dominating part during the next two years in laying the foundations of the ultimate victory. It was not to be expected that in the presence of so vast a con-

vulsion discontents would not develop. They became clamant as the true character of the struggle emerged. Asquith had made no change in the political constitution of his cabinet at the outbreak of war, although he had taken the leaders of the Opposition into his confidence and private counsels, but by the spring of 1915 it became clear that this informal relation would have to yield to a formal coalition.

In February Bonar Law and Lord Lansdowne intimated that they could accept no responsibility for the way in which the war was being conducted, and in the popular press a powerful and ceaseless agitation arose, directed mainly against Asquith, Grey and Haldane, and inspired by the inevitable shortage of munitions which the progress of the war had revealed. Coincidentally, a violent disagreement as to the employment of the navy in the Gallipoli adventure had arisen between Churchill, the first lord of the Admiralty, and Fisher, the first sea lord, and on May 26 Asquith reformed his cabinet on a coalition basis, bringing in the leaders of the Opposition and excluding Haldane. To meet the growing need for munitions, a special Ministry of Munitions was set up with Lloyd George at its head.

The reconstruction of the Ministry did not allay dissatisfaction. Within the cabinet friction developed, and, outside, the press agitation grew in violence. There was a persistent leakage of cabinet secrets, certain newspapers betraying a knowledge of most confidential Government business with such regularity as to suggest inspiration. A phrase, "Wait and See," which Asquith had used in reply to a question in the House of Commons years before, became the daily gibe of the malcontent press, and Sir Edward Grey, then in the midst of the most delicate situation with the United States, was accused of "feeding Germany" because of his attitude on the subject of contraband from America. The war-weariness that had overtaken the country provided an atmosphere in which this propaganda of discontent flourished, and the prime minister was the easier target for attack because he neither "squared" the press nor hit back at his critics. The inevitable rupture came in the autumn of 1916, when the German raid into Rumania—now seen in its true proportions—served to drive home the attack, and when Asquith was severely stricken by the loss of his eldest son in the war.

It arose over a question of cabinet reorganization. For some time the formation of an inner cabinet had been under discussion. At the beginning of Dec. 1916 Lloyd George, who upon the death of Kitchener had become secretary for war and whose prestige with the press had long been in the ascendant, submitted a definite scheme for the formation of such a body. From this body the prime minister was to be excluded. His right to control policy was not challenged, but he would not direct the deliberations of the inner cabinet. The *coup* burst upon the country with the announcement of the popular newspapers that Lloyd George was "packing up" in sheer despair at the inefficient conduct of the war. His highly confidential challenge to the position of Asquith was under consideration when an article appeared in *The Times* (then owned by Northcliffe) giving full details of the supposed arrangements and suggesting that Asquith had already agreed. Lloyd George denied any knowledge of this article; but Asquith, after consulting with his friends, decided to reject the proposal. Upon this Lloyd George resigned, and his resignation being followed by that of other influential members of the cabinet—including some who hoped that their action would give the prime minister the opportunity of reforming his cabinet on a new basis—Asquith informed the King that he could no longer be responsible for carrying on the business of government; and within a few days the second Coalition Government was formed with Lloyd George as prime minister. (*See* ENGLISH HISTORY: *1901–28;* WORLD WAR.)

Thus ended Asquith's long and memorable tenure of the premiership. For the remainder of the war he occupied a seat in the front Opposition bench, speaking rarely and only on occasions when the interest of the nation seemed to demand his intervention. At the election of 1918, when Lloyd George swept the country with an appeal for the maintenance of the Coalition, he did not escape the general wreck of the Liberal Party, losing the seat of East Fife, which he had held throughout his parliamentary career. In 1920 he returned to the House of Commons as member for Paisley and resumed his position as head of the remnant of the succeeding parliaments. In 1924, after an election fought on the issue of protection, he, as the head of a pivotal majority, was responsible for the accession to power of the first Labour Government, and later in the year for the Government's overthrow on a question of alleged governmental interference with the prosecution of a communist. At the next election he was defeated and retired to the Lords as earl of Oxford and Asquith.

Other honours were conferred on him. He became a member of the judicial committee of the privy council, a knight of the garter and a fellow of the Royal Society. After he entered the House of Lords he rarely intervened in public discussion. But at the outbreak of the General Strike in 1926, he urged the paramount duty of concentrating on the struggle against the "coercion of a new dictatorship," though he blamed the Government for not taking steps during the preceding nine months to make constructive proposals for the coal industry. Some recrimination followed, and there was a split in the Liberal Party (*q.v.*). He still retained the leadership of the Liberal Party, to which Lloyd George had now returned. But on the outbreak of the General Strike in 1926 a sharp difference appeared in the attitude of Lord Oxford and Lloyd George towards the event, and the latter declined to consult his colleagues. Lord Oxford thereupon formally intimated that he could have no political relations with him, and as the result of the consequent breach Oxford retired from any active part in the affairs of the party which he had led for 18 years. In his retirement he devoted himself to writing a book of reminiscences and reflections, under the title of *Fifty Years of Parliament,* and in the autumn of 1927 he also published a volume of his speeches. Thereafter his health gave way and he died on Feb. 15, 1928, being buried, according to his wish, in the churchyard of All Saints church, Sutton Courtney, Oxfordshire, where he had long had a country home.

Asquith will take his place among the most illustrious of British prime ministers, not merely by virtue of the momentous events in which he played a part, but still more because of his remarkable parliamentary gifts. In this respect he was in the true succession to Gladstone. He had little of the Sinaitic fervour of that great man, but he was not inferior to him in his mastery of the House of Commons. That mastery was achieved, not by emotional passion, but by the force, direction and lucidity of his speech, the intellectual sovereignty that he exercised over his audience, and the qualities of a plain, unaffected character and a singularly dispassionate mind. No man who ever played a great part in affairs was more conspicuously free from the common vices of public life. If he was ambitious it was only the ambition of conscious power directed to public ends. He was the least egotistic of men, and his magnanimity almost bordered on weakness. He was so little of a demagogue that he seemed to avoid rather than invite popular applause, a character to which a certain temperamental shyness contributed. His loyalty to his colleagues, even when they were lacking in loyalty to him, was one of his most striking attributes, and he was so indifferent to his own interests that he not only allowed the praise that belonged to himself to be appropriated by others, but often assumed the burden of mistakes which others had committed. He was the antithesis of that 18th century statesman of whom it was said that if there was credit to be got no one was so skilful in wriggling in, and if there was discredit to be borne no one was so skilful in wriggling out. He bore the odious slanders and insults of a demented press during the war with a certain proud and indifferent scorn, and his bearing both in private and public after the consummation of the intrigues against him was a model of dignity and public spirit. He was never betrayed into violent speech, and if his passion were roused, it was roused, not by personal issues, but by the outrages against public law and the sanctity of constitutionalism. He shared with the younger Pitt the view that the greatest quality in statesmanship was patience, and in all the perplexities with which he had to deal he exercised that quality to the utmost. He would never force a situation while there was a hope that a reasonable and pacific solution could be found. This confidence in the beneficent

operation of rational processes led many to suspect him of weakness, and it is undoubtedly true that there was in him an indisposition to anticipate events or to indulge in the histrionics of statesmanship. But on vital issues he was adamant, and his judgment on all great matters was never vitiated by the smaller considerations of personal and irrelevant motives. His mind moved in the undistracted orbit of a deeply considered philosophy of government, and it may be said of him, as of another, that if he was sometimes on the wrong side, he was never on the side of wrong. He will live in history not only as one of the most illustrious of British premiers but as a type of all that is best in the English character.

The general affection and regard in which Oxford was held was shown by the gift, in 1927, from 17 of his friends and admirers, including some Conservatives, of a capital sum and an income for life. By his first marriage he had four sons and one daughter. Raymond Asquith, his brilliant eldest son, was killed in action in 1916. By his second marriage he left a son, Anthony, and a daughter, Elizabeth, Princess Bibesco. He was succeeded in the earldom by his grandson, Julian, only son of Raymond Asquith.

(A. G. GA.)

*See* his *Occasional Addresses, 1894–1916* (1918); *The Genesis of the War* (1923); *Fifty Years of Parliament* (1926); *Speeches* (1927), and his *Memories and Reflections, 1852–1927,* published posthumously (1928). *See* also Lady Oxford, *The Autobiography of Margot Asquith* (1922), and the many memoirs of contemporary statesmen.

**OXFORD AND ASQUITH,** MARGOT, COUNTESS OF (1864–1945), the sixth daughter of Sir Charles Tennant, 1st Bart., married, in 1894, as his second wife, H. H. Asquith, later the Earl of Oxford and Asquith (*q.v.*). Before her marriage she was well known as a member of the coterie known as the "Souls," and maintained her reputation as one of the wittiest and most brilliant women in London society. In 1922 she published *The Autobiography of Margot Asquith* (2 vol.), which reflected the natural frankness of her character. It is a valuable chronicle of the time. She died in London on July 28, 1945.

Her other works include *Places and Persons* (1925), *Lay Sermons* (1927) and a novel *Octavia* (1928).

**OXFORDSHIRE** or OXON, a southern midland county of England, bounded northeast by Northamptonshire, northwest by Warwickshire, west by Gloucestershire, south-southwest and southeast by Berkshire and east by Buckinghamshire. It was originally part of the Mercian kingdom; but its boundaries, except for the Thames on the south (71 mi. from Kelmscot near Lechlade, Gloucestershire, to Remenham below Henley-on-Thames, with the exception of two points near Oxford), are artificial. They were slightly changed by act of William IV and Victoria and by the Reading extension order of 1911 and enclose an area of 748.8 sq.mi.

The 14 Oxfordshire hundreds include five of the Chiltern hundreds, the jurisdiction over which belonged to the manor of Benson and in 1199 to Robert de Harecourt.

**Structure and Topography.**—The county lies across the central portion of the Jurassic and Cretaceous outcrops. The strike of the strata is in each case from north-east to south-west, for Tertiary movements have tilted them gently down to the south-east so that the transition from north-west to south-east is from older to newer rocks passing in succession from the Lias over the Lower, Middle and Upper Oolite to the Lower Greensand, Gault, Upper Greensand and Chalk. In the north-west, the Marlstone of the Middle Lias and the Limestones of the Oolitic series are permeable and relatively resistant, and the Marlstones and the Inferior Oolite rocks being specially hard, stand out as a sharp north-west edge, continuing the line of the Cotswolds at a lower level (average 500 ft.), but rising to 700 ft. in Edge Hill in the north-east of the county. In the south-east, the chalk is also permeable and resistant, and the hard chalk-with-flints crowning the Chilterns also presents a sharp edge to the north-west.

Between these two upland regions the intermediate geological series forms a broad vale (20 m.) of alternating clays and calcareous, sandy beds. The Upper Greensand forms a low feature at the foot of the chalk hills; this is succeeded by the Gault, with width of outcrop varying from 4 m. to 1½ m. between Dorchester and Sydenham. The lower Greensand appears from beneath the Gault at Culham and Nuneham Courtney and in outliers north of Cuddesdon; Portland limestone, Portland sands and Purbeck beds lie between it and the Kimmeridge clays, which outcrop between Sandford and Waterperry. Coral Rag is traceable from Sandford to Wheatley and beyond this comes a broad outcrop of Oxford clay followed by the Cornbrash (a brownish rubbly limestone). This outcrops at Norton Bridge, Woodstock and Shipton, forms a broad plateau between Middleton Stoney and Bicester, and also occurs as inliers at Islip, Charlton, Merton and Black Horse Hill. The county lies almost wholly in the basin of the upper Thames, in which the significant drainage is that of the Cherwell-Thames. The drainage pattern as a whole, consists of numerous consequent streams from the scarplands (Evenlode, Windrush, etc.), which have been captured and diverted into the Cherwell-Thames by powerful subsequent streams (Ock, Upper Thames, Ray, Thame), working along lines of weakness in the strike of the rocks, obsequent streams flowing down the scarp edge often being a further result of the capturing.

The Cherwell occupies a broad sag between Edge Hill and the Northampton Uplands. It flows south-south-east, joins the Thames coming from the west at Oxford, after which the combined stream continues the south-south-east direction, passing by a deep gorge through the chalk between Wallingford and Reading. That the gap must have originated north-west of its present position is argued from the fact that the level of the river bed at this point is 100 ft. while that of the hills on either side is 700–800 feet. It is an old, but rejuvenated drainage system, which, working upon calcareous rocks, has given rise to a characteristic topography; streams graded to base level but with very steep-sided upper valleys and wide intervening spaces between the head streams that have no surface streams; broad main valleys from which streams have disappeared, or where drainage is beneath the surface; misfit streams, due to capture by the river Severn of an earlier drainage to the Thames from the Welsh plateau, or to carving out of valleys by flood waters following the retreat of the ice. There is little glacial drift except in the north-east of the county. Gravel deposits, both plateau (North Leigh, Combe, Tiddington, etc.) and flood plain (Bampton, Oxford, Dorchester, etc.), are very important; tracts of clay-with-flints, brick-earth and gravel, as well as outliers of the London clay (Nettlebed, Caversham, etc.) occur on the dip slope of the chalk.

**History and Early Settlement.**—The bare Lias and Oolite uplands and the flood plain gravels were sites of late Neolithic settlement, as witness numerous Long Barrows (characteristic of the Cotswold area) as far east as the Cherwell. The Rollright stones (probably Neolithic) on the Oolite scarp need special mention. Quantities of bones of cattle, pigs, sheep, etc., are found in the gravels, and pottery (characteristic of the Wash area) is distributed east of the Cherwell-Thames line. Settlement on the dip slope of the Chilterns was debarred by forests, as also in the forested north-eastern portion of the county, but the Icknield Way, generally on the Greensand, and the Ridgeway, on the Chalk above, followed the scarp face to the Thames crossing, forming parallel routes to a trackway along the limestone uplands. An influx of the people who made Beaker pottery is indicated for the region between the Evenlode and the Windrush and on the valley gravels (Eynsham, Stanlake, Brighthampton, Oxford, Burcot, Dorchester, etc.). In the Iron Age camps were established along the same routes (*e.g.*, Chastleton, Tadmarton). During the Roman period the area was thickly populated and roads were made linking Alchester and Dorchester in the Cherwell-Thames with Towcester (Northamptonshire) to the north and Silchester (Hampshire) to the south. Alchester was also connected by Akeman Street with Verulamium (Hertfordshire) to the east and Cirencester (Gloucestershire) to the west. The Saxon settlements are noticeably on valley sites, occupied in pre-Roman times, and these have continued as nucleated settlements to the present day; isolated farms are noticeably on plateau or vale from which forest was cleared comparatively late. In the 6th century the West Saxons took Benson and Eynsham. (*See* the *Saxon Chronicle* for 571.)

In the 7th century the Mercians held all the northern border of

the Thames, and during the 8th century this district fell to Wessex after the battle of Burford, and to Mercia after a battle at Benson, when it was included in the diocese of Lincoln. The bishopric at Dorchester given to Birinus (the apostle of Wessex), 634, seems to have come to an end on the establishment of the see of Winchester. Before the Mercian conquest in 777 Oxfordshire was in the diocese of Sherborne. In 873 the jurisdiction of Dorchester reached to the Humber, and when the Danes were converted it extended over Leicestershire and Lincolnshire, Oxfordshire forming about an eighth of the diocese. In 1092 the seat was transferred to Lincoln. In 1542 a bishopric of Osney and Thame was established, taking its title from Oxford, the last abbot of Osney being appointed to it. In 1546 the existing bishopric of Oxford was established. The ecclesiastical boundaries remain as they were when archdeacons were first appointed—the county and archdeaconry being conterminous. The county, excepting the parish of Taynton in Chelmsford diocese, is in the diocese of Oxford.

The Danes overran the county during the 11th century; Thurkell's army burnt Oxford in 1010, and the combined armies of Sweyn and Olaf crossed Watling Street and ravaged the district, Oxford and Winchester submitting to them. At Oxford, in 1018, Danes and Englishmen chose Eadgar's law. Here also Harold allowed Tostig to be outlawed and Morkere to be chosen earl in his place, thus preparing the way for his own downfall and for the Norman Conquest. The destruction of houses in Oxford recorded in the Domesday Survey may possibly be accounted for by the ravages of the rebel army of Eadwine and Morkere on this occasion. Large possessions in the county fell to the Conqueror, and to Odo, bishop of Winchester. The bishop of Lincoln and many religious houses (*e.g.*, Abingdon, Osney and Godstow) held much land in the county. Robert D'Oiloi, heir of Wigod of Wallingford, held many manors and houses in Oxford, of which town he was governor. The importance of Oxford was already well established; the shire moot there is mentioned in Canute's Oxford laws, and it was the seat of the county court from the first, the castle being the county gaol. For events between this period and the Civil War *see* OXFORD (city). The dissolution of the monasteries, though it affected the county greatly, caused no general disturbance.

When King Charles I. won the battle of Edgehill (Oct. 23, 1642), Oxford at once became the stronghold of the royalist cause. For the campaign of 1643 its rôle was to detain the main parliamentary army until the royalists from the north and the west could come up, after which the united forces were to close upon London. More than once, notably at Chalgrove Field (June 18, 1643), Prince Rupert's cavalry struck hard and successfully. In the campaign of Newbury skirmishes took place as the parliamentary troops under Essex passed through north Oxfordshire on their way to the relief of Gloucester, and at the close of the campaign the fortresses of the county offered the defeated royalists a refuge which Essex was powerless to disturb. In the following campaign Charles abandoned the idea of an envelopment and decided to use Oxfordshire as the stronghold from which to strike in all directions. Material wants made it impossible for Charles to maintain permanently his central position, and eventually Essex headed for the south-west, leaving Waller to face the king alone. The battle of Cropredy Bridge followed (Jan. 29), and the victorious king turned south to pursue and capture Essex at Lostwithiel in Cornwall. In the operations of 1644 Oxfordshire again served as a refuge and base (Newbury and Donnington).

On the appearance of Cromwell and the New Model army a fresh interest arose. Leaving Windsor (April 20, 1645), the future Protector carried out a daring cavalry raid. He caught the royalists unawares at Islip, pursued the fugitives to Bletchington and forced the governor to surrender. He swept round Oxford, fought again at Bampton, and rejoined Fairfax, in Berkshire. A few days later Charles again marched northwards, while Fairfax was ordered to besiege Oxford. Charles was compelled to turn back to relieve the city, and the consequent delay led to the campaign and disaster of Naseby. Yet even after Naseby Oxfordshire still retained its importance, but in 1646 the Roundheads closed in from all sides and Stow-on-the-Wold witnessed the final battle of the war. On May 9 Banbury surrendered, on June 24 Oxford capitulated, and three days later Wallingford, the last place to give in, followed its example.

**Architecture.**—The limestone of the Oolite series has provided beautiful material for both ecclesiastical and domestic architecture, the castles, of which there are few, were probably built for temporary defence in the civil strife of Stephen's reign (1100–1135). Considerable portions of the Norman Oxford castle survive, and slighter remains of the castle at Bampton, the seat of Aylmer de Valence in 1313. Among remains of former mansions Greys Court near Henley-on-Thames (14th century), Minster Lovell, on the Windrush above Witney, and Rycote, between Thame and Oxford may be noted. Minster Lovell was the seat of Francis, Lord Lovel, the son of a Lancastrian who incurred the hatred of that party by serving Richard III.; he afterwards aided Lambert Simnel, and mysteriously disappeared after the battle of Stoke.

Rycote is of fine Elizabethan brick and in the chapel attached to the manor there is remarkable Jacobean woodwork, the entire fittings being of this period. Here Elizabeth resided both before and after her accession. Broughton castle near Banbury (14th century), Shirburn Castle (mainly 15th century Perpendicular) and Stanton Harcourt (1450, with a gatehouse of 1540, a vast kitchen and Pope's Tower) are ancient mansions still inhabited. Mapledurham, on the Thames above Reading, is a fine Tudor mansion of brick; and Water Eaton on the Cherwell, is a singularly perfect Jacobean house of stone.

A large number of monastic foundations arose in the neighbourhood of the university; Augustinian at Bicester, Caversham, Cold Norton, Dorchester, Osney (a magnificent foundation just outside the walls of Oxford) and Wroxton; Cistercian at Bruern and Thame; Benedictine at Cogges, Eynsham, Milton; Mathurin at Nuffield; Gilbertine at Clattercote; Templar at Sandford-on-Thames.

Gosford possessed one of the only two preceptories of female Templars in England. Of all these, excepting the abbey church at Dorchester, remains are scanty. The boundary walls still stand of Godstow nunnery on the Thames, the retreat and burial place of Rosamund Clifford, or "Fair Rosamond," the object of Henry II's famous courtship.

In ecclesiastical architecture Oxfordshire, apart from Oxford itself, is remarkably rich, but nearly all the churches are of mixed dates. Iffley, Adderbury and Minster Lovell are types of a single style. Iffley, 1 mi. S. of Oxford, is one of the finest examples of pure Romanesque in England, with a highly ornate west front. Adderbury, 4 mi. S. of Banbury, is a great cruciform Decorated church with a massive central tower and spire. Minster Lovell, also cruciform, is pure Perpendicular; its central tower is supported on four detached piers.

The short, ungainly spire of Oxford cathedral was among the earliest, if not the first, constructed in England and served as a model from which were probably developed the splendid central spires of the great churches at Witney, Bampton, Shipton-under-Wychwood and Bradwell. There are also fine spires at Bloxham, Adderbury and King's Sutton (in Northants).

Bloxham church, mainly Decorated, with Romanesque portions and a remarkable Early English west front is one of the largest and most beautiful in the county. In the west, Burford (Romanesque and later) is noteworthy, and in the porch of the fine Romanesque church of Langford is a crucifix with the figure cloaked. At South Leigh, Beckley and Swinbrook are remarkable mediaeval mural paintings, while at Caversfield there is what is probably the oldest church bell in England—cast before 1219. About 5 mi. north of Oxford there are Kidlington (Decorated), with a beautiful needle-like Perpendicular spire, and Islip, as the birthplace of Edward the Confessor. Ewelme church (Perpendicular) is remarkable for the tomb of Alice, Duchess of Suffolk (1475), gorgeous with tracery and gilded canopy, and that of Sir Thomas Chaucer (1434), with enamelled coats of arms.

Here William de la Pole, Duke of Suffolk, founded in 1436 the picturesque hospital and free school still standing.

**Climate and Agriculture.**—The climate, healthy and dry,

except in the low ground bordering the Thames, is colder than the other southern districts in England, especially in the exposed regions of the Chilterns. The county is essentially rural. The surface soils lie in belts, corresponding to the underlying rocks, the heavy clays giving rise to grasslands and the calcareous, sandy soils to arable. Many villages occur where springs issue at the junction of permeable and impermeable strata, thus securing flood-plain pasture for cattle, upland pasture for sheep and upland patches of lighter soil, with a sandy aspect, which could be worked by primitive communities often with a two-field rotation. Wool was early a source of wealth and was famous in the 12th and 13th centuries. Salt is mentioned in Domesday as a product of the county; glass was made at Benson and Stokenchurch in the reign of Henry VI and other subsidiary products were plush at Banbury, leather at Bampton and Burford, gloves at Woodstock and malt at Henley. In the early 14th century, Oxford was the second most prosperous county in England, but the Black Death (1349) and decreasing arable land, the enclosures of the 16th century and the wars of the 17th brought depression and discontent, and on the enclosure of Otmoor (1830) serious riots broke out.

A high proportion of the county (about 81% in 1939) is under cultivation. Stock are raised on the clay lowlands, and dairying (Shorthorns, Alderneys and Devonshire cows) is important. The Cornbrash is specially good for grain growing, but crops of wheat, oats and barley have declined (75,225 ac. in 1939 compared with 91,049 ac. in 1926).

Sheep (Southdowns, Leicesters and Cotswolds) are still reared in large numbers on the uplands and are folded on the root crops (turnips, swedes, mangolds), which are important. The cultivation of sugar beet, which was flourishing in 1926 (1,196 ac.), later showed a serious decline but by 1939 had risen again to 859 ac.

Many pigs are reared and poultry do well on gravel sites. The county has few mineral resources; iron is obtained at various places; Oolitic limestone is quarried for cement, stone slates and, though less than formerly, for building stone. The clays are used for brickmaking and have been largely utilized for the building of the new town which has arisen around the motor industry at Cowley southeast of Oxford. The National Trust owned 380 ac. in the county in 1942.

**Manufactures.**—These are mainly those dependent on agriculture. Blankets are manufactured at Witney and tweeds at Chipping Norton. There are paper mills at Shiplake, Sandford-on-Thames, Wolvercot and Eynsham, using the pure water of the streams.

Agricultural implements and portable engines are made at Banbury, where there is also plush, shag and girth weaving. Gloves and polished steel are industries at Woodstock. Lace is made by country women. Banbury has been long celebrated for the manufacture of a peculiar cake.

**Communications.**—Many of the roads are ancient routes on the plateau or following the strike of the rocks, but the main railways are markedly transverse, linking London with the industrial northwest. The county is served entirely by the G.W. railway (except for a branch of the L.M.S. railway from Bletchley to Banbury and to Oxford). One main line from London passes through the Reading gap to Oxford, and here bifurcating, sends one line north along the Cherwell valley to Banbury and another across the northwest of the county, via the Evenlode valley, to link up with the Severn valley, Worcester and Birmingham; Kingham on the borders of Gloucestershire being a junction for a line west to Cheltenham (Glouc.) and a line northeast to King's Sutton (Northants). There are numerous branch lines.

**Population and Administration.**—The area of the administrative county, excluding the city and county borough of Oxford, is 736 sq.mi. with a population (est. 1938) of 135,200. Being an agricultural county and not far from London it was very suitable as a reception area for wartime evacuees, whose immigration between Sept. 1939 and Feb. 1941 raised the population by 21%. The municipal boroughs are Banbury, Chipping Norton, Henley-on-Thames, Oxford, a city and the county town, and Woodstock. The county is in the Oxford circuit and assizes are held at Oxford. It has one court of quarter sessions and is divided into 11 petty sessional divisions.

The borough of Banbury and the city of Oxford have separate courts of quarter sessions and commissions of the peace, and the borough of Henley-on-Thames has a separate commission of the peace. The total number of civil parishes is 233. The ancient county (which in 1289 sent two members to parliament) was divided in 1918 into two parliamentary divisions, Banbury and Henley, each returning one member.

It also includes part of the parliamentary borough of Oxford, returning one member, in addition to which the university of Oxford returns two members.

BIBLIOGRAPHY.—*The Natural History of Oxfordshire* (Oxford, 1677, 2nd ed. 1705); Shelton, *Engraved Illustrations of the principal Antiquities of Oxfordshire, from drawings by T. Mackenzie* (Oxford, 1823); Sir T. Phillips, *Oxfordshire Pedigrees* (Evesham, 1825); J. M. Davenport, *Lords Lieutenant and High Sheriffs of Oxford 1086* (Oxford, 1868), and *Oxfordshire Annals* (Oxford, 1869); J. Phillips, *The Geology of Oxford and the Valley of the Thames* (1871); *Victoria County History, vol. i. and ii.* (1907); H. A. Evans, *Highways and Byways in Oxford and the Cotswolds* (1923); J. J. Walker, *The Natural History of the Oxford District* (1926).

**OXFORD UNIVERSITY.** The stories connecting Oxford university with Brute the Trojan, with king Mempeic (1009 B.C.) and with the Druids, cannot be traced back beyond the 14th century. The town, in fact, is considerably older than the university. (*See* OXFORD.) Authentic history appears to begin in 1133 with the arrival from Paris of the theologian, Robert Pullen, who lectured here. There is, however, little evidence that Oxford was regarded as a fully equipped university before 1163—allusions to its being a *studium generale* (*see* UNIVERSITIES) only occur after that date and these by some authorities are held to be inconclusive. Subsequent progress must, however, have been rapid as, about 100 years later, the deputies of Oxford, in an appeal to the king, described the university as *Schola secunda ecclesiae* or second to Paris. The coming of the religious communities, the Dominicans, Franciscans and Carmelites in the 13th century and the Benedictines a little later on, profoundly affected the advancement of learning. The names of Roger Bacon, Duns Scotus and Wycliffe, are sufficient to indicate the prominence of Oxford in the middle ages. The earliest colleges to be founded were University college (1249, the mythical foundation by Alfred in 872 is no longer accepted), Balliol (about 1263), Merton (1264). The last-named was established with a view to provide a collegiate discipline for the secular clergy, and its statutes served as a model for subsequent creations, not only at Oxford but at Cambridge. For the others *see* the list on pp. 994 and 995.

From the 13th century onward a succession of charters from the crown strengthened the position of the university at the expense of the town. At the Renaissance the new learning found its leading exponents in Erasmus, who lectured there, and in such famous scholars as Grocyn, Dean Colet and Sir Thomas More. The old scholasticism received its death-blow from the royal injunctions of 1535. Oxford, as well as Cambridge, suffered from numerous confiscations of land and revenues during the Reformation period. In 1571 the act of Elizabeth incorporated and reorganized the two universities. The statutes of the university were codified in 1636 by the chancellor, Archbishop Laud. With certain modifications, they formed the official code of the university till 1858. During the civil war the university sided with the king, while the town sympathized with the parliament, but no open breach between the two occurred. Under Cromwell, who acted as chancellor from 1651–57, a strong effort was made to restore the standards in work and discipline which had suffered from the civil wars. During the reign of James II, the university acquired great popularity by its successful resistance to James's effort to throw open the university to Catholics, even to the extent of imposing his own Catholic nominee on the fellows of Magdalen. The university, however, soon returned to its Jacobite allegiance, and at the coming of the Georges was definitely anti-Hanoverian, a phase, however, that came to an end after the visit of George III in 1785. In the latter half of the 18th century the influence of the Wesleys on Oxford was far less than on the country at large; on the other hand the Tractarian movement (*see* NEWMAN), at

the beginning of the 19th century had a most profound effect on the Church of England, which is still potent to-day. There was a general rise in the level of studies towards the end of the 18th century, as written examinations gradually supplemented the old oral examinations, often merely formal, and henceforth the range of studies themselves extended. By the reform of 1858 the professoriate was increased, reorganized and re-endowed, and dissenters were admitted to entrance to the B.A.—the M.A. being thrown open in 1871.

The reforms of 1877 directed a certain proportion of the college revenues to the use of the university—especially for the encouragement of natural science, and improved the position of professors and lecturers, thus leading to the growth of a regular resident professoriate. Schools and degrees alike multiplied (*see* UNIVERSITIES) and the history of the university was one of general progress and expansion. None the less there was a widespread feeling that a certain amount of reform was advisable if the university was to keep step with the times. In 1909 Lord Curzon, the then chancellor of the university, issued his *Principles and Methods of University Reform.* Committees of council were formed to prepare definite schemes. Several reforms were proposed, notably the abolition of compulsory Greek, the reform of the Hebdomadal Council (*see* below), a remodelling of the boards of faculties, and a revision of the financial relation between the university and the colleges. Most of these have since (*see* below) been realized in one way or another.

The two most important facts in the history of the university since 1911 have been the World War and the two commissions. In the war 14,561 Oxford men served in the British forces, and 2,660 lost their lives. Again, thanks to the O.T.C., nearly 2,000 Oxford men received commissions in the first two months of the war, while for the last three years of the war, there always were nearly 2,000 cadets in Oxford. The examination schools and those colleges which were not given up to cadets became hospitals. The number of undergraduates fell to 1,087 in Jan. 1915, and 550, 460 and 369 in the same months in 1916, 1917 and 1918 respectively. The tide began to turn in the latter part of 1918; in Jan. 1919 there were 1,357 men in residence; and in the following 18 months the entries were so heavy that by Oct. 1920 there were about 4,500 men and 650 women actually in residence. Since that time, all the men's colleges have striven to reduce their numbers; so that the figures for undergraduates were, in 1928, about 3,500 men and 750 women. Women, in 1920, were admitted as full members of the university, but a statute was passed in 1927 limiting their number to one-fourth that of men.

**New Statutes.**—The royal commission, set up in 1919, reported in 1922. Its recommendations were embodied in statutes by a second commission (set up 1923) which came into force in 1926. It was satisfactory to Oxford men to find that a body appointed by a reforming Government, and composed of men of all political parties, reported so favourably on the work of the universities as a whole; so far from being pronounced to be homes of idleness, the main complaint made against most of the teachers was that they worked too hard. (See *Report,* pp. 26, 39, 48.) To remedy this, and to allow for the extension of university activities, the royal commission recommended a grant to Oxford and to Cambridge of £110,000 a year each; only £60,000 was given at first, but in the spring of 1925 this was increased to £85,000.

The aim of the commissions especially was to encourage research work. The growth of this was already a marked feature in Oxford. To encourage it, the degrees of Bachelor of Letters and Bachelor of Science were set up in 1895, the Doctorate of Philosophy in 1917; the regulations for the B.Litt. have now been (1927–28) remodelled in the light of experience. In the examination, too, for the honours degree in natural science, students of chemistry can only obtain a class if they spend a year on a piece of research. Probably the most important proposal in the new statutes is the setting apart, out of the Government grant, of an annual sum of £10,000 to assist college lecturers, who will be appointed by the boards of the faculties to be also "university lecturers," carrying out some special work.

Apart from this grant, the most important changes have been: (1) The full enjoyment of college scholarships will be limited to those in need of financial help; the election, however, will be made by colleges as before, and entirely on intellectual grounds. (2) All professors are made ex officio fellows and members of the governing bodies of colleges. But these changes only make statutory and universal what was already done in most colleges. (3) A retiring age is fixed for all posts, whether college or university. A pension scheme has also been instituted. (4) The machinery of university government has been changed. The Hebdomadal Council is now made representative of the whole university, not of separate orders of members, and congregation is to consist entirely of those doing university work, whether teaching or administrative. These changes again had been largely anticipated by university action since 1900. (5) The power of convocation to override congregation is practically abolished. This change is more important in theory than in practice; the one subject on which convocation had interfered decisively—the refusal to open theological degrees to members of all denominations—had been settled by agreement in 1920. (6) The general board of faculties, set up in Lord Curzon's reform of 1913, has been made more representative of the whole university, and given fuller power over its studies. The financial machinery of Oxford had been already remodelled by statutes passed in 1912 and 1920.

On the whole it may be said that the essential principle of Oxford life, the independence of colleges, has been maintained. The university can advise as to college elections and appointments, and make general rules, but colleges retain their full powers of election and administration.

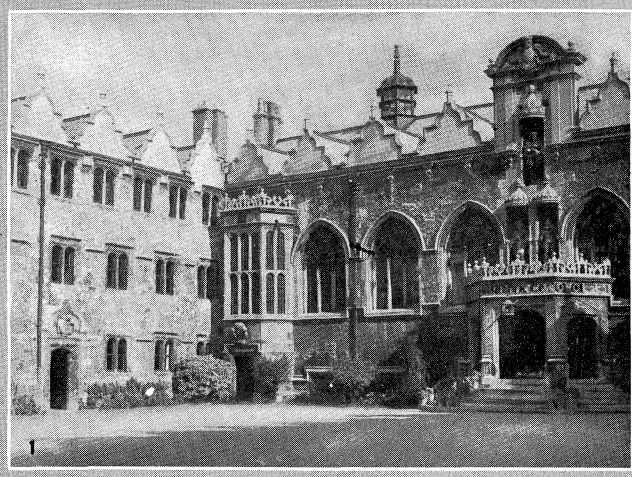
**Benefactions.**—Natural science has been the chief gainer from recent benefactions, with new laboratories for engineering (1912), for chemistry (thanks mainly to Dyson Perrins) in 1915, for pathology from the Dunn trustees and for biochemistry from Mr. Whitley and the Rockefeller foundation (opened in 1926 and 1927 respectively). The Welch bequest (1915) has added another £50,000 to the resources of biological science, and the Government, by placing at Oxford the institutes of Agricultural Engineering (1923) and of Imperial Forestry (1924), has shown its confidence in the oldest university as the fittest place to provide for the newest needs of the empire.

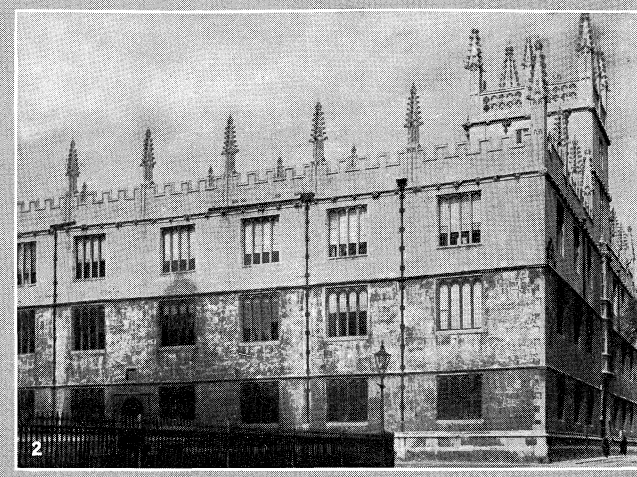
Next to the development of natural science, the most marked feature of the last 20 years has been the growth of modern language teaching. Professorships of French, Italian and Spanish have been founded by Sir B. Zaharoff, A. Serena and W. R. Morris respectively; Sir Heath Harrison has provided scholarships for undergraduate travel (1919), and Mr. Laming has founded travelling fellowships in connection with his old college, Queen's (1924). Closely allied with this development is the increasing number of fellowships for study in the universities of the United States (*e.g.,* the Commonwealth and the Davison fellowships), which are being founded by Americans as a counterpart to the work of Cecil Rhodes. His trustees are building, on part of what had been the garden of Wadham, a great building, designed by Sir H. Baker, to be a centre of the advanced studies, on the humanistic side, of students from the whole English-speaking world.

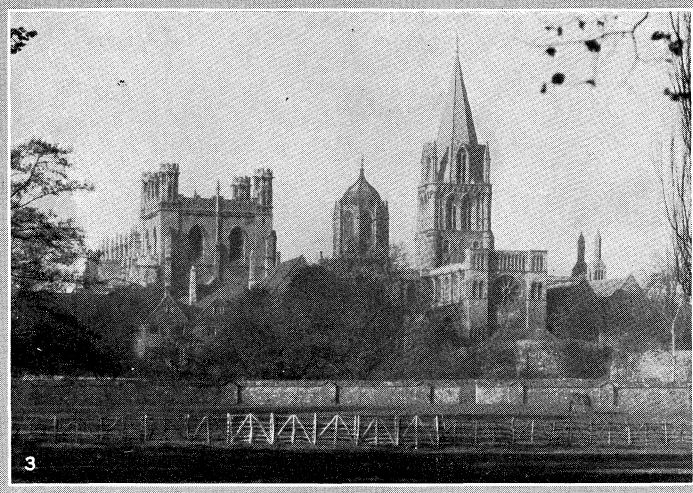
The Bodleian continues to receive gifts, not only of books and pictures as in Lord Curzon's Napoleonic collection (1925), but also in cash, as Walter Morrison's £50,000 in 1920, but its accommodation is becoming seriously inadequate, and during the next decade either great extensions must be carried out, or the policy of the library seriously changed. In any case, very large benefactions will be required. The same must be said of the Oxford Preservation Trust, founded 1927, to preserve the beauties of Oxford, both in the city itself and also in its surroundings. Mention should also be made of Barnett house, founded in 1914 in memory of Rev. S. A. Barnett, for the promotion of social and economic studies.

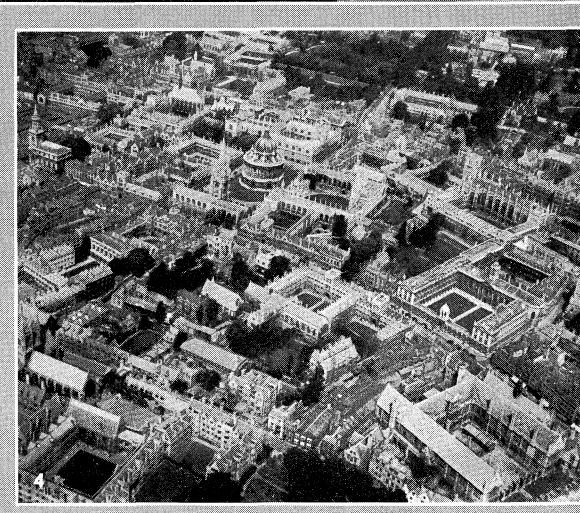
**List of Colleges and Halls.**—In addition to the three colleges mentioned above, University, Balliol and Merton, the other colleges in their order of foundation are: Exeter (originally called Stapelton Hall, 1314), Oriel (1326), Queen's (1340, named after the well-known Queen Philippa), New college (creation of William of Wykeham, 1379), Lincoln (1427), All Souls (1437), Mag-

# OXFORD UNIVERSITY









PHOTOGRAPHS, (1, 2, 5) HERBERT FELTON, (3) UNDERWOOD PRESS SERVICE, (4) TOPICAL PRESS AGENCY, (6) BRITISH-COMBINE

## SOME VIEWS OF OXFORD

1. Oriel college, showing a corner of the quadrangle. 2. Bodleian library extending over upper story of "Old Schools building." 3. Christchurch from Merton fields. "Tom Tower" built by Wren in centre, cathedral spire to right, hall and belfry to left. 4. General view of Oxford from the air. University church (spire), Radcliffe library (dome) and Bodleian library surrounded by college quadrangles. 5. Corner of quadrangle of Corpus Christi college, showing entrance and sundial. 6. Magdalen college and bridge

dalen (1458), Brasenose (1509), Corpus Christi (1516), Christ Church (begun by Wolsey in 1525, final foundation by Henry VIII., 1546), St. John's (1555), Trinity (1555), Jesus (founded by Queen Elizabeth, 1571), Wadham (1612, charter received 1610), Pembroke (1624), Worcester (1714), Keble (created as memorial to John Keble, 1870), Hertford (after many vicissitudes, 1874). For further details *see* OXFORD. Of the various academical halls, St. Edmunds (reputed foundation, 1226) is the only one that now survives.

Non-collegiate students were first admitted in 1863. They are known as members of St. Catherine's college. There are four women's colleges, founded—Somerville (1879), Lady Margaret Hall (1879), St. Hugh's Hall (1886) and St. Hilda's (1893); a certain number of women are also admitted to the university as "home students." Among the independent foundations mainly intended for teaching theology are Pusey House (1884) and Wycliffe Hall (1878), both Church of England, and Mansfield college (1886) and Manchester college (1893, Nonconformist).

**Other Academic Buildings of Note.**—Oxford also possesses an unusual number of fine academic buildings—to quote only the names of some of the principal ones—they are described at length in the article on OXFORD; first, the notable group of buildings comprising the Bodleian library, the University school, the Convocation house with the Sheldonian theatre and the original Ashmolean museum, and the Ratcliffe library not far away. "The university church" of St. Mary lies just to the south of the latter. Another massive pile of buildings is devoted to the Taylor institute, the University galleries and the present Ashmolean museum. Other important buildings are the University museum, the Pitt-Rivers Ethnographical museum, the University observatory, and the famous Clarendon press. Mention should also be made of the botanical garden by the Cherwell and the Oxford Union Society, founded 1625.

**University Constitution and Art Institution.**—"The chancellor, masters and scholars of the University of Oxford" form a corporate body, within which the colleges are so many individual corporations. The highest officer of the university is the chancellor, who is elected by the members of convocation, holds office for life, and is generally a distinguished member of the university. The vice-chancellor is practically the head. He is nominated annually by the chancellor, and must be the head of a college. Two proctors (*q.v.*) are appointed annually by two of the colleges in rotation. The university returns two members to parliament, the privilege dating from 1604, under a system of proportional representation.

The Hebdomadal (from Greek ἑβδομάς, the number seven; the Hebdomadal board instituted in 1631 was appointed to hold a weekly meeting) Council consists of the chancellor, vice-chancellor, the ex-vice-chancellor or the next vice-chancellor, and proctors as official members and of 18 other members (heads of houses, professors, etc.) elected for terms of six years by the congregation of the university. The council takes the initiative in promulgating, discussing and submitting to convocation all the legislation of the university, and controls its general business and its policy. The ancient house of congregation includes all college deans, examiners and Regent masters, *i.e.*, M.A.'s of not more than two years' standing; it once was concerned with university education and discipline, but it now has practically no functions beyond the granting of degrees. It lost its wider powers under the act of 1854, when the congregation of the university was created. This body, which includes, besides certain officials, all members of convocation concerned in the educational and administrative work of the university who have resided for a fixed period within 2½ m. of Carfax, approves or amends legislation submitted by the Hebdomadal Council previously to its submission to convocation; it also has considerable powers in the election of the various administrative boards. The house of convocation consists of all masters of arts and doctors of the higher faculties who have their names on the university books, and has the final control over all acts and business of the university. There are boards of curators for the Bodleian library, the university chest and other institutions, delegates of the common university fund, the museum and the press, for extramural teaching, local examinations and other similar purposes, visitors for the Ashmolean museum and university galleries, and many other administrative bodies. There are boards for the following faculties: theology, law, medicine, natural science and arts (including *literae humaniores,* oriental languages and modern history). The general board of the faculties, elected by all the resident teachers in the university, arranges and controls the teaching, appoints one class of university lecturers, and can make suggestions to colleges as to the appointment of the fellows as lecturers, on the recommendation of the special boards of faculty. The income assigned to it for the purpose is £10,000. Among the numerous professorships and readerships in the various subjects of study, the oldest foundation is the Margaret professorship of divinity, founded in 1502 by Margaret, countess of Richmond and mother of Henry VII. This was followed by the five Regius professorships of divinity, civil law, medicine, Hebrew and Greek, founded by Henry VIII.

The colleges consist of a head, whose title varies in different colleges, fellows (who form the governing body) and scholars. To these are to be added the commoners, *i.e.*, those who either receive no emoluments, or hold exhibitions which do not (generally) entitle them to rank with the scholars. The college officer who is immediately concerned with the disciplinary surveillance of members of the college *in statu pupillari* is the dean (except at Christ Church). Each undergraduate (this term covering all who have not yet proceeded to a degree) is, as regards his studies, under the immediate supervision of one of the fellows as tutor. The examinations for the B.A. are as follows: (*a*) Responsions, always now passed before entrance; exemption is granted to all candidates who have taken the school's leaving certificate. (*See* EXAMINATIONS.) (*b*) Honours or pass moderations, the latter often takes the form of a diploma in a special subject. (*c*) Final schools (in the case of *literae humaniores,* called familiarly "Greats," and now applied to other honours schools), with pass schools for ordinary students. Arrangements exist whereby members of the universities of Cambridge or Dublin may be "incorporated" as members of Oxford university; and whereby the period of necessary academical residence at Oxford university is reduced in the case of students from "affiliated" colleges within the United Kingdom. Special provisions are also made in the case of students from any foreign university and from certain colonial and Indian universities.

BIBLIOGRAPHY.—*Oxford University Calendar* (annual); *Oxford Historical Register;* Oxford Historical Society publications; "College History" series; Anthony à Wood (*q.v.*) (for earlier history); H. Rashdall, *Mediaeval Universities* (2 vols.); Sir C. Mallet, *History of the University of Oxford* (3 vols.); *Oxford and Oxford Life,* by J. Wells; Marquess Curzon, *Principles and Methods of University Reform* (1909); *Report* of Royal Commission (1922). (C. BR.; J. WS.)

**OXIDATION** and **REDUCTION** are chemical terms which are constantly employed to express two opposing reactions. In the first place, oxidation denotes a direct addition of oxygen to an element or compound, as in the burning of sulphur to sulphur dioxide or the conversion of carbon monoxide into the more oxygenated carbon dioxide, the latter chemical change being manifested in the blue flame frequently observed in a brightly burning coal fire. Secondly, oxidation may indicate a removal of hydrogen from a hydride or other hydrogenated substance, as in the incomplete combustion of sulphuretted hydrogen, $SH_2+O=H_2O+S$, or in the conversion of oxalic acid into carbon dioxide and water, $H_2C_2O_4+O=2CO_2+H_2O$. Thirdly, oxidation involves an increase in the valency of an element, even although there may be no direct addition of oxygen or removal of hydrogen, as, for example, in the change of ferrous to ferric salts, $2FeSO_4+H_2SO_4+O=Fe_2(SO_4)_3+H_2O$. The action of the oxygen is indirect and the oxygen itself may be derived from the air or from a chemical reagent, such as potassium permanganate or bichromate. Similarly stannous chloride is converted into stannic chloride, $SnCl_2+2HCl+O=SnCl_4+2H_2O$.

In the former instance the valency of iron is increased from two to three; in the latter the valency of tin is changed from two to four. Oxidation is often facilitated by the presence and interaction of water, as in the rusting of iron to hydrated ferric oxide (*see*

CORROSION), or in the permanent bleach of coloured goods (cottons, calico, etc.) as carried out by chlorine water. In the latter instance the effective agent is probably hypochlorous acid (HClO).

Reduction is the converse chemical change to oxidation. Firstly, reduction in its original metallurgical sense implies a removal of oxygen from an oxide. Tinstone (cassiterite) heated with carbon or anthracite becomes reduced to free tin, $SnO_2+2C=2CO+Sn$. Occasionally it is an analogue of oxygen, such as sulphur or selenium, which is removed from the metal. In the Welsh process of lead smelting lead sulphide and lead sulphate interact and the lead of both compounds is reduced to the metallic condition, $PbS+PbSO_4=2Pb+2SO_2$. Secondly, reduction signifies an addition of hydrogen, as in photosynthesis (*q.v.*), $CO_2+H_2O=(CH_2O)_x+O_2$, where carbon dioxide is reduced successively to formaldehyde and other more complex carbohydrates. When arsenious oxide is treated with a mixture evolving hydrogen, oxygen is replaced by this element, $As_4O_6+24H=4AsH_3+6H_2O$. Thirdly, reduction involves a decrease in the valency of an element as when a ferric salt is converted into ferrous salt by nascent hydrogen (engendered by zinc and dilute sulphuric acid), $Fe_2(SO_4)_3+H_2=2FeSO_4+H_2SO_4$. Occasionally such reductions are effected by light or radiant energy and such changes are utilized in photography: thus, ferric oxalate is reduced to ferrous oxalate, $Fe_2(C_2O_4)_3=2FeC_2O_4+2CO_2$, and aqueous mercuric chloride is reduced to mercurous chloride $4HgCl_2+2H_2O=2Hg_2Cl_2+4HCl+O_2$.

(G. T. M.)

**OXIDE,** in chemistry, a binary compound of oxygen and another element. Oxides are the most plentiful and characteristic components of the earth's hydrosphere and lithosphere; the former of these envelopes consists essentially of water, the commoner oxide of hydrogen, and the latter largely consists of simple and complex oxides. The second type of oxide is the more abundant and includes such important rock-forming materials as carbonates, silicates, aluminates, and aluminosilicates. The ordinary ingredients of soil, subsoil, and rocks, including sand, clay, marl, chalk, limestone, dolomite, mica, shale and slate are composed of oxides in either anhydrous or hydrated forms.

Oxygen can be made to combine directly with most elements, although sometimes it will not do so in the entire absence of water vapour (*see* DRYNESS, CHEMICAL); in a few cases in which direct methods are unavailing, as, for example, in the case of noble metals such as gold or platinum which remain unaffected in air even at very high temperatures, indirect methods can be used and oxides can be prepared from the salts of the metals. Hitherto, however, it has been found impossible to prepare oxides of bromine or of the inert gases helium, neon, argon, etc.; fluorine was (until 1927) regarded as being in this category, but it has now been made to yield an oxide indirectly. (*See* FLUORINE.)

Many elements form a series of several oxides; thus, nitrogen yields five: $N_2O$, NO, $N_2O_3$, $NO_2$ ($N_2O_4$ at lower temperatures), and $N_2O_5$. In general, the acidic character of the oxide increases with increase in the oxygen content. For purposes of classification, it is usual to assign a typical oxide to each element; usually this oxide is the highest having acidic or basic properties and is related to the position of the element in the periodic classification (*see* PERIODIC LAW) as follows: The typical oxides of Group I. are of the form $M_2O$, those of Group II. of the form MO, those of Group III. are $M_2O_3$, and so on, those of Group VI. being $MO_3$.

**Types of Oxide.**—Oxides are often classed as (1) acidic oxides; (2) basic oxides; (3) amphoteric; (4) neutral; (5) suboxides; (6) saline oxides; and (7) peroxides (either acidic or basic); an oxide may not fall clearly into any one of these classes, but have the characteristics of two.

(1) Acidic oxides are those which combine with bases or basic oxides to form salts. Many of the oxides of non-metals, *e.g.*, carbon, nitrogen, phosphorus and sulphur, are of this type. Some acidic oxides are "mixed" anhydrides; thus nitrogen peroxide reacts with water to give two acids, nitrous and nitric, and with bases to form nitrites and nitrates.

(2) Basic oxides similarly react with acids or acidic oxides to form salts, and many of the oxides of metals fall into this class.

(3) Amphoteric oxides behave as acidic oxides towards bases and as basic oxides towards acids; thus, zinc and aluminium oxides dissolve in either acids or bases to give salts of the acid or zincates (aluminates) of the base, respectively.

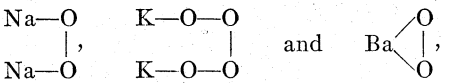
(4) Neutral oxides are those which neither react to form salts nor combine with water to give acids or bases; carbon monoxide and nitrous oxide are examples, for, although they result from formic and hyponitrous acids, respectively, by loss of water, they do not combine with water to give these acids and are therefore not acidic anhydrides.

(5) Suboxides are oxides having less oxygen than those oxides which give rise to a definite series of salts, and in a sense they are neutral oxides, for on reacting with an acid they give the metal and a salt corresponding to a higher oxide. Few suboxides are definitely known, but that of lead, $Pb_2O$, exhibits the behaviour just described—there are no such salts as $Pb_2SO_4$ or PbCl, and the action of acids upon it results in the production of metallic lead and a salt derived from PbO.

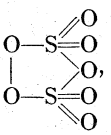
(6) Saline oxides of non-metals are not known. As indicated above, some metals form two oxides of which the lower is basic and the higher acidic; two such oxides may therefore combine to give another oxide which is to some extent a salt. Many higher oxides of metals may thus be regarded as saline, *e.g.*, $Pb_3O_4=2PbO\cdot PbO_2$; $Pb_2O_3=PbO\cdot PbO_2$.

(7) Peroxides are, strictly, those oxides having more oxygen than the typical oxide as determined by the periodic classification. This definition, however, fails in certain cases, for it would exclude lead peroxide, $PbO_2$, from the category, since this is regarded as typical of Group IV. to which lead belongs, whereas the oxide is certainly a peroxide. It is therefore customary, in the case of basic peroxides, to regard them as being those oxides which are more highly oxygenated than the oxide which gives rise to a regular series of salts, and since, in the case of lead, this is the oxide PbO, the oxide $PbO_2$ is a peroxide. In the case of acidic peroxides, permanganic anhydride $Mn_2O_7$, for instance, is the typical oxide of Group VII. and also gives rise (as an acid) to a definite series of salts (the permanganates), so no difficulty arises; and oxides such as $CrO_4$ and $S_2O_7$, which are higher than the typical oxides $CrO_3$ and $SO_3$, are acidic peroxides and give rise to perchromates and persulphates.

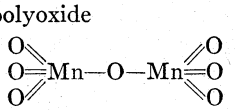
It is convenient to subdivide basic peroxides according to their chemical behaviour: those which react with water or with dilute acids to form hydrogen peroxide (a *neutral* peroxide)are classed as *superoxides,* and the others as *polyoxides.* Mendeleyev, to whom this idea is due, pointed out that this subdivision could be related to structural formulae, for the former class includes oxides in which the oxygen atoms are linked together, *e.g.*,



whereas in the latter class these atoms are all attached solely to the metal, *e.g.*, O=Pb=O, O=Mn=O. Such a subdivision can be extended to distinguish between acidic superoxides and polyoxides; thus, $S_2O_7$ is a superoxide



whereas $Mn_2O_7$ is a polyoxide



(compare above).

Peroxides are characterised by their oxidising properties; thus lead peroxide oxidises $SO_2$ so that the resulting PbO and $SO_3$ form lead sulphate $PbSO_4$; and manganese dioxide oxidises hydrochloric acid to chlorine, being itself reduced to the manganous state: $MnO_2+4HCl=MnCl_2+Cl_2+2H_2O$.

Many oxides combine with water to form hydroxides (*q.v.*), and all hydroxides lose water on heating to give the corresponding oxide. The chemical properties of an hydroxide are almost identi-

cal with those of the corresponding oxide, but the latter is somewhat more inert especially if it has been very strongly heated.

For further details *see* HYDROXIDE; OXIDATION and REDUCTION; and H. B. Weiser, *The Hydrous Oxides* (New York, 1926.) (A. D. M.)

**OXIMES,** in organic chemistry, compounds containing the grouping >C:N·OH and obtained by the action of hydroxylamine on compounds containing the >CO group. They were first prepared by Victor Meyer in 1882. The commonest are those of the general formulae RHC:NOH and RR′C:NOH where R and R′ are alkyl or aryl groups; the former, prepared from aldehydes, are known as aldoximes, and the latter, from ketones, as ketoximes.

The lower alkyl aldoximes and ketoximes are readily soluble in water, but the solubility decreases with increase in molecular weight; if an aryl group be present, the compounds are usually sparingly soluble in water. Generally the oximes are readily soluble in the common organic solvents and may be extracted from aqueous solutions by their means; they are weak acids and dissolve in aqueous solutions of alkali hydroxides to form salts which are decomposed, with liberation of the oxime, by carbon dioxide or by ammonium chloride. At the same time ethereal solutions of most oximes yield with hydrogen chloride precipitates of hydrochlorides, and sulphates may be obtained by dissolving the oximes in concentrated sulphuric acid; both hydrochlorides and sulphates are rapidly decomposed by water with regeneration of the oxime. Oximes are hydrolysed by boiling with dilute acids (the parent aldehyde or ketone being formed); on reduction with sodium amalgam in alcoholic acetic acid, or in the vapour phase by hydrogen in the presence of nickel (*see* HYDROGENATION), they yield primary amines; on oxidation they yield a number of products, aldoximes giving hydroxamic acids R·C(OH):NOH or peroxides R·CH:NO·ON:CH·R, and ketoximes nitro-hydrocarbons $RR'CH{\cdot}NO_2$. Dehydrating agents convert aldoximes into nitriles $RCH{:}NOH \longrightarrow RCN + H_2O$. With phosphorus pentachloride ketoximes undergo the Beckmann change (*see* below).

Aldoximes and ketoximes are generally prepared by the action of hydroxylamine (liberated from the hydrochloride *in situ* by sodium carbonate or sodium hydroxide) upon the aldehyde or ketone; they are also formed by the oxidation of primary amines with Caro's acid, $RR'CH{\cdot}NH_2 \longrightarrow RR'CH{\cdot}NH(OH) \longrightarrow RR'C{:}N{\cdot}OH$ (E. Bamberger, 1902), and by the reduction of primary or secondary nitro-hydrocarbons with stannous chloride and hydrochloric acid: $RR'CH{\cdot}NO_2 \longrightarrow RR'CH{\cdot}NO \longrightarrow RR'C{:}N{\cdot}OH$. Aldoximes are formed by the reduction of unsaturated nitro-hydrocarbons with aluminium amalgam in dilute acetic acid.

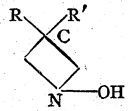
$RR'C{:}CH{\cdot}NO_2 \longrightarrow RR'C{:}CH{\cdot}NH(OH) \longrightarrow RR'CH{\cdot}CH{:}N{\cdot}OH$,

by the action of alkyl iodides on sodium nitrohydroxylamine and by the action of mercury fulminate on phenols or benzenoid hydrocarbons in the presence of a mixture of anhydrous and hydrated aluminium chloride (*see* ALDEHYDES). Ketoximes are formed by the reduction of pseudo-nitriles,

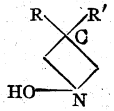
$RR'C(NO_2)NO \longrightarrow RR'C(NH{\cdot}OH)_2 \longrightarrow RR'C{:}NOH + NH_2OH$.

Many oximes form co-ordination compounds with metals and the insolubility of some of these compounds is utilized in quantitative analysis; for example, dimethylglyoxime and α-benzildioxime are used for the determination of nickel, and β-naphthaquinonemonoxime for cobalt.

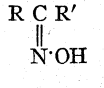
**Stereochemistry of the Oximes.**—Many unsymmetrical oximes (*i.e.*, where R and R′ are different) exist in isomeric forms. This isomerism is now usually explained on the hypothesis of Hantzsch and Werner (1890), in which the assumption is made that the three valency directions of the nitrogen atom do not lie in one plane, the space models of the compounds being represented as (I.) and (II.), or more briefly as (III.) and (IV.).



(I.)



(II.)

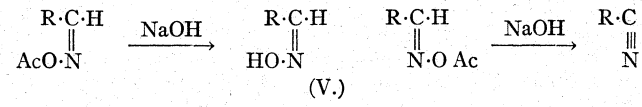


(III.)

(IV.)

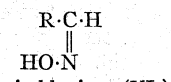
The isomerism is determined by the nearness of the hydroxyl group to R′ in one compound, and to R in the isomeride. Evidence that the three valency directions of a nitrogen atom doubly linked to carbon are not coplanar has been obtained by Mills and others. (*See* STEREOCHEMISTRY.)

The configuration of the aldoximes is determined by the action upon them of acetic anhydride, which converts both varieties to acetyl derivatives. One of these compounds on treatment with dilute sodium hydroxide is slowly hydrolysed back to the original oxime, and the other is at once decomposed to the nitrile. Hantzsch assumed that the compound containing the methine hydrogen and the acetoxy-group near together (V.)

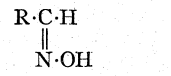


(V.)

would most readily lose acetic acid to give the nitrile; he therefore gave the configuration (VII.) to the oxime from which this acetyl compound was prepared and (VI.) to the other.

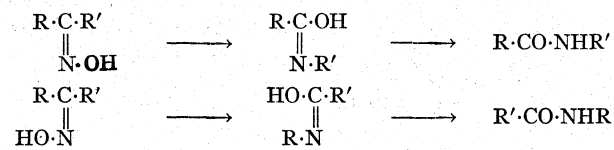


α- or anti-aldoxime (VI.)



β- or syn-aldoxime (VII.)

The configuration of the ketoximes is determined by the "Beckmann change" (1891) by which the ketoxime is converted into an amide, usually by the action of phosphorus pentachloride in ether at 0° C.



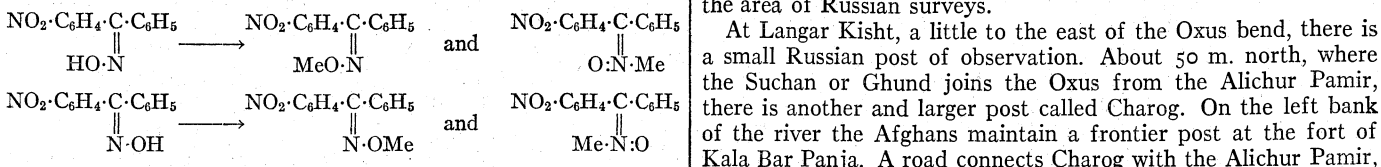

The assumption was made that the group adjacent to the hydroxyl changed places with it, and became attached to nitrogen. Meisenheimer, however, has adduced (1921) evidence in favour of the *trans* rather than of the above *cis* interchange of groups in the Beckmann change. Moreover, Brady and Bishop (1925) favour the *trans* rather than the *cis* elimination of acetic acid from the acetyl derivatives of the aldoximes. These authors suggest in consequence that the configurations assigned by Hantzsch should all be reversed. Since, however, the question is still unsettled, the old configurations are here retained.

Aldoximes in which R is an alkyl group are known only in the β- or *syn*-form; where R is a benzene or naphthelene nucleus, the oxime, as obtained by the action of hydroxylamine on the aldehyde, has the α- or *anti*-configuration. In order to obtain the syn-aldoxime in the latter case the oxime is dissolved in dry ether and the solution saturated with dry hydrogen chloride at 25–30° C. The precipitated hydrochloride is decomposed with aqueous sodium carbonate, and the syn-oxime obtained is purified by crystallization; or the anti-oxime, in benzene, is exposed in silica vessels to the action of ultra-violet light. In certain cases it has been found impossible to obtain the syn-aldoxime by any of the known methods. The syn-aldoximes are unstable and are converted to the anti-isomerides by traces of dilute acids, or in many cases by keeping; they are much weaker acids and less soluble than the corresponding anti-compounds.

Ketoximes in which R and R′ are both alkyl groups are known in one form only; where R is alkyl and R′ aryl, usually only one form is known, but where R and R′ are both aryl groups the action of hydroxylamine on the ketone frequently yields a mixture of the two isomerides which can be separated by fractional crystallization. There is no known method of converting the stable into the unstable isomeride in the case of the ketoximes; the reverse change occurs on keeping.

The alkylation of the oximes affords valuable support for the Hantzsch-Werner theory; for example, the isomeric *p*-nitrobenzophenone oximes yield four methyl derivatives, as demanded by the stereo-chemical hypothesis, the methyl group being

attached to the oxygen atom (*O*-ether) or to the nitrogen atom (*N*-ether), respectively:



The aldoximes give only three alkyl derivatives, both anti- and syn-aldoxime yielding the same N-alkyl compound, this being regarded as derived from the tautomeric form of the oximes RR'C:NH:O. (O. L. B.)

**OXNARD,** a city of Ventura county, California, U.S.A., on the Southern Pacific railway, midway between Los Angeles and Santa Barbara, and 4 mi. from the ocean. Pop. 4,417 in 1920 (30% foreign-born white); 1940 it was by federal census 8,519. It is the trading centre for an extensive agricultural district, and has a large beet-sugar factory and other industries. It is the hub of the harbour of Port Hueneme and site of an army air school. Oxnard was founded in 1898 and incorporated in 1903.

**OXUS** or AMU DARYA, one of the great rivers of Central Asia. From Lake Victoria (Sor-Kul) in the Pamirs, which was originally reckoned as the true source of the river, to Khamiab, on the edge of the Andkhui district of Afghan Turkistan, for a distance of about 680 m., the Oxus forms the boundary between Afghanistan and Russia. For another 550 m. below Khamiab it follows an open and sluggish course till it is lost in the Aral sea, being spanned at Charjui, 150 m. below Khamiab, by the wooden bridge which carries the Russian railway from Merv to Samarkand. The level of Lake Victoria is 13,400 ft. above sea. At Khamiab the river is probably rather less than 500 ft. The total length of the river is 2,400 km. and its catchment area about 300,000 sq.km. The rainfall of this basin varies probably between 90 and 150 cu.km. p.a. and its discharge into the Aral sea is about 32 cu.km. p.a. About 6,000 sq.km. depend on its waters for irrigation.

**Sources.**—The final survey of the Pamir region (wherein the heads of all the chief tributaries of the river lay hidden), by the Pamir boundary commission of 1895 established the following facts. The elevated mountain chain, now called the Nicolas range, which divides the Great from the Little Pamir, is a region of vast glaciers and snow-fields, supplying the greater part of the water of the lakes lying immediately north and south. The Nicolas range may be regarded as the chief fountain-head, through Victoria and Chakmaktin lakes, of at least two of the upper tributaries of the Oxus, namely, the Aksu (or Murghab) and the Pamir river, and as contributing largely to a third, the Ab-i-Panja. It is possible that there may be warm springs on the bed of Lake Victoria, as such springs are of frequent occurrence in the Pamirs; but there is no indication of them in the Chakmaktin basin, which is an expansion occurring in the course of the Aksu and not the fountain-head of the stream. There are indications that the beds of these lakes are rapidly silting. The enormous glaciers which lie about the upper or main branch of the Ab-i-Panja (called the Ab-i-Wakhjir or Wakhan), which rises under the mountains enclosing the head of the Taghdumbash Pamirs are another important source of the river. If the Aksu (or Murghab) and the Pamir river from Lake Victoria are to be considered in the light of independent tributaries, it is probable that the Ab-i-Panja contributes as much glacial flood to the Oxus as either of them.

**Kala Panja to Ishkashim.**—From the point where the rivers of the Great and Little Pamirs join at Kala Panja to Ishkashim, at the elbow of the great bend of the Oxus northwards, the river valley and the northern slopes of the Hindu Kush, which near Ishkashim extend in slopes of barely 10 m. in length from the main watershed to the river banks, have been carefully mapped. These slopes represent the extent of Afghan territory which exists north of the Hindu Kush between Kala Panja and Ishkashim. From Ishkashim northwards the river passes through the narrow rock-bound valleys of Shignan and Roshan, thence north and west through the mountains and defiles of Darwaz. This part of the Oxus, until it once again emerges from the Bokhara hills into the open plains bordering Badakshan on the north, falls within the area of Russian surveys.

At Langar Kisht, a little to the east of the Oxus bend, there is a small Russian post of observation. About 50 m. north, where the Suchan or Ghund joins the Oxus from the Alichur Pamir, there is another and larger post called Charog. On the left bank of the river the Afghans maintain a frontier post at the fort of Kala Bar Panja. A road connects Charog with the Alichur Pamir, following the general course of the Ghund stream, forming a valuable link in the chain of communications between Bokhara and Sarikol. Eighty-five miles north of Ishkashim, at Kala Wamar, the river which rises in the Little Pamir, and which is called Aksu, Murghab, or Bartang, joins the Oxus from the east. It is on this river that the Russian outpost, Murghabi, (or Pamirski), is situated, at an elevation of 12,150 ft. above the sea. Fort Murghabi is connected by a good military road with Osh. At this point the measurement of the comparative lengths of the chief Pamir tributaries of the Oxus is as follows:—to the head of the Aksu at Lake Chakmaktin 260 m.; to the head of the most easterly tributary of Lake Victoria, in the Great Pamir, about 230 m.; to the glacial sources of the Ab-i-Wakhjir, about 230 m. For 120 m. the two latter are united in the main stream of the Oxus, the volume of which has been further increased by the Ghund and Shakhdara draining the Alichur Pamir and the heights of Shignan.

**Ishkashim to Kolab.**—The narrow cramped valley of the river between Ishkashim and Kala Wamar is hedged in on the west by a long ridge flanking the highlands of Badakshan; on the east the buttresses and spurs of the Shignan mountains (of which the strike is transverse to the direction of the river and more or less parallel to that of the main Hindu Kush watershed) overhang its channel like a wall, and afford but little room either for cultivation or for the maintenance of a practicable road. Yet the lower elevation (for this part of the Oxus stream is not more than about 7,000 ft. above sea-level) and comparatively mild climate give opportunities to the industrious Tajik population for successful agriculture, and a track exists on the left bank of the river to Kala Bar Panja opposite the Ghund (or Suchan) debouchment, which is practicable for mules. There are no bridges, and the transit of the river from bank to bank can be effected only by the use of inflated skins.

Beyond the Bartang (or Murghab) confluence the valley narrows, and the difficulties of the river route increase. Between Kala Wamar (6,580 ft.) and Kala Khum (4,400 ft.), where the Oxus again bends southwards, its course to the north-west is almost at right angles to the general strike of the Darwaz mountains, which is from north-east to south-west, following the usual conformation of all this part of high Asia. Thus its chief affluents from the north-east, the Wanj and the Yaz Ghulam, drain valleys which are comparatively open. At Kala Khum the river is 480 ft. wide, narrowing to 350 ft. in the narrowest gorge. Its level varies with the obstructions formed by ice, falling as much as 28 ft. when its upper channels are blocked.

In the valleys of the Waksh and the Surkhab to the north of Darwaz, which form an important part of the province of Karategin, maple, ash, hawthorn, pistachio and juniper grow freely in the mountain forests, and beetroot, kohl rabi and other vegetables are widely cultivated. About the cliffs and precipices of the Panja valley near Kala Khum are the wild vine, cerasus and pomegranate, and the plane tree and mulberry flourish in groups near the villages. Here also, amongst other plants, the sunflower decorates village gardens. The houses are built of stone and mortar, and above the thatched straw roof which surmounts the double-storeyed buildings the square water-tower rises gracefully. The left bank of the river belongs to Afghanistan.

From Kala Khum, which fort about marks the most northerly point of the great bend of the Oxus round Badakshan, the river follows a south-westerly course for another 50 m. through a close mountainous region and widens into the more open valley to the south of Kolab.

The topography of Darwaz south of the river is not accurately known, but at least one considerable stream of some 60 m. in

length drains to the north-east, parallel to the general strike of the mountain system into the transverse course of the Oxus, which it joins nearly opposite to the lateral valleys of Yaz Ghulam and Wanj. This stream is called Pangi-Shiwa, or Shiwa. Another of about equal length, the Ragh or Sadda, starting from the same central water-parting of this mountain block, and included within the Oxus bend, follows a transverse direction at almost right angles to the Shiwa, and joins the Oxus valley near its debouchment into the more open Kolab plains, where the course of the Oxus has again assumed a direction parallel to the mountain strike. Towards its junction with the Oxus it cuts through successive mountain ridges, which render its course impracticable as a roadway. It is necessary to avoid the river, and to pass by mountain tracks which surmount a series of local spurs or offshoots from the central plateau, in order to reach the Oxus. The existence of this route, which traverses the Darwaz mountains from east to west, cutting off the northern bend of the Oxus, and connecting those easterly routes which intersect the Pamirs by means of the Ghund and Shakhdara (and which concentrate about Lake Shiwa) with Kolab in eastern Bokhara, is important. (*See* BADAKSHAN.)

**Badakshan Region.**—From about the point where the Oxus commences to separate Russian territory from the comparatively open Afghan districts of Rustak and Kataghan, it adopts an uncertain channel and splits, leaving broad central islands. Between Kolab and Pata Kesar, immediately north of the Turkistan city of Mazar-i-Sharif, there are at least three well-known *guzars* or fords. Besides the Kolab and Surkhab (or Waksh), the great muddy affluents from Karateghin on the north—the Kabadian, the Surkhan, and the Darbant are very considerable tributaries from Bokhara. The last is the river on which the well-known trade centre of Shirabad is built, some 20 m. north of the river. Near the junction of the Surkhan with the Oxus are the ruins of the ancient city of Termez, on the northern bank, and the ferry at Pata Kesar connects Bokhara and Mazar.

From the south the Kokcha and the Khanabad (or Kunduz) join the Oxus between Kolab and the Mazar crossings. The valley of the Kokcha leads directly from the Oxus to Faizabad, the capital of Badakshan, and its head is close above Ishkashim at the southern elbow of the great Oxus bend, a low pass of only 9,500 ft. dividing its waters from those of the main river. This undoubtedly was a section of the great central trade route of Asia, which once connected Ferghana and Herat with Kashgar and China. (*See* BADAKSHAN.) This river and the Khanabad tap the northern slopes of the Hindu Kush; their sources are in the unmapped Kafiristan mountains. To the west of the Kunduz no rivers find their way through the southern banks of the Oxus. Throughout the plains of Afghan Turkistan the drainage from the southern hills is arrested and lost in the desert sands.

At Airatan, a little above the Pata Kesar ferry, there are ruins, as also at Khisht Tapa (where the road from Kabadian to Tashkurghan leaves the river) and at Kalukh Tapa.

The Oxus in flood is here rarely less than 1,000 yards wide, and in some places fully a mile. Its winter channel is from two-thirds to three-fourths of its flood channel, except where it is confined within narrow limits by a rocky bed, as at Kilif, where its unvarying width is only 540 yards. The average strength of the current in flood is about 4 m. per hour, varying from $2\frac{1}{2}$ to 5 m. The left bank above Kilif is, as a rule, low and flat, with reed swamps and a strip of jungle between the reeds and the edge of the elevated sandy desert. The jungle is chiefly tamarisk and padah (willow). Swamp deer, pheasants and occasionally tigers are found in it. The right bank is generally higher, drier, more fertile and more populated than the left.

**Irrigation.**—A wide belt of blown sand (or Chul), sprinkled with saxaul jungle, separates the swamps on the south side of the river from the cultivated plains of Afghan Turkistan; but in places, notably for about 12 m. above Khamiab where the Russo-Afghan boundary touches the river, through the Khwaja Salar district and in a less degree for 50 m. above the Kilif ferry, the Ersari Turkman has repelled the encroaching desert sand-waves, and a strip of riverain soil averaging about a mile in width has been reclaimed and cultivated by irrigation. The cultivation, principally of wheat and barley, supported by canals drawn from the Oxus (the heads of which are constantly being destroyed by flood and again renewed) is of a very high order. The fields are intersected by narrow stone-walled lanes, bright with wayside flowers, amongst which the poppy and the purple thistle of Badghis are predominant; the houses, neatly built of stone, are scattered in single homesteads, substantial and comfortable; and the willow and mulberry offer a grateful shade in summer, when the heat is often insupportable. The fiery blasts of summer, furnace-heated over the Kizil Kum, are hardly less to be feared than the ice-cold north-western blizzards, which freeze men in the open desert, and frequently destroy whole caravans.

The Oxus ferries are large flat-bottomed boats which are towed across the river by small horses attached to an outrigger projecting beyond the gunwale by means of a surcingle or bellyband. They are thus partially supported in the water whilst they swim. The horses are guided from the boat, and a twenty- or thirty-foot barge with a heavy load of men and goods will be towed across the river at Kilif (where, as already stated, the width of the river is between 500 and 600 yards only) with ease by two of these animals. The Kilif ferry is on the direct high-road between Samarkand and Akcha. It is perhaps the best-used ferry on the Oxus.

Below Khamiab, to its final disappearance in the Aral sea, the Oxus flows through a vast expanse of sand and desert. Under Russian auspices a considerable strip of alluvial soil on the left bank has been brought under cultivation, measuring 4 or 5 m. in width, and there is more cultivation on the banks of the Oxus now than there is in the Merv oasis itself; but it is confined to the immediate neighbourhood of the river, for no affluents of any considerable size exist. The river is navigable below Charjui. There is now a regular steamer service as far as Pata Kesar. The steamers are flat-bottomed paddle boats drawing 3 feet. About 100 m. above the Aral sea is the ancient oasis of Khwarezm or Khiva, entirely dependent on the Oxus for irrigation. The river here perpetually shifts eastwards, causing a constant need for lengthening the irrigation channels lest the oasis become a desert.

**Previous Bed.**—It appears that there was a time in the post-Pliocene Age when a long gulf of the Caspian sea protruded eastwards nearly as far as the longitude of Merv, covering the Kara Kum sands, but not the Kara Kum plateau to the north, which is separated from the sands by a distinct sea beach. At the same time another branch of the same gulf protruded northwards in the direction of the Aral, probably as far as the Sary Kamish depression, which lies to the west of the Khivan delta of the Oxus, separated from it by wide beds of loess, clays and gravel, covering rocks of an unknown age. The Murghab river and the Hari Rud, which terminate in the oases of Merv and Sarakhs, almost certainly penetrated to the gulf of the Kara Kum, but the question whether the Oxus was ever deflected so as to enter the gulf with the Murghab cannot be said to be answered decisively at present. The former connection between the Caspian and Aral by means of the gulf now represented by the Sary Kamish depression seems to be admitted by Russian scientists, nor would there appear to be much doubt about the connection between the Khivan oasis and the north end of the Sary Kamish.

BIBLIOGRAPHY.—The *Report* of the Pamir Boundary Commission of 1895, published at Calcutta (1897); Dr. A. Regel, "Journey in Karateghin and Darwaz," *Investia*, Russian Geog. Soc., vol. xiii. (1882); translation, vol. iv. *Proc. R.G.S.;* Michell, "Regions of the Upper Oxus," vol. vi. *Proc. R.G.S.* (1884); Griesbach, "Geological Field Notes," No. 3, Afghan Boundary Commission (1885); C. Yate, *Northern Afghanistan* (London, 1888); Curzon, "The Pamirs," vol. viii. *Jour. R.G.S.* (1896); Kropotkin, "Old Beds of the Oxus," *Jour. R.G.S.* (September 1898); Cobbold, *Innermost Asia* (London, 1900); Bartold, *The History of Turkestan* (Tashkent, 1922, Russ.); R. Fox, *People of the Steppes* (1925).

**OXY-ACETYLENE BLOWPIPE.** An apparatus with a mixing jet which produces an intensely hot flame by projecting and burning acetylene with oxygen. It is of great value for metal working, producing a flame which attains about 6,000° F at the hottest part. In the high-pressure system, which is best for portable outfits, both the acetylene and the oxygen are delivered under pressure to the blowpipe, both from cylinders. In the

low-pressure system the acetylene is drawn direct from a generator. The blowpipes are manipulated either by hand, or guided in a machine. They are used for cutting out various shapes, parting thick sections, cutting out pieces for repairs or breaking-up purposes or welding to make new articles, and for various other purposes. When used for cutting, a separate jet of cutting oxygen is provided. This oxidizes or burns the hot metal. The oxide or "rust" thus formed is removed by the force of the jet and a cutting effect results.

When used for welding theoretically the welding flame should be neutral, that is, there should be no excess of acetylene or oxygen but in practice a little more oxygen than acetylene is used. Parts can also be heated conveniently for bending or straightening, and glass can be heated for working. The oxy-acetylene flame is too hot for brazing purposes, for which an oxy-coal-gas blowpipe has to be used. The approximate temperature of the oxy-acetylene flame may be compared with those of other flames from the following figures: Oxy-acetylene, 4,400° C; oxy-hydrogen, 2,420°; oxy-coal-gas, 2,200°; air-acetylene, 2,500°; air-coal-gas, 1,800°. (*See* WELDING.)

**OXYGEN,** a colourless, odourless, tasteless gas, somewhat heavier than air (sp.gr. 1·10523); it is slightly soluble in water. and this dissolved oxygen plays an essential part in the respiration of aquatic animals. (Symbol O, atomic number 8, atomic weight 16·000.) Oxygen combines with nearly all the elements under suitable conditions, but these reactions often do not take place if the substances are perfectly dry. With the exception of the "noble" metals, gold and the platinum group (*q.v.*), the metallic elements all oxidize when heated in oxygen, although molten silver dissolves 22 volumes of the gas without combining chemically with it, the absorbed oxygen escaping again when the metal cools.

Oxygen is by far the most abundant element, being nearly equal in amount to all the others put together. It forms 21% by volume of the atmosphere, eight-ninths by weight of water, and nearly one-half by weight of all the rocks composing the half-mile crust of the earth. Growing plants absorb carbon dioxide (*q.v.*), assimilating carbon and rejecting oxygen. It is the only gas able to support respiration.

**Preparation and Properties.**—It is readily prepared on a small scale by heating a mixture of potassium chlorate with about one-third of its weight of manganese dioxide, which facilitates the decomposition. From 1886, for about 20 years, oxygen was produced commercially by the Brin or barium oxide process. Barium monoxide was heated to 1,000° F and absorbed oxygen from the air to form the dioxide. At 1,600° the oxygen thus absorbed was again set free, the monoxide being regenerated. In later methods the temperature was maintained constant at about 1,200° F, and change of pressure was relied upon for determining the respective phases of oxidation and deoxidation. The purity obtainable, however, was not more than 94%.

In 1902 Linde applied the process of rectification to liquid air and was able to extract oxygen of 98·5% purity in economical yield. Air is freed of its carbon dioxide, compressed, cooled and then expanded, either in an engine doing external work or merely through a valve to perform internal molecular work; in both cases heat is lost and the temperature further lowered. This cooling effect is made cumulative by means of heat interchangers, tubular metal devices by which the cold gases after expansion are made to travel in indirect contact with and in counter-current to the incoming uncooled compressed air, so that the latter becomes continually colder at the point of expansion, until a limit is set by liquefaction. The liquid so produced is made to flow down a rectification column, fitted with numerous plates fashioned to ensure its intimate contact with ascending gas, which is produced at the base of the column by evaporating the liquid as it arrives there. When equilibrium is attained, almost pure oxygen can be drawn from the bottom of the column in gaseous or liquid form. Improvements in construction introduced in 1926 enable the separation of the nitrogen and oxygen of air to be effected almost completely, the oxygen purity being 99·5%, and the nitrogen over 99%.

Oxygen is also a by-product in hydrogen manufacture by the electrolysis of water. The much greater power consumption, however, prevents this process competing with the liquid-air process for oxygen production only. The gas is supplied in steel cylinders at a pressure of 120–150 atmospheres. During 1926 the world's production of oxygen, in cylinders, was about 5,000 million cubic feet. The estimation of oxygen in a gas is most conveniently made by means of an alkaline solution of pyrogallol, by metallic copper in conjunction with an ammoniacal solution of ammonium carbonate, by sticks of phosphorus, or by a weakly alkaline solution of sodium hydrosulphite.

Oxygen condenses to a pale blue magnetic liquid, boiling at −182·9° C. By rapid evaporation and consequent cooling, or by cooling in liquid hydrogen, oxygen forms a bluish-white solid, melting at −219° C. When gaseous oxygen is acted on by the silent electric discharge, an unstable modification, ozone (*q.v.*) $O_3$ is produced.

**Uses.**—Most of the oxygen is employed in industry for the fusion welding of metals, *e.g.*, steel, cast iron, aluminium, lead, and for the cutting of steel. Gas welding is generally accomplished by the aid of the oxy-acetylene flame, the two gases being supplied to a blowpipe wherein they are thoroughly mixed before combustion. In practice a little more oxygen than acetylene is used, and the resulting flame has an inner white core with a temperature above 4,000° C; it is quickly able to reduce these metals to the molten state locally, where two edges are to be joined. For metal cutting, a separate jet of "cutting" oxygen is provided in a similar blowpipe, either in the centre of the heating jet or behind it. As a rule, the melting point of an oxide is higher than that of the metal from which it is derived; but the fusion point of industrial iron varies between 1,400–1,500° C, and the mixture of iron oxides fuses at about 1,350° C. In the cutting the oxides of iron are formed and blown away in the molten state before the unoxidized iron reaches its melting point, the necessary temperature being maintained chiefly by the heat of combustion itself, but to a less extent by an independent heating jet. When the cutting blowpipe is moved mechanically, and therefore regularly, over the metal a remarkably smooth regular cut is obtained, even through metal 1⅞in. thick.

Oxygen is widely used in medical practice, inhalation being of service in cases of pneumonia, heart complaints, etc.; also in cases of gas poisoning, especially by carbon monoxide. It is used with nitrous oxide by anaesthetists.

Liquid oxygen has considerable industrial applications. If a rod of hard gas-carbon be heated to redness at one end and then immersed in liquid oxygen, it burns in the liquid with intense evolution of light and heat, the carbon dioxide resulting being frozen and retained as a white solid in the liquid. If the carbon is presented to the oxygen in a porous form, *e.g.*, wood charcoal, lampblack, soot, cork meal, sawdust, or wood pulp, the mixture forms a powerful explosive, more than twice as effective as blasting gelatine. It is so remarkably effective because the oxygen is free, and not chemically combined with other elements as in explosives like gunpowder or nitro-compounds, the explosion being an instantaneous oxidation of carbon, hydrogen or other elements. The materials are formed into cartridges in a paper wrapping; these may be 8in. long and 1½in. in diameter. They are thoroughly soaked in liquid oxygen and placed in the bore hole, and, after tamping, fired electrically or by fuse. This explosive has the great advantage that it automatically becomes dead in a short time if not fired, owing to the evaporation of the oxygen. It is exceptionally suitable for use in iron mines and in tunnelling, as it gives rise to no harmful gases.

The highly volatile liquid is transported in double-walled spherical vessels, made of spun copper with long, narrow necks. A good vacuum is created mechanically between the walls. When the excessively cold liquid oxygen is introduced into the vessel, activated charcoal (*q.v.*), placed in the vacuous space and in contact with the inner sphere, becomes cooled, and then possesses the remarkable property of absorbing the residual gas and converting the vacuum to one of an exceedingly high order (a few millionths of a mm. of mercury). This vacuum, coupled with the highly polished metal surfaces, prevents the ingress of heat

to a large extent. A 25-litre container (the usual size) loses by evaporation only 5% of its full liquid charge per day. The liquid is poured from them into smaller dipping flasks, of similar construction, but cylindrical in shape with open top, so that the cartridges can be readily inserted and withdrawn. (For oxygen in relation to muscular contraction *see* MUSCLE AND MUSCULAR EXERCISE.)

BIBLIOGRAPHY.—J. N. Friend and D. F. Twiss, *Text-Book of Inorganic Chemistry* (vol. vii, part i, 1924); J. W. Mellor, *A Comprehensive Treatise on Inorganic and Theoretical Chemistry* (vol. i, 1922); "Vacuum vessels," *Report of the Oxygen Research Committee* (Department of Scientific and Industrial Research, 1923); G. Claude, *Air liquide, Oxygène, Azote, Gaz rares* (Industrial, 1926); K. S. Murray, "Industrial Methods of liquefaction and practical applications of low temperatures," *Trans. Faraday Soc.* (vol. xviii, part 2, Dec. 1922); R. Granjon and P. Rosemberg, *Autogenous Welding (Oxy-Acetylene)*: practical manual (1914); *The British Acetylene and Welding Handbook* (The Acetylene and Welding Journal, 1923).

(C. R. H.)

**OXYHYDROGEN FLAME,** the flame attending the combustion of hydrogen and oxygen, and characterized by a very high temperature. Hydrogen gas readily burns in oxygen or air with the formation of water. The temperature of the flame is dependent on the circumstances in which the process takes place. It obviously attains its maximum in the case of the firing of pure oxyhydrogen gas (a mixture of hydrogen with exactly half its volume of oxygen, the quantity it combines with in becoming water, German *Knall-gas*). It becomes less when the oxyhydrogen is mixed with excess of one or the other of the two reacting gases, or an inert gas such as nitrogen, because in any such case the same amount of heat spreads over a larger quantity of matter. It acquired considerable application in platinum works, this metal being only fusible in the oxyhydrogen flame and the electric furnace; and also for the production of limelight, as in optical (magic) lanterns. But these applications are being superseded, *e.g.*, by the electric furnace, electric light and the oxyacetylene flame.

**OYAMA, IWAO,** PRINCE (1842–1916), Japanese field-marshal, was born in Satsuma. He was a nephew of Saigo, with whom his elder brother sided in the Satsuma insurrection of 1877, but he nevertheless remained loyal to the imperial cause and commanded a brigade against the insurgents. When war broke out between China and Japan in 1894, he was appointed commander in chief of the 2nd Japanese army corps, which, landing on the Liaotung peninsula, carried Port Arthur by storm, and, subsequently crossing to Shantung, captured the fortress of Wei-hai-wei. For these services he received the title of marquess, and, three years later, he became field-marshal. When (1904) his country became embroiled in war with Russia, he was appointed commander in chief of the Japanese armies in Manchuria, and in the sequel of Japan's victory the mikado bestowed on him (1907) the rank of prince. He received the British Order of Merit in 1906. He died on Dec. 12, 1916.

**OYER AND TERMINER,** the Anglo-French name, meaning "to hear and determine," for one of the commissions by which a judge of assize sits (*see* ASSIZE). By the commission of oyer and terminer the commissioners (in practice the judges of assize, though other persons are named with them in the commission) are commanded to make diligent inquiry into all treasons, felonies and misdemeanours whatever committed in the counties specified in the commission, and to hear and determine the same according to law. By the Treason Act 1708 the crown may issue commissions of oyer and terminer in Scotland for the trial of treason and misprision of treason.

In the United States oyer and terminer is the name given to courts of criminal jurisdiction in some states, *e.g.*, New York, New Jersey, Pennsylvania and Georgia.

**OYSTER.** Oysters are bivalve molluscs of the class Pelecypoda (or Lamellibranchia) and phylum Mollusca. They occur mainly between tidal levels or in shallow water near the estuaries, and are found along the coasts of all continents except those bordered by the polar seas. True oysters differ among themselves in shape, size, ornamentation and colour of the shell, and somewhat in their anatomical and physiological characters. Many other marine molluscs which are popularly called oysters, such as pearl oysters (*Pinctada*), or window-pane oysters (*Placuna*), are fundamentally different from the true oysters, which are included in the family Ostreidae. Fossil oysters occur from the Triassic period onward, while the type form begins in the Jurassic.

**Distribution of Commercial Species.**—More than 100 living species of oysters have been described but of these only a few are of economic significance. The most important commercial species are given in Table I. The nomenclature employed in the table is the same as that used by the United States National museum.

**Anatomy.**—The oyster shell is composed of two valves held together at the hinge by an elastic ligament. The upper valve is usually flat, whereas the lower one is concave, providing space for the body of the oyster. The concave shell is the one by which the oyster is attached to the bottom. The chief sections of the soft part of the oyster can easily be seen if one of the shells is removed and the animal examined. A thin membrane, called the mantle, lies against the inner sides of the shells. The functions of the mantle are to protect the more vital organs which it covers and to secrete the shell. Near the centre of the body is the large adductor muscle which serves to close the shells. The main body of the oyster lies between the right and left folds of the mantle and is attached to it and the adductor muscle. Under the mantle, at the anterior end of the body, four thin lips, or palps, are found and following them there are four rows of sickle-shaped organs, known as the gills. The latter are covered with microscopic hair-like structures, or cilia, which are arranged in rows. The cilia lash continuously creating a current of sea water over the gills, which serve as organs of respiration, and at the same time procure food from the surrounding water. The mouth of the oyster lies between the palps and opens into the gullet, or oesophagus, which leads from the mouth to the stomach. The stomach, which is surrounded by a large digestive gland, opens into the intestine, a long coiled tube ending in the vent, or anus. Reproductive organs, or gonads, consisting of numerous microscopic tubules containing eggs, or sperm, occupy a large portion of the body during the period when the oyster is nearing spawning. The gonads spread between the folds of the intestine and envelop it, as well as the stomach and the digestive gland. The sex cells are discharged from the gonads through the opening situated below the adductory muscle. The heart of the oyster lies in a thin-walled sack, or pericardium, located directly in front of the adductor muscle. The nervous system is very simple consisting of several ganglia, or knots, of nervous tissue and a series of small nerves extending to various organs.

TABLE I.—*Commercial Species of the Genus Ostrea*

| Common name | Scientific name | Where found |
|---|---|---|
| (1) American oyster | *O. virginica* | Atlantic coast of N. America from St. Lawrence river to Mexico. |
| (2) European or flat oyster | *O. edulis* | Mediterranean sea, Atlantic coast of Europe and British Isles. |
| (3) Australian rock oyster | *O. commercialis* | N.W., N., E. and S.E. coasts of Australia; East Indies; India; Norfolk Is.; New Caledonia; N. Is. of New Zealand; N.E. coast and Inland sea, Japan; S.E. coast of South Africa. |
| (4) Japanese gigantic oyster | *O. gigas* | N.E. coast of Japan and coast of China. Introduced to Pacific coast of the U.S. |
| (5) Portuguese oyster | *O. angulata* | S.W. European and N.W. African coasts. |
| (6) Chinese oyster | *O. rivularis* | Coast of China; Ariake and Kozima bays of Japan. |
| (7) Pacific coast oyster | *O. lurida* | West coast of N. America from British Columbia to California. |
| (8) Australian mud oyster | *O. angasi* | S. and S.E. coasts of Australia, Tasmania, and S. Is. of New Zealand. |
| (9) Japanese oyster | *O. denselamellosa* | S. and E. coasts of Japan. |
| (10) Indian oyster | *O. cucullata* | S. and W. coasts of India. |

**Sex and Reproduction.**—In regard to the sex characters oysters can be subdivided into two categories. The species belonging to the first category exhibit rhythmical consecutive sexuality. The best known examples of this type are the European oyster (*O. edulis*), the Pacific oyster (*O. lurida*), *O. denselamellosa* of Japan, and *O. angasi* of Australia. In all these cases the initial sexual phase is usually male (protandry), followed by a series of alternating female and male phases throughout life. As a rule, the adult oyster completes one male and one female phase each year,

but in some cases individuals may have three phases of functional sexuality during that period. In addition to individuals of regularly alternating sexuality the population may contain a small number of true males which retain the male phase indefinitely, sometimes throughout life.

The species of the second category exhibit alternative sexuality. This type is exemplified by the American oyster (*O. virginica*), the giant Japanese oyster (*O. gigas*) and the Australian oyster (*O. commercialis*). At the first spawning season the majority of young oysters function as males. However, previous to sexual maturity the gonads of young oysters may show all gradations from true males, in which no ovocytes can be found, to those which develop directly into ovaries. After the second spawning season the number of individuals in each sexual phase is almost equal. The adults function seasonally as separate sexes, although some of them have been proven to be subject to a change of sex in the interval between the two spawning seasons. Functional hermaphrodites are occasionally found.

Oysters may be divided into larviparous and oviparous types. In the first group, exemplified by *O. edulis, O. lurida* and *O. denselamellosa,* the fertilized eggs and larvae are retained for a considerable period in the mantle cavity of the parent oyster. Later the larvae are released into the surrounding water where they complete their development. In oviparous oysters the eggs and spermatozoa are discharged directly into the water and the larvae develop outside the parent's body. Examples of oviparous oysters are *O. virginica, O. gigas* and *O. commercialis.* Oysters begin to spawn in the spring or early summer when the water temperature becomes sufficiently warm. The European species commences spawning when the water temperature reaches 59°–60°F., and the American oyster, *O. virginica,* soon after the temperature reaches and passes 63° or 64°F. However, in southern latitudes this level is attained in advance of maturation of the oyster gonads and, therefore, spawning occurs at higher temperatures. The extent of the spawning periods for several species of the oyster in different geographic localities is given in Table II.

TABLE II.—*Spawning Seasons*

| Kind of oyster | Locality | Extent of spawning season | Authority |
|---|---|---|---|
| American (*O. virginica*) | Nova Scotia | Late July–early Aug. | T. C. Nelson |
| | Long Island sound | Late June–Sept. | V. L. Loosanoff |
| | Chesapeake bay | May–Oct. | V. L. Loosanoff |
| | Galveston bay (Tex.) | Late March–? | A. E. Hopkins |
| European (*O. edulis*) | Norway (fattening ponds) | Aug.–Sept. | B. Helland-Hansen |
| | Fall estuary (England) | End of June–Oct. | J. H. Orton |
| | Thames estuary (England) | End of May–Sept. | E. O. Anson and P. S. Willet |
| | Arcachon (France) | May–Sept. | M. De Bon |
| | Taranto (Italy) | March–Oct. | B. Dean |
| Pacific coast (*O. lurida*) | British Columbia | May–end of July | J. Stafford |
| | Puget sound (U.S.A.) | May–Oct. | A. E. Hopkins |
| | South California | April–Nov. | W. R. Coe |
| Australian rock (*O. commercialis*) | New South Wales | End of Dec.–May | T. C. Roughley |
| Japanese gigantic (*O. gigas*) | State of Washington (U.S.A.) | July–Oct. | M. B. Schaefer |

In larviparous oysters the female-functioning individuals discharge their eggs from the reproductive glands but retain them inside the brood chamber formed by the gills and two folds of the mantle. The eggs, which are about 150$\mu$ in diameter ($\mu = \frac{1}{1000}$ of a millimetre), begin to develop into embryos after having been fertilized by the male cells, or spermatozoa, which enter the mantle chamber of the female with a current of water. The embryos commence swimming when three or four days old. At the age of four or five days the shells of the embryos begin to form and the small animals gradually enter the larval stage. Up to this point the embryo remains white in colour but, as the shell grows larger, the larva becomes gray and then passes through various shades of blue-gray, slate and, finally, becomes bluish-black when the shell is grown to the size of 180 to 210$\mu$. During the latter stage, which is usually reached in about ten days, the larva leaves the parent to swim freely in the sea. This free-swimming period extends from a week to ten days or more depending upon the water temperature, being shorter when the temperature of the surrounding water is above normal. At the end of the free-swimming period, when the size of about 270$\mu$ is reached, the larva descends to the bottom and metamorphoses into a juvenile oyster, thus changing to a permanent sedentary life. In the biology of the oyster this act is usually called "setting." The larva may set on any object in the water possessing a clean, hard surface. Upon descending to the bottom the mature larva crawls about for some time seeking a suitable spot for attachment and, upon finding it, cements the left valve of its shell to the substratum. After setting is accomplished the young oyster is known as "spat."

A very large European female oyster may produce about 1,000,000 larvae during each spawning phase. Younger animals, however, yield far fewer larvae than older ones. *O. edulis* of marketable size produces from 250,000 to 500,000 larvae. In the oviparous species, such as *O. virginica,* individuals of both sexes discharge their reproductive element directly into the water, where fertilization occurs. A good sized individual may emit several million eggs at one spawning. The egg, which is rather small (about 50$\mu$), develops after fertilization into an embryo and larva in 8 to 12 hours. Within about two days the larva grows a complete bivalve shell and is known at that stage as "straight hinge larva." The free-swimming period of the larva extends from 8 to 21 days, being shortest when the water temperature is highest. During that period the larva continues to grow and increase in size, and passes through the so-called early and late umbo stages. Upon reaching the size of about 380 to 420$\mu$ the larva sets in much the same manner as that described for the European oyster. After setting, the larva quickly metamorphoses into a juvenile oyster and becomes known as "spat" or "set."

Spawning of ripe oviparous oysters can be easily provoked by a sudden rise in temperature, or by chemical stimulation. Artificial fertilization can be performed in this type of oyster by mixing ripe eggs and sperm in sea water. In larviparous oysters artificial fertilization is more difficult. By keeping the oysters for several weeks in water the temperature of which is above 70° F. they can be induced to develop eggs or spermatozoa even in the winter time, the period when under natural conditions the oysters are hibernating. The eggs, if fertilized, will develop into larvae which appear normal in their form and behaviour. The larvae of the oviparous (*O. virginica*) and larviparous (*O. lurida*) oysters can be obtained in midwinter using this method.

**Food, Feeding and Fattening.**—The food of the oyster consists of microscopic plants and animals present in the water. The food forms, which are of different kinds and sizes, are collectively called "plankton." Organic detritus resulting from the disintegration of plants and animals also contributes to the oyster diet. Many types of marine bacteria are ingested and probably utilized. Oysters obtain their food by means of the gills. The lashing cilia covering the gills create a current of water which enters the inhalant chamber of the oyster, and is expelled from the exhalant chamber. The gills constitute the sole partition between these two chambers. In straining water through the gills the oyster retains a considerable number of plankton organisms, although a certain percentage of small elongated forms devoid of any appendages may escape. The food particles caught on the surface of the gills are imbedded in a sticky substance, mucus, and then pass along the edges of the gills to the palps, which may either direct food into the mouth to be eaten, or reject it. Unwanted material is carefully collected together and finally expelled from the shell. After entering the mouth the food is conducted through a narrow gullet into the stomach. The small food organisms are digested mainly by being engulfed by the wandering cells of the oyster body, which are capable of penetrating through the walls of the stomach into its cavity, enveloping particles of food, and migrating back through the stomach walls. The food assimilated by the wandering cells is later distributed to the various tissues. An important part in digestion is played by a long, transparent, gelatinous structure, known as the crystalline style which is found in the alimentary canal of the oyster. The style contains an enzyme to dissolve starchy food, so that it can later be absorbed by the cells of the digestive gland.

The absorbed food is stored in the body of the oyster. These animals are said to be "fat" when the body is large and plump. This condition may be caused either by the development of the spawning products, or by the accumulation of the reserve food materials. Fatness during the breeding time is usually of the former type, whereas the accumulation of the reserve products occurs mainly after the end of the breeding season, when the oysters feed very actively. The stored material consists largely of animal starch (glycogen), which in the living animal is found in the large bladder cells located in most parts of the body. In the American oyster, *O. virginica,* of Long Island sound the accumulation of glycogen begins early in September and continues until the beginning of hibernation, which takes place early in December. In the case of *O. edulis,* the animals begin to store large quantities of glycogen as early as August. Thus the oyster is in its best condition for eating during the fall and winter months. In warmer waters, such as those of Louisiana and Texas of the United States, fattening of the oyster does not begin until some time in December.

Oysters feed most efficiently when the surrounding water is relatively warm. The American oyster, *O. virginica,* ceases to feed and enters the state of hibernation when the water temperature decreases to approximately 41°F. Other oysters probably behave similarly but the water temperature minimum varies for each species. Under favourable conditions *O. virginica* and *O. lurida* keep their shells open approximately 20 hours during each 24-hour period. No correlation was found between the opening and closing of the shell and the time of day. A large *O. virginica* can pump through its body as much as 27 litres of water per hour. The average rate of pumping, however, is much less. The rate of pumping is controlled by the temperature and other factors, such as turbidity or number of food organisms present in the surrounding water.

The meat of the oyster contains large quantities of nutritive substances necessary for a balanced diet. It is very high in copper and iron, and because of this oysters are often prescribed for anaemic patients. The meat also contains iodine, which is necessary for the normal activities of the thyroid gland and helps prevent goitre. Its proteins are especially high in nutritive value, and the carbohydrates present in the form of glycogen are readily digested and assimilated. Phosphorus and calcium are present in relatively high quantities. The meat of the oyster also contains most of the essential vitamins.

**Growth.**—The rate of growth of oysters varies greatly, depending mainly upon the temperature, food content of the water and season of the year. Generally the growth is more rapid in warmer waters. *O. virginica* of southern waters reaches the marketable size of 3½ in. to 5 in. in two years. In Long Island sound, where the summer is shorter and the water temperature cooler, the oyster reaches the same size in four or five years. The average sizes of a Long Island sound oyster at the end of the first, second, third, fourth and fifth growing periods are ¾ in., 2¼ in., 3 in., 3½ in. and about 4 in. respectively. In the case of the European oyster, the average size at the end of the first summer lies between ⅓ and ⅝ in. The average sizes at the end of the second, third, fourth and fifth growing periods are 1⅓ in., 2 in., 2½ in. and 2⅝ in., respectively. *O. lurida* reaches the marketable size of approximately 1½ in. in three or four years. *O. commercialis* is usually marketed at the age of three years, while the giant Japanese oyster transplanted to the Pacific coast of the U.S.A. may be marketed at the age of two years. Oysters, if left undisturbed, may attain considerable length. Specimens of *O. virginica* measuring more than 14 in. in length have been recorded. The same is true of *O. gigas.* Although the exact age which an oyster may attain cannot be definitely stated, judging by the number of layers composing the shell some very large individuals of *O. virginica* examined were at least 25 years old.

**Enemies, Parasites and Diseases.**—During their existence oysters are attacked by numerous enemies. The embryos and larvae are eaten in large numbers by ctenophores, jellyfish, many varieties of young fish, barnacles, certain bivalves and worms, ascidians, hydroids and probably by numerous larval and adult crustaceans. Spat, young and old oysters are destroyed by starfish, especially of the genus *Asterias,* and oyster drills or tingles (*Urosalpinx* and *Eupleura* in America, *Murex* and *Purpura* in Europe, and *Xymene* and *Drupa* in Australia). The drills bore round holes with their rasping tongues through the shells of the oyster and eat the meat. Whelks or conchs of the genus *Thais* are often very destructive to oyster beds. Some fishes, such as the drumfish (*Pogonias*) of America and *Myliobatis* of Europe and Australia, which possess large crushing teeth, occasionally invade the beds and destroy a large number of oysters. Sponges (*Cliona*) form a series of tunnels in the shells of the oysters. Mud worms of the genus *Polydora* sometimes cause serious mortality. Oysters are parasitized with a number of forms. The gregarine, *Nematopsis,* is found in many organs of *O. virginica* and in the kidneys and gills of the European oyster. A spirochaete, *Cristispira,* occurs in the crystalline style. The bucephalus larva of the trematode, *Gasterostomum,* lives in the body tissues. A species of parasitic copepod, *Mytilicola,* was found to infest the oysters on the Pacific coast of the U.S.A. Females of the crab, *Pinnotheres,* living in the mantle cavity of the oysters were reported to eat the gills of their hosts.

A large group of animals competes with the oyster for food and living space. All bivalves and, in general, all animals which live under the same conditions and feed in fundamentally the same way as the oyster, should be placed in this category. Common mussels, *Mytilus edulis,* sometimes form beds over the oysters smothering the latter. On some English beds and in Puget sound a gasteropod mollusc, *Crepidula,* is inimical to the cultivated oyster beds. Barnacles, ascidians and bryozoa, when present in large numbers, may seriously interfere with the normal existence of the oyster. Various adverse conditions are known to cause diseases and heavy mortality among the oysters. A marked reduction in salinity of the water over the oyster beds, caused by an unusually large inflow of fresh water, may either greatly weaken or kill the population of the oyster beds. Cases are known when oysters, especially those on beds exposed at low stages of the tide, were killed during freezing weather. Turbulence caused by the storms often results in covering the oysters with a heavy layer of sand and silt which smothers the molluscs. Pollution of the water with large quantities of oil and industrial or domestic waste creates adverse conditions which may eventually result in the death of the oysters.

**Oyster Industry.**—In several countries, especially the United States, France, Netherlands, United Kingdom and Australia, the oyster fishery represents an important industry. The United States leads all the other countries in the quantity of oysters grown for the market and in the value of the product (Table III).

TABLE III.—*Quantity and Value of Oysters Produced in Certain Countries, Various Years* (*)

| Country | Year | Quantity (meat) | Value |
|---|---|---|---|
| | | *Pounds* | |
| United States† | 1931 | 101,035,825 | $10,300,168 |
| France | 1930 | 13,255,336 | 1,141,563 |
| Netherlands | 1931 | 389,188 | 692,355 |
| United Kingdom | 1931 | 104,790 | 279,759 |
| Australia | 1931 | 351,309 | 276,794 |
| Denmark | 1931 | 705,472 | 200,464 |
| Japan | 1930 | 2,326,464 | 179,759 |
| New Zealand | 1931 | 335,713 | 160,255 |
| Canada‡ | 1931 | 766,615 | 145,989 |
| Mexico | 1930 | 179,420 | 60,033 |
| Cuba | 1932 | 49,220 | 13,850 |
| Irish Free State | 1931 | 961 | 2,394 |
| Germany | 1932 | 10,362 | 2,137 |
| Turkey | 1924 | 18,383 | 2,129 |
| Union of South Africa | 1932 | 1,261 | 960 |
| Dominican Republic | 1931 | 3,175 | 480 |
| Italy | 1929 | 34,955 | § |
| Norway | 1929 | 4,409 | § |

*Data by the U.S. tariff commission.
†1940 production—89,684,000 lb. valued at $8,467,000.
‡1940 production—755,000 lb. valued at $188,529.
§No data available.

The approximate annual production of the world's oyster meats approaches 120,000,000 lb. In most countries, however, the oyster yield has shown a decline since the beginning of the 20th century. Among the causes of this decline over-fishing, increasing pollu-

tion and lack of proper cultivation may be mentioned as paramount factors. The latter cause is especially obvious in the U.S.A. where only about 10% of the bottom suitable for growing oysters is under cultivation. This relatively small area produces, nevertheless, approximately 55% of the total oyster crop of the country.

**Oyster Farming.**—Oyster farming is conducted on a large scale in many countries. The cultivation of oysters consists of four main steps: care of the beds; securing set; growing oysters; and conditioning them for the market. The care of the beds consists of hardening the bottom and cleaning away old shells, debris and all natural enemies of the molluscs. The cleaning of the bed is usually carried on in the spring and early summer as preparation for securing a new generation of oysters. Spawning beds containing large numbers of mature oysters are ordinarily maintained in the vicinity of the grounds where setting is expected.

When the larvae are ready to set various materials, usually called cultch, are placed on the cleaned beds to provide setting space. In the United States, Canada and Great Britain the common practice is to use clean shells, especially those of oysters. In the Netherlands and France clay tiles coated with lime are laid on the bottoms. In Italy, Australia, Norway, China and Japan, branches of trees are placed in the water. Stones are also used in Australia, New Zealand and China. In all instances it is especially important that the cultch be clean at the time the larvae are ready to set. If placed in the water far ahead of the setting time, the material is soon overgrown with marine organisms and covered with silt, thus becoming unsuitable for attachment of the larvae. Places where setting of oysters usually occurs and where the cultch should be planted are determined by local experience. Ordinarily such areas occur in the vicinity of the natural beds.

Methods for growing oysters differ somewhat in different countries. However, they usually consist in transplanting young animals from the setting area to locations where they will grow faster. This method is widely practised in the United States, while in some sections of Australia oysters are grown on platforms elevated from the bottom. For the cultivation of *O. lurida* of the Pacific coast of the United States, an elaborate system of dykes has been devised. Transplanting assists in breaking up clusters of the young oysters. The single animals, if planted so that they have enough space for growth, acquire a very good shape and usually grow much faster than those living under overcrowded conditions. The final stage of oyster culture consists in the fattening of the animals for the market. Oysters of premarket size are simply transplanted from the growing grounds to the special beds and left there until they fatten. In France oysters are fattened artificially and rendered green by being kept in claires, or ponds, in which a very rich growth of the diatom, *Navicula ostrearia,* is cultivated. The green colour of these oysters is caused by the accumulation of pigment from the ingested diatoms in their gills and palps. A similar natural greening of oysters occurs in certain creeks in England. On some American beds, as well as in many other parts of the world, the green colour of the oysters is due to the accumulation of copper which they derive from the surrounding sea water. In some isolated sections of the Atlantic coast of the United States the oyster gills may acquire a black colour. The cause of this phenomenon is still undetermined.

Artificial production of oysters in enclosed small bodies of water was first practised by the Romans, and after 1900 was tried in almost every country where oysters are grown. In some instances a certain success was attained but, in general, these attempts were not profitable.

**Sanitary Control.**—Oysters may filter from sea water and retain alive in their bodies certain pathogenic bacteria which, if swallowed by man, may cause diseases. Therefore, in the United States, Great Britain, Canada, France and many other countries, the oyster industries are subjected to very strict sanitary regulations. Waters from which oysters are taken to be sold as food are under the constant supervision of health authorities. After the animals have been removed from the shells their purity is determined by a rigid bacteriological examination. Oysters failing to meet this test cannot be released for the market. The places where the oysters are opened, and all the equipment that comes in contact with the animals are maintained at a very high degree of cleanliness. Employees engaged in opening oysters are required to undergo periodic medical examinations to show that they are not suffering from contagious diseases.

In the summer months, especially towards the end of the breeding period, oysters are usually poor because of the great expenditure of material needed for the production of spawn. However, fat oysters coming from pure water may be eaten at any season without danger to the human health.

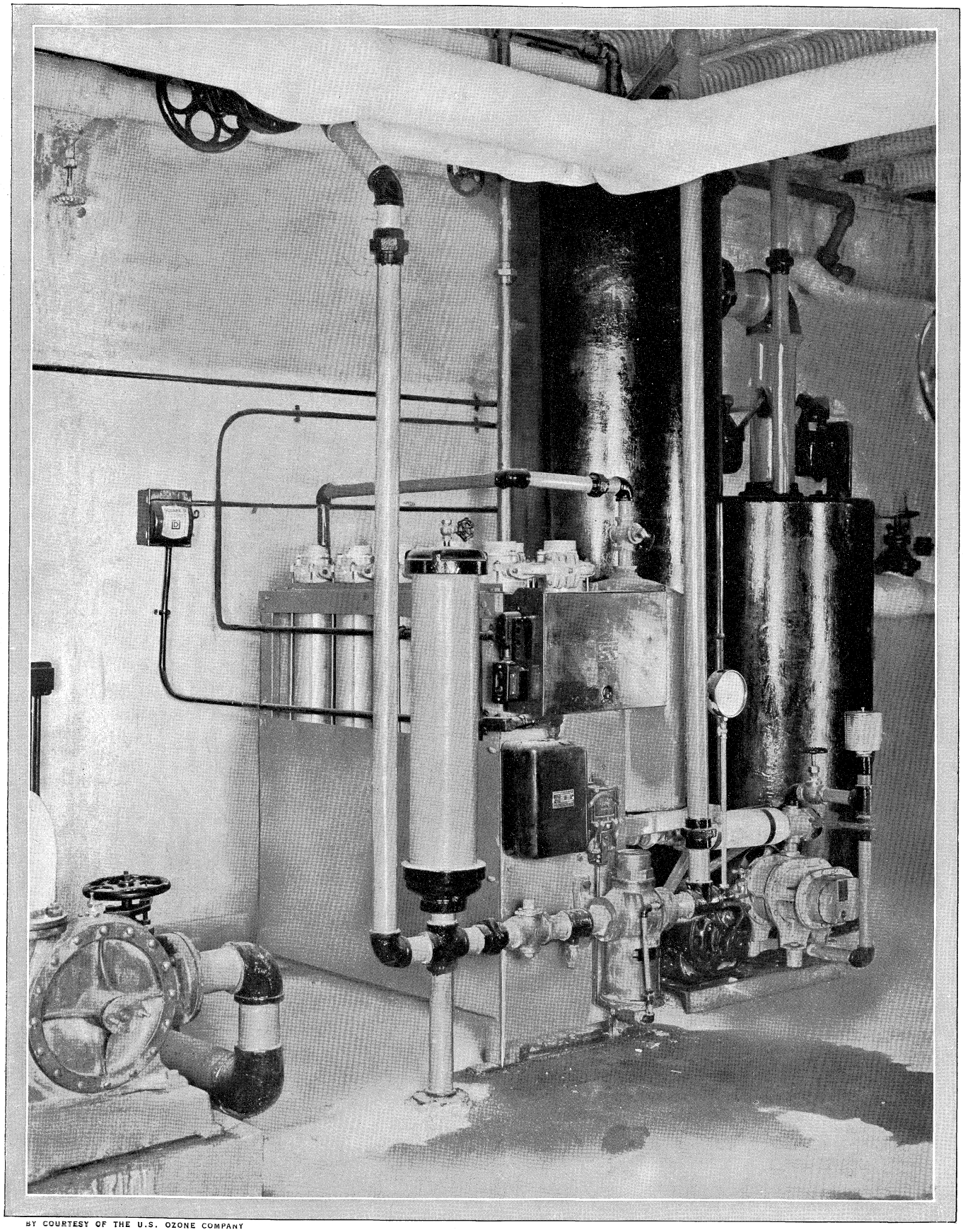
BIBLIOGRAPHY.—For European oyster and general bibliography *see* J. H. Orton, *Oyster Biology and Oyster Culture* (1937). American oyster—E. P. Churchill, Jr., "The Oyster and the Oyster Industry of Atlantic and Gulf Coasts," *U.S. Bur. Fish.,* Document No. 890 (1920); R. H. Fiedler, "The Story of Oysters," *U.S. Bur. Fish.,* Fishery Circular 21 (1936); V. L. Loosanoff and J. B. Engle, "Spawning and Setting of Oysters in Long Island Sound in 1937, and Discussion of the Method for Predicting the Intensity and Time of Oyster Setting," *U.S. Bur. Fish.,* Vol. 49, No. 33 (1940). Australian oyster—T. C. Roughley, "The Story of the Oyster," *Australian Mus. Mag.,* II (1925). Pacific coast oyster—P. S. Galtsoff, "Oyster Industry of the Pacific Coast of the United States," *U.S. Bur. Fish.,* Document No. 1066 (1929); A. E. Hopkins, "Experimental Observations on Spawning, Larval Development, and Setting in the Olympia Oyster, *Ostrea lurida," U.S. Bur. Fish.,* Bull. No. 23 (1937). Japanese oyster—I. Amemiya, "Ecological Studies of Japanese Oysters," *Journ. Coll. Agric., Imp. Univ., Tokyo,* Vol. 9, No. 5 (1929). Indian oyster—P. R. Awati and H. S. Rai, "The Bombay Oyster," *Indian Zool. Memoirs III* (Lucknow, 1931). On the sex of oysters *see* W. R. Coe, "Sexual Differentiation in Mollusks," *The Quarterly Review of Biology,* Vol. 18, No. 2 (1943). (V. L. L.)

**OYSTER BAY,** an unincorporated town of Nassau county, New York, U.S.A., on the north shore of Long Island, 28 mi. N.E. of the Brooklyn borough hall; served by the Long Island railroad and in summer by ferries to Greenwich, Stamford and New Rochelle. Pop. 1940, 4,981. The village of Oyster Bay Cove had a population of 466 in 1940. There are many country estates in the vicinity. Oyster dredging is the principal industry. Oyster Bay was the home of Theodore Roosevelt, and his grave is on a hillside in Youngs Memorial cemetery. His home, "Sagamore Hill," stands on high ground, commanding delightful views. A seaside park, established as a memorial to Roosevelt, was opened in 1928. Oyster Bay harbour was explored by de Vries in June 1639. A settlement from Lynn, Mass., was attempted in 1640 but was prevented by Governor Kieft, and for some years the territory around the harbour was claimed by both English and Dutch. The first permanent settlement was made by Peter Wright and others from Massachusetts in 1653. The harbour was a famous smuggling centre at the end of the 17th century.

**OYSTER CATCHER** or SEA PIE, a genus of wading birds, allied to the plovers. Conspicuous in both sexes by its black and white plumage and long red beak, the common oyster catcher (*Haematopus ostralegus*) is found on all coasts from Iceland to the Red sea. It feeds largely on marine worms, crustaceans and molluscs, and is very wary. The hen lays three clay-coloured eggs blotched with black, usually on a shingle bank near the sea. The young are at first clothed in protectively-coloured down and can run at once. Usually seen in pairs, oyster catchers sometimes congregate in large flocks. The courtship consists of a dance in which one or both birds run round piping. Sometimes this dance, losing its original significance, is performed as a social function by a number of birds.

The American species (*H. palliatus*) has a longer bill and less white on the back, and its call note differs from the musical "tu-lup" of the European bird. Various other species occur, some of which are entirely black.

**OZANAM, ANTOINE FRÉDÉRIC** (1813–1853), French scholar, was born at Milan on April 23, 1813. Antoine studied law at Paris, where he fell in with the Ampère family, Chateaubriand, Lacordaire, Montalembert and other leaders of the neo-Catholic movement. In conjunction with other young men he founded in May 1833 the celebrated charitable society of St. Vincent de Paul, which numbered before his death upward of 2,000 members. In 1840 he became assistant professor of foreign literature at the Sorbonne, and in 1844 full professor. He died at Marseilles on Sept. 8, 1853.



BY COURTESY OF THE U.S. OZONE COMPANY

## TYPE OF OZONE WATER-PURIFIER FOR SWIMMING-POOLS

Water-purifier, showing row of ozone generators in centre. Ozone, a more active form of oxygen, is produced in these generators, by the action of the so-called silent, or brush high-tension electric discharge. Brought in contact with water from the swimming-pool, the action of ozone is to oxidize and destroy bacteria and organic matter, transforming them into harmless products, and rendering the water free from objectionable and dangerous elements

Ozanam was the leading historical and literary critic in the neo-Catholic movement in France during the first half of the 19th century. In contemporary movements he was an earnest advocate of Catholic democracy and socialism, and of the view that the church should adapt itself to the changed political conditions consequent to the Revolution.

His works were published in eleven volumes (Paris, 1862–65). They include *Deux chanceliers d'Angleterre, Bacon de Verulam et Saint Thomas de Cantorbéry* (Paris, 1836); *Dante et la philosophie catholique au XIII*ème *siècle* (Paris, 1839; 2nd ed., enlarged 1845); *Études germaniques* (2 vols., Paris, 1847–49), translated by A. C. Glyn as *History of Civilization in the Fifth Century* (London, 1868); *Documents inédits pour servir à l'histoire de l'Italie depuis le VIII*ème *siècle jusqu'au XII*ème (Paris, 1850); *Les poëtes franciscains en Italie au XIII*ème *siècle* (Paris, 1852). His letters have been partially translated into English by A. Coates (London, 1886).

There are French lives of Ozanam by his brother, C. A. Ozanam (Paris, 1882); Mme. E. Humbert (Paris, 1880); C. Huit (Paris, 1882); M. de Lambel (Paris, 1887); L. Curnier (Paris, 1888); and B. Faulquier (Paris, 1903). German lives by F. X. Karker (Paderborn, 1867) and E. Hardy (Mainz, 1878); English biography by Miss K. O'Meara (Edinburgh, 1867; 2nd ed., London, 1878).

**OZARK MOUNTAINS,** more properly called highlands, are a group of moderate elevation lying in five States, Missouri, Arkansas, Oklahoma, Kansas, and Illinois. The total area is estimated at about 50,000 sq.m., of which 33,000 are in Missouri. The highland is an elevated peneplain developed upon an asymmetrical dome whose apex is formed by igneous rocks outcropping in St. Francois and adjacent counties, in Missouri. The topography is dominantly of the ridge and valley type; most of the area has been sculptured out of limestone by streams with the abundant aid of underground solution. Except on the south and south-east the transition from highland to plain is very gradual. On the south-east there are high rocky bluffs that rise precipitously on the Mississippi, and on the south the Boston mountains constitute a well-defined escarpment bordering on the Arkansas lowlands.

The Bostons of Arkansas, reaching elevations of about 2,300 ft. above sea-level and the highest points in the Ozarks, have been sculptured into truly mountainous form by the Arkansas and White river systems. In Missouri there are several isolated knobs more than 1,700 ft. above sea-level and one, Taum Sauk, in Iron county reaches an elevation of 1,750 feet. Turbulent streams flowing through deep cut gorges, numerous caverns and springs, and well-wooded hills have made parts of the Ozarks attractive to summer visitors.

BIBLIOGRAPHY.—C. O. Souer, *The Geography of the Ozark Highlands of Missouri* (1920) and *Missouri Geological Survey* (vol. 8 1894).

**OZOKERITE** or **OZOCERITE** may be designated as crude paraffin wax; it is found in many localities in varying degrees of purity, and is named from Gr. ὄζειν, to emit odour, and κηρός, wax. Specimens have been obtained from Scotland, Northumberland and Wales as well as from about 30 different countries; it was formerly worked commercially in Utah, U.S.A., but these deposits are now worked out and the sole sources of commercial supply are in Galicia, at Boryslaw, Dzwiniacz and Starunia. While formerly as much as 20,000 tons were mined annually, the industry has latterly suffered from the competition of the greatly increased output of paraffin wax extracted from petroleum.

Ozokerite usually occurs in thin stringers and veins up to 1ft. or so in thickness and is believed to have originated from the slow evaporation and oxidation of paraffin base petroleum. It is generally characterized by a higher melting point than the wax extracted from oils, though the paraffin "scale" deposited on the casing of certain oil wells in Trinidad was found to approximate closely in melting point to native ozokerite.

As found native, ozokerite ranges from a very soft wax to a black mass as hard as gypsum, the specific gravity varying from ·85 to ·95 and the melting point from 58° to 100° C. It is soluble in benzene, chloroform, carbon disulphide, etc. Galician ozokerite varies from light yellow to dark brown and usually melts at 62° C.

The ozokerite as mined is separated from its mineral impurities by boiling in water, when the wax rises to the surface. This crude ozokerite is refined by treatment first with concentrated sulphuric acid and afterwards with charcoal, the result being the ceresine or ceresin of commerce.

On distillation in a current of superheated steam, ozokerite yields a candle-making material resembling the paraffin obtained from petroleum and shale-oil but of higher melting point, and therefore of greater value if the candles made from it are to be used in hot climates. There are also obtained in the distillation light oils and a product resembling vaseline (*q.v.*). The residue in the stills consists of a hard, black, waxy substance, which in admixture with india-rubber is employed under the name of *Okonite* as an electrical insulator. From the residue a form of the material known as *heel-ball,* used to impart a polished surface to the heels and soles of boots, is also manufactured. (J. R.)

**OZONE** is a gas which possesses the odour of chlorine or of moist phosphorus. It may be formed (*a*) by chemical action; (*b*) by electrolysis; (*c*) by the electro-static field; (*d*) by ultra-violet rays; (*e*) by the radioactive elements; (*f*) by incandescent solids in air; (*g*) by the evaporation of water. Ozone has found quite general usage in many countries for the purification of water. At Philadelphia a Vosmaer sterilizing tower 33 ft. high and 3 ft. in diameter has been shown to be capable of sterilizing 50,000 gallons of water per hour, using an ozone concentration of one gram per cu. metre; the plant supplying Paris deals with 24 millions of gallons of water daily. Ozonized air has been utilized in food preservation, in surgery and therapeutics, in the bleaching and refining of oils, fats and varnishes. Its use in the fine chemical industry is of increasing importance. It is successfully employed in the manufacture of the flavouring material, vanillin, and the perfume, heliotropin.

Ozone, allotropic oxygen, chemical symbol $O_3$ (*see* ALLOTROPY), is normally a colourless gas. In great thickness or under pressure the colour is blue. It is sparingly soluble in water (coefficient of solubility, 0·494); it has been liquefied to a deep blue liquid which is, however, dangerous to handle owing to its tendency to spontaneous explosion. Its boiling point is variously given as −106° C (Olszewski) and −119° C (Troost). Ozone is seven times as soluble in carbon tetrachloride as in water. Its solutions in this solvent and in acetic acid, acetic anhydride and chloroform are blue and fairly stable.

The simplest form of laboratory ozonizer was due to W. von Siemens (1857) and consists of two concentric glass tubes, the inner surface of the inner one and the outer surface of the outer one being coated with tin foil, and each of the tin foil conductors being in metallic contact with the terminals of an electrical induction coil. A slow stream of dry oxygen is passed through the ozonizer and under the influence of the silent electric discharge the gas becomes charged with from 3 to 8% of ozone. Two types of ozonizers are employed on a large scale: those which have dielectrics in the path of the discharge—the Siemens and Halske, and Linder ozonizers—and those which have no dielectrics—the Schneller and the Vosmaer ozonizers. In the "ozonair" system a series of mica or micanite plates covered on both sides with a gauze of aluminium alloy are mounted side by side in a case into which air can be passed. Alternate plates are charged and earthed. The production is about 40–60 gm. of ozone per kilowatt-hour of energy at a concentration of 2 gm. of ozone per cu. metre of air.

The first recorded observation on ozone was by Van Marum (1785) who found that electrified oxygen had a peculiar smell and tarnished mercury. In 1840 C. F. Schönbein noticed these properties in air subjected to the silent electric discharge, in oxygen generated by electrolysis of water and in the slow aerial combustion of phosphorus. He gave to the new gas the name ozone (ὄζειν, to smell). Ozone is evolved in many chemical reactions, as by the action of sulphuric acid on barium or sodium peroxide and on many per-salts (perborates, percarbonates, permanganates, persulphates, etc.). Fluorine decomposes water with the production of blue ozonized oxygen (H. Moissan, 1891). The least volatile portions of liquid ozone contain a denser gas of great chemical activity to which the name *oxozone* has been given with a molecular formula $O_4$. (C. D. Harries, 1911. *See* OZONIDES.)

The constitution of ozone as $O_3$ was demonstrated by T. Andrews and P. G. Tait (1860), J. L. Soret (1866–67) and B. Brodie

(1872), by making use of the fact that certain essential oils (cinnamon and turpentine) absorb ozone without taking up any marked amount of oxygen. The loss in volume by absorption of the ozone from ozonized oxygen was twice that observed during the original ozonization of the gas. It was inferred from these experiments that 3 volumes of oxygen are condensed to produce 2 volumes of ozone. This conclusion was confirmed by comparing the rates of diffusion of ozone and chlorine, when the density of ozone calculated on the basis of T. Graham's law of gaseous diffusion was approximately 24 (H=1), agreeing with a molecular formula of $O_3$ (48).

BIBLIOGRAPHY.—E. Andreoli, *Ozone* (1898); H. de la Coux, *L'Ozone* (1904); A. Vosmaer, *Ozone, its Manufacture, Properties and Uses* (1916); E. K. Rideal, *Ozone* (1920); M. Moeller, *Das Ozon* (Brunswick, 1921); J. W. Mellor, *A Comprehensive Treatise of Inorganic and Theoretical Chemistry,* vol. 1 (1922). (G. T. M.)

**OZONIDES,** in chemistry, combinations of organic compounds with ozone. Soret's observation that ozone (*q.v.*) is absorbed by turpentine and oil of cinnamon was a forerunner of the remarkable results subsequently obtained by C. D. Harries (1905–15) by passing ozonized oxygen into solutions of unsaturated organic compounds in inert solvents such as methyl or ethyl chloride or glacial acetic acid. Ethylene gives ethylene ozonide, $C_2H_4O_3$, which on treatment with water furnishes formaldehyde and hydrogen peroxide. Benzene gives rise to an explosive triozonide, $C_6H_{6,3}O_3$, which is decomposed by water to give glyoxal. Oleic acid from olive oil gives an ozonide which on decomposition gives two aldehydes and their two peroxides. These decompositions of ozonides are used in determining the position of unsaturated ethylene linkings in the organic molecule and also in the preparation of certain aldehydes. Harries applied the method of ozonide decomposition to the problem of the constitution of caoutchouc and indiarubber. In certain instances unsaturated organic compounds take up $O_4$ at the double linkage. The products are termed oxozonides, and are regarded as being due to the presence of oxozone, $O_4$, in ozonized oxygen. Propylene gives $C_3H_6O_4$ and butylene forms both ozonide, $C_4H_8O_3$, and oxozonide, $C_4H_8O_4$.

*See* T. E. Thorpe, *Dict. of Applied Chemistry,* vol. v. (1924).

*END OF VOLUME SIXTEEN*

W
PRINTED IN THE U. S. A. BY R. R. DONNELLEY & SONS CO.